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1913—1914.

THE improvement which occurred in the electrical industry during the year 1912 has been maintained during the past 12 months. For most of us the period has been a very busy one, so that the months have flown past. It seems but a very little while since we were briefly reviewing the previous year, and venturing a forecast of what 1913 would bring. We suggested that there would not only be no cessation to the then prevailing prosperity, but that the year would see more electrical business done in both large and smaller classes of manufactures than ever before. We believe that our forecast has proved to be perfectly correct, for on every hand there have been evidences of great activity. It has been difficult for the factories to keep pace with the demand, and manufacturing companies have reported a better rate of profit earned upon their products. And as we step out into the New Year, most encouraging statements reach us, showing that, whether or not we are on the verge of trade depression in some other industrial departments, there is little occasion to fear a falling-off in electrical business during 1914. Large contracts in connection with railway electrification, new power station and distribution work, telephone extensions, and a most gratifying progress in the applications of electricity to cooking and heating, accompanied also by new work in electric vehicles and a continuation of the big demand for electrical devices used in other automobiles—all of these have furnished our factories with plenty to do for some time to come, and there is no prospect of orders falling off at present. Electricity has become so necessary to our industrial and domestic occupations, that it has a practically unlimited and inexhaustible field at home, while abroad the same thing is happening, opening out abundant opportunities which are bound to grow still further as passing years witness the general development of the world.

Some of the well-known manufacturing companies which have for years past struggled with adversity, have carried through financial reorganisation schemes, and on reduced and rearranged capitals they should in future be able to pay dividends if they are securing their share of the present brisker and more profitable trade.

So far as manufacturing is concerned, the year has been comparatively free from actual labour outbreaks, but at times there have been ominous overhanging clouds, threatening general industrial disorganisation if they should burst. A number of local disagreements have arisen between electrical installation workers and their employers, in consequence of demands for higher wages. London is now the objective of the Wiremen's Union, and master contractors have taken special steps in order to negotiate with that organisation. It is impossible to foretell what the course of events may be in the labour world during 1914, for it takes but a spark accidentally struck to set the whole ablaze. This very sensitive state of mind cannot be permanent—the relations of capital and labour are in a state of flux. Someone has got to be master, or stability is impossible. In the interests of prosperity for both master and man, we devoutly hope that there will be no open warfare during the year upon which we have started.

In regard to our foreign electrical trade for the 11 months so far covered in the year's official returns, the exports of electrical goods and apparatus, excluding machinery and uninsulated wire, were more than a million pounds value in excess of those of the previous year, while machinery exports showed considerably over $3\frac{1}{2}$ millions sterling advance. The aggregate increase in imports in both departments was under £600,000. The total figures were:—Imports, £8,100,000; exports, £39,100,000.

In the sphere of electricity supply, a noteworthy feature has been the continued fall in the price of turbo-generators; the turbines are built for higher speeds, more compactly and yet as efficient as the earlier designs, and so low is the price that the condensing plant in a recent instance actually cost more than the turbo-generators. The progress of the Diesel engine has been retarded by the high price at which oil fuel still stands, but the year has been marked by the inauguration of a complete gas power installation at Accrington (which is going to be greatly extended) with by-product recovery plant, and by the harnessing of the River Dee for the benefit of the Corporation of Chester, where Mr. Britton now stands in the shoes of the celebrated miller. Good progress is being made with the electric lighting of villages, notably in the hilly districts of Yorkshire, where a number of small water-powers have been utilised.

The development of the applications of electricity continues with unabated vigour, and the chief cities are installing large extensions to their generating plant, almost always involving the use of high-pressure three-phase current and transmission from an external station. It is a matter for surprise that our central-station engineers, with few exceptions, continue to think in small sizes, though Messrs. Parsons have built a 25,000-KW. turbo-generator to a foreign order.

While there is not much to record about tungsten lamps except a further reduction in prices, the ½-watt lamp has been developed, and we are promised that it shall appear on the market before long, when the electric lighting of the streets will receive a further impetus, and arc lamps, with the exception of the flame type, will be hard hit. The opening of several all-electric restaurants during the year augurs well for the future of electric cooking, which, indeed, has made excellent progress in 1913; and the large numbers of radiators now in use prove that, in spite of the cost, electric heating possesses very substantial advantages under certain conditions.

The battle of tariffs goes on perpetually; the "telephone" system and its allies and the "assessment" system are coming more and more into vogue. We look forward to the time when the lighting peak will be relatively so far reduced by the development of "other uses" and by the increasing economy of the lamps, that a flat rate of 1d. a unit, or less, subject to a minimum payment to cover fixed charges, will be the rule. The efforts of the "Point Fives" to extend the adoption of a halfpenny tariff, and to assist manufacturers towards the standardisation of cooking apparatus, deserve a word of commendation.

The electricity supply of London has become a prominent question, and preliminary steps have been taken with a view to its reform, which will be the subject of Parliamentary deliberation this year; a saner view has been taken generally of the relations between companies and communities, and many agreements have been made for bulk supplies of energy.

The formation of an Association of Station Engineers, arising out of correspondence in our pages, has been a notable feature of the year; it is evidence of the existence of a strongly-felt want, which the I.E.E. has hitherto failed to recognise, though there are indications that the matter is receiving more attention in high quarters now.

The opening of several railless trolley systems during the year, and the satisfactory working of these and other installations, affords strong evidence that the motor-'bus does not meet all the requirements of rural districts, in spite of the enthusiastic claims of its supporters—based largely, no doubt, upon its success under the exceptional conditions prevailing in London; the L.C.C. tramways have had a temporary reverse, but are steadily regaining their position, and the outcome has undoubtedly made for the public benefit. Electric traction on railways has made steady progress, although practically no new lines have been put in service except extensions to existing systems. This year we hope to see electric trains running on portions of the North and South Western Railways, and further sections of the Brighton Railway. The N.E. Railway has an important new section in course of electrification. The I.E.E. has arranged for a feast of technical information on the subject for the spring, and we feel that we are on the brink of a vast development in this connection.

An important departure was made by the Lancashire and Yorkshire Railway, which put in operation a new section worked with high-pressure direct current. The East London Railway electrification was at last completed, and started work early in the year, but the Midland Railway to Tilbury and Southend is still only going to be electrified. A start has been made with the great railway scheme of the City of Melbourne, with which good progress should be made this year.

Amongst other noteworthy projects contemplated in the Empire are the electrification of the suburban railways of Sydney and Bombay, the big scheme of the West Australian Government in conjunction with the Corporation of Perth, and the future electrification of some sections of the State Railways in South Africa. Progress in Canada has continued, though hampered by the tightness of money; the Canadian Pacific Railway Co. and the Canadian Northern have decided to electrify portions of their great undertakings. In the Argentine the Buenos Ayres Traction Co. are constructing an important system of electric railways, partly underground, of which one section has been opened. In fact, electrification is now the question of the hour in railway circles. Not only is the complete equipment of tracks going on, but also the use of internal-combustion engines provided with electric transmission to motors propelling the trains is making progress.

In the United States an immense amount of railway electrification is in progress; and the opening of the Lötschberg tunnel electric railway through the Alps has further facilitated intercourse between Italy and the west of Europe.

The first electrically-propelled ship of considerable size built in this country—the *Tynemount*—was completed in the autumn.

The electric vehicle now shows signs of vitality, welcome after the disheartening difficulties which have encumbered its progress in the past, and the supply authorities have taken definite steps towards developing this important outlet for their energy.

In the telegraph field the most notable event has been the settlement of the political controversy which has raged around the question of the Imperial wireless system, and the placing of the first contracts with the Marconi Co., of which the current year will doubtless witness the partial completion. Duplex wireless has been established between Ireland and Canada. Foreign telegraph rates have been further lowered, and a new loaded telephone cable (the longest yet made) has been laid between Newcastle (Ireland) and Nevin, in Wales. The success of automatic telephone exchanges in this country has been demonstrated, and important developments of the system are foreshadowed by the Post Office; a new automatic system, invented by Betulander, has been introduced. Unfortunately, the British telephone service is still very far from satisfactory, and the Post Office appears to be quite unable to raise its efficiency to a reasonable standard. Wireless telephony has been carried on experimentally over a distance of 300 miles.

The properties of radium have been, and are being, studied by an army of investigators, and the immense benefits which it is capable of conferring upon suffering humanity have been more and more fully demonstrated; even cancer, in its earlier stages, has been proved amenable to its influence. Improved methods of extracting radium have been developed, and practically the whole production is devoted to the cure of disease.

During the year there have been called off the stage of human existence an exceptionally large number of men well known, directly or indirectly, in the electrical world. They include:—The Earl of Crawford, Sir Wm. Preece, Sir Wm. White, Sir W. H. Bailey, Sir Wm. Arrol; Professors J. T. Nicholson, J. Milne, F. Gotch, H. Weber and A. Slaby; Dr. Rudolf Diesel and Dr. Gustaf de Laval; Messrs. J. H. Cawthra and A. S. Giles; Messrs. Sydney Woodfield, C. H. Gadsby, and R. S. Erskine; Messrs. J. Howden, H. Aron, Alfred Apps, George Matthey, Arthur Chamberlain, E. M. Underdown, John Trotter and T. Frame Thomson.

The Copper Position.

The copper position has certainly improved since last writing, and at the moment the appearances justify a moderate degree of optimism regarding the near future of business. The tone has certainly improved quite appreciably, and with it there has been a modified return of confidence amongst consumers, who as a body had allowed their reserves to run down very low. It is noteworthy that the restoration in moderate degree of confidence followed upon the disappearance of the premium on cash copper. It is curious how that, as soon as there are obvious evidences of a manipulated position in copper, as shown by forward deliveries standing at a discount compared with cash, enthusiasm evaporates from the market, and a reaction follows with a depressed feeling, while so soon as the position is reversed, there is immediately a moderate restoration of interest in the position. It was the development of the premium on cash and near deliveries a little while ago that put the finishing touch to the bull movement by inducing all-round liquidation on a heavy scale, and the development of energetic operations by the bears. Actually the depression in prices seems in the light of events to have been carried too far, and we are now in the stage when there should be a rectification of prices based upon intrinsic conditions which, as has been pointed out before in this column, are not so bad. The very worst has been made of everything during the past month or so, and it seems time that there was a new swing to the pendulum. The closing days of the old year, at all events, showed a considerably better feeling, and it would not be surprising if something in the nature of revived interest were taken in the metal by consumers, and possibly, too, by speculators, with the early days of 1914. The statistical situation is far from bad, and, indeed, contains moderate possibilities of a favourable character for the bulls, always provided there are no further untoward happenings, and these good points may have effect soon. There is still but a very small, even dangerously small, visible supply in the world, while the most recent reports as to consumption are rather better both here on the Continent, and in America. In Germany the Siemens Co.'s shareholders have been informed that the company's business continues to develop satisfactorily, and in other directions a rather better account is given of things. The excess of pessimism has indeed passed, it is felt, and should America now settle down to make the best of the new tariff and other matters which have been worrying capital of late, there might quite easily be a very different appearance put on affairs. At all events, the new year is usually a time of hope, and while making allowance for this very natural feeling, there seem substantial grounds for casting gloom aside and taking a moderately cheerful view of industrial conditions and possibilities. The new year will fail, of course, in some of its promises, but there is no reason for holders to be mournful to the point of despair as regards prices. For one thing the threatened big increase in output across the Atlantic has not yet assumed the proportions which had been feared, and this in itself is comforting for holders of the metal and shares, while even if there is to be an advance, it can hardly be of sufficient extent seriously to affect consumption. It may be taken for granted, however, that there is not much likelihood of any really great rise in prices, and that what improvement does occur will not be larger than is to be justified by intrinsic conditions. Lately the market has been rather unduly depressed and the moderate reaction seems fully justified.

Transport Problems in Berlin.

It was mentioned in this journal several months ago that schemes appeared to be shaping in the direction of the formation of a combination of the principal transport undertakings in Berlin—the Grand Berlin Tramways Co., the Elevated and Underground Electric Railway Co. and the General Omnibus Co. At that time the two former secured a large financial interest in the latter, and since then rumours have been rife, particularly quite lately, that the tramway company proposes to take over a block of shares in the railway company or otherwise establish a community of interests with the railway. It is true that informal discussions of points affecting the two undertakings took place some time ago, but the tramway company now states that there is no foundation for the rumours of a projected community of interests between the three enterprises. The discussions between the tramway and the railway companies did not lead to any practical result, and the negotiations were consequently discontinued. Nevertheless the quotations for the shares of the three transport undertakings have rapidly advanced. Those of the tramway company have fully recovered the loss incurred since last September, but the shares have not reached the level of the quotations which prevailed at the beginning of 1913; and the increase in the shares of the omnibus company has not yet attained the level of 191 per cent. which obtained prior to the announcement of the financial interest taken in the undertaking by the two other companies last August. On the other hand, the shares of the railway have arrived at the unprecedented price of 145 per cent. The course of the quotations and the attitude of the tramways company seem to suggest the possibility of a traffic trust in the near future.

A Report on Companies.

Some interesting items appear in the Annual Report by the Board of Trade, under Sec. 283 of the Companies' (Consolidation) Act, 1908, for 1912.

The Bankruptcy Act, which was passed in 1913, contains a provision applying the law relating to bankruptcies to limited partnerships, the winding up of which could previously be effected by means of a winding-up order under the Companies' (Consolidation) Act, 1908; the provisions of that Act which relate to the winding up of limited partnerships have now been repealed as regards England.

The total number of limited partnerships registered since the Limited Partnership Act, 1907, came into force, is only 530. Its provisions have not, therefore, been made use of to any considerable extent, which is, doubtless, largely due to the fact that in the same year that the Act was passed a section was included in the Companies' Act, 1907, granting certain exceptions and privileges to companies (to be called private companies), which included in their articles of association the restrictions laid down by that section.

Perhaps the most interesting case of a company against which a winding-up order was made during the year may be noted.

The A, Ltd., with a nominal capital of £100 in 1,000 shares of 2s. each, was formed in 1912. It was promoted by A for the purpose of acquiring from himself, his wife and family, the whole of the assets of A & Co., Ltd., of which they had possession as the holders of the debentures, for a certain sum. The consideration for the transfer was the issue to the holders of debentures in A & Co., Ltd., of debentures for a similar amount in the new company. The sole director of the company was the promoter, and his son acted as secretary; all shares were issued and were subscribed for by them.

This method of forming a new company to acquire the assets of the old company by means of the issue of debentures appears to have been first adopted by the promoter A in 1899, and there have been not less than 14 limited companies, of which the present company is the direct outcome, promoted by A, and of all of which he was the sole director, each company being formed for the purpose of acquiring and continuing the business of its predecessor. The promoter, in taking advantage of the limited liability Acts, has been able to trade without making himself personally liable for the debts contracted in the name of the company.

In 1912 the promoter A took possession of the company's assets for the debenture-holders, and yet another company was registered to which the assets have been transferred by the receiver for the debenture-holders for debentures in the new company. There are consequently no assets for the unsecured creditors.

THE EVOLUTION OF THE MODERN OIL SWITCH.

By W. J. P. ORTON.

It is a fact worth remarking that the first commercial oil switch to be put into regular use was invented and designed by Mr. Ferranti about 20 years ago.

This oil switch had its main contacts in air, and only the auxiliary break in oil. It, however, differed in one essential point from the modern switch in that the final break took place on the surface of the oil, the arc being smothered by drawing one of the contacts well under the oil. This feature has been superseded in all later designs, the endeavour now being to immerse the arcing contacts under a good head of oil.

Another feature of Mr. Ferranti's switch was the quick break, and the importance of this has been thoroughly realised at the present date.

Concurrently with this switch, the Continental and American engineers were developing a line of air-break switches, in which the horn break was the essential feature of the former, and a quick long break from carbon contacts of the latter. These types, however, were short-lived, owing to the increasing size of generators to be controlled, and to the electrical disturbances which were set up by the long pulsating arc in air.

The design which next appeared hailed from the States, and was in a form with which we are now all familiar, and which, except in some rather important details, still prevails. In order to reduce fire risks, particular care was taken to keep the quantity of oil in the cans at a minimum. This theory has, however, been abandoned, and the volume of oil has been increased as much as possible.

The chief reasons for this change are that on severe short-circuits a certain quantity of oil is thrown out of the can even when special precautions are taken, and a large volume of oil is necessary both above and below the arcing contacts in order to drown the arc.

In the early stages of the oil switch design it was recognised that for the safety of the operator and the switchgear as a whole, it was important to place the oil switches in fireproof cubicles remote from the panels, and since remote mechanical operation presented many difficulties, and in some cases was impossible, the electrically and air-operated switches were evolved. The former have been the more successful, and have now been standardised into two main types, viz., solenoid operated and motor operated.

Considerable ingenuity has been displayed in the mechanical development of these two varieties, but space only permits of the consideration of some of the features of the former. There are, however (or, perhaps, one should say were), two points in which the solenoid-operated switches were imperfect, viz. :—

1. They were not loose-handled; that is to say, an operator, by keeping the control circuit closed on the solenoid, would cause the main switch to remain closed, or to keep on closing on a short-circuit or overload.

2. The break was not as quick as it should be, since when the throw-off springs were made sufficiently strong the solenoid was either too weak to close the switch, or assumed such proportions that the closing current became excessive for the work to be done, and the mechanism could not be made suitable to withstand the violence of the closing movement.

It is possible to overcome the first disadvantage in several ways, and the two which have been frequently adopted are either to design the apparatus which governs the control circuit so that its movements are, to a large extent, independent of the operator, or to make the closing mechanism of the oil switch itself on the loose-handled principle.

The first method has the advantage of simpler design, since the controller which completes the circuit through the closing or tripping solenoids can be made loose-handled without any great exercise of ingenuity, the parts being small and light, and without any great mechanical strain upon them. An alternative scheme is to develop the controller mechanism so that it operates automatically by the use of a push button.

The second method, in which the loose handle on the oil switch itself is employed, though utilising a well-understood feature, is more difficult of application. This is due to the heavier masses to be moved, and to the large stresses which the moving parts have to undergo. It is important, moreover, that the loose-handle lever to which the solenoid plunger is attached should, in the event of the oil switch opening, reset itself without fail in readiness for the next closing operation.

In order to produce a mechanism which can be depended upon in all emergencies, great attention has had to be given to all details; but, in spite of obstacles, the desired result has been satisfactorily attained.

The above short description gives a slight insight into some of the problems which confront the would-be designer, and of the difficulties which have been surmounted with varying degrees of success.

With the advent of the large power stations which are now built or being contemplated in all civilised countries, manufacturers of switchgear have been called upon to give very stringent guarantees for their oil switches, and to meet conditions quite new and unexpected. It has, therefore, been necessary most carefully to scrutinise all the details, and to carry out extensive and costly experiments, to enable oil switches to be made to withstand the severe conditions of modern practice.

It is, in fact, quite a common occurrence to provide switchgear for generating stations which normally have 50,000 H.P. or more of plant connected to the bus-bars, which, on short circuit, is capable of giving an output of at least three times its normal capacity.

Under these onerous conditions experience has shown, chiefly in America and on the Continent, that it is possible, when rupturing a short, to produce a violent explosion in the oil-switch tanks, which, in the older types of design, frequently resulted in the oil tanks being blown off, the oil set on fire, and the switch itself wrecked.

Invention, therefore, has been stimulated by necessity, and certain essential features of design have become standardised. For convenience, they may be summarised under the following headings :—

1. Strong mechanical design.
2. Reliability in operation, whether opening or closing.
3. Ease of inspection.
4. Quick break.
5. Adequate length and number of breaks.
6. Strong cans, and supports for the same.
7. Large volume of oil.
8. Sufficient head of oil above contacts.
9. Expansion chamber above the oil, with relief vent for the escape of gases.
10. Separation of phases, both in the tanks and outside them.

In explanation of the above essentials, it is unnecessary to remark on the first two, but the third calls for the particular attention of the designer, since it is a point which is easily overlooked. In order to keep oil switches up to the highest pitch of excellence, they should be frequently overhauled to ensure that the oil is clean and free from carbonisation; that the main and arcing contacts are in good condition and alignment, and that all the mechanical parts are in working order and properly oiled to minimise friction.

It is obvious, from the foregoing, that not only should a switch be carefully inspected, whenever possible, after it has ruptured a severe short circuit, but those responsible should satisfy themselves that everything is up to concert pitch before any trouble occurs.

Nos. 4 and 5 are self-explanatory, except that it would be well to point out that by "quick break" the writer does not mean instantaneous action on a short, but rapid acceleration of the moving parts, when once the switch has begun to operate.

The number of breaks is usually confined to two per phase, but in some of the largest capacity these have been increased to four or more, especially when designs have been elaborated to include additional contacts to enable resistance or reactance to be introduced into the circuit before finally rupturing it. The latter method has been successfully attempted in the United States, and by the use of comparatively small reactance coils almost unlimited shorts have been interrupted without the switching apparatus being put out of action.

With regard to No. 6, it need only be said that it is just as important to have the strongest possible can supports, as to have a can which will stand up to the high internal pressure.

Nos. 7 and 8 may be considered together, as it is evident that a large head of oil over the arcing contacts, in order to be effective, necessitates a large volume of oil. At the same time, the greater the volume, the longer it will take to reach the danger point produced by gradual carbonisation.

The expansion chamber above the oil referred to in No. 9 is a feature of design that has only been recognised quite recently; but tests have proved that the existence of this chamber relieves the pressure inside the can when a heavy arc suddenly generates gases, and if in addition a baffled vent is provided, these gases are allowed to escape without the head of oil above the contacts being sufficiently reduced to need attention after every operation.

The necessity of the separation of phases mentioned in the last item, No. 10, is self-evident, since, if an arc should hold on for an appreciable length of time between phases or between contacts of the same phase, the switch is in danger of being badly burnt and rendered unserviceable.

The reader will appreciate from the foregoing how complex the design of large oil switches has become, and that a piece of apparatus which was formerly looked upon as fit for a junior draughtsman to tackle now needs all that experience and invention can evolve. These results, moreover, have only been arrived at by switchgear manufacturers after many mistakes, and by the expenditure of much time and money.

LONDON UNIVERSITY: A CRITICISM.

By G. E. MAPPIN.

Must we wait for another Lord Roberts to rouse England to a sense of her educational unpreparedness? How long will it be before we realise that, as in the Territorial Force, the training in our technical universities is too short?

Some time ago I returned to England after completing my education abroad, where I studied at two German technical universities and underwent a course of practical training in German works. I cannot but express surprise at the lowness of the standard required at home. To prove this, let us compare the latest programmes of London and Darmstadt Universities as regards electrical engineering.

Prospectus.—One must regretfully admit that the German is better arranged. The different programmes are placed together and contain numbered lists of the subjects read, with the hours devoted to each. A numbered syllabus of lectures is given, which enables the students to see at a glance what is studied, and makes it possible for them to choose any supplementary subjects they like.

Further, there is a detailed list of tours and excursions (some 28 in number), undertaken, during the past year, by professors and students of engineering, chemistry, and architecture, in which they visited various towns, works, &c., throughout Germany, Switzerland, and Italy. There is nothing corresponding to this in the English publication.

Examinations. — The passing-out examination of the German public schools, required of all undergraduates, is considerably harder than the "entrance" to an English University, yet the German course for architecture, chemistry, and engineering is four years in length, compared to the three generally required in England. German engineering students must go through at least one year's training in a works before taking the final examination.

Subjects Omitted at London.—Neither the time-table at Darmstadt, nor at any German University, is filled to its full capacity with subjects necessary for the examination, as seems to be the case at home, and for two reasons: to avoid overtiring the students, and to enable them to hear lectures that improve their general education, thus giving free play to the self-education so much under discussion at the present time.

The German programme devotes, in general, more time to any given subject than does the English, and is therefore more thorough.

The following lectures given at Darmstadt do not appear to be part of the curriculum of electrical engineering in London.

As part of the four years' course, we have Industrial Politics; Water-power Plant; Machine Planning; National Economy.

Then during the course it is recommended that the lectures on Water-power Machines, Elements of Law, Literature and History, and other subjects should be attended.

Lectures are also held on Factory Planning; Wireless; High Tension; Socialism and the Working Man; Finance, Credit and Banking; National Income and the Formation of Classes.

Criticisms and Suggestions.—Now what are the views of the University authorities on the subjects enumerated above? They must either (1) disapprove, or (2) approve of their being read.

If 1—On what grounds do they place themselves in opposition, not only to German, but also, I believe, to French practice?

If 2—Why do they not create fresh chairs?

If they have not the money, two courses appear open to them.

(*a*) To ask for funds from the City, the County, or the Government.

(*b*) To ally themselves with other Universities to urge the Government to give them a larger grant or to empower them to levy a University rate on counties in the neighbourhood of University towns.

We English pride ourselves on our thoroughness. I ask, with all deference, is the London programme thorough?

The Works of the Future.—The era of "mixed" works dawned some years ago, and they will become the works of the future. Our Consular reports from Frankfort O/M show the parlous state of the German "pure" works, due to the former's competition. When the "mixed" works increase in England, the same fate will overtake the "pure" concerns (*i.e.*, those not owning their own sources of raw material) on this side of the North Sea. What have the University authorities done to meet these changed conditions? Practically nothing! Or do they consider that the English course gives any lectures equivalent to the numerous chairs on the above subjects at a German University? What training are they giving to the future engineers, who may ultimately hold in their hands the fate of vast concerns, owning iron and coal mines, docks, canals, railways, cableways, blast furnaces, water-power stations, rolling mills, and erecting shops? Can they maintain that our training is in any way to be compared with that given in Germany?

We complain of the difficulties that beset a long theoretical course in this country. The Universities, I think, are largely to blame. Why do they divorce theory from practice, and grant degrees without insisting on at least one year's previous training in a works? Do they imagine that a few hours a week in the University workshop can be substituted for this?

The University Degree must be given after a long *practical*, as well as *theoretical*, training, and should not be based on the results of the latter alone. The degree should never be given on a three-year course, as this does not allow sufficient time for studying the subjects abovementioned.

The authorities may be afraid that if an engineer be not employed before he is 25 or 26, he will find it hard to obtain a post, but modern conditions demand a more lengthy training than was formerly necessary. Let them state boldly what they *know* to be the irreducible minimum of instruction required. Compromise is at once the strength and the weakness of our race; there must be none as regards technical education. The best is good enough for us, should be our motto. Of course, it will be difficult to convince people. In order to strengthen the hands of the Universities, a

Technical Education League

must be formed, with a definite programme, and propaganda made throughout the country, ere we can hope to arouse public opinion.

Is it too much to hope that one or more public-spirited manufacturers will come forward and provide funds for starting this league? An engineer, with a thorough knowledge of French and German, should be sent to visit a few works and to attend, say, a dozen lectures at one or two of the Technical Universities in these countries, this to be followed by a similar tour in England. He should issue a confidential report, the advice of perhaps three educationists would be taken, and programmes for engineering, chemistry, and architecture would be published, as the principles of the league. At the same time, technical education for the workmen on the thorough system in use in Germany would find a place in the propaganda.

These are, I know, very hard words, but I would ask it to be remembered that I am speaking from personal experience, acquired in England and during the time I spent in Germany (a time in which I had many opportunities of studying German industrial and economic conditions), and from facts obtained in visits to firms such as Krupp, as well as during a students' tour to various towns extending from Duisburg to Emden and Bremen.

London is the most important town in the kingdom; if we can persuade her University to move, we shall have gone a long way towards the educational reform of our country.

THE NEW SWITCHGEAR RULES OF THE V.D.E.

[COMMUNICATED.]

The switchgear standards which have recently been compiled by the Verband Deutscher Elektrotechniker (German Society of Electrical Engineers), and published in a preliminary form are, to all intents and purposes, the first attempt to treat the subject from a practical and scientific standpoint, and are a great advance on any similar set of rules which have been made public. Though switchgear as a whole is treated in this publication, by far the greater part deals with oil switches. The tables given are arranged in quite a novel manner and, in the author's opinion, the method of treatment is on the correct lines.

To begin with, the standard working voltages and currents are set forth, and little exception can be taken to these except that the low current ratings for H.T. apparatus of 2, 4, 6 and 10 amps. can seldom be required, and even if they were from an electrical point of view, they would be inadvisable from a mechanical one, since, if made of the correct dimensions for such small currents, their construction would be flimsy, or if made strong enough they would at once become as expensive as the larger sizes, and the *raison d'être* of their existence would vanish.

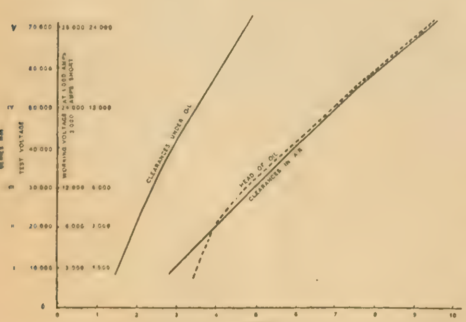


Fig. 1.

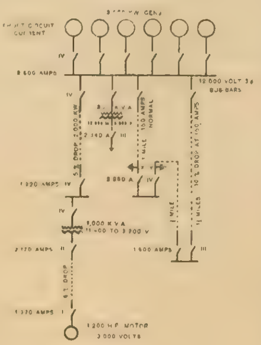


Fig. 2.

Under Rule 4 the new method of rating appears, *i.e.*, the apparatus is to be chosen not only according to the voltage and working current, but according to the calculated permanent short-circuit current to which it could be subjected in its position at the generating station, or on the distribution system. It may be said that the word "calculated" is the fly in the ointment, and that the calculated current may in practice be very different from the actual current.

If the reader, however, follows closely the examples given in the Rules, he will notice that estimates of the permanent short-circuit currents are in line with practical experience, and if they err at all it is on the high side with one exception, *i.e.*, no account is taken of the stored energy in the system, such as is represented by rotaries and other running machinery. On consideration, however, it may be assumed that this energy is largely dissipated before the oil switch comes into action, especially when it is remembered that the great majority of automatic switches are fitted with a time lag to prevent instantaneous operation.

The curves given in fig. 1 are an attempt to translate the figures tabulated in the German rules, but it will be seen that the method of rating the oil switches on their test volts makes it difficult to draw comparisons between German and English practice. In order, however, to make this possible, the author has given two columns of working voltages alongside the test voltages. The first column gives the working pressure for a permanent short-circuit current of 1,000 amps., and the second for 2,000 amps., though for a rough comparison the latter column can be neglected.

Let us consider, in the first case, the curve giving the clearances in air. These are undoubtedly larger than is usual either in English or American practice, and would necessitate wider spacing, not only in the switch parts themselves, but in the arrangement of brick or moulded stone cubicles so common in this country. On the Continent unenclosed iron structures are more common, and no doubt this design was in the minds of the framers of the Rules when settling these dimensions.

The clearances required under oil approximate closely to standard English design, except for voltages below 10,000, which is chiefly accounted for by the high test voltages specified, these being as high as three times the normal working voltages. In the Standardisation Rules published by the American Institute of Electrical Engineers, and those by the British Electrical and Allied Manufacturers' Association, the test voltage called for is only twice the normal for voltages of 2,500 and 2,250 and above respectively, though the time of application, viz., one minute, is the same in all three cases. It may be agreed, however, that at the lower working voltages faulty spots in the insulation do not show up in the short time of one minute, except with a test voltage of 10,000, and there is a good deal to be said from this point of view.

The third curve, giving the requisite head of oil above the arcing contacts, also closely agrees with English practice, and is a recognition of an important feature frequently neglected.

At first sight it would appear that some important points in the design of oil switches have been overlooked, but it will be seen that the volume of oil in the tank is practically fixed when the dimensions for clearances under oil and for head of oil are specified. The length of break under oil is purposely omitted, as great differences of opinion exist on this point, and it also depends to a certain extent on the design of the switch itself.

In order to make the calculations of the short-circuit currents clearer, the diagram given above, fig. 2, has been drawn.

It is assumed that there are six 3,000-KW., 12,000-volt, three-phase generators running in parallel on the bus-bars, and in addition four types of feeders are shown. The first feeds a sub-station, where the voltage is reduced to 3,000 in order to supply power to a 1,200-H.P. motor in the neighbourhood. The second feeds a step-down transformer in the generating station, while the third and fourth supply a ring main with two sub-stations.

The currents given in the figure are the permanent short-circuit amperes, and the Roman numerals refer to the series number of oil switches, as specified for these currents in the German rules.

It is obvious that all oil switches directly connected to the bus-bars should be of the same capacity, and capable of dealing with the short-circuit current of 2,600 amperes. A good example of the decreasing capacities of oil switches in series is given on the first feeder, where the size at the source of power is No. 4, while at the motor No. 1 size only is necessary.

The ring main feeders present a little difficulty, since if a short were to occur at x the oil switches in the adjacent sub-station need only have the capacity of No. 3, but if the short took place at y it would be necessary to have the larger capacity represented by No. 4. Since, however, the worst condition must be provided for, No. 4 switches would have to be installed in this sub-station.

In the second sub-station, which is situated at the middle point of the ring main, the largest short-circuit current which would occur only necessitates No. 3 oil switches, but for the sake of uniformity and interchangeability, most engineers would install No. 4 oil switches throughout the main, provided the cost of this larger switch was not prohibitive.

Referring to Rule 11, where the maximum allowable rises in temperature are given, sound discrimination is shown in allowing 40° C. rise for switches above 2,000 amperes, whereas those for 350 amperes and below are only allowed 20° C. rise. The reason for this is self-evident, since this temperature is measured on the surface of the oil, and in the smaller sizes of switches, where the masses of the copper conductors under oil are small, these might easily reach a temperature considerably higher than that at the surface of the oil.

Rule 16 calls for an unusual device intended to discharge the voltage rises occurring in normal service. This would probably take the form of a horn gap or non-arcing cylinders, but it could not be very reliable, and under most circumstances it would be advisable to construct the switches in such a way that their insulation should stand up to the surges in voltage.

Rule 20 is especially interesting, because it gives the relation between the normal current and the short-circuit current by which the sizes of the current-carrying parts are decided. The rated current is allowed to increase 250 times without time lag, and 150 times with inverse time lag, that is to say, it is assumed that the shortest time in which the relay will act is about 1½ seconds. The latter time is on the small side, and it would probably be safer to increase it to two seconds.

Relays with predetermined time lags independent of the intensity of the current are not much used in Germany, and this may explain the small increase of current over the normal which is allowed. This is given in the Rules by the formula $100/t$ where t is the time lag in seconds. It is not apparent why the formula $150/t$ should not be used, and assuming the author's figure of two seconds for the minimum time of action of an inverse time limit relay, the formula would then become $150 \times 2/t$. If the predetermined time limit were fixed at five seconds, then the maximum allowable permanent short-circuit current for an oil switch under these conditions would be $150 \times 2/5 = 60$ times the normal current.

Charge of Stealing.—Burnley Corporation having missed much copper wire, a watch was kept upon the electricity works. On December 15th, Wm. Denton (33), Peter Street, employed in the overhead equipment department, was seen to leave with two bags containing 145 lb. of copper and 24 lb. of brass. At the Police Court, on December 24th, a hope was expressed that the Bench would inflict a punishment which would be a deterrent to others. For accused it was explained that he had a wife and four children and an aged uncle to maintain. Prisoner was bound over.

THE IGNORANCE OF HOME OFFICE REQUIREMENTS.

By FRANK BROADBENT, M.I.E.E.

The increasing number of Home Office prosecutions of employers for non-compliance with the electricity regulations under the Factory Acts would appear to indicate either that the factory owners are not familiar with the requirements, or that they are prepared to take a sporting chance of not being found out; or, alternatively, if found out, of pleading ignorance of the law.

But how very few of us have anything beyond a very superficial knowledge of the laws which we daily incur the risk of breaking. We are prepared generally to leave it to the experts, the lawyers—to keep us right and to get us out of any scrape we may unwittingly get into, well knowing that a plea of ignorance of the law will not avail as an extenuating circumstance for breaking it.

The factory owner or employer who uses electricity for lighting or power, no doubt relies in the same way on "electrical experts," under which term he often includes anyone who sells or installs electrical apparatus.

In a recent case, in which Messrs. William Bayliss, Ltd., were fined £55 and costs for non-compliance with certain of the regulations, resulting in injury to a workman from a defective hand lamp, it was stated that "electrical experts" had seen and tested the apparatus only 14 days before the accident occurred, and that the defendant firm had been "let down" by these experts.

It would be interesting to know the qualifications of the experts who had inspected and approved a piece of apparatus, which was obviously not in accordance with the Home Office requirements, as according to the published reports the guard was in metallic connection with the lampholder, which was not earthed.

According to the reports, Mr. Ram stated that on testing the lampholder he found that the potential difference between lamp terminals and earth was 440 volts, although this was nominally a 110-volt installation. It appears that the lighting circuit is taken from a 440-volt three-phase circuit through an auto-transformer, and it was stated that the single-pole switch was, therefore, not sufficient to disconnect the lamp from the 440-volt mains. This point is not very clear, for although a single-pole switch obviously cannot disconnect two poles, if the auto-transformer were properly connected up, a single-pole switch ought to be sufficient to disconnect the lampholder terminals from the live main and reduce the pressure to earth potential. This, however, can only be done when the transformer is connected between one of the line terminals and the neutral point of the system. We then have very much the same conditions as occur in an installation connected to one side of a three-wire D.C. network. It is essential to connect the switches on the live and not on the earthed side of the system, as if placed on the earthed side, the full potential exists between the lampholder terminals and earth, even when the switch is off.

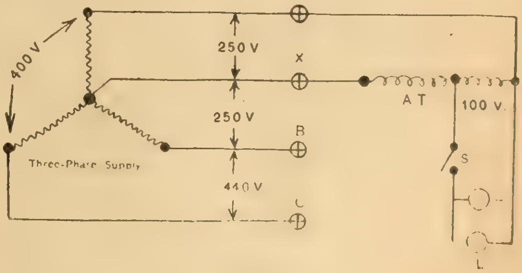


Fig. 1.

It is, however, perhaps not sufficiently appreciated that there is a right and a wrong way of connecting up an auto-transformer to an alternating-current circuit, and the two methods are shown diagrammatically in figs. 1 and 2. In fig. 1, which is the wrong method, the transformer winding is connected to one of the outers and the earthed neutral, the low-pressure tapping being taken from the outer terminal and a lower point which gives the required lamp pressure, say, 100-volts. If the lamp switches are connected to the neutral side of the circuit, it is clear that even when switched off, the lampholder terminals would show the full potential difference between the line and earth, that is to say, the full phase difference of potential, say, 250 volts. If, on the other hand, the switches are connected in the live side A, the lampholder terminals would, even when switched off, show a difference of potential of 150 volts to earth. In other words, if the phase voltage is 250 and the lamp circuit taken from the auto-transformer is 100 volts, the potential difference between the lamp terminals and earth would in the one case be 250, when switched off, and in the other case 150. The correct method is to connect up, as shown in fig. 2, in which the lamp circuit is taken off the neutral end of the transformer. If now the switches are connected up on the live side, that is the terminal nearest to the outer line, the lampholders are dead or at earth potential when switched off. Apart from factory work, there are, no doubt, quite a number of private house installations using low-voltage circuits taken through auto-transformers from public supply mains, in which the lampholders and other fittings are always subjected to a fairly high pressure when the switches are off and the wires are supposed to be dead.

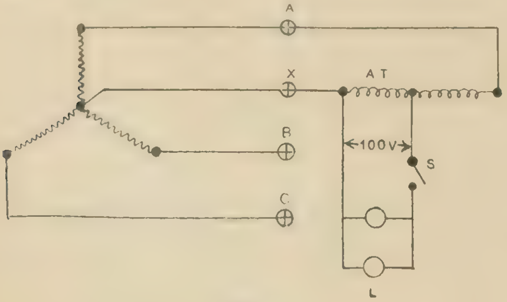


Fig. 2.

From the evidence given in the case against Messrs. Bayliss, it would appear that the lighting installation in question was taken from an auto-transformer connected up across two lines of a three-phase system, as shown in fig. 3, and not between one line and earth. Under these conditions, as Mr. Ram pointed out, it is not possible by means of a single-pole switch to disconnect the lamp terminals from the 440-volt mains, although, as mentioned above, it is difficult to understand how a P.D. of 440 volts was shown between the terminal and earth; one would suppose the P.D. to be about 250 volts assuming the neutral point of the system to be earthed. It is open to question whether or not such an installation as this should be allowed at all under the regulations, because, quite apart from the question of holders and portable hand-lamps, it is possible for an attendant to receive a serious shock from an *ordinary* lampholder or metal shade connected thereto, when taking out or replacing a lamp. Unless, therefore, the holders are either earthed or shielded, the installation does not comply with the following requirement:—

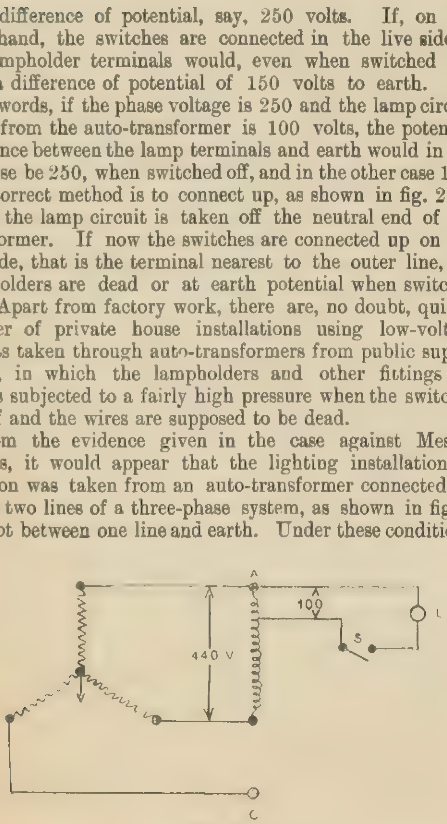


Fig. 3.

> "Where necessary to prevent danger, adequate precautions shall be taken either by earthing or by other suitable means to prevent any metal other than the conductor from becoming electrically charged."

Then as regards switch lampholders, there are patterns on the market provided with insulating covers which are supposed to meet all the regulations, and to outward appearances do so, but in some of them it is possible when metal shades are employed, as is quite common practice in factory work, for the shade to make contact with the metal body of the holder, and in this way quite neutralise the purpose of the insulating sheath. (See fig. 5.)

To revert to the question of acquaintance with the law, and in particular with the Home Office requirements, it appears to be the case that many electrical manufacturers and contractors have only a very superficial acquaintance with them. If this were not so we should not find some of our leading manufacturers advertising for sale "Home Office pattern fitttings," which are clearly not at all in conformity with the regulations. Take, for instance, the question of fuses; how often do we see the porcelain bobbin type of fuse with unprotected ends, such as is shown in fig. 4, advertised either as complying with Home Office requirements, or as suitable for power installations in factories, which is the same thing, when an examination of the rules would show that such a type is distinctly prohibited? Bearing on this, part of Regulation 5 reads as follows:—"Every fuse shall be either of such construction or so protected by a switch that the fusible metal may be readily renewed without danger." A fuse of the type shown cannot be handled without the risk of touching the live end to which the fuse wire is connected. The ordinary method of handling would be to grasp the porcelain tube in the hand and touch the live end with the thumb, whilst the other hand is resting on the earthed metal case.

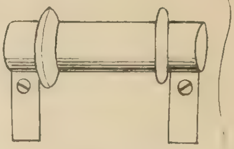
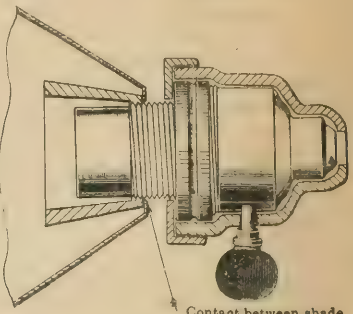


Fig 4.



Contact between shade and holder.

Fig. 5.

Not only do we find this type of fuse advertised as meeting all Home Office requirements, but it is repeatedly put forward by reputable contractors as a sample of the kind of thing they intend to use, and they seem quite amazed to learn that such samples do not comply with the Home Office conditions.

Even when manufacturers appreciate that a fuse handle should entirely shield the live contacts of the fuse, they frequently overlook the fact that metal fuse cases have to be earthed and made continuous with the conduits carrying the cables. The consequence is that a number of excellently-designed fuses are now enclosed in cast-iron cases, which are split across the centre of the cable inlet, the latter being provided with porcelain insulators to insulate the wire from the case. This is a most unsuitable type of fuse-box for a continuous piping installation, as it means that the pipes must be cut off and bushed on both sides of the fuse-box and short lengths of cable exposed between them. The fuse boxes and pipes must then be bonded together by means of an earthing wire, which may at any time be disconnected for testing and left adrift, so destroying the continuity of the piping system, and at the best it is a patchwork job.

Again, as regards enclosed switches, a large number of enclosed switches on the market have an open slot in the cover through which the switch handle operates. This is quite commonly supposed to fulfil all the requirements of the Home Office Regulations, but it is more than doubtful that it does so, as it is by no means impossible for an operator to receive a shock or burn in operating such a switch. This remark applies not only to the ordinary type of D.P. switch, but to motor-starting switches, a large number of which are provided with an open slot in the cover immediately facing the sliding resistance contacts.

The foregoing are but a few of the points to which attention might be drawn, but they are sufficient to show that there is still a great lack of appreciation on the part of manufacturers and contractors of the conditions to be fulfilled in factory work in order to fully comply with the Home Office requirements. This makes it exceedingly difficult for those whose business it is to plan and supervise such work to ensure that the conditions are fulfilled without their being stigmatised as faddists or cranks.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Antipodean Views.

I have read with interest in your issue of October 17th, under the heading of "Antipodean Views," a *résumé* of the impressions of an Englishman visiting Australia, and an Australian visiting Europe, and there are one or two matters which call for comment.

Mr. Justus Eck, whom I had the pleasure of meeting when he was here, mentions that "the Fire Underwriters' Associations when bringing in a fresh set of Electrical Rules do not permit of stocks under order, and in course of delivery being used." Such a condition of things would, as you rightly say, be a real hardship if it existed, but Mr. Eck has been wrongly advised on this matter.

The Federal Council of Underwriters (which body controls all matters, such as rules, throughout Australia) has for some years past adopted as its standard the British I.E.E. Rules with the addition of a few clauses to provide for local conditions.

Invariably a new edition is not adopted for at least six months after being issued by the British Institution, and then the rules do not come into operation for at least three months, which time is very often extended, after the date of issue. Importers, therefore, have plenty of time to get rid of existing stocks and stocks under order.

I notice that in commenting upon my contribution to the discussion upon Mr. Westwood's paper before the Victorian I.E.E., you say that my view regarding the use of railless trolley 'buses appears to be fallacious. I think your knowledge of Australian conditions and Australian roads is not very good.

Railless electric cars have not yet been tried in Victoria, and I do not think in Australia, but motor-'buses have, and are increasing in number within the city of Melbourne. As is well known, the surface of the streets in Melbourne is excellent; but in the suburbs, more especially those in the outer area, the roads, as a whole, are bad, and far too bad for 'buses or railless cars to run upon with any degree of comfort to the passengers.

Some time ago two lines of motor-'buses were put on in one of the suburbs; these cars ran for some time, but were unpopular. There was no appreciable increase in the traffic from month to month, the district did not go ahead, and the property valuations were not enhanced. Since then, upon both the routes where the motor-'buses were running, electric tramways have been built. From the time the rails were put on the road, settlement increased, the district went ahead by leaps and bounds, and property valuations went up. This improvement was marked even before the track was completed.

What has been the result of laying rails in the Caulfield district? From the time the electric tramway construction commenced the activity in building operations has been without parallel, certainly in any part of Victoria, and probably any part of Australia, and property values have increased probably 50 per cent.

The above facts seem to me to indicate that a railless system of traction is regarded as "portable," and too easily moved from one place to the other, so giving no permanence to the service; whilst, on the other hand, if the rails are nailed to the road, the general public regards the system with its resulting conveniences as being permanent, and so settles down to live in parts well out from the metropolis, and in parts that would be impossible residential areas without a fast and comfortable means of getting into the city.

Noel Murray.

Melbourne, *November 18th*, 1913.

The Lighting of Churches.

I should like to call attention to the very unsatisfactory way in which the electric light has been installed in many churches.

In some the lights are so high up that it is not easy to see average print; in others, it would seem as if when metallic-filament replaced carbon lamps the old shades were retained, the result being, as in a church I attended last Sunday, that fully half the filament is visible. It is well understood that this is bad for the eyes, yet there is no escape from it in one fitting or another.

In some churches lamps are simply strung round the columns, pointing up or down as taste directed, with no shades or screen of any kind; elsewhere iron rods stick out 4 or 5 ft. from the wall and slender cords carry pendants with three or more lights, often again without shades, or if with shades, they are very open ones.

The choir in many churches (including St. Paul's) looks like a bank with its rows of green shades, utterly out of place. I grant that the question is not an easy one in many churches, but I think better results could be obtained with a little thought and a little less reliance on the contractor, who, after all, is put in competition and naturally wants to get the work rather than to achieve an artistic result.

In new installations I would urge the full consideration of the best scheme suited to the building and invite tenders on the result; meanwhile, I would ask that lamps where the filament is seen should be replaced by obscured or semi-obscured ones.

P. Benham, A.M.Inst.C.E.

London, E.C.

Lead.

An article in your last issue under the above heading reflects a little, we are quite sure unintentionally, on statements made in our weekly "Lead Report," which you have so kindly inserted in your valuable paper.

We refer to the following remark made by the writer of the said article. "There have been rumours about of heavy quantities of lead arriving . . . , but the apprehension on this score proved to be overdrawn."

We beg to point out that from November 1st to December 15th, no less than 20,000 tons (in round numbers) arrived in the Thames, whereas in the five previous months, June to October inclusive, the total arrivals were under 47,000 tons, which conclusively proves the correctness of our statements. The result is shown by the fact that lead, which on November 10th was £20 10s. per ton, is now nearly £3 per ton lower.

Jas. Forster & Co.

London, E.C., *December 23rd*, 1913.

[Our correspondents have apparently misread our comments. The quotation given above omits an important clause. It should read: "There have been rumours about of heavy quantities of lead arriving; and *of substantial lots being put into warehouse*, but the apprehensions on this score proved to have been overdrawn." Later, in our leaderette, we remarked: "Although the arrivals of lead in London have recently been quite heavy, all the metal which came to hand was taken up easily."—Eds. E.R.]

"Rodolite" Heating Elements.

Our attention has been drawn to the letter on this subject in your current issue, and we beg to say that the references cited by your correspondents describe heating elements which differ in all essential details from our "Rodolite" glowers.

If your correspondents will publish details of the heating elements, which they say they have been using for some years, we think we shall be able to point out to them wherein the difference lies, as compared with "Rodolite" glowers, but we warn them beforehand that we are not going to be drawn into a controversy in your columns as to the respective merits or demerits of Bastian "Rodolite" glowers and these alleged similar heaters manufactured by some unknown maker.

We made a heating element of this same type ourselves early in 1910, and sold a few that year, but it is only within the last few months that we have been able to add those necessary finishing touches that go so far in differentiating between the interesting experiment and the commercial product of practical utility.

The Bastian Electric Heating Syndicate, Ltd.

C. Orme Bastian, *General Manager.*

London, W., *December* 30*th*, 1913.

Small Electric Light and Power Undertakings.

Being interested in this subject I have read Mr. H. P. Girling's article *re* the electric supply system which he has carried out at Barton-on-Humber with particular interest.

The arrangement of such installations is, in my opinion, well worth discussing, and I should therefore like to make a few friendly criticisms.

The value of Mr. Girling's article would, I venture to think, have been considerably enhanced had he given figures regarding the capital expenditure upon the component parts of the installation, including buildings, plant, battery, mains, &c.

The adoption of suction gas plant is interesting, and details as to cost of fuel, consumption per unit generated and load factor would have been of interest. There are, of course, plenty of makers' test figures available, but figures extending over a considerable period, giving fuel consumption over varying loads and including stand-by losses, are the only ones of material value. Many engineers who, like myself, are using Diesel engines, would appreciate working results obtained in this way. The results obtained with Diesel engines are, under normal circumstances, good and consistent, but, owing to the fact that the supply of fuel oil is at present practically a monopoly, and that perhaps after spending some thousands of pounds on such plant, one may be called upon to pay a prohibitive price for fuel, it is certainly desirable to obtain all the data possible concerning internal combustion plant which is not dependent upon one source for a supply of fuel.

As regards systems of supply, this is, of course, largely governed by local circumstances. The key-note, however, should be simplicity, and, bearing this point in mind, a slight additional capital expenditure may, in many cases, be warranted to secure that end. Under such circumstances the adoption of the simple two-wire system would do much to secure simplicity and reliability of operation. Such a system, with the negative pole earthed through suitable indicating and isolating devices would be extremely reliable as, should an incipient fault develop, it would become apparent at once and could be isolated and removed before serious trouble ensued.

The use of overhead work is certainly justified in rural districts, but in places where a number of services are required within a circumscribed area it is often complicated and unsightly, and the service lines themselves may cause considerable trouble. In order to avoid this it is sometimes the practice to run underground services from the nearest pole. This may, however, if carried out on an extensive scale, become expensive, the total cost being perhaps nearly as great as an underground system of distributors. Where overhead work is desirable it should be erected in a permanent manner, and it is suggested that if ordinary standard tramway insulators and trolley were used, a very satisfactory system could be erected. The difficulty of connecting new services to live mains is more apparent than real, particularly if two or three-core distributor is laid; while good modern cable, properly laid and protected, should be entirely immune from faults.

The provision of an engineer's residence adjacent to the works is very desirable. In such cases the engineer's residence should form the showroom, and if his kitchen is electrically equipped, prospective consumers could see electrical cooking carried out under practical conditions, and, if the engineer himself has a "well-fed appearance," he would constitute a walking advertisement for electrical culinary processes! The company would, of course, consider the latter point in fixing the engineer's salary.

In conclusion, I should like to congratulate Mr. Girling upon his method of starting up his gas engines, which, I am sure, is a considerable improvement upon the ordinary method of taking the starting current at full pressure from the station bus-bars.

Wm. J. U. Sowter.

Bray Electricity Works, *December* 23*rd*, 1913.

The Position of Railway Electrical Staffs.

During the past month the charge engineers in the various sub-stations on the Metropolitan Railway have been receiving leaflets from the A.S.R.S., who appear anxious to enrol them as members, and the argument on which they base their appeal is certainly sensible: also, they can see that by having the electrical staff on their side they gain a good point. If, during the last railway strike the electrical staff had gone out, this line, in particular, would have closed down for a certain time, but as it was, the electrical staff remained at their posts, and some did duty as drivers on the trains, and the drivers saw that without the electrical staff's co-operation their part of the work was very little affected.

Now as to the necessity of joining up with the A.S.R.S. At the present time we are classed with the uniform staff, but as we do not belong to the Society, we have no remedy for any grievance which may occur.

I should think it would be to the advantage of the company to place the electrical staff on the permanent staff, so that we should feel we were receiving some recognition of our existence in the scheme of the running of the Metropolitan Railway. At the present time no notice is taken of any petition we forward to the powers that be.

The majority of the staff agree that the A.S.R.S. have got us in our weak spot, and we cannot dispute their argument as stated, that we are treated as non-existent.

It now remains with the whole of the electrical staff to consider their position, and whether it would not be to their advantage to join up with the A.S.R.S., and so give what help they can to their brothers of the uniform staff.

Nemo.

Co-operative Electricity Supply.

During the leisure of the holidays, I have been much interested in Mr. Seabrook's letter on the above subject.

I am amazed to find such fallacious criticism of Mr. Chattock's proposals from one who has shown in his recent lectures that he holds quite sensible views on some of the minutiæ of business enterprise.

It seems as if the kinetics of his personality are a little uncontrolled when he enters the field of broad generalisation. He evidently thinks that the epithet of Socialism or Communism (which he incorrectly uses as a synonym) is crushing and final when applied to a proposal in itself sane and reasonable. A definition of this kind may influence a nervous old lady, but a thoughtful business man, above all an engineer, should not be alarmed, even if an attempt be made to identify a progressive policy with a word of traditional, if unmerited, opprobrium.

The proposition to nationalise the production of electric energy is not novel to those who follow the progress of modern thought, to even a limited extent.

Mr. Seabrook's fallacy is quite transparent in his apparently reasoned consequences from such unsupported assertions as, that nationalisation connotes "extinction of individual initiative," or that it connotes the negation of "working for reward in some shape or form."

Again, Mr. Chattock's argument was not that "because railways should be nationalised so ought electric supply." He associates the proposals as desirable, and says rightly that there is justification for considering both of them.

Mr. Seabrook's logic, with immense agility, overrides all argument, and without a vestige of proof states the direct negative!

His illustration in doubtful support of nationalised railways is singular. Does a man of his business experience suggest that military requirements should influence our ordinary railway administration more than they do to-day? If so, unlike the normal business man he attaches undue importance to risks that are remotely improbable.

I am glad to find one statement in Mr. Seabrook's letter that displays an intelligent anticipation of Social advancement. He says: "I believe strongly in altruism in business"; yes, I agree. The only obstacles to its speedier development are inertia and ignorance of what it implies.

The answer to Mr. Seabrook's fears of nationalisation may best be given in the words of Mr. H. G. Wells. Concerning the ideal State of the future, he says: "Whatever other types of property may exist, all natural sources of power, and, indeed, all natural products, coal, water, and the like, are inalienably vested in the local authorities, which will be the universal landowners and will probably control areas as large sometimes as half England. They will generate electricity by water power, by combustion, by wind or tide, or whatever other natural force is available, and this electricity will be devoted, some of it to the authority's lighting, and other public works, some of it as a subsidy to the world State authority, which controls the great railways and other apparatus of world communication, and the rest will pass on to distributing companies at a uniform fixed rate for lighting, heating and industrial purposes." The value of this ideal will be apparent to any thoughtful engineer. The conservation of the exhaustible natural resources of power, such as fuel, and the administration of the natural monopoly created by the establishment of the "universal-electric" age (in which we all believe) must desirably be undertaken by the State.

I hope Mr. Seabrook overlooks the question of land ownership, referred to in the quotation above, lest he should conjure up from it seven devils worse than the one of nationalised electricity. I have no doubt, however, that he would cheerfully proceed to exorcise them with the same facility and heartiness as he exemplifies with the bogey he has constructed out of Mr. Chattock's proposal.

Alban.

December 29th, 1913.

[Other correspondents who wish to express their views on this matter are requested to keep strictly to the subject, as we cannot afford space for a discussion on the merits of Socialism or Communism *per se.*—Eds. Elec. Rev.]

Electric Clocks.

Your correspondents appear to admit the truth of the Synchronome principles and that they have never been attacked. The difference of opinion is as to how far they may be ignored.

The champions of the two systems which transgress most of them give some plausible excuse with respect to one item, viz., the storage of power into a pendulum by the Hipp-Foucault method, and taking it out in contact-making energy. Their justification of this is attempted only with respect to time-keeping for ordinary purposes, and it cannot be too clearly understood by all those who seek for the highest precision of time measurement that such tricks cannot be played with a pendulum with impunity. The resulting errors would altogether submerge numerous refinements of astronomical observatory clocks, such as barometric compensation. I admit that these considerations do not apply to commercial purposes. The other matters I named are of more importance.

The community owe much to all who are exploiting simple systems of electrical impulse dials, and we cannot have too many if they are reasonably accurate and reliable. But it is just 75 years since the first system appeared, and a critical comparative survey of the hundreds of inventions produced in that period, mostly blunders, rubs in the lesson that only those which keep the rules can hope to survive.

Time is the only test of systems of time-keeping, and this reflection should put heart into all those who are striving to sell the best science with simple and reliable systems at the lowest possible price.

F. Hope-Jones, M.I.E.E.

London, W.,
December 29th, 1913.

Concerning a Review.

After reading your reviewer's reply to my complaint, I am no longer surprised at the nature of the review.

I made no complaint about the size of the book at the price, nor did I say that I bought it on the strength of a review. It is small justification for the reviewer to say in answer to my letter: "You cannot expect much for a shilling," and to point to another review as careless as his own. I was quite unaware that such are the lines reviewers work on.

The errors in the book are neither few nor, for anyone not thoroughly familiar with the plant, &c., illustrated in the diagrams, easy of correction. If the incorrect and misleading parts of the book are eliminated from the contents, the proportion of reliable matter remaining will be far below the usual.

I am not familiar with the courses of instruction in kindergarten schools; perhaps it is in such institutions that the seeds are sown of that carelessness and inattention to detail which are sometimes displayed in reviews.

The last paragraph but one of my last letter is only plain spoken. Is not the phrase "gratuitous insult" becoming hackneyed through continued use by people who object to have their errors pointed out to them?

I do not see why it should be a novelty for a buyer to criticise a review. As I said before, I take it that reviews are written for their guidance, not for the edification or otherwise of the authors.

R. Rankin.

Ilford, *December 29th*, 1913.

Association of Mining Electrical Engineers.

With respect to the correspondence in your columns on the above, I had not intended to associate myself with it, but as you make allusions to your view being backed up by one of those connected with the Association in its infancy, and who is now a leading official of one of the branches, I must take this opportunity of assuring those of your readers who are members of the above Association that I, personally, am not the person referred to, as I happen to fill the bill in both cases.

Referring to the notes by "F. W. A." (December 19th, 1913), he evidently seems imbued with a peak-load of self-conceit in his remark that there is not a member of "that illustrious body in a position" to "slate" your review, and further, if what he says in his second paragraph *is* correct, I am sorry for his short memory as to the subscription fees.

His principles, like those of his fellow commercial, must be of very low insulation value to take advantage of the lack of technical knowledge of his customers, no matter who they may be. He certainly does well to conclude his remarks under initials, and, like "Nemo, London," seek to hide himself, like the little boys who hide round the corners when snowballing.

J. Glynn Williams.

Cwmgwrach.

Smoke Nuisance.—The Guildford Electricity Supply Co., Ltd., was last month fined £3 in respect of black smoke nuisance, and was ordered to abate the nuisance within 14 days. Last June the company was fined £2 for a similar offence, and ordered to abate the nuisance, but, according to the Town Clerk, this order was not complied with. The present proceedings related to two days in November and two in December.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

An Alba Fitting.

The accompanying illustration (fig. 1) shows one of the Alba fittings which were specially designed by the British Thomson-Houston Co. for the Balham Palladium. This fitting, which is of Adams design, consists of a heavy chased corona suspended by four chains. Inside the corona is fixed a 16-in. Alba glass sphere, and from each of the arms depends a 6-in. ball. One 200-watt and four 60-watt Mazda lamps are used in each fitting. The metalwork of the fitting is of polished brass; its overall length is 4 ft., and its diameter 2 ft. 6 in. It affords a good example of the combination of efficiency and beauty in the design of lighting appliances.

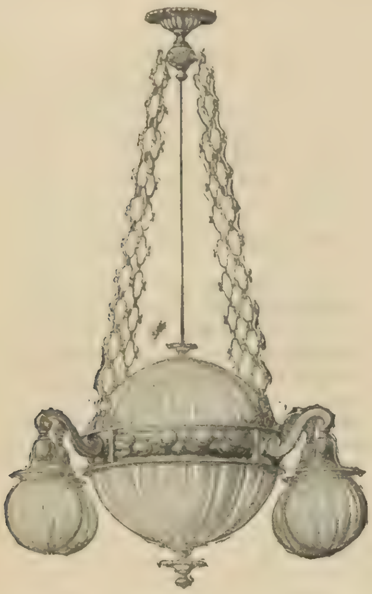


Fig. 1.—B.T.H. Alba Fitting, with Alba Glass Spheres and Mazda Lamps.

Portable Meter-Testing Resistance.

Since the introduction of low candle-power high-efficiency lamps, the importance of meter accuracy on small loads has increased greatly, and it is now a common practice to determine whether 8 or 10 watts will start a meter which, in the days of the carbon lamp, would have been considered quite satisfactory if it started at 30 or 35 watts. With a view to facilitating and rendering more accurate starting-load and light-load *in situ* tests on meters, Messrs. Ruhstrat Bros. (Göttingen) have placed on the market the pocket testing rheostat, illustrated in fig. 2. A suitable resistance—partly ballast and partly variable—is contained within a ventilated housing, on the top plate of which connecting terminals are provided. The resistance in circuit is varied by the central slider rod, the stem of which is calibrated to show the watts consumption corresponding to various settings, assuming a supply voltage of 110 or 220 volts as the case may be. In the 10 to 100-watt rheostat, the ballast resistance is 500 ohms and the regulable resistance 2,000 ohms; and in the 5 to 50 watts and 2½ to 50 watts rheostats, the ballast resistance is 1,000 ohms and the regulable resistances 4,000 ohms and 8,000 ohms respectively. The resistances are designed for five minutes' continuous service, but are not damaged if left longer in service; the exact starting load (in watts) of a meter may be read from the slider stem, or the meter accuracy may be tested at any desired load within the range of the rheostat (which is connected across the special test terminals provided on modern meters). This apparatus, which is equally suitable for use with D.C. or A.C. meters, measures 6½ × 4¾ × 1½ in. overall and weighs about 1 lb.—*E.T.Z.*

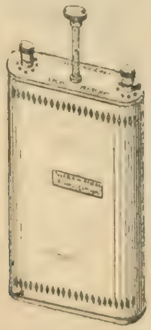
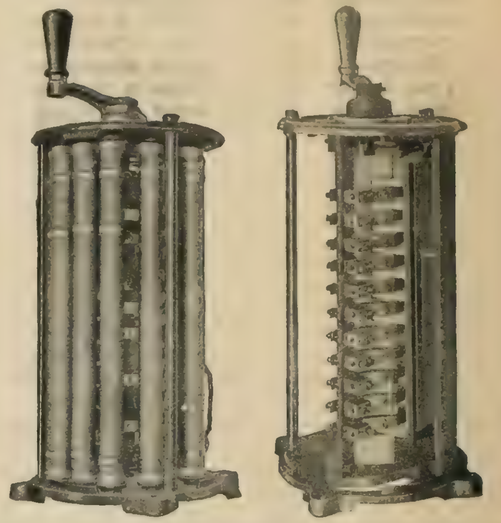


Fig. 2.—Pocket Testing Rheostat.

G.E.C. Controller with Self-Contained Resistances.

For the purpose of controlling small cranes and for installing in situations where space is at a premium, The General Electric Co., Ltd., of Witton, and 67, Queen Victoria Street, E.C., &c., have designed a form of controller in which the resistances are contained inside the controller case itself. In general, it may be said that this controller is a miniature edition of the larger sizes of G.E.C. controller, with the exception that it includes the resistances. The controller is circular in plan, and the resistances are fixed inside the controller casing, well away from the arcing parts. They are carried on insulating tubes threaded on vertical steel conduits, which are insulated from the case by means of porcelain insulators. If desired, the resistances can be supplied separately, in which case they are mounted in a separate protected frame, which can be placed any distance away from the controller. The design of the controller, however, is such that the inclusion of the resistances inside the controller is thoroughly satisfactory.



Figs. 3 and 4.—G.E.C. Controller: Interior, with and without Resistances.

"Meteor" Electric Sign.

A remarkable novelty in electric signs has been brought to our notice by the Meteor Manufacturing Co., of 98, Tollington Park, London, N. It consists simply of a sheet of plate glass, with the letters forming the announcement etched on the back slightly below the surface; tube lamps at the top and bottom, contained within the tubular frame, illuminate the interior of the glass plate, and the light reflected from the rough surfaces of the

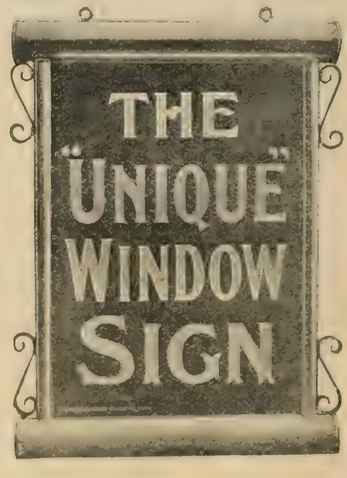


Fig. 5.—Meteor Electric Sign.

letters makes them shine out in a most striking and mysterious manner. The light passes into the plate through slits in the brass tubes, and is confined entirely to the substance of the plate. By using a white lamp at the top, and a ruby one at the bottom, a pleasant gradation of tints is produced, and if the lamps are connected to a flashing device a succession of varying colour effects results. The letters are bordered with black and gold, within which they appear white in daylight, the rest of the plate being quite transparent. The frame is of brass tube, with ornamental scrolls, producing a handsome appearance, and the signs are standardised in four sizes, with, of course, any lettering that may be desired. The lamps take only 17 watts each, so that the largest size, using six lamps, consumes 102 watts and the smallest 34 watts. Connection is made by a plug adapter and flexible with any bayonet socket. We understand that the sign, though only recently introduced, is already very popular, and certainly it is one of the best that we have seen as yet.

PHYSICAL SOCIETY EXHIBITION.

(*Continued from Vol. 73, page 1032.*)

Robt. W. Paul.

This exhibit included a number of new instruments, ranging over almost the whole field of electrical measurement. Among those for the accurate measurement of resistances, a simple form of Kelvin bridge suitable for measuring resistances from 1 ohm down to a few microhms may be described. Earlier forms of the Kelvin bridge were provided with high resistance ratios, each set being controlled by a plug switch. In the present instrument (fig 5) the resistance of the ratios is considerably reduced, so that higher sensitivity is attained, and they are connected to a double-pole switch, the pointer of which indicates directly the multiplier to be applied. The standard resistance consists of a slide-wire, with extensions connected to plug blocks; the slider is of novel construction, contact being made on the slide wire and on a copper rail by a copper roller, one end of which has a V-groove running on the slide wire, and the other a slightly curved contour running on the copper rail. On account of the difference in diameter of the two ends, a rubbing contact is obtained, a suitable pressure being applied by a spring in the slider. The Kelvin bridge, which is probably the best means known for measuring low resistances, such as those of copper bars or steel rails, and for standardising shunts, should come into more general use now that a convenient model is available.

A standard bridge, designed by Dr. C. V. Drysdale, for the comparison of standard resistances to one part in one million, and a modified Kelvin bridge, devised by Mr. S. W. Melsom, of the National Physical Laboratory, for the rapid comparison of ammeter shunts, were also shown.

In our notice of the last exhibition we described a resistance bridge in which the readings were given in a straight line of figures like those of a cyclometer dial; Mr. Paul has applied a similar system to the construction of a vernier potentiometer, in which no slide wire is used, the readings being given directly on a series of such dials. A simple portable potentiometer suitable for voltmeter calibration was also demonstrated (fig. 6). This potentiometer requires no accumulator or other external source of current, and reads directly in steps of 0·1 volt from 2 to 800 volts. A standard cell is contained in the potentiometer, and this very compact outfit is completed by a sensitive Unipivot galvanometer. The latter may take the form of a millivoltmeter, with shunts, so that ammeters as well as voltmeters can be standardised.

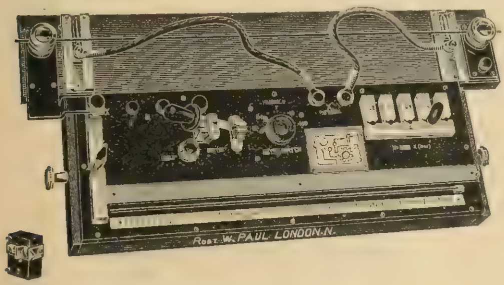


Fig. 5.—Kelvin Bridge.

For alternating-current measurements, the Duddell-Mather wattmeter is a recognised standard. This instrument has been redesigned with a view to overcoming the small change in sensitivity caused in the earlier forms by the warmth of the current coils acting upon the control spring. The latter is now placed in a separate compartment, open to the outer air. One of these wattmeters, with plugboard, suitable for 1,000 amperes, was exhibited.

Portable sub-standard instruments of the Irwin astatic pattern were shown; these are entirely unaffected by external fields, and give remarkably dead-beat and quick indications.

We illustrate a frequency meter designed by Mr. L. W. Wild, of the Westminster Testing Laboratory (fig. 7). With this instrument, frequencies between 10 and 500 per second are read directly on a scale, instead of in steps. The indications are independent of voltage variations, provided they do not exceed ± 20 per cent. Two laminated magnets, respectively of high and low inductance, provide magnetic fields which tend to move an aluminium vane in opposite directions, the position of equilibrium depending on the frequency alone. A choking coil damps out any harmonics which may be present, and renders the instrument independent of variations of wave form.

Several new forms of Unipivot galvanometer were exhibited, including a modification in which an extremely high sensitivity is attained; pointer instruments are now constructed to give a full scale deflection for 5 microamperes or 0·3 millivolt.

Among instruments for radiotelegraphic measurements was an improved thermal device, consisting of a heater through which a high-frequency current can be passed, and ten thermo-junctions, the tips of which are near the heater. With this device, currents down to a small fraction of a milliampere are readily measured on a sensitive moving-coil galvanometer, and the errors, liable to occur in high-frequency measurements when using a thermo-junction in contact with the heater, are entirely eliminated. For telephonic measurements a convenient source of current has been devised, called a Kumagen, which can be adjusted to give any frequency from 80 to 2,000 periods per second, and an output sufficient for all ordinary measurements. This portable generator is at present in use, in connection with a modified form of Max Wien capacity bridge, for testing telephone cables after laying. Several improved patterns of fixed and variable condensers for oil or air dielectric were shown, included shielded types.

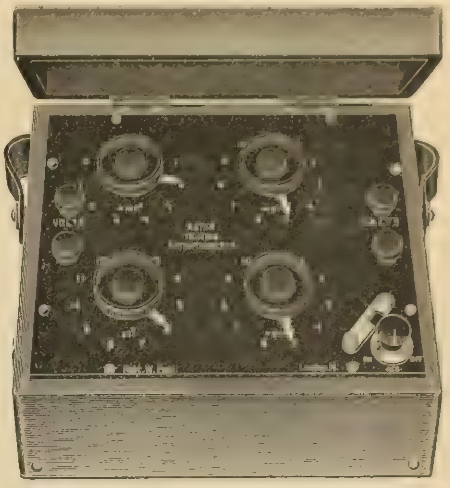


Fig. 6.—Portable Potentiometer.

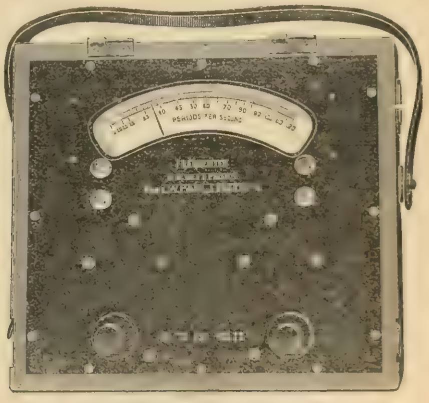


Fig. 7.—Frequency Meter.

Thermocouples and resistance thermometers for measuring the temperature of electrical plant, superheaters and so forth, were shown in considerable variety.

A series of simple and robust instruments for the college laboratory have been produced. They include an improved form of magnetometer with air damping, together with accessories for putting the magnetometer to a variety of uses. An ingenious magnetic balance was demonstrated; it provides a simple means for determining the strength of a magnet pole, and thereafter measuring current in absolute units by the attraction on that pole. The instrument is so designed that the action is limited to one pole of each magnet, the complications introduced in the ordinary balance by the interaction of the remaining poles being entirely eliminated.

Crompton & Co., Ltd.

In addition to a variety of small and large moving-coil and moving-iron instruments, portable testing sets, &c., Messrs. Crompton & Co. showed several new instruments. One of these was a portable voltmeter fitted in a strong oak case for portable use, with scale 6 in. long, and provided with a mirror for accurate reading. The movement is of the dead-beat moving-coil type, and is magnetically shielded. It is designed to give five ranges with a maximum of 600 volts, and is fitted with a switch by which the range may be changed. The switch contacts are contained inside the case, and are thus protected. A contact key is fitted, and also a zero-adjusting device operated from the outside.

A battery testing voltmeter was exhibited of the moving-coil type, dead beat, and of high resistance, in a case. The instrument is fitted with a handle, and contact is made by means of two spikes, one fixed to the instrument, and one held in the hand and connected to the instrument by a flexible lead. A Crompton potentiometer complete, with a set of accessory apparatus, was shown.

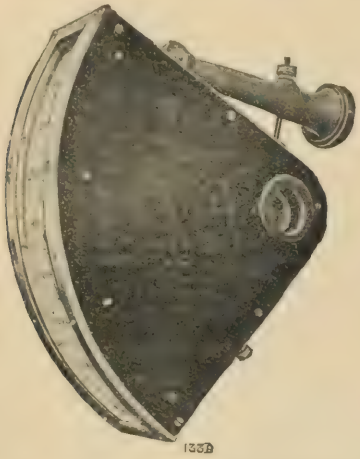


Fig. 8.—Crompton Edgewise Ammeter.

We illustrate in fig. 8 one of the firm's edgewise D.C. switchboard instruments of the moving-coil type, with dead-beat action, magnetically shielded, and with an evenly divided scale. Moving-iron instruments of similar pattern are made, as well as round and sector types.

John J. Griffin & Sons, Ltd.

The most noteworthy electrical feature of this exhibit was an electric hot-plate with automatic temperature regulation, for use in chemical laboratories. The plate is constructed of aluminium, which offers great resistance to acid fumes, and has a removable top which, when placed over the heating surface, forms a hot-air chamber about 2 in. deep. The heating elements are of a special flat design, made of nichrome foil, and the heating surface attains a maximum temperature of about 250° C. The temperature of the plate can be set at any desired degree up to this limit by turning a contact screw (*a* in fig. 10), the head of which is divided into five intervals each representing 10° C.; the brass tube *b* is divided into five parts each corresponding to 50° C., and thus any desired temperature can be reproduced exactly when needed. The action of the regulator depends upon the difference in expansion between the hot-plate and a nickel-steel rod attached to it; the free end of the rod *h* engages with a disk *e*, which is pivoted about two short pins *g* attached to the hot-plate. A brass strip *d* fixed to the disk carries a platinum contact opposite the platinum-tipped point *c* of the regulating screw. When the plate expands contact is made between *c* and *d*, and a small current derived from the mains actuates a relay (seen in fig. 9), tipping a mercury switch which cuts off the heating current. When the plate cools so far that the contact is broken, the heating current is restored. By this system of control the temperature is kept very uniform, the regulator being independent of fluctuations in the voltage of the supply and of atmospheric conditions; and no part of the electrical energy is wasted in regulating resistances. The mercury switch is made of quartz glass, and the relay current is very small, so that the platinum points are not burned by the make and break. Signal lamps are provided to show what is going on.

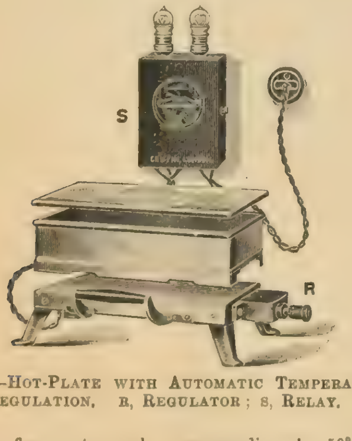


Fig. 9.—Hot-Plate with Automatic Temperature Regulation. R, Regulator; S, Relay.

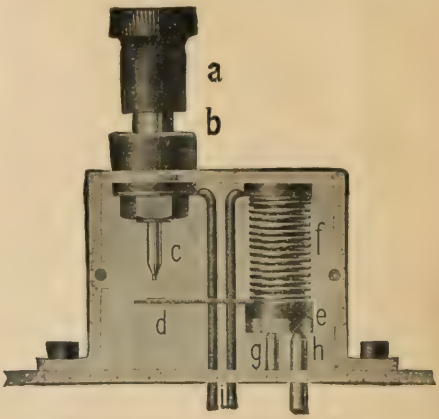


Fig. 10.—Details of Regulator.

The Synchronome Co., Ltd.

The Synchronome system of electric clocks was represented, as usual, by a large group of electrical impulse dials, operated every half-minute by a self-wound electrical time transmitter. In recent years the Synchronome Co., Ltd., under the general direction of Mr. Hope-Jones, has aimed at the attainment of the most accurate time measurement, and the electrically-driven pendulum exhibited was one of their latest astronomical regulators, enclosed in a glass cylinder between substantial iron castings. The ordinary high-grade Observatory clock of to-day has contacts applied to its pendulum, or to its delicate wheelwork, for the purpose of operating chronographs, &c. These are apt to be unreliable, and are detrimental to good time-keeping. Moreover, such clocks have to be wound up weekly, and where the case is really air-tight, in order to elude the barometric error, a stuffing-box is necessary for the winding-key.

These difficulties are overcome in the instrument exhibited. The Synchronome self-winding action is in the form of the "Inertia" escapement of Mr. W. H. Shortt, and the clock combines the advantages of a precision timekeeper with a switching operation which can be absolutely relied upon for the synchronous propulsion of secondary dials.

(*To be continued.*)

BUSINESS NOTES.

Whist Drive.—A whist drive and dance was held last week at the Bentley Parish Rooms, Bentley, in connection with the Football Club of Messrs. Rhodes Motors, Ltd., of Bentley. Prizes were given by Mr. Axeworth (manager), Mr. Pearson (stores manager), Mr. J. Codd, Mr. H. Nelson, and members of the team. Mr. H. Mason acted as M.C. at the whist drive, and, along with Mr. H. Gascoigne, fulfilled the same duties at the dance.

Bankruptcy Proceedings. — Frank West Suter, electrical and general engineer, residing at 67, St. John's Park, Upper Holloway.—Under a receiving order the first meeting of creditors was held on Tuesday at the London Bankruptcy Court. Mr. Egerton S. Grey, Official Receiver, reported that the debtor had lodged a statement of affairs showing unsecured liabilities £6,417, and no assets whatever. It appeared from the debtor's statements that he commenced business some 23 years ago in partnership with another person as electrical and general engineers at 276, Strand, W.C., removing later to 66, Berners Street, W. In 1895 they sold the business to a limited liability company, of which the debtor acted as managing director at a salary reaching a maximum of £350 per annum. Some years ago, on the sale of the company's business, the debtor was held to be liable for £6,175 under guarantees given by him to certain of the debenture-holders; those liabilities constituted his present indebtedness, and to them the failure was entirely ascribed. He was now in employment. In the absence of any proposal the case was left in the hands of the Official Receiver, to be wound up in bankruptcy.

W. H. DAVIS (lately trading as the General Incandescent Fittings Co.), Birmingham. January 7th, 1914, is the last day for the receipt of proofs for dividend by the Official Receiver, Mr. A. S. Cully, Ruskin Chambers, 191, Corporation Street, Birmingham.

CHAS. BLAKE (trading as the Bilston Electrical Co.), electrical engineer, Bilston, Stafford. First meeting was held December 31st, 1913, at the Official Receiver's office, 30, Lichfield Street, Wolverhampton; public examination takes place on January 21st, at the County Court, Wolverhampton.

WAKELIN BROS., LTD., 7, Tottenham Street, W.C.—A first and final dividend of 7½d. in the £ was payable December 31st, at 3, Fenchurch Street, E.C.

Water Softener Firms Amalgamate.—It is announced that arrangements have been concluded under which the two concerns of Lassen & Hjort, and Water Softeners, Ltd., will henceforth operate in the British Isles as a joint concern under the title of UNITED WATER SOFTENERS, LTD. Messrs. Lassen & Hjort are the patentees of a system of softening water by means of lime and soda, whilst Messrs. Water Softeners, Ltd., are the proprietors of the recently introduced "Permutit" regenerative process. The two processes are, in a very large number of cases, essential complements one of the other in order to secure the best results. The management of the new company will be in precisely the same hands as was that of the two original concerns, and pending the acquisition of new and more commodious offices, in which both staffs will be brought together under one roof, the business of the new company will be carried on jointly at the existing offices of the two concerns.

Australian Contract Specifications.—The Commercial Intelligence Branch of the Board of Trade has received from the office of the High Commissioner in London for the Commonwealth of Australia, copies of standard specifications for certain supplies which may from time to time be required by the Commonwealth Postmaster-General's Department, as follows:—Tinned copper wire, rubber-insulated and braided (Specification No. 486); tinned copper wire, silk insulated and cotton-covered (Specification No. 487); portable direct-coupled internal combustion engine and dynamo (Specification No. 489); galvanised iron cable terminal (Specification No. 491); electric clocks (Specification No. 492); cast-iron cable distributing box (Specification No. 493); paper-insulated lead-covered cable (Specification No. 494). These specifications may be seen by United Kingdom manufacturers at the C.I. Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

Theatre Installations.—At the new Golder's Green Hippodrome, which was opened on Boxing Day, MESSRS T. W. VAUGHAN & CO., LTD., of Islington, carried out the whole of the electric lighting work, including the stage, battens, transformers, motor generator, &c., also the fireproof curtain, fire hydrant, &c. The same firm have lately carried out cinema electrical installations at Hither Green, Wood Green, and several other places.

Catalogues and Lists.—MESSRS. MANLEY & SANDY, LTD., Caledonia Street, King's Cross, London.—8-page list illustrating the M. & S. miners' patent electric gas detector safety lamp, also equipments for lamp cabins.

MESSRS. BEST & LLOYD, LTD., Cambray Works, Handsworth, Birmingham.—List No. 106 describes and gives prices of the "Robj" cigar lighter and pillar lamp combined.

THE ELECTRICAL SUPPLIES CO., 41, Cheapside, London, E.C.—New net trade and export price leaflet of wires and cables, bell wires, flexible cords, &c.

MESSRS. T. W. BROADBENT, LTD., East Parade, Huddersfield.—New leaflet dealing with, and giving prices of, direct-coupled continuous-current generators of sizes ranging from 100 up to 500 KW. Copies will be sent on application.

Annual Dinners.—The Telac 20 Club, in connection with the officials of Messrs. J. H. Tucker & Co., electrical accessories manufacturers, Birmingham, held their second annual dinner at Ye Olde Royal Hotel. The president, Mr. J. H. Tucker, was in the chair, and in replying to the toast of "Our President," he expressed his appreciation of the objects of the club, and his wishes for its continued success. A smoking concert, arranged by Mr. H. Rodgers, followed, in which the following artistes were enthusiastically received:—Miss Evelyn Hollister, Mr. William Gumbley, Mr. Frank Knight, Mr. Arthur Riches, Mr. Gordon H. Haines. The menu card was cleverly designed by Mr. J. A. Crabtree, and the general arrangements were carried out by Mr. A. O. Davis, the hon. secretary.

The annual staff dinner of the Musselburgh and District Tramways Co. was held on December 22nd, Mr. C. W. Bentley, resident engineer and tramway manager, presiding over a company numbering 40. Those present included Bailie Constable and Mr. Watson, the commercial manager. Mr. Bentley read a letter from Mr. Cownie, a director of the company, and he followed with references to the Staff Recreation Club. Bailie Constable proposed the toast, "The Company," and Mr. Robb, electrician, seconded, Mr. Watson responding. A musical programme followed.

On Saturday, December 20th, Mr. Duncan Watson presided at the annual dinner of his firm—Duncan Watson & Co., of Berners Street, W.—held at the Frascati. Some 120 gentlemen were present, including Alderman Penton, ex-Mayor of Marylebone, Councillor Captain Ramsden, the borough electrical engineers of Poplar, Hackney and Hampstead, &c. In proposing the toast, "Staff and Employés," Mr. Watson took advantage of the opportunity of giving an imposing list of electrical installation contracts that had been carried out during the year for lords and ladies, mansions and missions churches and picture theatres, hospitals and warehouses. Mr. Puller replied on behalf of the staff, and Mr. Rawlinson for the men. The latter alluded to the "little trouble in the electrical world with regard to Trade Unionism," hoping that it would terminate to the satisfaction of all concerned. He referred also to the fact that the firm had always paid the full recognised rate of wages, and said that employment under Mr. Watson was congenial, many of the men present having been with the firm for 10 or more years out of the 18 of its existence. Mr. Blythem, chief-of-staff, proposed "The Visitors," and three gentlemen having replied, Alderman Penton proposed "The Chairman." This was received with great heartiness. The proceedings were interspersed with music and song.

Lead in 1913.—In the course of their report on the movements in lead during the year 1913, MESSRS. JAMES FORSTER AND CO. say that the continued scarcity which has run over nearly two years has been due entirely to the great consumption of lead for electrical work all over the world, which year by year increases, and which undoubtedly will increase for a long time to come. "The 'boom' in electrical consumption appears to have exhausted itself for the time being, and the reports from America and Germany are to the effect that of late there has been a considerable falling off in trade, with a consequent easing of the position, which is exemplified in a very considerable increase in arrivals on this market. . . . . . The future of the market depends largely on the requirements of the electrical trade, and we have little doubt that after a period of dulness of probably limited duration we shall have a renewal of activity."

Trade Announcements.—MESSRS. GEORGE ELLISON, of Birmingham, announce that they have opened a branch office at 4, Cannon Street, Manchester, to deal with their Lancashire and Yorkshire business. The branch will be under the management of Mr. W. A. Kirkham, who will have at his disposal a staff of assistants capable of dealing with any inquiries for switchgear in these areas. To relieve the pressure on the estimating staff at the Birmingham head offices, clients in the two counties referred to are asked to forward their inquiries to the branch office.

Premises at 2, Chester Road, Macclesfield, have been opened by MESSRS. J. H. RIGBY & CO., electrical engineers and contractors.

During January MESSRS. NALDER BROS. & THOMPSON, LTD., will be moving into much larger works at 97A, Dalston Lane, Dalston, N.E., which they are fitting out on up-to-date lines. The works are within easy access of the city, only five minutes' walk from Dalston station on the N.L. Railway.

Mr. H. G. W. Haslett, who has been connected with the electrical trade for the last 15 years, a considerable portion of the time being with Messrs. Krupka & Jacoby, Ltd., informs us that he has entered into partnership with MESSRS. RALPH H. HAYLOCK & SON, mechanical and electrical engineers, 63, Queen Victoria Street, E.C.

THE BRITISH ECONOMICAL LAMP CO., LTD., have removed from 9, Old Bailey, to Windsor House, Kingsway, W.C., where they have taken ground floor and basement premises. The showroom of electrical fittings and accessories will be ready in a few days for inspection by the trade.

Book Notices. — Hazell's Annual, 1914. London: Hazell, Watson & Viney, Ltd. 3s. 6d. net.—This hardy annual has now reached its twenty-ninth edition. Its front cover describes it as "the one book of reference indispensable for every one." Its contents have been revised to November 25th, and under the editorship of Mr. T. A. Ingram, M.A., &c., every effort has been made to ensure its being a faithful record of the movements of the time. Our own experience is that we are so intent on living that we soon forget many of the important events even of a year, and it is only in preparing or reading reviews of such a period that one gets anything like a true idea of how much happens in a little time. *Hazell* is a summary of the present position of all sorts of subjects—religious, social, scientific, industrial, political and so forth. There is a review of "Engineering Schemes and Problems in 1913," and the usual section on electric supply—(a printer's error gives the Willesden station the first *Ljanstrom* (!) turbine put down in this country)—while we also casually notice one on cables and wireless telegraphy, including a map of the Imperial wireless scheme.

Whitaker's Almanack, 1914. 2s. 6d.; and *Whitaker's Peerage, Baronetage, Knightage and Companionage*, 1914. 5s. London: J. Whitaker & Sons, Ltd.—None of us can afford to be long without our *Whitaker* at hand. It has made a place for itself that no other work can fill. For the reader it is sufficient to be informed that the new edition of the work is "out" and that many of the sections have been extended and new ones added, the latter including the provisions of the Home Rule Bill and an article on Cable and Wireless Telegraphy. The second of these volumes, the *Peerage*, is alphabetically arranged throughout, and is a most useful volume for all who ever have to search for information respecting those upon whom birth or bestowed honours have conferred titular distinction.

Gas Works Directory and Statistics, 1913-14. London: Hazell, Watson & Viney, Ltd. 10s. 6d. net.—This directory, which was issued two or three months ago, and should have been reviewed before, has been revised up to August, 1913. It contains information, in a useful form, respecting gas works at home and abroad, and a general index of officials connected therewith.

Colliery Manager's Pocket-Book, Almanac and Diary for 1914. Edited by H. Greenwell. London: *Colliery Guardian* Co., Ltd. Price 2s.—This, the forty-fifth edition of this annual, contains the whole of the numerous Acts and Regulations relating to British coal-mining, accompanied by a host of statistics and data on all subjects that come within the manager's purview. Apart from the official regulations and memoranda, only a few pages are devoted to electrical notes, and in view of the important part played by electricity in the colliery nowadays, this section appears to us to be quite inadequate. As the manager is the official responsible to the law for the efficiency of the electrical department, we imagine that he will need a great deal more information on the subject than is here provided, though the rest of the book is an almost inexhaustible store of useful information.

"*Journal* of the Institution of Municipal Engineers." Vol. V, No. 18. November, 1913. London: The Institution. Price 1s.

"*Journal* of the United States Artillery." Vol. XL, No. 3. November-December, 1913. Fort Monroe, Va.: The Coast Artillery School Press.

"*Boletin* de le Sociedad de Fomento Fabril." Vol. XXX, No. 11. Santiago de Chile: The Society.

"Annual Report of the East Africa Protectorate for the Year 1912-13." By F W. Major. Mombasa: The Customs Department.

"Anleitung zum bau Elektrischer Haustelegraphen-Telephon, Kontroll und Blitzableiter-Anlagen." Edited by Akt.-Ges. Mix and Genest. 1914. Berlin: A. Seydel.

"Soft Soldering, Hard Soldering and Brazing." By James F. Hobart. Price 4s. net. "Transmission Line Formulas for Electrical Engineers and Engineering Students." By H. B. Dwight. Price 8s. 6d. net. 1913. London: Constable & Co.

"Fowler's Mechanical Engineer's Pocket-Book, 1914." Price 1s. 6d. net. "Fowler's Mechanics' and Machinists' Pocket-Book and Diary, 1914." Price 6d. net. Manchester: Scientific Publishing Co

"Celluloid Dangers—with some Suggestions." By D. W. Wood. 1913. London: British Fire Prevention Committee. Price 2s. 6d.

"Electrical Engineers' Diary, 1914." London: S. Davis & Co. Price 3s. 6d.

"Examinations in Science and Technology, 1913." London: Wyman & Sons, Ltd. Price 9d.

"*Transactions* of the Illuminating Engineering Society." Vol. VIII, No. 8. November, 1913. New York: The Society. Price 75 cents.

"*Memoirs* of the College of Science and Engineering, Kyoto Imperial University." Vol. 5, No. 8. October, 1913. Kyoto, Japan: The College.

"*Boletin* de Ingenieros." Vol. IV, No. 3. November 16th, 1913. Mexico: Secretaria de Guerra y Marina.

Calendars and Diaries.—The Armorduct Manufacturing Co., Ltd., of Farringdon Avenue, London, E.C., have issued to users of their perpetual desk calendar a set of refill engagement slips for 1914, to take the place of the record of 1913 just removed.

From Mr. John Whitelaw, 15a, Duncan Street, Edinburgh, we have received a wall calendar with monthly sheets for the year, each sheet having a half-tone picture of general interest.

Messrs. Venner & Co., of 6, Old Queen Street, Westminster, have sent to all their usual friends, as a New Year souvenir, a handy little toothpick. Their stock has been practically exhausted, but any of the aforesaid friends who appear to have been overlooked, are asked to communicate with the firm.

From the Sun Electrical Co, Ltd., of 118 and 120, Charing Cross Road, London, W C., we have received a specimen of the penknives that they are distributing to customers and friends. Should any of these have gone astray in the post, a word to the firm will bring a second along. If any recipients prefer not to accept a knife as a gift and would like to send a small coin to the firm, money so received will be credited to the Electrical Trades Benevolent Institution. Now we shall all have pensions!

The *Chemical Trade Journal*, in accordance with its custom, has issued a wall calendar for 1914, with monthly sheets.

To Messrs. Switchgear & Cowans, Ltd, Springfield Lane, Salford, Manchester, we are indebted for a capital breastpocket diary and notebook (Letts's) for 1914, with insurance coupon. The opening pages contain neatly arranged illustrated matter and prices relating to some of their standard electrical items in common use, including circuit breakers, oil switches, and mining switchgear. A limited number of copies are still available for "suitable applicants."

From Pope's Electric Lamp Co., Ltd., of Hythe Road, Willesden, we have received a wall calendar for the New Year with tear-off daily slips.

From Messrs. Stewarts & Lloyds, Ltd., we have received one of their excellent desk calendars for 1914 with monthly cards. The framework is, as before, in white and gold.

From the Electric Construction Co., Ltd., we have received a very acceptable vest pocket card and stamp case containing calendar and engagement diary for 1914 (a Letts's "Peerless"), with accident insurance coupon.

The Diamond Coal Cutter Co., of Wakefield, has issued a wall calendar for the year with monthly slips.

The excellent poster recently issued showing in a homely fashion how a Bastian electric radiator makes you as warm as toast, has been issued from 185, Wardour Street, W., with Mr. Bastian's compliments, in the form of a calendar with monthly tear-off slips for 1914

Messrs. Hayward Tyler & Co., Ltd., of 99 Queen Victoria Street, E.C., have circulated among their friends a pocket diary with 1914 and 1915 calendars. As usual a number of pages are devoted to useful memoranda on water pumping and other such matters.

We have again been favoured with one of the very presentable pocket diaries of the Dussek Bitumen Co., of Canal Bank, Deptford, S E. It has ample daily spaces, card stamp and other pockets, also an insurance coupon.

Messrs. Alfred Graham & Co., of St. Andrew's Works, Crofton Park, S.E., have issued one of their handy pocket volumes containing speed and tide tables for the principal seaports of the United Kingdom for 1914. Other information given relates to port charges, knot tables, distance tables, electrical terms, &c. A 1914 calendar appears at the beginning, and some pages for memoranda at the end, of the book.

Messrs. Nalder Bros. & Thompson, Ltd., of 97a, Dalston Lane, London, N.E., have issued a calendar in their now quite familiar style and size with monthly slips for 1914. A list of agents keeping stocks of the N.C.S. manufactures appears at foot of each sheet.

The Electric Supply Publicity Committee, of 20a, Tudor Street, London, E.C., has issued a calendar for 1914 for circulation by supply companies and local authorities. Four circular views in colour show electricity in service in the home. Personally, we prefer not to be in an overwhelming blaze of light when we want to get to sleep. The monthly date slips each have a different illustration showing domestic electrical applications.

Messrs. Thermit, Ltd, of 27, Martin's Lane, Cannon Street, E.C., again send one of their pocket note-books. It is not a diary, but contains 1914 and 1915 calendars. As usual the opening pages are full of information, appropriately illustrated, concerning the Thermit system of welding.

LIGHTING and POWER NOTES.

Alton.—Prov. Order.—The U.D.C. has decided to make inquiries as to the cost of obtaining a prov. order for electricity supply.

Ardee (Co. Louth).—An E.L. scheme for this town is to embrace about 30 lamps of 50 c.p. each, at an annual cost of 30s. per lamp.

Atherton.—The U.D.C. is proposing to adopt a revised scale of charges for power and heating, ranging from 1½d. to ¾d. per unit, the latter for over 12,500 units per quarter.

Aylesbury.—The U.D.C. has decided to purchase a site on the Canal Wharf for £754 for the proposed electricity works.

Basingstoke.—L.G.B. Inquiry.—Mr. T. C. Ekin, on December 18th, held an unopposed inquiry into the application of the T.C. to borrow £14,000 for the purposes of an electricity undertaking. There was a balance of £1,005 on the sum asked for, which would be apportioned as to £600 for meters and services, and £455 for mains extensions. The L. & S.W. Railway Co. has provisionally agreed to take 50,000 units per annum at 2d. per unit, and would probably require 80,000. The charge to small consumers would be 6d. per unit.

Bexley.—Street Lighting.—A scheme, prepared by the Electricity Committee, for improving the public lighting has been approved by the U.D.C. The scheme provides for 100 lamps in four roads and 80 lamps in eight roads. All lamps at the junctions of streets (except where 100-c.p. lamps are used) are to be of 80 c.p., and the remainder of 40 c.p. The Committee is prepared to give the improved lighting at the same cost as at present, viz., £1,235.

Blackrock.—Prov. Order.—The U.D.C. prov. order for electric light has been extended for one year.

Bradford-on-Avon.—The U.D.C. and the R.D.C. have been asked to consent to the application of Mr. J. H. Edwards for a prov. order for E.L. The U D.C. has arranged to consider the matter early in January, and the R.D.C. has deferred discussion pending the receipt of further information.

Brighton.—Electric Cooking.—The T.C. has decided to supply electricity to the Royal Sussex County Hospital on special terms, whereby the demand will be more than doubled, and 20,000 or 30,000 additional units will be used for cooking, the account being increased from £100 to £250 per annum.

Bromley (Kent).—A new tariff for electricity, under which consumers will be supplied on a fixed quarterly charge, based on the adequate lighting of the whole of the premises, plus 1½d. per unit, for lighting, heating or cooking, has been brought into operation by the E.L. and Power Co.

Brough (Penrith).—E.L. Scheme.—At a meeting held last week it was decided to form a company for the purpose of installing electric light in the village.

Canada.—By-laws have been passed as follows:—Medicine Hat, to expend $150,000 on plant extensions at the electricity works; and Beausejour, Man., to install an electric light system, at a cost of $3,000.—*Canadian Electrical News.*

The South Vancouver (B.C.) ratepayers are supporting a proposal to construct a municipal power plant on the Fraser River, at a cost of $300,000.

Chiswick.—E.L. Purchase Scheme.—The future of the electricity undertaking, when it is purchased, came up for discussion by the District Council last week, and it was decided that for five years the Council shall work the undertaking itself, despite counter proposals that the Council should be left free to consider the matter when the purchase price is settled.

Coggeshall (Essex).—E.L. Scheme.—Steps are being taken by private persons to provide a supply of electricity for the parish.

Continental Notes. — Norway. — The Norwegian Hydro-Electrical Nitrate Co. has recently placed an order with the Thune Works for 18 large Babcock & Wilcox boilers, which are to be installed in the company's new factories at Rjukan II. The heat will be derived from the electrical furnace gases, and the total capacity of the boilers will be 35,000 h.p. The same works have obtained an order from the Cristiania Council for seven boilers, which are to be installed at the municipal electrical works.

Sweden.—It is reported from Stockholm that a new company has recently been formed for the purpose of acquiring and developing waterfalls and selling the electrical energy obtained from them. The capital has been fixed at a minimum amount of £833,300, and the shares are to be offered to the public at 110 per cent. The new company will thus, from the start, have a reserve fund of £83,300 at its disposal. Two electrical power stations, viz., at Ramnes and at Seglingberg, have already been acquired by the company, and will be paid for in shares.

Germany.—According to Engineer Baumann in the *Electrotechnische Nachrichten*, the future of Berlin's electricity supply is rather a complicated problem. The municipal contract with the Berlin Electricity Works expires on October 1st, 1915, and, should the city take over the company, municipal management, according to this writer, will certainly involve higher administrative costs, and less freedom in technically developing the undertaking. The writer considers that either a bulk supply purchased from the company, for the centre of the city, or a scheme of joint control, would be the best solution of the problem.

Austria.—The report of the Vienna municipal electricity department for the year 1912, shows that at the end of that year there were working 18 steam engine sets of 36,800 h.p., and 12 turbine sets with a total of 101,500 h.p. The cable network has risen to 45·63 km., and the connected installations for light and power supply to 9,235. The total invested capital amounts to 114·14 million kronen. The receipts were 32·395 million kronen, and there was a gross excess of 17·39 million kronen. Coal deposits at Zillingdorf are to be used to generate electricity when the station at Ebenfurth is completed, the current being transmitted to Vienna, to displace in part the electricity generated there from imported coal.

Russia.—Plant is being established at the works of the Société Metallurgique du Sud-Ural, to utilise the water power of Lake Oust-Kataw in the generation of electrical energy for power purposes.

Connah's Quay.—Electric Lighthouses.—On Tuesday, last week, the new electric lighthouses which have been erected on the lower walls of the Dee for the Dee Conservancy Board were set in operation. The whole of the electrical installation—viz., the cable and lamp fittings—has been carried out by Messrs. Summers and Sons, at a cost of over £1,000, and the cost of the towers, about £225, has been borne by the Board. It is also proposed to install lights on the upper wall of the river, and in addition to these, floating lights are to be laid in the river channels below the town of Flint, the current being supplied from the works of the firm mentioned.

Croydon.—The T.C. has decided to extend the mains to the Woodside district, at an estimated cost of £798, and will probably supply a factory *en route* with current.

Dublin.—Street Lighting.—The Electricity Supply Committee has issued a report stating its intention to gradually replace the present arc lamps, which are becoming inefficient, with the best type of flame arc lamps. A number of tenders had been received, but the firms whose lamps were up to the standard required, were not at first disposed to give a free trial of a full circuit of 22 lamps, without which the city electrical engineer did not consider that a proper trial could be made. The General Electric Co. and Messrs. Johnson & Phillips agreed to the terms, and the trials proved so satisfactory that the Committee recommended the taking over of the lamps. Trials were also made of a new type of contact gear, and in this case Messrs. Crompton and Co.'s was found most efficient.

Easingwold.—E.L. Scheme.—Mr. Chas. E. Best, the representative of the company promoting the proposed E.L. scheme, has informed the R.D.C. that it is proposed to supply current at 6d. per unit, and that a capital of £2,000 will be needed. It is understood that the Council will raise no objection.

Harwich.—Prov. Order.—A special meeting of the T.C. recently agreed to the action of the General Purposes Committee in giving notice of its intention to apply for a prov. order for electric light. A report on the matter prepared by Mr. Haydn Harrison was also approved.

Masham.—The U.D.C. has approved a draft agreement with the company promoting an E.L. scheme for the district.

Haslingden. — Public Lighting. — The electrical engineer has been instructed to prepare an estimate for fixing electric lights on all the tramway standards from Hudrake to Lockgate, and altering the system from three lights to two lights. The Electricity Committee has approved a scheme for lighting the main road from Hudrake to the borough boundary at Baxenden.

The B. of T. has sanctioned the purchase of machinery in connection with the sub-station at a cost not exceeding £700.

Heston-Hounslow.—E.L. Costs.—In a recent debate on the subject of electricity v. gas, Mr P. E. Rycroft, referring to the cost of electric lighting, mentioned that for 40 houses in one road the average cost last year was £3 6s. 4d. per house; 16 large houses paid £7 4s. 6d. each, and 21 houses in another road averaged £2 4s. each. Mr. Rycroft submitted that the average householder would prefer to pay this figure for electricity than to have gas supplied free.

Holmer.—The Hereford T.C. has informed the R.D.C. of its intention to apply to the B. of T. for an order to supply electricity at Holmer, and to dispense with the consent of the R.D.C. A conference between the Councils is to be held with a view to an amicable settlement.

Hoylandswaine.—Proposed E.L.—The U.D.C. has resolved to ask the Yorkshire Electric Power Co. for its terms for the electrical lighting of the streets and cottage houses.

Ilford.—L.G.B. Inquiry.—A recent application by the U.D.C. for a loan of £21,578 for extensions at the electricity works and the provision of a refuse destructor met with opposition from the Seven Kings Ward ratepayers.

Kingston-on-Thames.—The T.C. has accepted an offer of £750 from the M.A.N. Co. as compensation for the delay in the delivery of the two Diesel engines.

Kirkby Stephen.—E.L. Scheme.—Mr. C. H. Best, of Bradford, has given notice to the East Ward R D.C. that a company is being formed for the purpose of supplying electricity to Kirkby Stephen and the immediate neighbourhood. It is the intention of the promoters to apply for a prov. order forthwith.

Manchester.—Trafford Park Power Purchase.—The Corporation Parliamentary Bill discloses that £200,000 will be the sum paid for the works and property of the Trafford Park Power and Light Co. There is considerable expenditure for the electricity undertaking proposed in addition to this sum, but no actual figure is given.

Northampton.—The E.L. and Power Co. has reduced the price of electricity for lighting and cooking from 1½d. to 1d. per unit.

Peterborough.—The Corporation having received an application from Messrs. Farrow & Co. for a supply of power to their factory at Fletton, has decided to offer a minimum of 75,000 units per year for five years, at 0·9d. per unit. The cost of the main to the factory is estimated at £1,888.

Reigate.—Prov. Order.—Mr. Gilbert Allom intends applying for a prov. order for E.L. for the parishes of Banstead, Walton-on-the-Hill, and Kingswood. The Kingswood Ratepayers' Association has suggested that power should be obtained in the order to secure current for public lighting at half the maximum rate.

South Africa.—The Ladysmith (Cape Province) municipality proposes to borrow £7,000 for an electric lighting scheme.

The Cape Town Corporation proposes to call a ratepayers' meeting to sanction a loan of £100,000 for electric lighting purposes. Of this amount, £67,707 has already been authorised by the Council. The expenditure of the following sums will have to be specially authorised:—

Cape Town.—Extension of mains, services and meters, £11,500; coal-handling plant, £1,500; supply to proposed blanket factory, £700; contingencies, £5,000.

Kalk Bay.—Changing voltage, £1,150; extension of mains and private connections, £1,500; estimated cost of connecting Cape Town with Wynberg and Kalk Bay, £9,182.

Four additional sets of steam turbines and generators, of a total of 48,000 kw. capacity, and three 7,500-h.p. steam turbine-compressor sets, have been lately ordered from the A.E.G., of Berlin, by the Victoria Falls and Transvaal Power Co.

According to the *African World*, a proposal is on foot to construct a large electrochemical works at Tweefontein, adjacent to the colliery of that name. Plans prepared by Messrs Harpur Bros. and Co. indicate a Mond producer plant to deal with 400,000 tons of coal a year, boilers fired with producer gas, and a steam turbine plant of 15,000 kw. The chemical plant will produce 22,000 tons of sulphate of ammonia and 10,000 tons of tar and distillates a year. Tests with this coal in similar producers show a yield of 119 lb. of sulphate of ammonia per ton under ordinary working conditions. The power plant will be coupled by means of a 50-mile, 80,000-volt transmission with the Rand power supply.

Rathmines (Dublin).—L.G.B. Inquiry.—Mr. P. C. Cowan held an inquiry last week into an application by the U.D.C. for sanction to a loan of £12,160 for the purpose of extending the electricity works and purchasing a free wiring installation. There was no opposition.

St. Albans.—Workhouse Lighting.—The B. of G. has decided in favour of electric lighting in the workhouse.

Stratford-on-Avon.—Plant Extensions.—The E.L. Co. has installed a new 150-H.P. Hornsby engine and 80-KW. Newton dynamo. A cooling tower has also been erected, the work being carried out to the specifications of Mr. C. D. Falcke, London, and under the superintendence of the resident engineer.

Torres.—E.L. Proposals.—In their report to the T.C. on the proposed E.L. scheme, Messrs. J. & W. Purves suggest that 84 50-C.P. street lamps should be installed—72 estimated to cost 30s. per lamp per annum, and 12 all-night lamps costing 50s. per annum each ; 6d. per unit would be charged to private consumers for lighting, and 3d. per unit for power and heating. The annual expenditure is estimated at £789.

Weaverham. — Village Supply. — The villages of Sandiway, Cuddington, Oakmere and Gorstage have now secured a supply of electricity, the extended supply of the Weaverham Electric Supply Co. being officially started last week by Dr Smith, chairman of the company. The directors and officials afterwards took dinner together upon the invitation of Messrs. Johnson and Phillips, Ltd., who carried out the contract. The Weaverham Electric Supply Co. was formed in 1910, and started supplying electricity in the following year to 20 consumers with an aggregate of 1,000 lamps. At the end of 1912 there were 65 consumers, and 5,000 lamps were in use in Weaverham ; whilst there are now 6,500 lamps in use. In the district for which the new supply caters there are 25 consumers with an aggregate of 2,500 lamps. Current for power purposes is supplied at 1d. per unit, and for lighting at 6d. per unit. The cottager is allowed the use of one light per week for 3d., and there is no restriction on the use of his light. The transmission from Weaverham to Sandiway and other villages is by 3,000-volt underground duplicate cables, the supply being transformed down to 220 volts for local use. Mr. A. J. Leigh was the consulting engineer for the scheme.

West Yorkshire. — E.L. Powers. — The Yorkshire Electric Power Co. has asked the Stanley, Methley and Birkenshaw U.D.C.'s, the Tadcaster and Barnsley R.D.C.'s, and the Hemsworth P.C. to support its application for powers to supply electricity for lighting.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Suburban Car Service.—The suburban Tramways Co. has asked the Corporation to amend the agreement between the company and the Corporation, especially with reference to the payment by the Corporation of 3½d. per car-mile for traffic expenses and rolling stock charges, which the company thought should be increased. A sub-Committee was appointed to consider the matter. A sub-Committee is also considering a proposal to purchase the Militia Barracks for car-sheds and tramway purposes. It is estimated that the alterations would cost £9,192.

Continental.—Italy.—Figures recently published show how much the introduction of electric tramways into some of the principal Italian cities is due to foreign capital and enterprise. The electric tramways of Milan have an extent of 131 km., 126 of which form the network installed and worked by the Italian Edison Co. The Naples system of tramways, 142 km. in extent, is owned by the Società Anonima dei Tramways Napoletani, whose headquarters are at Brussels. The tramways at Brescia of the Società Ellettrica Bresciana, 55 km. in extent, the 29-km. urban network at Turin of the Società Torinese di Tramways e Ferrovic Economiche, and the 18-km. system of the Unione Italiana Tramways Elletrici at Genoa, are apparently of Italian ownership ; but the 83-km. system at Florence of Les Tramways Florentins is a Belgian undertaking. So also is the 106-km. network of the city of Vercelli, but the motive power in this case is steam. Altogether, 351 km. out of a total of 463 are the outcome of foreign electrical enterprise and capital.

According to the *Standard*, the Direction of the State Railways is now electrifying the tunnels north of Genoa, and the stations of Genoa and S. Pierdarena. At the same time operations are being carried on for the double-tracking of the line between Genoa and Spezia.

Darwen.—The manager has presented a report to the Tramways Committee relative to the three months' working of cheaper fares, and it has been decided to adhere permanently to the fares. An increase of 26·75 per cent. in the receipts between the hours of 12 noon and 2 p.m. has been recorded as a result of the dinner-hour tickets. Deducting the general increase of 8·7 per cent. over the whole system during the previous six months, the increase is 18·05 per cent. Extra cars have been required to deal with the increased traffic, but after allowing for this the extra cars return a profit of 5·15d. per car-mile. The all-round net increase in favour of the new cheap return tickets and dinner-hour tickets is 18 per cent.

Huddersfield.—The borough engineer has been instructed to report upon doubling the track on the Outlane, Longwood, and Sheepbridge tramway sections.

London.—It is reported that trials are being made by the Aerated Bread Co., Ltd., with an electric motor van for the delivery of goods to the various depôts.

The new Bill, which the G.N. and Metropolitan Railways are introducing, seeks to hand over to a joint Committee of the two companies, the G.N. and City line recently acquired by the Metropolitan Co. It would also empower the G.N. Co. and the joint Committee to construct new railways. It is proposed to connect the line to the Metropolitan Railway and a direct connection with the Waterloo and City line is contemplated

According to the *Daily Telegraph*, the L.C.C. trailer-tramcars have been so successful on certain Southern routes that, pending the sanction of the B. of T., the Council is obtaining prices for 150 trailer cars and about 200 couplers. The new cars are to be of a different pattern to those in use at present.

Oxford.—The Watch Committee has decided to recommend that five licences each should be granted to Mr. Morris, Mr. Cownie (National Electric Construction Co.), and Messrs. Tilling, for motor-'buses ; meanwhile, Mr. Morris has commenced a service of 11 'buses (unlicensed) to various parts of the city. A meeting of the Tramways Co. has also been held, when an official statement of this company's position in regard to the recent developments was made.

Nelson.—Railless Traction Scheme.—The Tramways Committee is considering a scheme of railless traction for Walverden and Southfield districts. An extension of the present system is regarded as impracticable owing to the expense of widening streets. After considering the claims of motor-'buses and railless traction, the Committee strongly favours the latter. A scheme will come before the Council at an early date.

Walthamstow. — The G.E. Railway Co. has written stating that it is unable to agree to the Council's proposal to run tramways into the Hoe Street Station yard, and suggesting that the tramway should run down Selborne Road. The company is to be informed that while the Council's proposal, as originally made, could probably be carried out for the cost of the work alone, the alternative proposal would entail the cost of a prov. order, which would make the cost prohibitive.

TELEGRAPH and TELEPHONE NOTES.

Anglo-Swiss Telephony.—The Post Office announced this week that on and after January 1st, 1914, telephonic communication with Basle, Geneva and Lausanne would be obtainable from all subscribers' telephones and call offices within the Inner London telephone area which are available for inland trunk service. The charge for a call of three minutes' duration will be 7s. 6d. during the hours of day service, and 4s. 6d. during the hours of night service.

Egypt.—It is stated that the telephones of Egypt are about to be taken over by the Government and nationalised, the purchase price mentioned being £E.1,300.000. The capital of the Telephone Co. of Egypt in 1911 was £E.400,000. The number of shares now in circulation is 36,000 of a face value of £E.5 each, while there are 4,000 founders' shares. The reserve fund of the company amounts to £E.88,728. In all there are 47,346 km. of telephone wire in Egypt, the property of the company. For the year 1912 the revenue of the company was £E.145,348, and the expenditure £E.81,294, leaving a profit of £E.64,054, from which a dividend of 12 per cent. was paid.—*I. and E Engineer.*

Germany.—The German Reichspostamt has decided that wireless communication between Germany and her African Colonies shall be opened on May 15th next. To this end work is being prosecuted at the head station at Nauen day and night. To guard against eventualities, besides the five towers 120 m. high, a giant tower of a height of 250 m. is being built, at the rate of 20 m. a week. A large Arco high frequency machine will also be employed, whose high-frequency capacity of over 150 KW. is said to exceed that of any high-frequency machine hitherto built.

Lancashire and Cheshire.—Important developments in connection with the telephone and telegraph services are pending in various parts of South Lancashire and North-East Cheshire. Since April 1st last, 57 miles of new underground pipes have been authorised for local exchange services, of which 26 miles have already been laid.

New Telephone Cable.—The laying of the new cable between Nevin, in Carnarvonshire, and Howth, near Dublin, was completed this week by the P.O. cable ship *Monarch* in heavy weather. The cable is nearly 74 miles long, and contains four cores, with Pupin loading ; it was made by Messrs. Siemens Bros. and Co., and is the longest submarine telephone cable yet laid.

New Wireless Stations. — The new wireless station at Cape Finisterre, constructed by the Compania Nacional de Telegrafia sin hilos, has been opened for public service. It has a range of 400 km. A station at Cape Palos, with a range of 200 km., has also been inaugurated. Progress is being made with the erection of the station at Almellones, near Malaga.—*Electron.*

(*Continued on page* 23.)

THE RJUKAN NITRATE WORKS AND ELECTRICAL PLANT.

I.—THE POWER PLANT.

[BY OUR SPECIAL CORRESPONDENT.]

Among the best known Norwegian waterfalls is the Rjukan—the highest one in the country—which owes much of its fame to the wild and lovely scenery which surrounds it on all sides.

The Rjukan Waterfalls.

During the last few years great changes have taken place near Rjukan, and much of its one-time natural beauty, the delight of the sightseer, has disappeared to give place to the utilitarian development which is such a feature of modern Norwegian life.

Thus, as our views show, this wild mountain valley of a few years ago, now contains a town of 5,000 to 6,000 inhabitants, which has sprung into existence as a direct result of the water-power development at Rjukan.

This, moreover, has resulted in the annual production of 100,000 tons of fertilising nitrates, a material which is almost indispensable to the agriculturist. Our first view shows the Rjukan before it was harnessed, while the lower views on page 20 show Saaheim in 1907, and part of the same place in 1912 with the Rjukan I factories on the left.

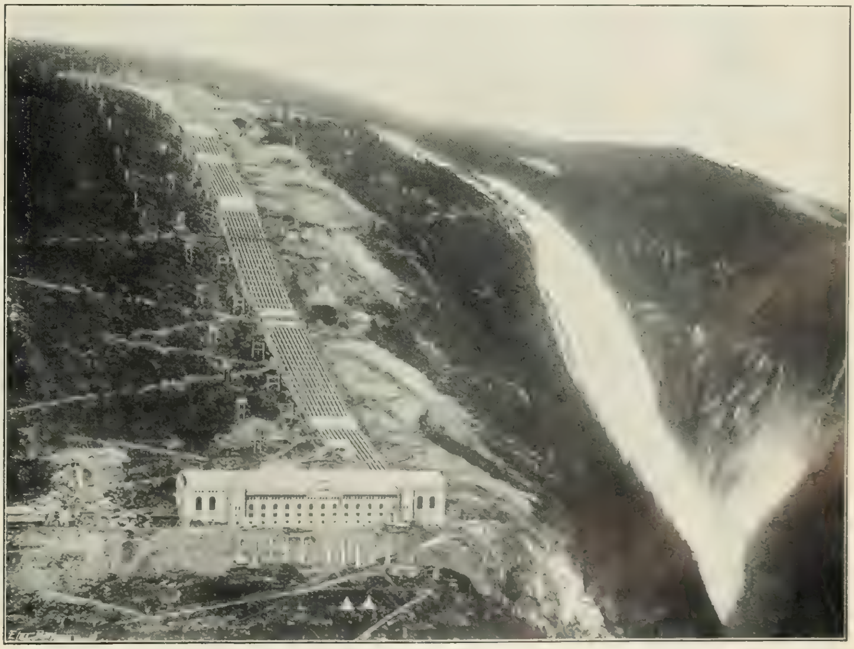
The Rjukan waterfall, from which energy is derived for the nitrate works, is situated on the Maane River, and has a natural head of 260 m., which has been artificially increased to 570 m.

The whole scheme for the harnessing of the fall has been divided into two stages, Rjukan I and II, of which the first was completed in 1911, and the second will be completed in 1915. The total amount of power has been estimated at nearly 270,000 electrical H.P., of which 145,000 H.P. will be developed at Rjukan I, and about 125,000 H.P. at Rjukan II.

General Description.—The regular supply of water to the two power stations is secured by a lake, the Mösvandsdam, which is situated about 900 m. above the sea, and is capable of holding 850 million cb. m. of water. It is the largest artificial lake in the world for the storage of water for industrial purposes. From the Mösvandsdam the water is conducted 4 km. through a tunnel with a transverse section of 26 sq. m. to a collecting basin, and then falls through ten flumes to the Vemork power station, 300 m. below. The diameter of each flume is 1·5 m. at the upper end, gradually decreasing to 1·25 m. at the lower end. The upper sections are of riveted steel-plate, while the lower ones, where the pressure reaches 30 atmospheres, are made from 1-in. welded plate; the flumes rest on a foundation built upon the solid granite of the mountain. The total quantity of water passing through these flumes is 50 cb. m. per second.

From the Vemork power station electrical energy is transmitted over high-tension cables to the nitrate works at Saaheim, which are situated about 5 km. below in the valley.

The Turbines.—In the Vemork power station are installed 10 turbines, each of 15,700 H.P., and efficiency 80 per cent.; the latter would be somewhat higher at a normal load of about



The Vemork Power Station, Pipe Line, and Fall.

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14,300 H.P. Nine turbines meet normal load conditions, one being kept in reserve in case of accidents. The turbines are double Pelton wheels with two nozzles per wheel, and the speed regulation is by pressure oil motors and automatic pressure regulators, which act when the pressure of water in the flumes exceeds a certain limit. Apart from the above, there is also installed a 1,000-H.P. unit, which serves as a reserve exciter and supplies the lighting.

The Generators.—These are coupled direct to the turbines; each has a capacity of 17,000 K.V.A., ·6 power factor, and generates energy at 10,000-11,000 volts pressure and 50 cycles, the speed being 250 R.P.M.

When these machines were ordered, the arrangement for the coupling of the electrochemical furnaces in the factories had not been decided, and nine of the generators were therefore ordered as double units, each half with a capacity of 8,500 K.V.A., but so constructed that they could work either together or separately. The machines are of the two-bearing type, as is the case with the tenth generator, which is a single machine. It was specified that the weight of any single piece should not exceed 15 tons, also that the largest diameter for transport should not exceed 4 m. Each generator is provided with a direct-coupled exciter, for greater security of working. The arrangement has disadvantages, but the power and space required are somewhat less than when separate exciters are employed.

The Mösvandsdam, showing Headworks, &c.

The generators are provided with a special ventilation system, with ducts for the incoming and outgoing air and 280 cb. m. of air per second are required. This arrangement was adopted, as otherwise it would have been necessary to renew the air in the engine room every three minutes to make it possible for the attendants to stay there during the cold season.

A large ventilating tunnel has, therefore, been provided in the foundations, from end to end of the engine room, with branches of smaller dimensions leading to the divided generators, in which are placed adjustable valves for reducing the air pressure. These valves are regulated from switch pillars, which also serve as instrument pillars for the generators. The air after passing through the generator windings is conducted to vertical channels discharging into the atmosphere. The various air channels are interconnected to make it possible to conduct the hot air back to the incoming ducts during the winter, when it is necessary to preheat the air somewhat, to melt snow and ice in order to prevent it from accumulating and obstructing the channels.

The generators have been supplied partly by the Allmänna Svenska Elektriska Aktiebolaget, in Sweden, and partly by the Brown, Boveri Co.

In the case of the Swedish generators, constructed as double units with very little space between, the stators, each built in four parts, are arranged to move sideways on the bed.

The stator core plates are ·35 mm. thick, arranged in 16 different groups with intermediate air spaces 10 mm. wide between each group, and open slots for the windings. The internal core diameter is 4,150 mm., and the external diameter 4,800 mm.

There are three slots per pole per phase, and four conductors per slot. A built-up copper bar conductor is employed, threaded through micanite tube, and filled in solid with wax in order to exclude all air; in the insulation of the end windings mica and wax-impregnated tape are employed. The coils are held in the slots by wedges and the end turns are rigidly supported.

The two halves of the double unit are isolated by means of a fireproof wall between them. The weight of the generator complete is 243 tons, and of the rotor 93 tons.

The latter consists of a steel spider carrying cast-steel magnet rings, with central ventilating spaces and solid pole shoes. The field windings are of rectangular copper strip, and fans and deflectors are provided to ensure the correct distribution of the ventilating air. Both mechanical and gravity lubrication is provided to the bearings, which are water cooled. The exciters are 10-pole machines, designed to meet the conditions resulting from varying speed.

The Brown-Boveri double-generators are of simpler construction. The stator core, which has an internal diameter of 4,400 mm. and external diameter of 5,000 mm.,

1907. 1912.

View of the Town of Saaheim and Nitrogen Works in 1912, and of the Undeveloped Site Five Years Earlier.

is constructed with open slots, four per pole per phase, and three conductors per slot.

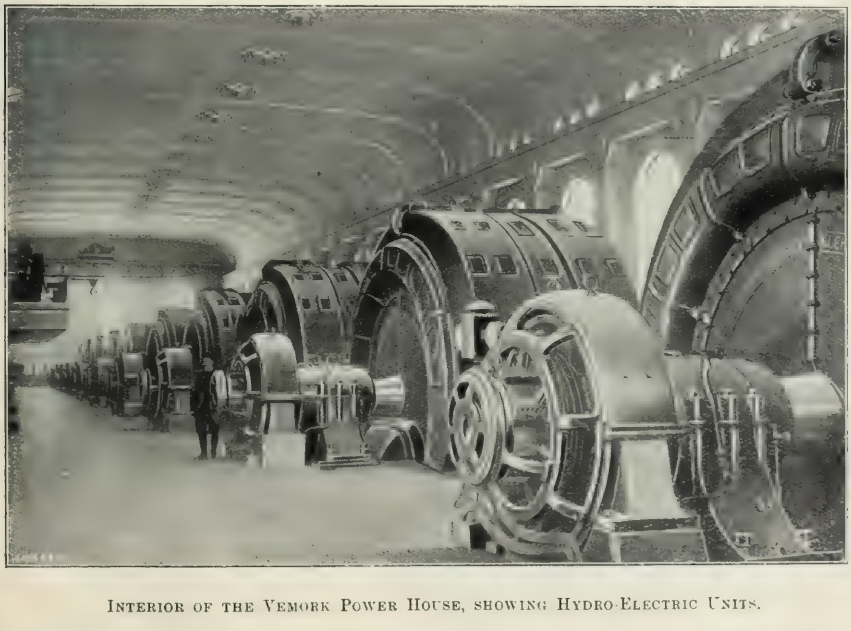
The rotor, which weighs 90 tons, carries six forged steel magnet rings in two groups with a space between. Cast-steel poles with laminated steel pole shoes are fitted, the windings being of copper strip.

As in the case of the Swedish machines, the exciters are direct-coupled ten-pole generators.

Apart from the double generators, there is a single generator of Brown, Boveri construction, which is, however, built in two parts placed close to each other; this construction was adopted for practical reasons, in view of the great size of an ordinary type of machine.

The switchgear is placed in a separate building, 75 m. long, of reinforced concrete, the switches, bus-bars, &c., being enclosed in fireproof cells. The instrument and control board is on a gallery in the engine room. The chief feature of the switch arrangement is the provision made for each generator to supply over its own transmission line to the particular group of furnaces belonging to it. With this object in view, the 500-ampere leads from each generator are connected direct to the transmission line; it has, however, been found desirable, in order to reduce surges due to the switching in of the furnaces, to connect several machines in parallel, and for this purpose a line-switchboard is provided in shunt with the system of bus-bars. In order to facilitate the switching in or out of the generating sets, the main bus-bars are divided into sections by nine oil switches. The generating sets are coupled through choke coils and water-jet dischargers to the main oil switches and bus-bars, from which the outgoing cables, pass to the transmission lines.

This switchgear occupies three floors in the switch house, the lightning arresters and choke coils in connection with the outgoing lines being installed on the top floor.



Interior of the Vemork Power House, showing Hydro-Electric Units.

The instrument board on the gallery, which is equipped with Siemens & Halske instruments of the Ferraris type, automatic signal lamps, &c., was supplied by the French Westinghouse Co.

Overhead Transmission Lines to Nitrogen Works, Saaheim.

The Transmission.—This is designed to transmit 170,000 K.V.A. over the 5 km. intervening between the power station and factories; 18 cable systems connect up the nine double generators, and two are provided for the single generator, the transmission being arranged so that the supply voltage in the factories averages 9,500 volts, while the generating station pressure averages 10,500 volts.

It was, in the first instance, decided to use copper cables, and the order for these was placed, but the price of aluminium falling to £59 per ton, led to a reconsideration of the matter, and, as a result, aluminium cables were adopted instead, with a saving of 30 per cent. when the copper cables were sold; copper was, however, used for a distance of 1,650 m. The copper cables have a sectional area of 150 sq. mm. and each consists of 37 single wires, drawn in a semi-hard condition.

The aluminium cables each consist of 19 wires with a sectional area of 300 sq. mm.

The transmission route was a difficult one, running through a narrow river valley, and it was finally decided to adopt a system comprising 35 groups of masts of five each, the total number of masts being 175. The foundation for the group of five masts has to support about 1,100 tons.

The masts are of steel, each weighing about 2 tons: the cables are spaced 1,200 mm. apart, this distance being fixed to allow a safe margin when the cables swing in stormy weather.

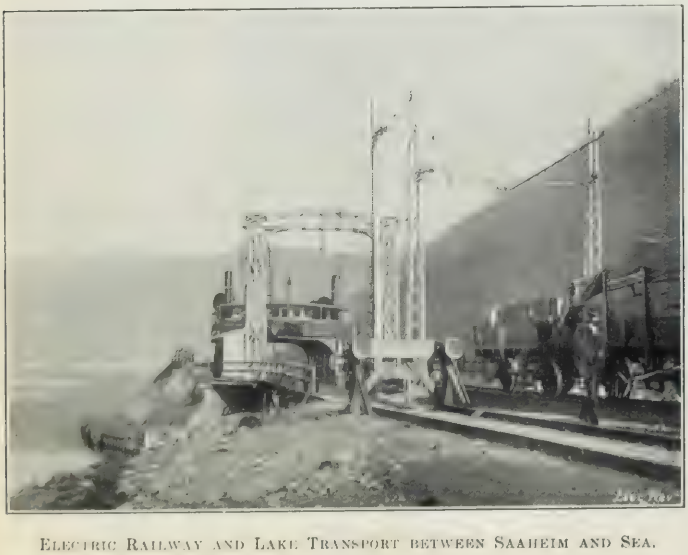
The distance between the groups of masts varies considerably on account of the uneven ground; the average distance is about 100 m., but in some places spans are used up to 250 m. The masts are fitted with protecting-nets in order to allow of repairs being carried out on one line while the next is alive. The insulators were tested to 70,000 volts. The whole transmission line was completed in 1911 and tested soon afterwards at 30,000 volts. Since that time the transmission plant has been constantly at work, and has given great satisfaction. As an instance of what strain such a plant can be subjected to, it may be mentioned that the cables not in use have frequently been covered with a layer of snow up to 8 cm. thick, and the natural thickness of a cable has even been increased to 25-35 cm. by the snow. When in use the cables are only covered with some rime frost.

Storage Buildings for Nitrate Products.

Transport from Rjukan I.—Between the Vemork power station and the nitrate factories at Saaheim a railway has been built along the mountain side, some 5 km. long, and is worked by steam.

The products from the factories are forwarded by rail to the Tinsjö Lake, which is situated about 10 miles from Saaheim; this railway is worked electrically.* On arrival at Tinsjö, trains of up to 14 wagons are embarked on ferry steamers, in order to avoid transhipment, and after a two hours' journey across the lake to Tinoset, are transferred to another electric railway running to Notodden, a distance of about 19 miles. Here the goods are transferred to large barges for a four-hour journey across the lake of Nordjö, at the lower end of which three locks connect with the sea at the town of Skien, where the company has erected some huge buildings for the storage of the products until they are shipped.

Rjukan II.—As previously mentioned, the Vemork power station for Rjukan I is situated 300 m. above the Lake of Tinsjö, and it is now intended to employ the same water for another power scheme, Rjukan II, for which purpose the water will pass through a tunnel, 32 sq. m. in area to Saaheim. Work on this is now proceeding, and a number of adits have been driven into the mountain, some of them to a depth of 90 m., in order to reach the line of the tunnel. Above Saaheim a distributing basin of 1,000 sq. m. area is now under construction, to receive the water from the tunnel, and directly underneath this dam is the site for the Rjukan II power station. The fall will be about 280 m., and it is estimated that the power developed will amount to about 125,000 h.p. From both stations the production will thus amount to nearly 270,000 h.p.



Electric Railway and Lake Transport between Saaheim and Sea.

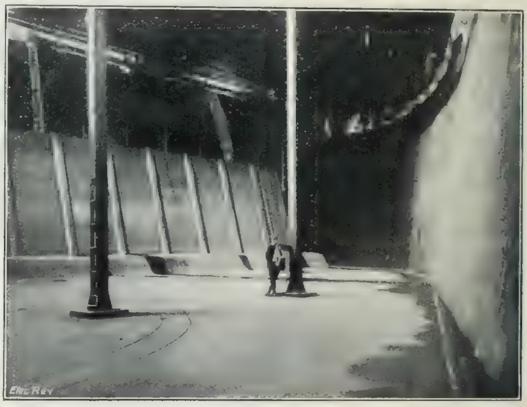
In conclusion, it may be mentioned that the company also has the Tyin and the Matre Waterfalls, with a total capacity of 160,000 h.p., and another project is under consideration in Norway for the harnessing of some 250,000 h.p. But Rjukan I and II combined will scarcely be surpassed by any other power scheme in Norway and, so far, the Vemork power station is the largest electrical plant in the world under one roof.

NOTES FROM CANADA.

[From our Special Correspondent.]

The correspondence which has recently appeared in the columns of the Review on the subject of Canadian electrical trade is very interesting on this side.

Discussion of Canadian electrical matters in your paper has, during the last two years, largely centred on the "National Electrical Code," and the Underwriters' Laboratories in Chicago. To some extent this is perhaps natural, but it must be remembered that there are many electrical things with which the Underwriters' rules are not concerned excepting in regard to installation.



Distributing Basin, Rjukan II Power Scheme.

The "National Electrical Code" is silent as to the types or methods of manufacture of generators, motors, transformers, meters, and all kinds of instruments, so that manufacturers of these and the question of Canadian trade in them are practically unaffected by the Underwriters. It may be said that these rules deal with *installation* of *all* electrical machinery, apparatus, &c., and with the *design* and *manufacture* of only such materials or articles as are used for the transmission, distribution, control and utilisation of electric energy but not of those which are employed in its generation, transformation or measurement.

It is freely admitted that the N.E.C. is far from perfect, and as has been already stated in these notes, the Underwriters themselves acknowledge their inability to do more than *suggest* such rules as have special reference to the life hazard.

Mr. Andrews's remark as to there being "a number of . . . very necessary rules and regulations *for the protection of life* in Canada" (the italics are those of the present writer) is hardly correct as it stands ; the rules are made primarily to take care of the fire risk, and the great majority of them have been drafted *after* a fire has occurred from some particular cause, in order to guard against a similar happening in the future—incidentally, many of the rules cover the life hazard also, but they can hardly be said to be rules *for the protection of life.*

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* See Elec. Rev., February 28th, 1913.

Undoubtedly one of the chief, if not the chief, defects of the N.E.C. is that the body responsible for it is not in a position rigidly to enforce its requirements in all instances, and it is a matter of common knowledge that a very great deal of work here is never inspected at all, and the Underwriters themselves occasionally "wink at" certain work not strictly up to standard, if the "risk" is worth taking on as an insurance. Again, at least one of their rules is practically a dead letter, as although insulation resistances for installations of various total amperes capacity are given, it is probable that not one installation in 10,000 ever has any sort of an insulation resistance test applied to it. The writer has personal knowledge of one installation where a man has installed his own fittings and made all his joints without any solder—no inspection or test of any kind was made at the time he asked for current, and no questions were asked about the installation. In another installation a man has an "earth" affecting half his lights, and, as a consequence, he gets his current for half the house without its going through the meter ; this has been the state of affairs for about two years, ever since current was first turned on to the house, but no test has ever been made. As it happens, the latter fault chiefly concerns the supply company, which is being defrauded of some of its revenue, but a nasty shock can be obtained from the gas pipe in that house ; and, what is more, there are two gas meters in the cellar, and a distinct spark can be obtained by touching together the pipes leading from these meters. These, of course, are matters which do not affect the manufacturer at home.

In view of Mr. Evershed's recent paper read before the I.E.E. on insulation resistance, it may be interesting to record here that the familiar "Megger" has been put to an unexpected use in this country—apparently with success. The instrument has been used for testing the separate units of suspension type insulation, and is capable of indicating faulty members, the resistance of which, so far as puncture is concerned, is liable to be low, to an extent that is quite surprising. The ordinary electrical engineer would hardly expect that such an instrument would show a reading when applied to an insulation designed to withstand a puncture test of 20,000 volts or more, which may, though faulty, be capable of withstanding, perhaps, half that potential ; such reading may be used as a fairly reliable indication that the insulator will not stand up to the puncture test.

TELEGRAPH and TELEPHONE NOTES.

(*Continued from page* 13.)

New Zealand.—The Governor of New Zealand has made Regulations to come into force on July 1st, 1914, to the effect that any steamship registered in New Zealand and carrying passengers, which is engaged in the foreign or intercolonial trade, and any home-trade steamship authorised to carry not less than 150 passengers at sea, will not be allowed to leave a New Zealand port unless she is equipped with a wireless telegraph installation having a radius of at least 100 miles and carries a skilled operator.—*Board of Trade Journal.*

Pocket Wireless Again.—It is reported in the *Daily Mail* that a pocket wireless telegraph receiver, in the form of a small telephone, which needs no antenna, has been presented to the French Astronomical Society by an engineer, M. Justin Landry. This instrument, which slips with ease into the coat pocket, has only to be brought into contact with any metallic surface, such as an iron railing, a brass curtain rail, or the metal fittings of a motor-car, to enable a listener in Paris to hear the time signals from the Eiffel Tower. Thirty miles from Paris an ordinary spade stuck in the ground forms a receiving station adequate to catch a wireless message, while a telegraph pole with its wires will serve the same purpose to a distance of over 650 miles.

Portsmouth Dockyard.—It is stated that the future semaphore tower, to replace the one that was recently burnt, will be of the Eiffel Tower pattern and fitted with wireless telegraphy.

The Baudot System.—Successful experiments have been made between the London and Birmingham telegraph offices with an elaboration of the Baudot duplex instrument, by which it is possible to make a single wire carry 12 messages simultaneously. Hitherto the limit has been eight simultaneous messages in practical working. The Baudot system is to be adopted between London and Glasgow and Liverpool.

Trunk Telephone Cable.—The Post Office is laying a trunk telephone cable between London and Brighton, a distance of 53 miles. The order for the cable was placed with Messrs. Johnson & Phillips, Ltd., who have begun the work of drawing it in.

Wireless in the Arctic.—The Marconi Co. is engaged on the construction of new wireless telegraph stations in the Arctic Circle at Ketchikan and Juneau. At Ketchikon the plant will be 50 kw. in capacity, and will be capable of working with Seattle, 600 miles to the south, and with Juneau, 200 miles further north. The Juneau station will have a 10-kw. transmitter. These stations form the first links of a chain to provide Alaska with a commercial wireless service connecting it with the United States. As business grows the chain will be developed and provided with auxiliary stations further north.—*Standard.*

Wireless Station at Carnarvon.—The accompanying illustration shows the masts of the new long-distance station which has been erected by the Marconi Co. at Cefndu, near Carnarvon, for trans-Atlantic communication. The station is at an altitude of 800 ft. above sea level, and the last row of masts, according to the *Wireless World*, stands at 1,400 ft. The aerial consists of 32 wires supported on 10 tubular steel masts, each 400 ft. high. For the foundation blocks some 6,000 tons of concrete were used. The earth system consists of two large circles of plates sunk in the ground. There are two generating sets of 500 h.p. for permanent service, as well as various machines for experimental work with continuous waves. All the power used is obtained from the North Wales Power Co.'s station at Llanberis, at 30,000 volts. The station will work direct with New York, in duplex. Copies of the photograph can be obtained from Mr. R. C. Symons, of Llanberis.

Wireless on Board Ship.—Of the 3,500 coast and shipboard stations existing in June last, according to the International Berne List, England owned 138 and 1,062, and Germany 110 and 522, or together 53·9 per cent. of the total. The foundation of the Debeg Drahtlose Telegraphie in 1910 tended greatly to enhance the German figures, the installations of that company on German ships having advanced from 26 in the year named to 355 in the current year. The most important installation made by the company is that on the ss. *Imperator*, which has been designed, profiting from the *Titanic* disaster, to surpass all previous ship installations. A greatly augmented machinery equipment, to minimise the risks of a breakdown, an increased staff (three skilled telegraphists), with five rooms for their working and accommodation, and threefold antennæ installations, fitted to more than one mast, with an independent minor installation for subsidiary services, are among the features of the improvements ; while the ranges of the sending instruments are (1) 1,500 to 3,000 km., (2) 600 to 1,200 km., and (3) the "Help" call 200 to 400 km.

Wireless in the Antarctic.—A relief ship is now on the way to bring back Dr. Mawson's expedition from the Antarctic regions, and has called at Macquarie Island, where the wireless station which has maintained communication with the expedition is to be placed on a permanent basis, the information obtained from it having proved of great value in forecasting the weather. Dr. Mawson has demonstrated that whenever there is a bright aurora it is impossible to transmit wireless messages. By establishing direct communication with Melbourne, he was able to make magnetic observations at Adelie Land simultaneously with tho made at Melbourne.

CONTRACTS OPEN and CLOSED.

OPEN.

Ainsworth (near Bury).—January 5th. Electric lighting at the Sanatorium, for the Bury and District Joint Hospital Board. Specifications 10s. (returnable). F. Wild, Clerk to the Board, Cross Street, Bury.

Australia.—SYDNEY (NEW SOUTH WALES).—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

March 2nd. Sydney Harbour Trust. Circular Quay. Three electrically-operated semi-portal travelling cranes for Berths Nos. 1, 2 and 3, Woolloomooloo Bay. Particulars from Engineer-in-Chief of the Trust.

ADELAIDE.—February 11th. P.M.G. 50 cable terminals. See "Official Notices" to-day.

MELBOURNE.—February 17th. P.M.G. Cable boxes. See "Official Notices" to-day.

Belgium.—January 10th. Belgian Post and Telegraph authorities in Brussels (Salle de la Madeleine). Supply and laying of a quantity of telephone cables in the Antwerp district.

January 24th.—Municipal authorities of Tongres. Extension of the plant at the central electric lighting station in the town.

Bradford.—January 3rd. Corporation. Supply of electric trolley vehicle equipment. See "Official Notices" December 12th.

Brentwood.—January 17th. Petrol-driven electric lighting plant (50 lights) for Branch Asylum, Harold Court, Harold Wood. See "Official Notices" to-day.

Canada.—OTTAWA. January 15th. The General Superintendent of the Government Telegraph Service, Public Works Department, Ottawa, is inviting tenders for 10 knots of submarine cable (gutta-percha, four conductors) and 14 knots (gutta-percha, two conductors). Deposit 10 per cent. with tender. Specification, &c., may be seen and obtained at the C.I. Branch of the Board of Trade, in London.

Dundee.—January 30th. Corporation (*a*) 5,000-KW. steam turbine and alternator; (*b*) condensing plant; (*c*) 750-KW. rotary converter, with transformer. See "Official Notices" to-day.

France.—January 8th. French State Railway authorities in Paris (42, Rue de Chateaudun). Supply of two batteries of accumulators at the sub-station at Asnières, and the maintenance of same during 15 years.

Halifax.—Corporation. Ten miles of trolley wire. Town Clerk (Mr. Percy Saunders), Town Hall, Halifax.

Ipswich.—January 31st. Corporation. (*a*) Three-phase 300 K.V.A., 3,300-volt alternator, rotary converter with transformer, A.C. booster and C.C. exciter, automatic voltage regulator and booster, cable connections. (*b*) Three 50-K.V.A. three-phase transformers. (*c*) H.T. three-phase main switchboard. (*d*) H.T. and L.T. switchgear. (*e*) Two motor or rotary converters, each 250 KW. See "Official Notices" to-day.

London.—L.C.C.—January 13th. Installation of 130 lighting points at Popham Road Elementary School, South Islington. See "Official Notices" December 19th.

January 20th and 21st. Installations at Vernon Square Elementary School, Finsbury, E.C. (241 wiring points and 318 lights), and at Raneleigh Road Elementary School, Pimlico, S.W. (210 wiring points, 258 lights). See "Official Notices" to-day.

ISLINGTON.—January 28th. Corporation. Twelve months' supply of electrical and engineers' stores. See "Official Notices" to-day.

G.P.O.—January 5th. Telephone silence cabinets, for the P.M.G. See "Official Notices" November 21st.

Manchester.—January 6th, Tramways Committee. Pitch for paving purposes. Mr. J. M. McElroy, General Manager.

New Zealand.—January 30th. Fielding Borough Council. Two Diesel engines, A.C. generators, 2,400 volts single-phase 50 periods, exciters, switchboard, fuel storage tanks, crane, &c. Further particulars are given in the *Board of Trade Journal.*

Northampton.—January 12th. Corporation. Double line of tramways to Far Cotton and doubling of section of Kingsthorpe route, also the necessary overhead equipment, underground feeders, telephones, &c. Specifications (£5 deposit) from Mr. A. Fidler, Borough Engineer, Guildhall.

Plymouth.—January 19th. Corporation. Twelve months' supply of arc lamp carbons, electricity meters, transformers, cables, &c. See "Official Notices" to-day.

Salford.—January 12th. Corporation. Three-phase extra high-pressure and medium-pressure switchgear, also two 300-K.V.A. three-phase power transformers. See "Official Notices" to-day

Spain.—The municipal authorities of Valdepenas de la Sierra (province of Guadaljara) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

St. Albans.—January 14th. Electric light installation, Workhouse, for the B.G. Mr. E. F. W. Hicatt, Clerk, Chequer Street.

St. Helier (Jersey).—Corporation. Concession for the supply of electrical energy for light, heating and power. (Population 26,000.) See "Official Notices" to-day.

Swansea.—January 8th. Corporation. One or two years' supply of motors and starting switches. See "Official Notices" December 19th.

Wolverhampton.—January 19th. Corporation. Two water-tube boilers complete with superheaters and mechanical stokers. See "Official Notices" to-day.

CLOSED.

Aldershot.—The U.D.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for cable needed for extensions to Eggar's Hill.

Australia.—Queensland Railways Department. Electric lamps for two years, from January 1st, 1914. The Edison & Swan U.E.L. Co., Ltd.—*Tenders.*

N.S.W. Ports and Harbours.—Four electric motors, £133. Siemens Bros. Dynamo Works, Ltd.—*Australian Mining Standard.*

Batley.—It is stated that the Electricity Committee has accepted the tender of the Brush Electrical Engineering Co., for a 1,200-KW. Ljungstrom turbo-generator.

Bedford.—The Borough Education Committee has appointed Messrs. James & Sons contractors for carrying out the electrical work for the ensuing half-year.

Belgium.—Six firms—four Belgian and two German—submitted tenders to the Belgian Post and Telegraph Authorities for the supply and installation in the basement of the G.P.O. in Brussels, of three air compressors and three vacuum pumps, all to be electrically operated. The lowest tender was that of Messrs. H. F. Dencker, of Ixelles, Brussels.

Bingley.—The U.D.C. has accepted the following tenders:—

Western Electric Co., Ltd.—Laying of services.
Carr & Co.—Wiring of Town Hall and premises (excluding the public baths).

Canada.—MONTREAL.—A contract has been awarded the Canadian General Electric Co., by the Montreal and Southern Counties Railway Co., for the electrical equipment of the Rougemont sub-power station; and one has been given to the Canadian Westinghouse Co., of Hamilton, for the electrical equipment of an order of cars, from the National Steel Co., for the Montreal and Southern Counties Railway Co. The town of Neepawa (by its consulting engineers, W. E. Skinner, Ltd.), has ordered from the Canadian General Electric Co. one 150-K.V.A., 450 R.P.M., 2,400-volt three-phase, 60-cycle, A.C. generator.—*Canadian Engineer.*

Dover.—The following tenders were received by the T.C. for installing electric light in the Barton Road Schools:—

J. Wright & Sons	£85
R. W. Robson	£66 (alternative £64)
E. A. Pinto	£65 (alternative £68)
V. P. Martin	£51

East Grinstead.—The U.D.C. has provisionally accepted, subject to the sanction of the L.G.B. to a loan, the tender of Messrs. Heenan & Froude for a refuse destructor, at £2,896.

Hull.—The B. of G. has accepted the tender of Messrs. Clarke & Graham, for the supply of electrical goods for the next three months.

London-Brighton.—Messrs. Johnson & Phillips, Ltd., recently secured the order for manufacturing and laying a new trunk telephone cable between London and Brighton, a distance of 53 miles, and have now commenced the work of drawing-in.

Mynachdy Colliery.—The Mynachdy Colliery Co. has placed an order with Messrs. Johnson & Phillips, Ltd., for the supply and erection of complete 11,000-volt sub-station equipment and overhead line, also L.T. mining type switchgear, transformers and cables.

Stoke-on-Trent.—The T.C. has accepted the tender of Messrs. David Rowell & Co. for expanded metal screens for the electricity works.

Weaverham.—Messrs. Johnson & Phillips have in hand for the Weaverham E.S. Co., a complete generating station equipment, comprising gas-driven generating set, motor-alternators, step-up transformers, H.T. and L.T. switchgear; also high and low-tension underground and overhead cables.

Worksop.—The order for the wiring of the workhouse has been placed with Mr. E. W. Shotton, Worksop, at £108.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, January 2nd. At Holborn Restaurant. Smoking Concert.

Junior Institution of Engineers.—Friday, January 2nd. At 8 p.m. At 39, Victoria Street, S.W. Paper on "Electric Cooking." By Mr. E. J. Hazelton.

Rontgen Society.—Monday, January 5th. At 8.15 p.m. At Middlesex Hospital, Mortimer Street. Paper on "Histological Changes produced by X-rays on Animal Tissues; Destructive and Hyperplastic Action of X-rays; Practical consequences in regard to Radio-Therapy and protection of the Radiologist," by Dr. Jean Clunet.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, January 6th. At 7.30 p.m. At Municipal School of Technology, Paper on "D.C. Power in the Machine Shop," by Mr. E. Blackmore.

Royal Institution of Great Britain.—Tuesday, January 6th and 8th. At 3 p.m. At Albemarle Street, W. Continuation of Lectures to Juniors on "A Voyage in Space," by Prof. H. H. Turner.

Royal Society of Arts.—Wednesday, January 7th. At 5 p.m. At John Street, Adelphi. Juvenile Lecture on "Electric Vibrations and Wireless Telegraphy," by Mr. R. P. Howgrave-Graham.

Batti-Wallahs' Society.—Wednesday, January 7th. At 7 p.m. At Victoria Mansions Restaurant. Informal Meeting.

Institution of Civil Engineers of Ireland.—Wednesday, January 7th. At 8 p.m. At Dublin. Ordinary Meeting.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, January 7th. At 7.30 p.m. At the University, Edmund Street. Paper on "The Development of Electric Power for Industrial Purposes in India," by Mr. H. R. Speyer.

Institution of Electrical Engineers.—Thursday, January 8th. At 8 p.m. At Victoria Embankment, Paper on "British Practice in the Construction of High-Tension Overhead Transmission Lines," by Mr. B. Welbourn.

Concrete Institute.—Thursday, January 9th. At 7.30 p.m. At Denison House, 296, Vauxhall Bridge Road, S.W. Paper on "Factory Construction," by Mr. P. M. Fraser.

Greenock Electrical Society.—Friday, January 9th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Papers on "Thoughts on Cable Chemistry," by Mr. Lowrie Sinclair, and "Cable Faults and their Causes," by Mr. L. Hogg.

Junior Institution of Engineers.—Friday, January 9th. At 8 p.m. At 39, Victoria Street. Paper on "The Future of the Institution," by Mr. C. H. Woodfield.

Saturday, January 10th. Visit Works in progress at London Docks for the Port of London Authority.

Manchester Association of Engineers.—Saturday, January 10th. At Grand Hotel, Aytoun Street, Manchester. Paper on "Transmission of Power by Chains," by Mr. H. T. Hildage.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued:—

Monday, January 5th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.

Tuesday, January 6th.—"B" Company. Ditto.

Wednesday, January 7th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, January 8th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, January 9th.—"D" Company. Technical instruction, 7.30 to 9 30 p.m. Special class on Crossley engine, 7 to 8 p.m.

Saturday, January 10th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Provisional Orders.—The B. of T. has issued its usual list of applications for provisional orders deposited on or before December, 1913, for consideration in the 1914 session. Names of promoters and names and addresses of agents appear in tabular form.

International Electrical Congress, San Francisco, 1915.—The International *Electrical* Congress is to be held at San Francisco, September 13th to 18th, 1915, under the auspices of the American Institute of Electrical Engineers by authority of the International Electrotechnical Commission, and during the Panama-Pacific International Exposition. Dr. C. P. Steinmetz has accepted the Honorary Presidency of the Congress. The deliberations of the Congress will be divided among 12 sections, which will deal exclusively with electricity and electrical practice. There will probably be about 250 papers. The first membership invitations will be issued in February or March, 1914. Attention is drawn to the distinction between this Electrical Congress and the International *Engineering* Congress, which will be held at San Francisco during the week immediately following the electrical congress. The engineering congress is supported by the Societies of Civil, Mechanical and Marine Engineers, and by the Institutes of Mining and Electrical Engineers, as well as by prominent Pacific Coast engineers who are actively engaged in organising it. This Congress will deal with engineering in a general sense, electrical engineering subjects being limited to one of the 11 sections, which will include about 12 papers, treating more particularly of applications of electricity in engineering work. The meeting of the International Electrotechnical Commission will be held during the week preceding the Electrical Congress

The Electrical Engineers' Ball, 1914.—Notwithstanding the increase of social engagements which during the winter season make their appeal to the members of electrical institutions and societies and to others interested in the electrical profession and industry—dinners, concerts, conversazioni, informal evenings, and so on—the Electrical Engineers' Ball continues to hold a place quite apart from all the rest as an evening when, with complete unanimity, all give themselves up to enjoyment, and forget for the time being that there are such things as professions and industries. How representative the function is may be gathered from the following list of members of the Committee for the next Ball, which is to take place at the Hotel Cecil on Friday, February 20th. Those who take part in the evening, and in the organisation of the arrangements connected therewith, do so with the idea of providing an evening's enjoyment of such a class and character as is afforded by no other fixture of the season, and in this they have hitherto always been successful.

Alabaster, H.
Anderson, A. Bruce
Bailey, F.
Baldwin, O. H.
Belfield, R.
Berry, H. H.
Blunt, W. W.
Bowden, J. H.
Brown, D. A.
Byng, Leonard
Callender, T. O.
Colton, C. S.
Davenport, F. R.
Dobson, Sydney
Elder, T. C.
Ferranti, S. Z. de
Fox, E. J.
Garcke, E.
Gatehouse, T. E.
Geipel, K.
Geipel, Wm.
Gray, Jas.
Gray, R. Kaye
Hadley, A. E.
Hawes, F. B. O.
Hill, Charles
Highfield, J. S.
Hirst, H.
Holden, Col. H. Capel
Hooper, J. P.
Hunter, C. E.
Kingsbury, J. E.
Leaf, H. M.
Lonsdale, W. S.
MacKay, H. T. S.
Madgen, W. L.
Matthews, W. Lee
Mordey, W. M.
McMahon, P. V.
Murray, Lee
Nalder, F. H.
Nash, E. A.
O'Meara, Major
Pearson, Hugh A.
Railing, M. J.
Roberts, Martin F.
Robinson, Leonard L.
Rosenthal, J. H.
Rowell, P. F.
Rutherford, W.
Sharp, Sydney
Shepherd, J.
Siemens, Alex.
Sillar, A. M.
Scholey, H.
Smith, Frederic
Sparks, C. P.
Steinitz, J. J.
Sutton, G.
Taite, C. D.
Taylor, J.
Taylor, Godfrey M. C.
Wallis-Jones, R. J.
Willcox, F. W.
Wilson Prof. E., F.R.S.
Wordingham, C. H.

Executive Committee.—Baldwin, O. H.; Fox, E. J.; Madgen, W. L.; McMahon, P. V.; Shepherd, J.; Wallis-Jones, R. J.; and Wordingham, C. H.

Hon. Secretaries.—Alabaster, H.; Sillar, A. M.

Hon. Treasurer.—Kingsbury, J. E.

Institution and Lecture Notes.—Institution of Civil Engineers.—At a Students' Meeting on December 19th, Mr. W. E. Gurry, Stud.Inst.C.E., read a paper entitled "Air Filtration and the Cooling and Ventilating of Electrical Machines." The chair was taken by Mr. J. S. Highfield, M.Inst.C.E.

Institution of Electrical Engineers.—The following is the programme of the Newcastle Local Section for the second half of the session 1913-14:—

January 12th.—"British Practice in the Construction of High-Tension Pole Lines," by D. Welbourn.

January 26th.—"Inductance and Inductance Coils for Industrial Work," by E. F. Hollis.

February 9th.—"The Need for a Testing Authority," by W. Aitken. (This paper will be read privately.)

February 23rd.—"Some Railway Conditions governing Electrification," by E. T. Smith.

March 16th.—"Suggested Methods of Improving the Telephone Service," by C. Turnbull.

April 6th or 13th.—Address and Demonstration, "Electric Furnaces," by V. Stobie.

May 4th.—"Electric Heating and Cooking," by W. A. Gillett.

May 26th.—Annual general meeting. Paper to be decided later.

On Friday, the 19th ult., the Birmingham Local Section held its seventh annual dinner at the Grand Hotel, Mr. A. M. Taylor being in the chair. Among the guests present were the Lord Mayor of Birmingham (Lieut.-Col. Martineau), Mr. Hartnell, chairman of the Yorkshire Section, I.E.E., Mr. Home-Morton, chairman of the Birmingham Mechanical Engineers, and others. The Corporation electric supply department was represented by Mr. R. A. Chattock. A most enjoyable evening was spent, and the dinner was followed by an entertainment.

The toast of "The King" having been duly honoured, the chairman proposed "The Institution of Electrical Engineers." He said the Institution was not only one in which the community had great confidence, but also one representing many interests. There were telegraph and telephone engineers, mains engineers, bulk supply engineers, and tramway engineers. He hoped before long to see the general electrification of the main long-distance railway lines. Besides these there were the engineers engaged in electric furnace work and in electrochemical processes, as well as manufacturing engineers. All classes were equally looked after by the Institution, and were united by a common bond of interest. The Institution was originally formed to deal with telegraph engineering, but its range of subjects had now widened considerably. Some of those present dealt with currents so enormous that they could melt bars of copper and steel, while some others dealt with the feeble currents of wireless telegraphy. He wished to put before them the great quantity of work that fell to the lot of the President of such an

Institution as the I.E.E. The position was no sinecure. Apart from his own consulting work, which was anything but small, the President had to perform many duties. He presided over the meetings of no fewer than 28 Committees, besides being present at the various meetings at which papers were read. The speaker, therefore, had much pleasure in coupling with the toast the name of Mr. Duddell. The President, in responding, said he felt that the Institution had the interests of the electrical engineering profession at heart. With regard to the electrification of the main lines of railway, referred to by the previous speaker, the I.E.E. had arranged for a series of papers to be given dealing with the difficulties met with, and the best ways of overcoming them. He hoped to see the cost of steam-generated power much reduced in the near future, so that we should be in a position to compete with other countries where cheap water-power was obtainable, especially in the electrochemical and electrometallurgical manufactures, and thus to regain what little ground we had lost.

Mr. J. F. C. Snell (Vice-president I.E.E.), in proposing "The Birmingham Local Section," said that in Birmingham the engineering profession had many interests. Great credit was due to the city electrical engineer, Mr. Chattock, and his staff for the way in which they had succeeded in reducing the cost of energy in Birmingham. The local sections of the I.E.E were a source of strength to the Association. Dr. A. H. Railing replied in a humorous vein. He assured Mr. Snell that they took a lively interest in the proceedings of the Institution in London, not only when they agreed with them, but, as in the case of the revision of the I.E.E. articles, when they did not. The speaker said that Birmingham was most favourably situated as an engineering centre, with coal and iron close at hand in abundance. It was therefore up to the engineers in the district to make the most of their advantages, for the sake of Birmingham, the country generally, and themselves.

The toast of "Our Guests" was then proposed by Mr. R. A. Chattock, who thanked the previous speakers for their kind references to himself and his staff. He said that cheap electrical power was the life-blood of the nation, without which it could not hold its own against other countries. He himself advocated the national centralisation of power, and considered the cost of generating could be much reduced thereby, to the great advantage of manufacturers. He also touched upon the benefits of electric accumulator vehicles from the central station engineer's point of view, and pointed out that the charging of batteries for these conveyances would provide a useful day load. The Lord Mayor, in reply, said that in his school days the study of electricity had not yet penetrated the public schools, and he therefore looked with some awe upon the controllers of this mysterious force, but felt relieved to find that they had dinner just like ordinary people. He regarded cheap electricity as a means to attract traders to the city and to abate the smoke nuisance.

Mr. Solomon, in a brief and amusing speech, proposed the health of "The Chairman," Mr. Taylor, who replied.

The proceedings closed with a vote of thanks to the local hon. secretary, Mr. J. D. Morgan, who carried out the whole of the arrangements for the dinner.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—At the monthly meeting of the East of Scotland branch, a discussion was held on a paper contributed by Mr. J. P. C. Kivlen on "The Specifying and Buying of Mining Electrical Plant." Mr. W. A. Wilson (British Insulated and Helsby Cables, Ltd.) said it was suggested in the paper that cable makers should manufacture a concentric cable made up with twin or multiple cores. If the demand justified it such a cable would doubtless soon be available, but he feared that the much-enhanced price, due to the high cost of manufacture—especially of small quantities—would nullify any technical advantage it might have. He strongly disagreed with the author's opinion respecting the use of paraffin wax for filling joint boxes. Not only was this material hygroscopic, but it contracted very considerably on cooling—shrinking always towards that portion which remained liquid longest—with the result that the wax shrank, not only from the sides, but also from the fittings or other heat-conducting bodies in the box, so that should water enter it found a clear pathway to the very heart of the cable fittings. Serious results must inevitably happen in course of time if this material were employed. Some little time after paper cables were introduced, the use of paraffin wax for the purpose of filling end connections and so on was absolutely prohibited on account of the unfortunate results obtained. Mr. Sutcliffe (Messrs. Siemens Brothers) maintained that if some rigid form of specification was scrupulously followed, it would be to the mutual interest of users and manufacturers. The discussion was adjourned till next meeting.

At a meeting of the Yorkshire Branch, at Leeds, a paper on "The Choice of Electrical Machinery for Use in Mines," by Mr. J. P. C. Kivlen, was read and discussed.

Under the auspices of the West of Scotland Branch, a public meeting of all those interested in the handling of colliery electrical plant was held in Hamilton Town Hall on December 20th. Mr. D. M. Mowat, general manager of the Summerlee Coal Co., who presided, said that the Association, which was formed in 1909, had already a membership of 1,100 in 10 branches throughout Britain, the West of Scotland Branch being the strongest of all, with 250 members. Mr. Alex. Anderson, president of the Association, delivered a lecture on the "Transmission of Electricity," and an interesting discussion followed.

BATTERSEA POLYTECHNIC, S.W.—A course of advanced lectures on "Generating Stations," by Mr. W. H. Patchell, has been arranged to take place on the following Mondays, at 7.30 p.m.:—January 9th, 26th, February 2nd, 9th, 16th. The lectures will cover the following ground:—Generating Station Design—Choice of site—Choice of system; Prime Movers. Steam—Reciprocating Engines, Turbines; Steam Auxiliaries; Steam Boilers—Gas Engines—Oil Engines; Electric Generators; Lay-out of small Station for Lighting and Power Supply; Lay-out of Large Generating Station. The lectures are intended for advanced students. Admission is free, and no tickets are required.

SOCIETY OF ENGINEERS (INC.)—The Council may award in 1914 a premium to the value of £10 10s., for an approved essay on "The Status of the Engineering Profession." The competition is open to all; particulars can be obtained from the Secretary, 17, Victoria Street, Westminster. The last date for receiving essays is May 30th, 1914.

Appointments Vacant.—Junior shift engineer, for Southport Corporation (25s.); shift engineer, A.C. power station, for Reigate Corporation (28s.); assistant electrical engineer, age 26-33, for Singapore Municipality ($250 month); sub-station shift engineer, for Bristol Corporation (35s.); car-shed superintendent, for Falkirk and District Tramways Co. (£2 10s.). Particulars are given in our advertisement pages.

Fatality.—On Saturday an inquest was opened at Foleshill, Staffs, on the body of George Oliver Randle, 23 an assistant electrician at Exhall Colliery, who was killed electrically whilst at work there on December 23rd.

Dr. L Orton stated that he was called to the workings of the colliery and saw the body of the deceased. Workmen were trying artificial respiration, although the man had been dead two or three hours. He found an abrasion on the inside of the right thumb and on the back of the fingers of the right hand. The left hand was unmarked, but the face was pallid and the pupils were dilated. From the appearance of the remains the witness concluded that death was due to electrical shock. On examining the cable which deceased was said to have been splicing, he found that the whole of the strand had been severed. The cable was cased, but the copper wire was protruding some inches at either end, and it was evident that the man was making a joint.

Mr. W. Johnson, jun., representing the Warwickshire Miners' Association, thought it would be better to postpone the proceedings until the various representatives were present.

A juryman asked if there were any india-rubber gloves which the deceased could have used while splicing the cable.

The Coroner: We shall get that at the adjourned inquiry. The question is a proper one. For this work proper gloves and mats should be provided.

The inquiry was adjourned.

Copper.—Messrs. Merton's statistical circular gives the situation on December 15th (mid-month). On that date English stocks showed a loss of 84 tons for the fortnight, and French stocks an increase of 160 tons. Afloat from Chile the quantity was less by 325 tons, and from Australia by 650 tons. What are generally known as European supplies show, therefore, a decrease of 899 tons on the fortnight; including Rotterdam, Hamburg and Bremen and estimates for other European ports the decrease is 669 tons. The three German ports show interesting figures, being altogether, at the present time, 5,637 tons.

Supplies for the fortnight show North America low, Spain and Portugal above the average, Chile shipments just on, and Australian rather above the average. Total deliveries low.

American stocks had much appreciated during November, to the extent of 6.859 tons. The world's supply without Holland and Germany for the same date showed 42 877 tons, an increase of 6,989 over the figure for the end of October. The total visible supply is given (end of November) as 48,154 tons, or an increase of 7,789 tons during the month.

X-Ray Developments.—It is reported that a new method of generating X-rays has been discovered by Dr. W. D. Coolidge, of the General Electric Co., U.S.A. A new type of tube is employed, and the rays produced are extremely powerful compared with those obtained by the ordinary methods, while they are under complete control.

Electric Hair Brushes.—Referring to an inquiry in our last issue, the Light Electric Motor Co., Ltd., of Meads Lane, Seven Kings, Essex, inform us that they are the makers of Maclean's patent electric hair brushes. The company entered into an agreement with the late John Maclean in 1905, for the purchase of his patent electric motor hair brush and other electric specialities; the death of Mr. Maclean (who was at the time managing director of the company) took place in 1906, but the machine is still called by some "Maclean's motor hair brush."

Educational Notes.—NORTHAMPTON POLYTECHNIC INSTITUTE.—A special course of six lectures on "Secondary Batteries," by Mr. W. R. Cooper, will be delivered on Wednesday evenings, commencing January 28th. A special course of lectures and laboratory work on "Radio-Telegraphy," by Mr. E. F. Perrin, will also be delivered on Monday and Thursday evenings, from January 26th to May 14th.

CRYSTAL PALACE SCHOOL OF PRACTICAL ENGINEERING.—The new course will commence on Wednesday, January 7th. Particulars are given in our advertisement pages.

KING'S COLLEGE FACULTY OF ENGINEERING.—Special advanced courses are arranged in "Irrigation," by Mr. N. F. Mackenzie, for Thursdays, at 6 p.m., commencing January 15th, and in "Thermo-dynamics," by Mr. J. Swinburne, for Fridays, at 6 p.m., commencing January 30th. First lecture free to public Particulars are given in our advertisement columns.

The I.E.E. Annual Dinner.—The annual dinner of the Institution of Electrical Engineers is to be held on Thursday, February 5th, in the Grand Hall, Hotel Cecil.

Legal.—DUBLIN COUNTY COUNCIL *v.* POSTMASTER-GENERAL.—Mr. Justice Dodd has given judgment in the Dublin Courts in favour of the defendant in the claim by the Dublin County Council (see ELEC. REV., December 12th, 1913, page 951) that the Postmaster-General was bound to carry out the agreement entered into with the Council by the National Telephone Co. to supply telephone connections and apparatus to the offices of the secretary of the Council, the county surveyor and the solicitor to the Council. His Lordship held that the Postmaster-General was not bound by the conditions and stipulations formerly binding on the Telephone Co.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On December 20th, Mr. J. W. Beauchamp, engineer and manager of the West Ham Corporation electricity supply, presented MR. W. T. HELLABY, late superintendent of the Representatives' Department, with a marble clock, on behalf of the staff and employés, on the occasion of his leaving to take up his appointment as assistant sales manager for the Sunderland electricity undertaking. Mr. Beauchamp made brief reference to the good work done by Mr. Hellaby in furthering the interests of the sales department, and Mr. Hellaby suitably responded. In the evening a farewell dinner was given to Mr. Hellaby at Frascati's Restaurant. Mr. F. Farndon, sales manager of the West Ham Corporation electricity undertaking, presided, and among the visitors were Mr. Councillor Kensett; Messrs. Sumner Smith (the British Electric Equipment Co., Ltd.); W. E. Bull (Falk, Stadelmann & Co., Ltd.); E. P. Barfield (the Edison & Swan Electric Light Co., Ltd.); Mr. Bardell (Siemens Bros. Dynamo Works, Ltd.); Messrs. Goldby and Yates (Messrs. Gillespie & Beales, Ltd), and Mr. Clark (of Johnstone & Cumbers), Sugar House Lane, Stratford.

The marriage took place on December 22nd, at St. John's Episcopal Church, Perth, of MR. R. S. SMITH, shift engineer at Perth Electricity Works, to Miss Isabella Powrie.

MR. W. GEO. STOCK has been appointed assistant engineer at the electricity works, Hindhead.

MR. ALEX. FRASER, electrical and mechanical engineer, Aberdeen, has been appointed sales engineer for Scotland for Messrs. Siemens Brothers Dynamo Works. Glasgow will be his headquarters. Mr. Fraser has held for the past three years the position of engineer-in-charge at the power station of the Glasgow Corporation electricity department.

MR. H. E. MUNDAY, of Devonport Dockyard electric power station, has been appointed charge engineer at the Cheltenham Corporation electricity works.

MR. PERCY HALE, who is leaving the Buxton electricity works to take up another appointment, has been presented by the staff with a fountain pen. The presentation was made by Mr. G. W. Botting, chief assistant.

The Faversham T.C. has appointed MR. G. SUMMERVILLE, borough electrical engineer, to supervise all the electrical machinery at the sewage ejector and main pumping stations at a salary of £20 a year, with a grant of £20 for services already rendered.

The Morecambe T.C. has appointed MR. A. W. ANNETTS as electrical engineer at a salary of £150 per annum, and to retain for three months, at a monthly salary of £3 3s., the services of MR. L. B. HOGARTH, who is leaving for Whitehaven, as advisory engineer.

The Erith U.D.C. has decided to increase the salary of the electrical engineer and tramways manager from £350 to £400 per annum as from November 17th.

The Newport (Mon.) Electricity Committee has granted a bonus of 25 guineas to the borough electrical engineer (MR. NICHOLS MOORE), and 10 guineas to the deputy engineer (MR. THAINE) in recognition of services rendered in installing the new plant. A sum of 25 guineas is to be divided amongst the workmen.

Stoke-on-Trent T.C. has appointed MR. P. D. WRIGHT, of Paisley, as switchboard attendant at the Stoke works.

When a recommendation was made at the last meeting of the Dunkalk Urban Council that MR. J. M'ENTEE, Belfast, be appointed assistant electrical engineer at an initial salary of £100 a year, Mr. J. M. Johnson protested against the "over-weighting of the electric undertaking by the creation of jobs." Mr. P. A. Spalding, chief engineer, said there was no electric station in the kingdom with the same output as Dundalk that had not the services of an assistant engineer. The appointment was carried by 10 votes to 3.

MR. A. J. BECKETT, borough electrical engineer at Bridlington, has resumed his duties on recovery from an illness. At a meeting of the T.C. on December 22nd, the Mayor expressed gratification at seeing Mr. Beckett in his place again, and expressed a hope that he would soon be quite restored to health.

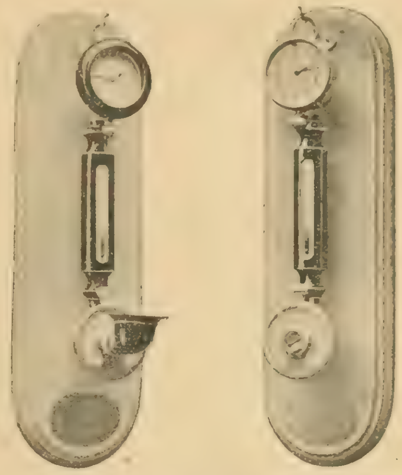
MR. E. S. RILEY, of Hull, has been appointed assistant on the engineering staff at the Walthamstow electricity works, at a salary of £150 per annum. MR. A. D. AXFORD, of Dover, has also been appointed assistant in the department's showroom.

MR. J. FITZGERALD, after eight years' service with the Bristol Corporation electricity department as assistant engineer in various departments, is taking up a position as representative engineer at the Bristol branch of Simplex Conduits, Ltd.

The Rochdale Electricity Committee has recommended an increase of £50 a year in the salary of the electrical engineer, bringing it up to £500 per annum.

Tramway Officials.—MR. J. W. BLAKEMOOR, chief traffic clerk to the Salford Corporation Tramways, has been recommended for appointment to the post of traffic superintendent. It was also recommended that MR. F. ELLWOOD be appointed chief traffic clerk.

General.—On Saturday, December 20th, at the Guernsey State Telephone Offices practically the whole telephone staff and Council were present at an interesting function. The first retiring president of the Council, MAJOR-GENERAL F. B. MAINGUY, was presented with a souvenir as a token of the appreciation in which he has been held by the Council and staff during his 15 years' chairmanship of the department. Major-General Mainguy, it is stated, was the promoter and main mover in the scheme for providing Guernsey with a State-owned telephone system. The chair was occupied by Jurat J. Esten de Jersey (the actual president), and an appropriate address was made by Mr. R. McLean, the resident manager and engineer, respecting the history of telephony in Guernsey, and the important service rendered in connection with it by Major-General Mainguy, and expressing the great regret of all that he had decided to retire from the presidency of the Telephone Council. Jurat de Jersey then presented a wallet containing a telephone handset of novel and ingenious design—comprising a timepiece, barometer and thermometer. We give illustrations showing this unique present, the metal parts of which are in oxidised silver, the whole set being mounted on a walnut base.



GUERNSEY TELEPHONE PRESENTATION. THE RIGHT-HAND ILLUSTRATION SHOWS THE EAR-PIECE AND MOUTH-PIECE REMOVED.

DR. EMIL RATHENAU, the moving spirit of the Allgemeine Electricitäts Gesellschaft, of Berlin, celebrated his 75th birthday on December 11th last. Congratulations!

MR. ROLAND F. HUGHES, at present with Messrs. Chamberlain and Hookham, Birmingham, has received an appointment as chief tester in the meter and instrument department of the British Westinghouse Co., Ltd., Manchester.

MR. DAY, of the electrical department, Surrey Commercial Docks, Port of London Authority, has been presented with an electrical engineering dictionary, on the occasion of his resigning to take up the position of electrician at the University of Hong Kong.

We read in the *Times* that PROF. SILVANUS P. THOMPSON has been elected a corresponding member of the Academy of Sciences of Bologna.

According to the *Canadian Electrical News*, PROF. L. A. HERDT, of McGill University, has been appointed by the city of Quebec to advise on electrical conditions in that city.

It is stated in a daily paper that MR. THOMAS PARKER is resigning his seat on the board of the Metropolitan Railway Co.

Just as we go to press the list of New Year Honours is announced. A baronetcy has been conferred upon MR. WM. BEARDMORE, chairman of the well-known firm of engineers, &c.—Wm. Beardmore & Co., Ltd.; the honour of knighthood has been conferred upon PROF. ERNEST RUTHERFORD, F.R.S., of Manchester University, whose brilliant work in chemical science, and particularly his researches in radio-activity, are well known to our readers; geological science is honoured by the appointment of SIR ARCHIBALD GEIKIE to the Order of Merit; MR. W. T. FRANKS, Comptroller-General of Patents, &c., is made a C.B. in the Civil Division; and MR. U. F. WINTOUR, Director of the Board of Trade Exhibitions Branch is in the Foreign Office honours for appointment as a C.M.G. To all of these we offer our hearty congratulations.

Will.—The late SIR W. H. BAILEY left £68,318 gross and £37,394 net personalty.

NEW COMPANIES REGISTERED.

British Central Electrical Co., Ltd. (132,783).—This company was registered on December 15th, with a capital of £3,000 in £1 shares, to take over the business carried on by E. S. Conradi and J. F. Conradi at 6-8, Rosebery Avenue, E.C., as the "British Central Electrical Co.," and to carry on the business of electrical engineers and contractors, suppliers of electricity, electric manufacturers, dealers in electric, magnetic and galvanic apparatus, &c. The subscribers (with one share each) are:—E. S. Conradi, 6 and 8, Rosebery Avenue, E.C., electrical engineer; J. F. Conradi, 6 and 8, Rosebery Avenue, E.C., electrical engineer. Private company. E. S. Conradi and J. F. Conradi are permanent governing directors, subject to holding three-fifths of the ordinary share capital. Registered by J. Hands, 97, Gresham Street, E.C.

Trans-Oceanic Wireless Telegraph Co., Ltd. (132,843).—Registered December 17th, by Coward & Hawksley, Sons & Chance, 30, Mincing Lane, E.C. Capital, £200,000, in £1 shares. Objects: To acquire from Marconi's Wireless Telegraph Co., Ltd., certain lands, hereditaments and rights in the counties of Carnarvon and Merioneth, together with the wireless station in course of erection thereon, and a sole licence to use the patents of the vendor company for purposes of direct wireless communication between Great Britain and certain stations in the U.S.A., to work, carry on, develop and turn to account the said property, rights, station and licence, to carry on the business of proprietors, managers of and dealers in telegraphic and telephonic works, systems, lines, stations and exchanges, electricians, manufacturers, generators, accumulators, suppliers and distributors of electricity for telegraphic and telephonic communications (whether wireless or otherwise) and for lighting, heating, traction and motive power purposes, receivers, transmitters, carriers and distributors of telegraphic and telephonic messages, telegrams, news and intelligence, managers conductors and performers of all business and service connected therewith, and with telegraphic and telephonic communications, &c. The signatories (with one share each) are:—H. W. Allen, 51, Braxted Park, Streatham Common, S.W., chartered secretary; H. W. Corby, 81, Cecile Park, Crouch Hill, N., chartered secretary. Private company. The first directors (to be not less than three or more than 10) are Guglielmo Marconi, Marconi House, Strand, W.C.; Godfrey Charles Isaacs, 7, Hanover Terrace, Regent's Park, N.W.; Capt H. R. Sankey, 7, Charlby Grove, Ealing, W.; and M. A. Braunstein, Norfolk House, Norfolk Street, W.C.; qualification, £100; remuneration, £2,000 per annum, and a further £500 per annum for every 5 per cent. dividend in excess of 7 per cent. (maximum in any year £3,000) divisible. Registered office, Marconi House, Strand, W.C.

Colston Electrical Works, Ltd. (132,853).—This company was registered on December 18th, with a capital of £3,500 in £1 shares (1,000 6 per cent. cumulative preference), to take over the business of electrical engineers carried on by G. J. T. J. Parfitt and W. J. Webber, as "Parfitt, Webber & Co.," at 9 10, Denmark Street, Bristol. The subscribers (with one share each) are:—E. W. Brock, Priory Road, Keynsham, glass tile manufacturer; A. E. Finch, 57, Orchard Street, Weston-super-Mare, electrical engineer. Private company. The number of directors is not to be less than two or more than seven; the first are Miss H. L. W. Parfitt, E. W. Brock and A. E. Finch. Registered by Wansboroughs & Co., Lion Chambers, Broad Street, Bristol.

Aladdin Lamp Syndicate, Ltd. (132,887).—This company was registered on December 19th, with a capital of £3,000 in 2,700 ordinary shares of £1 each, and 6,000 deferred shares of 1s. each, to acquire from Baron Adolphe Ott von Batorkez und Verinkhaz, of 3, Perham Road West Kensington, inventions relating (*a*) to a machine for cutting glass bulbs, and for regenerating electric and other lamps; and (*b*) to an improved metallic-filament lamp, both protected by French patents. The subscribers (with one share each) include G. P. Almond, Avoca Lodge, Village Road, Middlesex, mining engineer. Private company. The directors are to number not less than two or more than five. Baron Adolphe Ott may either become a director or nominate one director; G. P. Almond signs as a director. Registered office, 6, Moorgate Street, E.C.

Electrical Services, Ltd. (132,856).—This company was registered on December 18th with a capital of £1,000 in £1 shares, to carry on the business of electrical, mechanical and motor engineers, manufacturers of and dealers in motor vehicles, mechanical, electrical, magnetic, telegraphic, telephonic and other appliances, &c. The subscribers (with one share each) are:—E. Muff, 9, Aldermanbury, Bradford, stuff manufacturer; L. V. B. Burrows, 50, Horton Lane, Bradford, electrical engineer. Private company. The number of directors is not be less than two or more than five; the first are not named. Solicitor, C. T. Rhodes, 3, Commercial Street, Halifax. Registered office, 48, Tunbridge Road, Bradford.

Wessex Engineering Co., Ltd. (132,916). — Registered December 19th, with a capital of £20,000 in £1 shares, to acquire certain British and foreign patent rights of and relating to improvements in internal combustion engines together with the plans, drawings, models, moulds, appliances and other accessories, to carry on the business of manufacturers of and dealers in motor cars, carriages, cycles, omnibuses, tramcars, airships and other vehicles for aerial navigation, gasoline, oil, petrol, electric and steam engines, &c., and to adopt agreements (*a*) with the B. and D. Syndicate, Ltd., M. E. Dunscombe, F. B. Bond and H. J. Howard relating (*inter alia*) to the acquisition of certain patents, inventions and rights referred to therein, and (*b*) with Prof. W. Morgan relating to management. Minimum cash subscription, seven shares. The first directors are the Hon. E. Fielding, A. A. Allen, M.P., Prof. W. Morgan, B.Sc., J. A. Bartlett and W. Yatman; qualification, £100. Registered by Warren, Murton and Miller, 45, Bloomsbury Square, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Pacific and European Telegraph Co., Ltd. (36,683).—Capital, £100,000, in £10 shares. Return dated November 25th, 1913. All shares taken up. £40,000 (£4 per share paid). Mortgages and charges: £68,000.

Montevideo Telephone Co., Ltd. (27,208).—Capital, £160,000, in 87,000 pref. and 73,000 ord. shares of £1 each. Return dated November 12th, 1913. 86,492 pref. and 72,680 ord. shares taken up. £159,172 considered as paid. Mortgages and charges: Nil.

Rangoon Electric Tramway and Supply Co., Ltd.—Trust deed, dated November 13th, 1913, to secure £300,000 deb. stock, with a premium of 5 per cent. upon redemption, charged on freehold and leasehold property, and the company's undertaking and other assets, present and future, including uncalled capital, subject to prior charges. Trustees: Sir John G. Hill, 10, Water Street, Liverpool; and Sir John Harmood-Banner, 24, North John Street, Liverpool.

Telephos Domestic and Street Lighting Co., Ltd.—Particulars of £10,000 7½ per cent. first mortgage debs., created October 23rd, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £8,000. Property charged: The company's undertaking and property, present and future, except uncalled capital. No trustees.

United Electric Tramways of Monte Video, Ltd.—The Court has ordered that the particulars filed on January 18th, 1909, of a series of debentures created by the company, be rectified by the substitution of the figures "£100,000" in lieu of "£200,000." (The figures related "to the amount of the present issue.")

Magneta Time Co., Ltd.—Debenture dated December 10th, 1913, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Miss M. D. Fox, 108, Philbeach Gardens, S.W.

New Phonopore Telephone Co., Ltd. (44,654).—Capital, £10,000 in £1 shares (9,000 ordinary and 1,000 founders): return dated November 14th, 1913; 7,141 ordinary and 1,000 founders' shares taken up, £1 per share called up on 6,741 ordinary, £6,731 paid, leaving £10 in arrears; £1,400 considered as paid on 400 ordinary and 1,000 founders'. Mortgages and charges: At date of return, £3,700; since registered: mortgage for £500 and further advances not exceeding £1,500.

Venezuela Telephone and Electrical Appliances Co., Ltd. (31,305).—Capital, £85,000 in 70,000 ordinary shares of £1 each and 1,500 preference shares of £10 each. Return dated December 2nd, 1913. 70,000 ordinary and 860 preference shares taken up, £1 per share called up on 13,494 ordinary and £10 on 860 preference, £22,094 paid. £56,506 considered as paid on 56,506 ordinary. Mortgages and charges: £200,000.

New St. Helens and District Tramways Co., Ltd. (59,426).—Capital, £150,500, in 20,100 preference and 10,000 ordinary shares of £5 each. Return dated November 14th, 1913, 15,980 preference and 9,000 ordinary shares taken up, £5 per share called up, £125,410 paid, including £510 on 1,020 forfeited shares. Mortgages and charges: Nil.

Electric Reduction Co., Ltd. (54,724).—Capital, 40,000 in 16,200 preference and 23,800 ordinary shares of £1 each. Return dated November 13th, 1913, all shares taken up, £1 per share called up on 13,000 preference, £13,000 paid, £27,000 considered as paid on 3,200 preference and 23,800 ordinary. Mortgages and charges: £5,000.

W. Sisson & Co., Ltd. (82,295).—Capital, £25,000 in £1 shares (5,000 pref., 13,000 ord., and 7,000 def.); return dated September 16th, 1913; 3,375 pref., 11,701 ord., and 7,000 def. shares taken up; £1 per share called up on 3,375 pref. and 6,251 ord.; £9,626 paid; £12,450 considered as paid on 5,450 ord. and 7,000 def. Mortgages and charges: Bank overdraft limited to £5,000 (actual amount at date of return, £4,615 11d.).

Chesham Electric Light and Power Co., Ltd. (90,833).—Capital, £25,000 in £1 shares; return dated September 8th, 1913; 15,007 shares taken up; £7 paid; £15,000 considered as paid. Mortgages and charges: £10,000.

Delhi Electric Tramways and Lighting Co., Ltd. (88,758).—Issue on December 15th, 1913, of £1,500 "bearer" debs., part of a series of which particulars have already been filed.

Cross & Cross, Ltd. (105,754).—Capital, £2,000 in £1 shares. Return dated July 2nd (filed September 27th), 1913. 920 shares taken up. £765 paid. £155 considered as paid. Mortgages and charges: £600.

Yarmouth (I.W.) Electricity Supply Co., Ltd. (56,884).—Capital, £5,000 in £5 shares. Return dated October 29th, 1913. 361 shares taken up. £1,805 paid. Mortgages and charges: Nil.

Brown, Boveri & Co., Ltd. (89,167).—Capital, £50,000 in £5 shares (1,500 "A" and 8,500 "B"); return dated December 6th, 1913; all shares taken up; 15s. per share called up on 8,500 "B" £6,375 paid; £7,500 considered as paid on 1,500 "A." Mortgages and charges: Nil.

Consolidated Signal Co., Ltd. (71,141).—Capital, £425,000 in £1 shares (220,000 pref. and 205,000 ord.); return dated December 9th, 1913; 214,195 pref. and 150,548 ord. shares taken up; £1 per share called up on 24,999 pref. and 27,840 ord.; £52,839 paid; £311,904 considered as paid on 189,196 pref. and 122,708 ord.: mortgages and charges: Nil.

Feld Bros. & Co., Ltd. (105,577).—Capital, £5,000 in £1 shares; return dated October 7th, 1913; 1,402 shares taken up, £402 paid; £1,000 considered as paid. Mortgages and charges; Nil.

Dick, Kerr & Co., Ltd. (63,407).—Capital, £650,000 in £1 shares (350,000 pref.). Return dated October 23rd, 1913. 305,000 pref. and 260,000 ord. shares taken up. £565,000 considered as paid. (Previous returns have erroneously stated £265,000 paid on pref., and £300,000 considered paid on ord.). Mortgages and charges: £241,060.

Frederick Braby & Co., Ltd. (2,537C).—Capital, £400,000 in 37,500 ord. and 2,500 pref. shares of £10 each. Return dated September 2nd, 1913 (filed November 25th). 27,500 ord. and 2,500 pref. shares taken up. £10 per share called up on 16,750 ord., £6 on 3,250 ord., £1 on 7,500 ord., and £10 on 2,500 pref. £219,520 paid, including £20 on five shares forfeited. £13,000 (£4 per share) considered as paid on 3,250 ord. Mortgages and charges: £55,000.

Amazon Telegraph Co., Ltd. (44,532).—Capital, £250,000 in £10 shares. Return dated December 2nd, 1913. All shares taken up. £250,000 paid. Mortgages and charges: £287,100.

CITY NOTES.

Argentine Tramways and Power Co.

Mr. W. Sandford Poole presided on Tuesday at the offices, 62, London Wall, over the first annual meeting of the above company. The proceedings were purely formal, and the following report to September 30th, 1913, was adopted:—"The horse tramways and the concession for the construction and operation of electric tramways and an electric lighting and power system in Santa Fé have been transferred to the company. A site for the power house and car-sheds has also been acquired. Under the construction contract with Messrs. J. G. White & Co., Ltd., the work of converting the horse tramways owned by the company to electric traction is progressing satisfactorily, and the first section, some 8 miles of track, is expected to be ready for service in March next. Arrangements for constructing the remaining sections and the lighting system are also in the hands of Messrs. J. G. White & Co., Ltd., and are being pressed forward. The directors report, with very great regret, the death on September 30th last of Mr. T. Frame Thomson, their chairman. Mr. W. Sandford Poole has been elected to fill the vacancy thereby created, and has been appointed chairman."

German Electrical Companies.

The report of the Siemens-Schuckert Works Co. for 1912-13 states that a slackening of the brisk demand occurred in the spring as a result of the diminution in the spirit of enterprise in Germany and abroad in consequence of the political disquietude. This state of affairs also continued into the new financial year, but a change for the better had now to be recorded. The working results for the year were satisfactory. The capacity of the works had been considerably increased by the extensions carried out in the preceding year, thereby providing for a new period of advancement. During the year the company's German works delivered 132,800 generators, motors and transformers of a total of 4,064,228 H.P., as compared with 134,539 and 3,737,674 H.P. in 1911-12. The period of development of the industry was naturally connected with that of the general national economy. But independently of this circumstance the formation of an opinion of the future was supported by the fact that the supply of electrical energy had frequently only been carried out in an incomplete manner and in part still required to be undertaken. The company had received an order for the electrical equipment of a trial train in connection with the experiments to be made on the Berlin City and Circle railways, and a large number of locomotives for main lines were under construction in the shops. Orders were also obtained for the Berlin Electric and Underground railway and the Hamburg railway, together with numerous contracts for tramways and for railways for ironworks and mines, and greater activity also took place in electric drives and equipments for industries. It is further mentioned that a large expansion occurred in the export trade.

The report of the directors of the Siemens & Halske Co. for 1912-13 states that the ascending line which the course of business assumed in preceding years continued in all branches in the past year. The results obtained by the Siemens-Schuckert Works, in which the company is a joint partner with the Electricity Co. (late Schuckert), of Nuremberg, and which represents an amalgamation of the heavy electrical engineering departments for the purpose of excluding mutual competition, also turned out satisfactorily. The number of officials and workers employed by the company at the Siemens-Schuckert Works rose from 70,000 in 1911-12 to 81,235 last year, but the effect of this increase was substantially surpassed by the fresh augmentation in the turnover. It was now over ten years since the rearrangement of the entire undertaking was initiated which led to the formation of independent companies for the heavy branches, and the system had been of advantage to the development of both spheres of activity as they mutually obtained greater liberty for advancement. Whilst the expansion of the light and heavy departments first took place in Germany and was soon followed in Austria-Hungary and England, the same practice had now been brought into operation in Russia. The company always had in view the question that the requisite funds should be able to be placed at its disposal to provide for further sound development and the extension of the manufacturing activity, but a limitation had been set to the investment of capital in electrical undertakings, etc. During the past few years a considerable extension had taken place in the light electrical branches and in many departments there had been an unforeseen development. The introduction of automatic and semi-automatic telephone exchanges was making good progress, and in all cases the installations had well withstood the test. Orders for interurban telephone cables for abroad were also on hand, and the high speed telegraph apparatus enjoyed growing popularity with home and foreign telegraph administrations. A number of novelties in instruments and electro-medical appliances had been placed on the market. The employment of electric power for the movement of points and signals was still increasing. Concerning the glow lamp factory the report remarks that a considerably greater production took place in the year, and the manufacture of a new wire lamp, brought out by the United States General Electric Co. was begun on the basis of the agreement existing with that company in regard to the interchange of patents for metallic filament lamps. The efforts put forth to obtain increased lighting per unit of energy had led to noteworthy progress also in the case of arc lamps, and the flame carbons made in various grades by Siemens Brothers & Co. had largely contributed towards this result. The extensions made during the year in the network of the Berlin Electric and Underground railway had provided good employment for the railway department, and the company had also received a large constructional order for the municipal railway between the North and the South of Berlin. It is added that the working of the elevated railway in Hamburg developed satisfactorily so that large repeat orders were secured.

French Electrical Companies.

The amalgamated undertaking of the supply companies in Paris—the Compagnie de Distribution d'Electricité—will replace the Union des Secteurs, in January. The company, which has an ordinary share capital of £4,000,000, now proposes to make an issue of £1,000,000 in the form of 5 per cent bonds. The commission will increase the total loan capital to £4,000,000, as there are already in circulation bonds for £2,000,000 of the 3½ per cent class and £1,000,000 of the 4 per cent. type.

The Electricité de Paris earned gross profits of £268,000 in 1912-13 on an ordinary share capital of £1,000,000, this comparing with £222,000 in the preceding year. As net profits the accounts show the sum of £101,000 as against £82,000 in 1911-12. It has been decided to distribute 16/- per share on the 100,000 shares of £10 nominal, the rate contrasting with 14/4½ per share in the previous year. The loan capital amounts to £947,000, whilst the securities in portfolio represent the value of £672,000.

The Compagnie Générale d'Electricité of Paris, whose share capital was increased from £720,000 to £1,000,000 last January, records gross profits of £191,000 in 1912-13 as against £144,000 in the preceding year; and net profits of £116,000 as compared with £104,000. In addition an extraordinary profit of approximately £40,000 was realised from the sale of shares held in the Energie Electrique de Catalogue, which amount has been placed to the reserve fund, thus raising the latter to £1,064,000 as contrasted with £626,000 in 1911-12. The dividend is at the rate of £2 per share as against £1 12s. in the previous year. The loan debt now totals £984,000, or £20,000 less than in 1911-12.

The Société d'Electro-Métallurgie of Dives, which has an ordinary share capital of £800,000, reports net profits of £59,000 for 1912-13 as compared with £28,000 in the previous year. The latter, however, only comprised a period of six months, whilst production in 1912-13 was prejudiced for a time through an outbreak of fire at the works. It is proposed to pay a dividend of 5 per cent. on 40,000 shares, this contrasting with the same rate on 30,000 shares in the preceding year. Excepting a sum of £6,000 the insurance companies have reimbursed the company for the damages caused by the fire. The directors, however, protest against the custom of the insurance companies in making deductions for the depreciation of the insured plant, seeing that the company has paid the full amount of the premiums for years past.

Russian Siemens-Schuckert Works.—As legal sanction has now been given to the alteration in the name of the Russian Schuckert Co. to that of the Russian Siemens-Schuckert Works, and to the increase in the share capital from £300 000 to £1,500,000, the Russian Siemens & Halske Co. is transferring the whole of its heavy electrical engineering departments to the Siemens-Schuckert Co., in which the company remains financially interested. On the other hand, the Siemens & Halske Co. will continue the light electrical branches, including railway safety appliances and signalling and wireless telephony and telegraphy, which are to be developed by the devotion of the whole of the works in St. Petersburg to these branches. It is also proposed to make comprehensive extensions of the works taken over by the Siemens-Schuckert Co., particularly the dynamo works and the works for material for the Army and the Navy, which will be completed in the current financial year.

Spain.—A company has just been formed in Brussels, with a capital of £60,000 and the title La Société des Tramways Electriques d'Alicante, to acquire and carry on certain electric tramways in Spain.

Japan.—The report of the Tokio Electric Light Co. for the last financial half-year, shows a net profit of £190,804, increased by the amount brought forward to £235,829. A dividend of 10 per cent. is being declared.

During November last a sum of £60,500 was invested in the electrical industry in Japan, £10,000 being in respect of new enterprises, and £50,500 for the extension of old concerns.

Bell Telephone Co. of Canada.—The directors have declared a dividend of 2 per cent., payable on January 15th.—*Financier.*

Paris Compressed Air Co.—The accounts of the Compagnie Parisienne de l'Air Comprimé (Secteur Popp), whose direct interest in the supply of electricity expired with the close of 1913 when the Union des Secteurs was replaced by the Compagnie de Distribution d'Electricité, show net profits of £207,000 for 1912-13 on a share capital of £1,000.000, as contrasted with £137 000 in the preceding year. It has been decided to pay a dividend of £1 16s. per share on the ordinary capital, this being the same rate as in 1911-12, and to allocate £80,000 to the special reserve fund. The company, whose electricity supply business yielded nearly four times the gross profits realised from the compressed air branch in 1912-13, remains indirectly interested in the lighting of Paris through its shareholding in the Compagnie de Distribution, whilst the compressed air concession will not lapse before 1927.

Consolidated Diesel Engine Manufacturers, Ltd.—The Shareholders' Committee has asked the board to call a meeting for January 14th to consider its report on investigation of the company's affairs.

Clevedon, Portishead and District Electric Supply Co., Ltd.—The first ordinary general meeting of this company was held on December 18th. The chairman explained that the meeting was necessary in order to comply with the Board of Trade Regulations, and moved the adjournment until some time in February. This was carried. Mr. F. Christy stated that the supply of current was available on August 19th, and the company commenced with three customers, whereas there were now 54 consumers, in addition to the public lighting throughout the district, which was giving every satisfaction. Many electric kettles, domestic irons and radiators were in use, and the progress made during the period was eminently satisfactory. It was anticipated there would be quite a decent balance of profit to carry forward when the accounts were made up. Mr. Christy also stated that it was hoped that the Clevedon district would have the opportunity of taking the light towards the end of the coming year.

India.—The Ahmedabad Electricity Co., Ltd., held its first statutory general meeting in November at Bombay, Sir H. E. E. Proctor presiding. The report stated that the licence granted by the Bombay Government, under the Indian Electricity Act, to Killick, Nixon & Co., was now vested in the company. The agreement between the company and the Ahmedabad Municipality providing for the supply to the latter of a minimum of 30,000 units per annum had been duly executed. Building operations for the generating station were to commence on December 1st, and the first unit of plant was expected to arrive next May. They regretted that they had been unable to obtain earlier delivery. The supply was not likely to be available until September. In the absence of Mr. T. O. Callender, Mr. W. Roberts, of Callender's Co., was asked to join the board. The chairman, in moving the adoption of the report to October 31st, said that the delay in giving supply was quite unavoidable owing to the impossibility of obtaining early delivery of the Diesel engines, the demand for which was very great indeed. The prospectus specified a low-tension D.C. system of distribution, but, acting on expert advice, they were changing their minds and adopting A.C.—3 300-volt three-phase transformed down to 400-volt three-phase four-wire for general purposes. This would lend itself to more ready expansion. They were also slightly increasing the initial capacity of one of the generating sets, involving an extra cost of £550, but they would reduce the cost per KW. They had received many inquiries for current, and did not anticipate any difficulty in disposing of the output estimated in the prospectus.

The Hon. Sir Jamsetji Jejibhoy seconded, and the report was adopted.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be quoted in the Official List :—

American Telephone and Telegraph Co.—$29,077,800 additional convertible 4½ per cent. gold bonds.

Rangoon Electric Tramway and Supply Co., Ltd.—Scrip £48 per cent. paid for £100,000 5 per cent. mortgage debenture stock.

The Committee has ordered the undermentioned to be quoted in the Official List :—

London Electric Railway Co.—36,357 ordinary shares of £10 each, fully paid, Nos. 1 to 36,357.

Underground Electric Railways Co. of London, Ltd.—Further issue of £76,000 4½ per cent. bonds of 1933 of £100 each, Nos. 16,688 to 17,447.

STOCKS AND SHARES.

Tuesday Evening.

Convention and custom immemorial demand that some sort of review of the preceding twelvemonth should be made on New Year's Eve. Times there are when this is far from a pleasant business, and this is one of those instances. The year just closing has been a very bad one for the Stock Exchange, for reasons familar to everybody interested in stocks and shares, and which have been duly chronicled from time to time in these columns. How bad it has been, a glance at the following tables helps to show. Amongst the welcome surprises, however, may be noted the steadiness of London's electricity supply shares, variations in which have been comparatively few throughout the period. In order to make a good start, we will first take this particular market, showing the net fluctuations this year. Here is our catalogue of ordinary shares in most of the leading companies :—

	Dec. 31st, 1912.	Dec. 30th, 1913.	Rise or fall.
Brompton and Kensington	9	8⅞	— ⅛
Charing Cross	4⅞	4¾	— ⅛
Chelsea	4¾	4⅞	+ ⅛
City of London	17	17	—
County of London	12¾	12	— ¾
Kensington and Knightsbridge ..	7⅞	7⅞	—
London Electric..	1¾	1⅜	— ⅜
Metropolitan	3⅝	3½	— ⅛
Notting Hill (Preference)	10¼	10⅛	— ⅛
St. James's and Pall Mall	10	8¾	— 1¼
South London	8½	8 7/16	— 1/16
South Metropolitan (Preference) ..	1 7/32	1 5/32	— 1/16
Westminster	9	8½	— ½

All the railway markets in the Stock Exchange have suffered from one cause or another, and Home Rails have been particularly affected by labour troubles dear money, and competition from other investment sources. The principal feature is the heavy fall in Central London non-assenting issues, as may be seen from the following short table of stocks and shares, which embraces representative examples of electrical traction descriptions :—

	Dec. 31st, 1912.	Dec. 30th, 1913.	Rise or fall.
British Elec. Trac. Pref.	12½	12½	—
Central London, Deferred	83	6 ½	— 20½
" " Assented	—	79	—
London United Trams. Deb.	70½	59	— 11½
Metropolitan Railway Consol.	53¼	45¾	— 7½
Metropolitan District	40¾	32	— 8¾
Underground Elec. £10 Shares	4½	3⅛	— 1⅜
" Income Debs.	93½	89	— 4½

Brazil, Mexico and Canada have proved positive sieves for the loss of British capital during 1913. Brazil has been perturbed by the heavy fall in rubber and coffee, Canada by the scarcity of hard cash, coming on the top of over-trading in previous years, and Mexico, of course, by the revolution. It is a melancholy story which holders of securities in these three countries have to con this year, and the next examples give some idea of the slump which has taken place in the various kinds of issues :—

	Dec. 31st, 1912.	Dec. 30th, 1913.	Rise or fall.
Brazilian Traction, Ord...	94½	84	— 10½
Canadian Gen. Elec., Com.	115	106	— 8½
Mexican Light and Power, Com. ..	85	42	— 43
do. First Mort. ..	96	79	— 17
Mexico Trams, Com.	112	66½	— 44½
do. 6 per cent. Bonds ..	104	8 ½	— 21½
Monterey, First Deb.	87½	60½	— 27
Shawinigan Water	145	135	— 10
Rio de Janeiro Trams, First	103	100½	— 2½
Sao Paulo Trams, First	103	98½	— 4½

Foreign Tramway varieties have been fairly steady on the whole, with the exception of British Columbia Electric stocks. There has been a drop of 34 points in the Deferred, due, principally, to sympathy with the flatness of Canadian investments. We give a quintet of instances to show the rise or fall on the year :—

	Dec. 31st, 1912.	Dec. 30th, 1913.	Rise or fall.
Anglo-Argentine Trams 1st Pref. ..	4⅞	4 13/16	— 1/16
British Columbia Electric Deferred ..	141	107	— 34
Calcutta Trams Ordinary..	5⅞	6¼	+ ⅜
Para Electric Railways Ordinary ..	7½	5¾	— 1¾
United Electric Tram, Monte Video ..	5¾	4⅝	— 1⅛

Stocks and shares in the Telegraph and Telephone market have gone softly. American Telephone and Telegraph stock, after being 142, fell to 115; this was the heaviest decline during the year, but there has been a recovery from the worst. The excitement in Marconis has been spasmodic, and the market has fallen upon quiet days, the drop on balance amounting to 28s. 9d. The examples which follow are representative of the various classes of companies concerned with this industry :—

	Dec. 31st, 1912.	Dec. 30th, 1913.	Rise or fall.
American Telegraph and Telephone..	142	125½	— 16½
Anglo-American Preferred	111½	105¾	— 5¾
Direct United States	7¼	6½	— ¾
Eastern	134½	125½	— 9
Eastern Extension	13¼	12¼	— 1
Globe Telegraph and Trust	10⅜	10⅞	+ ½
Great Northern	28½	31½	+ 3
Indo-European	57	58	+ 1
Marconi's Wireless	4¾	3 5/16	— 1 7/16
Oriental Telephone	1 23/32	1 13/16	+ 3/32
Reuters	10¾	9	— 1¾
United River Plate Telephone.. ..	7 3/16	6⅝	— 9/16
West India and Panama..	3⅛	2⅜	— ¾
Western Telegraph	13¼	12⅝	— ⅝

It remains only to add a selection from the Manufacturing group, an outstanding feature of which is a substantial recovery in the price of Crompton Debenture stock. It is said in the Stock Exchange that the electrical manufacturing companies are doing much better than they were a year ago, but as to this the readers of these notes are probably in a position far better for judging accurately than the writer of them. The movements, it will be observed, show a preponderance of rises over declines :—

	Dec. 31st, 1912.	Dec. 30th, 1913.	Rise or fall.
Babcock & Wilcox	3 3/16	2⅞	— 5/16
British Aluminium	¾	1 1/16	+ 5/16
British Insulated	7¾	8	+ ¼
Brush Second Deb.	30	25	— 5
Callender's Cable	10⅞	10⅞	—
Castner-Kellner	3 11/16	3 11/16	—
Crompton Deb.	61	70½	+ 9½
Dick, Kerr & Co.	1⅛	⅞	— ¼
Edison & Swan First Deb.	66	59	— 7
Henley's	12⅝	13⅛	+ ½
India-Rubber	10	12	+ 2
Telegraph Construction	35½	38	+ 2½

Remains there nothing further to add than the sincere wish that to all of those who are interested in electrical investments and businesses, the New Year may prove one of bountiful prosperity and sustained success.

Northern General Transport Co.—According to a financial daily, this company has been formed with the object (among others) of carrying on in the Northern Counties, transport business in all its branches, and especially with a view to consolidating the interests of the shareholders of the Gateshead and District Tramways Co., the Tynemouth and District Electric Traction Co., Ltd., and the Jarrow and District Electric Traction Co., Ltd.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 30th.	Rise + or Fall	Present Yield p.c. £ s. d.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	1/16 — 3/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11½ — 13½	+1	..
Do. Do. Deferred ..	100	..	..	4½ — 6	+ ½	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85 — 88	+1	6 16 4
Do. 7 % Non-Cum. Pr'f.	100	3	..	52 — 55	..	5 9 1
Do. 5 % Perp. Deb. ..	100	5	5	92 — 95	..	5 5 6
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 80	..	5 12 6
Central London Railway, Ord. ..	100	3	3	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 8
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896 .. .	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	94 — 96	..	5 4 2
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½ xd	..	6 13 4
Do. 4 % Deb.	100	4	4	71 — 76 xd	..	5 5 8
Lancashire United, 5 % Deb. ..	100	5	5	75 — 79 xd	..	6 6 7
London and Suburban, Ord. ..	1	..	..	7/32 — 11/32	+ 1/32	..
Do. Do. 5 % Cum. Pref.	1	..	5†	[illegible] — 11/16	+ 1/16	..
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	72 — 77 xd	..	5 17 0
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	57 — 61 xd	..	6 11 2
Metropolitan Railway Consol. ..	100	1⅝	1¼†	15½ — 16	+ 2¼	3 19 [illegible]
Do. Surplus Lands	100	2¼	2¼†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan District Ord. ..	100	Nil	..	31¾ — 32½	+ 1¾	Nil
Do. 6 % Deb.	100	6	6	133 — 136 xd	..	4 8 8
Do. 4 % Deb.	100	4	4	90 — 92 xd	..	4 7 0
Do. 4 % Prior Lien	100	4	4	94 — 96	+1	4 3 4
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	80 — 84 xd	..	5 7 2
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — 13/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70 xd	..	5 14 4
Underground Elec. Railways ..	10	..	..	3¼ — 3½	..	Nil
Do. "A"	1/-	..	..	⅜ — 7/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	111 —113	..	5 6 2
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	88½ — 89½	+ ½	6 14 10
Yorkshire (West Riding), Ord. ..	5	Nil	..	¼ — ½	..	Nil
Do. 6 % Pref.	5	3	4	3½ — 4	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	80 — 85 xd	..	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 30th.	Rise + or Fall	Present Yield p.c. £ s. d.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 11/16 — 4 15/16 xd	+ ⅛	5 11 4
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16 xd	+ ⅛	6 3 11
Do. 4 % Deb.	100	4	4	88 — 90 xd	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Do. 5 % Deb.	100	5	5	97½ — 99½	+ ½	5 0 6
Auckland Trams, 5 % Deb. ..	100	5	5	100 —102 xd	..	4 18 0
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	92 — 94 xd	..	4 15 9
Do. 5 % 2nd Deb.	100	5	5	97 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	83 — 85	—1½	7 1 2
Brisbane Trams Invt., Ord. ..	5	8	8	7½ — 7¾	..	5 3 8
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	96 — 99 xd	..	4 11 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	105 —109 xd	..	7 6 10
Do. Pref. Ord.	100	6	6	102 —106	..	5 13 2
Do. 5 % Pref.	100	5	5	102 —105	..	4 15 3
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —104	..	4 6 7
Do. 4¼ % Con. Deb.	100	4¼	4¼	92 — 95	..	4 9 6
Calcutta Trams, Ord.	5	7½	5†	6 — 6½	+ ⅛	5 15 5
Do. 5 % Pref.	5	5	5	4¾ — 5⅛ xd	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	93 — 96 xd	..	4 13 9
Cape Electric Trams	1	5	5	21/32 — 23/32	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5¼ — 5⅝	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96 xd	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90 xd	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord. ..	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4⅜d.	6	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1⅛ — 1 3/16 xd	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 11 3
„ Elec. Tr. (1904), Deb. ..	100	5	5	99 —101 xd	..	4 19 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	81 — 84	..	5 19 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	65 — 68	—6	10 5 10
Do. Gen. Con. 5 % Bonds ..	..	5	5	77 — 82	..	6 2 0
Do. 6 % Bonds	100	6	6	80 — 83	+2	7 4 7
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	5½ — 6	— ¼	8 6 8
Do. 6 % Pref.	5	6	6	4½ — 5	— ⅛	6 0 0
Do. 5 % 1st Deb.	100	5	5	94½ — 96½	..	5 3 8
Perth (W.A.) Elec. Tr., Ord., ..	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5⅛ — 5⅜	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	99½ —101½	..	4 18 6
Do. 5 % Mort. Bonds	100	5	5	90 — 92	..	5 8 9
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 —100	..	5 0 0
Singapore Trams, 5 % Deb. ..	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video ..	5	7	7	4⅜ — 4⅞	— ⅛	7 3 7
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Dec. 30th.	Rise + or Fall	Present Yield p.c. £ s. d.
	*	1912.	1913.			£ s. d.
Bournemouth & Poole, Ord. ..	10	4½	4½	9 — 10	— ½	6 0 0
Do. 4½ % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. Second 6 % Pref.	Stock	4½	4½	93 — 96 xd	..	4 13 9
Do. 4½ % Deb. Stock	5	10	9†	8⅝ — 9⅛	..	4 9 9
Brompton & Kensington, Ord. ..	5	7	7	8¼ — 8¾	..	4 0 0
Do. 7 % Cum. Pref.	100	[illegible]	4	90 — 93	..	4 6 0
Central Electric Supply, 4 % Guar. Deb.	5	5	5†	4½ — 5	..	5 0 0
Charing Cross, West End & City	5	4½	4½	4 — 4½	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	3½ — 4 xd	..	5 12 6
Do. "City Undertaking" 4½ % Cum. Pref.	100	4	4	89 — 91 xd	..	4 8 0
Do. Do. 4 % Deb.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Chelsea, Ord.	Stock	4½	4½	94 — 97 xd	..	4 12 9
Do. 4½ % Deb.	10	9	6†	16½ — 17½	..	5 2 10
City of London, Ord.	10	6	6	13 — 14	..	4 5 9
Do. 6 % Cum. Pref.	Stock	5	5	114 —118 xd	..	4 4 9
Do. 5 % Deb.	100	4½	4½	97 — 99 xd	..	4 11 0
Do. 4½ % Second Deb. ..	10	6	5†	11¾ — 12¼	..	4 18 0
County of London, Ord.	10	6	6	11½ — 12	..	5 0 0
Do. 6 % Pref.	Stock	4½	4½	101 —103 xd	..	4 7 5
Do. 4½ % Deb.	Stock	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Second Deb. ..	£3	..	..	5/16 — 9/16	..	Nil
Edmundson's, Ord.	5	6	6	3⅞ — 4¼	..	7 1 2
Do. 6 % Cum. Pref.	5	..	..	1½ — 1⅞	..	..
Do. 6 % Non-Cum. Pref. ..	100	4½	4½	80 — 83	..	5 8 5
Do. 4½ % First Mort. Deb. ..	6	6	6	4⅝ — 4⅞	..	6 3 1
Folkestone	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 5 % Cum. Pref.	100	4½	4½	89 — 91	..	4 19 0
Do. 4½ % First Deb.	[illegible]	9	8†	8¾ — 9¼	..	4 17 9
Hove	10	6	5†	9¾ — 10¼	..	5 17 1
Kensington & Knightsbridge, Ord.	5	8	8†	7⅝ — 8⅛	..	4 17 6
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅛ — 1⅜	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4	4†	3½ — 3¾	+ ⅛	5 6 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 4⅞	..	4 14 9
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	95 — 98 xd	..	4 11 10
Do. 3½ % Mort Deb.	Stock	3½	3½	77 — 81 xd	..	4 6 5
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 - 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10¼ xd	..	5 11 [illegible]
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord. ..	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref	5	7	7	6⅝ — 7⅛	+ ⅛	4 18 3
Do. 3½ % Deb.	100	3½	3½	81 — 84 xd	..	4 3 4
South London, Ord.	4	5½	..	2⅝ — 3¼	..	6 15 4
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99 xd	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/32 — 1 7/32	..	5 14 9
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	5/16 — 9/16	..	..
Do. 5 % Cum Pref.	5‡	3	..	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord.	5	10	10†	8¼ — 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4 13/16 — 5 3/16	..	4 6 10

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 8s. in Funded Dividend Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 30th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Adelaide, 6 % Pref.	5	6	6†	5⅛ — 5⅜	..	5 11 7
Calcutta, Ord.	5	6½	6†	7⅛ — 7⅜	..	5 11 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	8	104 —109 xd	..	7 6 10
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 — ⅝	..	7 12 0
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88½ — 90½	..	6 12 7
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94 xd	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94½ — 96½	..	5 8 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	6†	11/32 — 13/32	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102½ —104½	..	4 15 8
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104 xd	..	4 16 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	68 — 73	..	7 0 10
Mexican Lt. & Power, Common	$100	4	4	40 — 44	−3	9 1 10
Do. 7 % Cum. Pref.	$100	7	7	74 — 79	−4	8 17 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	77 — 81	..	6 3 5
Do. 5 % 2nd Mort. Bonds	100	5	5	66 — 71	..	7 0 10
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	58 — 63	..	7 16 0
Montreal, Lt., H. and Power	$100	9	10†	216 —222	..	4 10 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	101 —106	..	5 13 2
Do. 5 % Deb. Stock	Do.	5	5	93 —100 xd	..	5 0 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital	$100	5½	6†	133 —137	−2	4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ —107½	..	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	96½ — 98½	..	4 11 5
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	89 — 91	..	5 8 9
Victoria Falls Power, Pref.	1	6	6	25/32 — 27/32	−1/32	7 2 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 8

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 30th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	⅝ — ¾ xd	..	8 0 0
Babcock & Wilcox	1	16	14†	2 13/16 — 2 15/16	..	5 8 11
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 — 1⅛	..	..
Do. 6 % Cum. Pref.	1	6	6	25/32 — 29/32	..	6 12 6
Do. 5 % Prior Liens Debs.	100	5	5	94 — 97	..	5 3 2
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	8†	7¾ — 8¼	..	6 1 8
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	[illegible]	Nil	..	1 1/16 — 1 3/16	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	⅛ — ⅜	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80 xd	+5	6 5 0
Do. 4½ % Deb.	100	4½	4½	35½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27 xd	+2½	16 13 4
Callender's Cable	5	15	5†	10½ — 11¼	..	6 13 4
Do. Pref.	5	5	5	4¾ — 5 xd	..	5 0 0
Do. Deb.	100	4½	4½	95 — 98 xd	..	4 8 6
Castner-Kellner	1	20	22½	3⅝ — 3¾	..	6 0 0
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co., Deb.	100	5	5	68 — 73	..	6 17 0
Dick, Kerr	1	Nil	..	5/16 — 9/16	..	—
Do. Pref.	1	6	6	23/32 — 27/32	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	57 — 61	..	6 11 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	½ — ⅝	..	7 5 6
Do. Pref.	1	7	7	15/16 — 1 1/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	9⅞ — 10⅜	..	5 15 8
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12¾ — 13½	..	5 11 1
Do. Pref.	5	4½	4½	4¾ — 5	−1/16	4 10 0
Do. Deb.	100	4½	4½	100 —102	..	4 8 3
India-Rubber, G. & T.	10	7½	5	11½ — 12½	..	6 0 0
Do. Pref.	10	5	5	9½ — 10	..	5 0 0
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	62 — 66	+1	6 1 3
Do. B 4 % Cum. Pref.	100	..	..	48 — 53	+13	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 30th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	6½ — 6¾	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	..	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	124 —127 xd	+10	6 6 0
Do. Collat. Trust	$1000	4	4	88 — 91	..	4 8 0
Anglo-American Telegraph	Stock	3	3	63 — 66	..	4 11 0
Do. 6 % Pref.	Do.	6	6	105½ —106½	+ ½	5 13 6
Do. Def.	Do.	30/-	..	24⅜ — 24⅞	..	6 0 7
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7 5/16 — 7 9/16	..	5 5 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	78 — 80 xd	..	5 0 0
Cuba Telegraph	10	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	10	10	10	14¾ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	3¼ — 3¾	..	5 6 8
Do. 10 % Cum. Pref	5	10	..	6¾ — 7¼	..	6 18 0
Direct United States Cable	10	4	4†	6¼ — 6¾	..	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	124 —127	..	5 10 3
Do. 3½ % Pref. Stock	Do.	3½	3½	75 — 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 3 4
Eastern Extension	10	7	7	12 — 12½	..	5 12 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust	10	6	6†	10⅝ — 11⅛ xd	..	5 7 10
Do. 6 % Pref.	10	6	6	11¾ — 12¼ xd	..	4 18 0
Great Northern Telegraph	10	20	5†	30½ — 32½	..	6 2 8
Indo European Telegraph	25	13	5†	57 — 59	..	5 10 2
Mackay Companies Common	$100	5	5	79 — 83	..	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	64 — 68	..	5 17 8
Marconi's Wireless Telegraph	1	20	20	3¼ — 3⅜ xd	..	5 18 6
Do. 7 % Cum. Partic. Pref.	1	17	..	2 9/16 — 2 13/16	+1/16	6 1 0
Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	23/32 — 25/32	−1/32	6 8 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97¾ — 98¼	..	4 11 5
Oriental Telep. and Elec.	1	10	10†	1⅞ — 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1 1/16 — 1 3/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	85 — 87 xd	..	4 12 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97 — 99	..	4 1 0
Reuter's	10	10	10†	8½ — 9½	+ ½	10 10 6
Submarine Cables Trust	Cert.	6	6	122½ —125½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 11
United River Plate Telephone	5	8	6†	6⅝ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	4⅞ — 5⅛ xd	..	4 18 0
West Coast of America	2½	2½	..	1 5/16 — 1 7/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	1½	2¼ — 2½	..	5 0 0
Do. 6 % Cum. 1st Pref.	10	6	6	9¾ — 10¼	..	5 17 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	98 —100	..	5 0 0
Western Telegraph, Ltd.	10	7†	7	12⅝ — 13⅛ xd	..	5 6 8
Do. 4 % Debs.	Stock	4	4	90 — 92 xd	..	4 7 0
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 5 per cent., October 2nd, 1913.

New Swedish A.E.G. Works.—It is reported that the A.E.G. of Berlin has just acquired from the town of Malmö, in South Sweden, a large site on the harbour, on which it is the company's intention to build large works for the manufacture of electrical goods. The Swedish Industrial Association submitted a protest to the authorities of Malmö, in which it was pointed out that the new project would do great harm to the Swedish electrical industry, which had no lack of competitors as it was, and there was thus no reason to dispose of a most valuable site to a foreign firm, which could only have one purpose in view, viz., that of getting a footing in the Swedish market at the expense of the home industry. It was further pointed out that the purchase price, 11s. 2d. per sq. metre was a bargain and quite ridiculous in comparison to the value of the site in question. The Malmö authorities did not, however, take any notice of this protest and the contract with the A.E.G. has been signed. The new factories will find employment for 1,200 men.

Imports into East Africa.—In his report for the year 1912-13, Mr. Major, Chief of Customs, East Africa Protectorate, says that the "activity of the electrical industry during the year is modestly reflected in the returns of electric apparatus imported, which amounted to £3,489." The increase was £1,550, or 80 per cent. over the figures for preceding year. The consignments were mostly from the United Kingdom. The imports of iron and steel manufactures (£28,100), and wires (£3,252), nearly doubled in value, the increase being from £16,613 in 1912, to £31,352 in 1913. The United Kingdom has 64 per cent. of the trade in iron and steel manufactures, but in wire she contributed £35 only, Austria-Hungary's share coming to £1,737, and Germany's to £1,480. The import trade in industrial machinery advanced from £21,065 to £51,572—145 per cent. increase. The trade is in the hands of English manufacturers, Continental countries and the United States only improving by £500.

THE RIGHTS OF A SPECIALIST OR SUB-CONTRACTOR.

[FROM A LEGAL CONTRIBUTOR.]

There is no class ot person more concerned with the relationship between employer, contractor and sub-contractor than the electrical engineer—using that term, for the moment, to include the wiring contractor and the supplier of electrical fittings. His main concern, of course, is to get paid for the work he carries out; and if it is a question against whom he shall make his claim, he naturally prefers to make it against the right person. Whether he can claim from the employer or the contractor is a question which it is by no means easy even for the lawyer to solve.

A recent case in the House of Lords (Ramsden & Carr *v.* Chessum & Sons, *Times*, Nov. 11th) has drawn attention to the question in a somewhat new aspect. The facts were very simple.

The defendant firm, who were builders, contracted to erect a cinema theatre, the contract being in the form as approved by the Royal Institute of British Architects. The architect to the building owners employed the plaintiffs as specialists to supply certain door handles and door fittings. At the time of receiving the order from the architect, and for some time thereafter, the plaintiffs were ignorant of the names of the builders. The goods were duly supplied and were used by the defendant firm in carrying out their contract. Progress-certificates were granted from time to time under which the defendant firm received large sums from the building owners, but the defendants had not been paid anything which was referable in any possible way to the plaintiffs' goods.

Mr. Justice Hamilton, who tried the case in the first instance, held that the plaintiffs were entitled to recover. He was reversed by the Court of Appeal (Lord Justice Kennedy dissenting). His judgment has now been restored by the House of Lords. The Lord Chancellor, in giving judgment, said that the plaintiffs had failed to show that the architect had acted as agent for the builders; that the plaintiffs had no claim as for money had and received; but that the fact that the goods were delivered to and used by the defendant firm raised no implied promise by them to pay for them.

In the result the sub-contractors had judgment for £142 odd after a long and expensive litigation.

The decision in this case seems to render it desirable to set forth the general principles of law applicable to sub-contractors.

Generally speaking, where there is no stipulation against sub-contracting a contractor may employ sub-contractors. The rule, however, is subject to the qualification that it does not apply when the employer reasonably and naturally looks for the personal service and attention of the contractor. Thus, if the work in hand were of a highly special character it would not be competent for a contractor who was skilled in that class of work to hand over his performance to some-one else. It is otherwise, however, when the work involves the exercise of no special degree of skill. Cockburn, C. J., in British Waggon Co. *v.* Lea, 1880, 5 Q.B.D. 149 (at p. 153) thus stated his views of the law on the subject: "Much work is contracted for which it is known can only he executed by means of sub-contracts; much is contracted for as to which it is indifferent to the party for whom it is to be done, whether it is done by the immediate party to the contract, or by someone on his behalf. In all these cases the maxim, *qui facit per alium facit per se*, applies."

The employer is not liable to a sub-contractor, unless an agreement between them can be proved. Such an agreement will not be implied from the mere acceptance of the sub-contractor's work. For instance, where an employer contracted with a builder to do certain work on his house, and a tradesman supplied goods to the builder for use on the house, it was held that the employer was not liable for their price (see the case of Brahmah *v.* Abingdon, cited in Paterson *v.* Gaudasequi, 1812, 15 East, 62). The employer does, however, become liable if it can be shown that there is a contract between him and the sub-contractor. For instance, in another case a contractor employed a mason to do certain work as extra to the contract. In an action for work and materials by the mason against the contractor's employer, the plaintiff stated that the work in question was extra to the contractor's contract, and that he had agreed with the contractor to do the work. On production of the contractor's contract, the jury found that there was a distinct contract between the mason and the employer for the work sued on, and judgment was entered for the plaintiff (Eccles *v.* Southern, 1861, 3 F. & F. 142).

An employer may also become liable to a sub-contractor by going surety for him. In that case, however, there must be something in writing, as a contract of guaranty cannot be sued on unless it is written. But there is a difference between a promise to pay the debt of another and a direct promise to be liable oneself in any event. In the latter case, a written contract need not be proved. Thus, if the employer promises to pay the sub-contractor out of moneys which he has to pay to the head contractor, this would be treated as a direct promise to pay (Dixon *v.* Hatfield, 1825, 2 Bing, 439).

There is another way in which the employer may become directly liable to a sub-contractor. It may be proved that the head contractor in employing the sub-contractor really acted as the agent for the employer. The onus of proving this will be on the sub-contractor (see Woodward *v.* Buchanan, 1870, L.R. 5 Q.B. 285).

It is obvious that when a sub-contractor is employed the question whether he will continue to be employed depends upon the conduct of the head contractor. Thus, if the head contractor does some act which entitles the employer to put an end to the contract, the sub-contractor may in his turn be ousted. In that case, the sub-contractor may bring an action for damages against the head contractor, as the law implies that the head contractor will do nothing to prevent the sub-contractor completing his work and earning his profit.

The question—who is the sub-contractor to look to for his remuneration?—naturally turns upon the conditions of his employment. In an ordinary form of agreement a clause is inserted providing that the contractor will pay to the sub-contractor "the sum of £ when the engineer for the time being of the said corporation (*i.e.*, the employer) shall have certified in writing that the said work has been finished and completed to his satisfaction." Other terms are sometimes inserted providing for payment by instalments.

The question of liability largely depends upon whether the contractor was constituted the agent of the employer to employ the sub-contractor or to purchase goods from him, and to establish privity of contract between the employer and such sub-contractor. Where the defendant (a building owner) entered into a contract with a builder by which the latter agreed to build a house for him under the supervision of an architect, the contract provided that the provisional sums for goods to be ordered from special artists or tradesmen should, as the architect should certify, be payable by the builder or the building owner.

The exact terms of the clauses were that: "The provisional sums mentioned in the specification for materials to be supplied or for work to be performed by special artists or tradesmen, or for other works or fittings to the building, shall be paid and expended at such time and in such amounts and to and in favour of such persons as the architect shall direct, and sums so expended shall be payable by the contractor without discount or deduction or by the employer to the said artists or tradesmen."

Special goods according to a particular design were ordered by the builder from the plaintiff, who was a metal worker, and the architect certified the sum for these goods as due from the defendant to the plaintiff, deducting the amount from the certificate given to the builder. It was held that the plaintiff was entitled to recover this sum direct from the building owner (Hobbs *v.* Turner, 1901, 18 T.L.R. 235). In the absence of such a clause a specialist or sub-contractor would be compelled to look for his remuneration to the person who directly employed him, namely, the head contractor.

Trouble frequently arises where, owing to the insolvency of the contractor, the sub-contractor is compelled to look to the building owner. He often makes such a claim without avail; but by means of a special clause this difficulty may be avoided. So in *re* Wilkinson *ex parte* Fowler (1905) 2 K.B. 713 a district council entered into a contract with a contractor for the construction of certain sewage works. The contract provided that certain machinery for the works was to be supplied to the contractor by certain specified firms, and that "if the engineer shall have reasonable cause to believe that the contractor is unduly delaying proper payment to the firms supplying the machinery he shall have power, if he thinks fit, to order direct payment to them." The contractor having become bankrupt, it was held that the engineer had power to direct the payments to be made to the machinery firms direct. Mr. Justice Bingham said: "I think the clause means that if the persons supplying machinery to the contractor for the purpose of the contract are not promptly and properly paid by him, they can apply to the engineer, and then it shall be competent for the engineer to intervene, and by a proper certificate given in that behalf to require the Council to pay to the machinery firms the amount of their accounts directly—that is to say, not through the hands of the contractor at all, but the money is to be paid directly by the Council to the machinery firms."

If an employer reserves to himself the right of employing specialists to do any portion of the work on a large contract, he does not thereby give an implied undertaking to the head contractor that he will be responsible for any damage caused to the builder by any delay or default on the part of the specialists. In the case of Mitchell *v.* Guildford Union (68 J. P. 54, 1903) a builder undertook to do the whole of a certain piece of work for a certain sum, but part of it was to be done by specialists. The builder undertook to finish the work by a certain date unless he was hindered by (*inter alia*) delay on the part of the engineers or other specialists. The builder was not to be liable for any defects in works provided by the specialists, unless by reason of contributory negligence on his part, or his having paid any final balance to the specialists without first having the architect's written authority to do so. In the course of the work there was delay on the part of the specialists whereby the builder suffered damage. The builder brought an action for breach of contract against the building owners, alleging that under the contract and specification there was an implied promise on the part of the building owners that the delivering and pricing should be done at such reasonable times as to enable the builder to complete his work within a reasonable time thereafter, and that the building owners had broken one or both of these implied promises. It was held that on the proper construction of the contract and specification there was no such implied promise, and that there was no breach of contract on the part of the building owners affording the builder a right to damages (see also Leslie *v.* Metropolitan Asylums District, 1901, 68 J.P. 86). As a general rule, however, the subcontract contains a clause to the effect that "the subcontractor shall pay to the contractor the sum of £ as liquidated damages, and not by way of penalty, per day for each day after the day of that the work shall not be finished or complete, and it shall be lawful for the said contractor to retain the said sums out of moneys payable to the sub-contractor."

The liability of a sub-contractor for delay in completing the work he has undertaken to carry out depends on the terms of his contract with the head contractor. If he does not know that the head contractor has undertaken to do the work within a specified time, he will not be liable for the damages claimed and recovered by the employer for delay, but it is otherwise if it is shown that he knew what would be the consequences of delay. These principles may be illustrated by two cases. In the first of these (Portman *v.* Middleton, 1858, 27 L J.C.P. 231) the plaintiff contracted with a person who may be termed the employer to repair a machine. Part of the machine consisted of a firebox which the defendant was employed to make within a certain time, the plaintiff was unable to complete his contract with his employer, who sued for and recovered damages. It was shown, however, that the plaintiff would have had time to get another firebox elsewhere. The present action was brought to recover the damages paid to the employer from the sub-contractor. It was held that the damages paid could not be recovered, inasmuch as the terms of the contract with the employer were unknown to the sub-contractor, but that the plaintiff could recover from the defendant the sum of £82 which he had originally paid to the manufacturers, and the extra cost required in getting another firebox elsewhere. In the other case (Hydraulic Engineering Co. *v.* McHaffie, 1878, 4 Q.B.D. 670), the plaintiff company contracted with an employer to make a pile-driving machine. The defendant was employed to make a part of the machine and to deliver the same by the end of August, when, as he knew, the plaintiff company had to make delivery to the employer. The defendant was a month late in making delivery of his part, with the result that the employer refused to accept the whole machine. As it was of peculiar construction, no market could be found for it, and it was therefore sold as old iron. It was held that the plaintiffs were entitled to recover the profits which they would have made on the sale to the employer, and the expenditure thrown away on the other parts of the machine. From this it may be inferred that any sub-contractor for the execution of a portion of a contract for large works may find himself cast in very considerable damages if he is guilty of delay.

ELECTRIC CONVERTER FOR PRODUCING HIGH-FREQUENCY OSCILLATIONS FROM DIRECT CURRENT.

In a recent issue of the *Physical Review*, W. I. Book describes an "Electric Converter," for the production of high-frequency oscillations from direct-current supply, which apparatus differs much from all methods hitherto used to produce continuous oscillations, although the primary and secondary oscillating circuits are arranged as in the Duddell and Poulsen arc systems.

Referring to fig. 1, the Book converter consists of a powerful electromagnet with tubular pole-pieces *a*, about 7·6 cm. in diameter. The walls of the pole-pieces are reamed out to an end thickness of about 0·45 cm., and to each is attached, as shown, a fibre ring *b* about 10 cm. in outer diameter. This fibre insulation carries a copper cathode-ring *r* (5·6 cm. internal diameter), and one pole-piece is fitted with a fibre plug *c* through the centre of which passes a brass rod *d*. To the end of this rod, which is thus insulated from the pole-pieces, there is attached a zinc or carbon anode disk *e* (5·4 cm. in diameter). The fibre rings *b* project slightly beyond the pole-pieces, thus forming recesses into which are fitted mica disks *g*. The anode disk and the cathode ring are insulated completely from the pole-pieces, and the gap between the former obviously lies in a very powerful magnetic field when the magnet coils are excited.

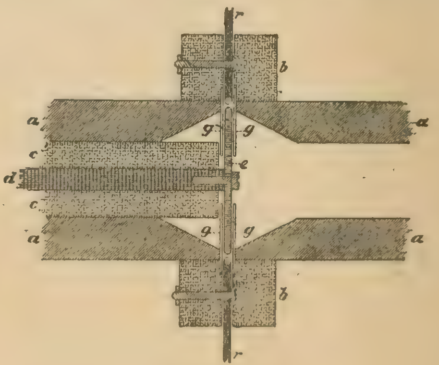


Fig. 1.

If a difference of potential of 500 volts be established between the anode and cathode under proper conditions, a discharge passes which, by the electrodynamic force to which it is subjected, is compelled to rotate in the annular air-gap between the electrodes. In order to produce oscillations in an oscillatory circuit shunted across the gap, it is necessary that either the anode disk or the cathode ring should have a rough surface, and in practice it is found best to put a regularly roughened surface on the cathode ring. The simplest and most successful method tried was to wind a soft copper wire of, say, No. 16 gauge on to a ring of No. 10 or 11 wire. This wire-wound ring *r* was then soldered into a circular hole cut in a sheet of copper, the latter serving for the connection of the negative supply lead and also as a heat radiator for the cathode ring.

The connections of the converter as used for the production of high-frequency oscillations in a secondary circuit (supply being taken from two ½-H.P. direct-current dynamos in parallel), are shown in fig. 2, in which R_0 represents a variable resistance capable of varying the main current from 0·1 to 1·0 ampere; I represents a D.C. milliammeter; L_0 a choke coil; G the converter gap; C_1 and C_2 variable oil condensers; L_1 and L_2 the primary and secondary of a closely wound induction coil; I_1 a hot-wire ammeter; and R_2 a variable resistance.

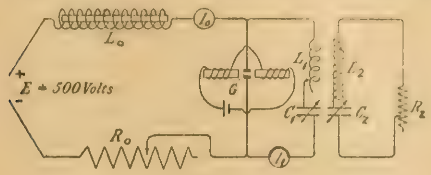


FIG. 2.

When the connections are made and the proper conditions established for the spark discharge, a spark will rotate in the converter gap between the inside disk and the outer, regularly notched ring. Because of the grooves in the latter, the sparking distance and hence the gap resistance alternates rapidly from a given minimum to a given maximum, but the choke coil in the main circuit meanwhile maintains a nearly constant supply of power through the gap. Owing to the periodically varying resistance of the gap, there is a periodically varying flow and ebb of energy in the primary oscillating circuit. The latter has a natural frequency of its own, and it would appear that the oscillating energy in the primary circuit reaches a maximum when the natural frequency of this circuit is an integral multiple of the frequency of flow and ebb of energy due to the varying resistance of the spark gap. However, the D.C. voltage impressed on the gap, the current in the main circuit, the average length of the spark gap, the pitch of the gap serrations, the intensity of the gap field and other variable factors make the complete determination of the interrelation of the main and primary oscillating circuits a less simple problem than might be expected.

The spark gap may vary in mean length from 0·2 to 2·5 mm. and with a gap of this length, it is necessary to start the discharge by some mechanical means, that actually adopted being to push a small wire into a groove in the fibre next to the cathode ring so that the wire short-circuits the electrodes. The main circuit being thus closed, the wire is immediately withdrawn and the spark discharge commences. Fig. 3 shows the result of using various gap lengths; the upper curves Zn_i and C_i show the variation in primary oscillating current with gap length, using zinc and carbon anodes respectively. The lower curves illustrate the variation in D.C. voltage across the gap. For best results, the spark gap should be from 0·4 to 1·5 mm. in length, and experience shows that zinc, carbon, brass and aluminium anodes are all practically of the same value.

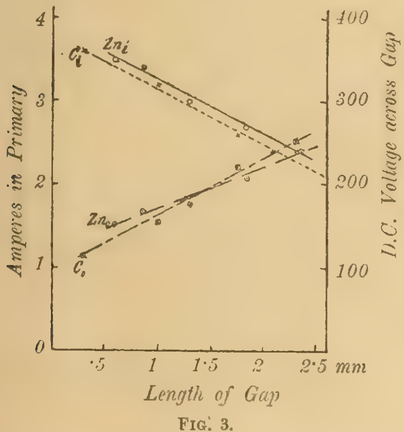


FIG. 3.

If all the conditions in the main and oscillating circuits be kept constant and the field be increased gradually, the current in the primary oscillating circuit increases to a maximum value (as shown by fig. 4, in which curves Z N_{2}, $_{3}$, $_{5}$, refer to gap lengths of 0·85, 1·3 and 2·3 mm. respectively). If the field strength be yet further increased, the spark discharge ultimately sputters or becomes noisy and the energy in the oscillating circuit is decreased rather than increased. No completely satisfactory explanations of this behaviour are yet available.

Curve I_1, fig. 5, shows the increase in primary oscillating current with increasing capacity in that circuit, and Curve I_0 represents the corresponding values of the supply current (gap field 4,500 gauss throughout).

When the main circuit current is too high, the spark discharge is irregular and little energy gets into the oscillating circuit. If the supply current be then gradually decreased, operation becomes smoother and the primary oscillating current increases gradually to a maximum for the capacity then in this circuit. Further slight reduction in the supply current then causes the spark to "blow out"—a phenomenon which suggests that as the energy in the oscillating circuit becomes greater a condition is reached in which the back E.M.F. of the gap, due to the oscillations, reduces the net voltage across the gap to a value too low to maintain the spark discharge.

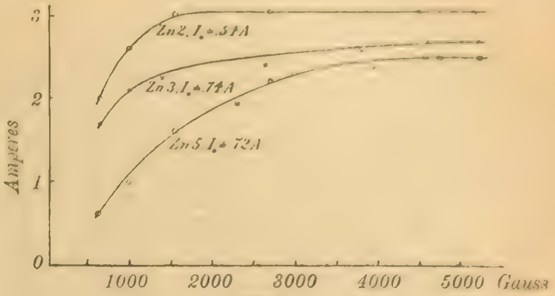


FIG. 4.

A very large number, say 25, of notches per unit length of arc in the spark-gap's circumference is rather disadvantageous than beneficial so far as concerns the amount of energy transferred to the oscillating circuits. If the number of notches be too great, the discharge spreads over several of them, and a regular and considerable variation of the gap resistance is no longer obtained. On the other hand, if the notches be too few, the number of pulses per second is insufficient, with a low field across the gap, to maintain the primary circuit oscillation. However, with only 54 notches in the entire circumference of the gap, the current in the primary increases rapidly as the gap field is strengthened, and best results are obtained with a cathode ring having 10 notches per cm. of arc.

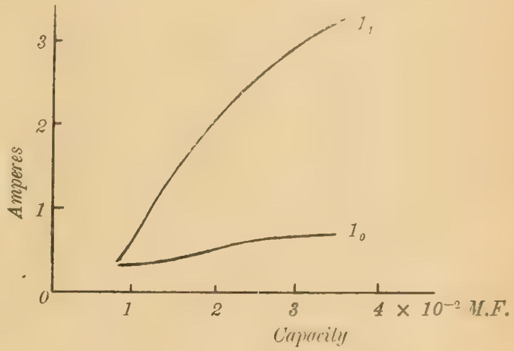


FIG. 5.

If the converter be in operation with slightly too great a supply current, tuning the secondary to the primary oscillating circuit has the same effect as gradually decreasing the supply current, *i.e.*, the spark discharge becomes more regular and quiet, and the primary current increases. If the gap be operating smoothly before the secondary is tuned, an attempt to effect tuning will often cause the spark to be extinguished.

An interesting application of the Book converter is to be found in wireless telegraphy. One means of producing signals is to join in series with the secondary (antenna) circuit a suitable resistance of, say, carbon-filament lamps, which is then shunted by the signalling key. An alternative method is to connect in parallel with the antenna circuit a secondary which can be tuned to the primary. A double action key is placed in these circuits so that, when the key is pressed, the tuned secondary circuit is interrupted, and energy flows into the antenna circuit, and is radiated from it. It is confidently expected that the Book apparatus will succeed not only in wireless telegraphy, but also in radiotelephony.

Railway Electrification in U.S.A.—An American railway contemporary says it has recently been announced that the Pennsylvania Railroad will electrify a suburban division between Broad Street Station, Philadelphia, and Chestnut Hill, a total distance of 12 miles. The electrification of the main line between Philadelphia and Paloi, which is the terminus for suburban trains, was announced some time ago. It is estimated that the work on the Chestnut Hill division will be completed in about one year. There are at the present time 66 trains per day on the Chestnut Hill branch and 85 trains per day operating between Paloi and Philadelphia.

NOTES ON INTERNATIONAL STANDARDISATION OF ELECTRICAL MACHINERY.

By A. R. EVEREST, M.I.E.E.

(*Paper read before the* Institution of Electrical Engineers, *at Birmingham, December 10th*, 1913.)

In order properly to discuss the work of the International Electrotechnical Commission, it is necessary to distinguish clearly between an "International Standard of Quality" and an "International Rating" for machines.

The rating of a machine is the output for which it is sold, and which is marked on its name-plate (rating plate). This output is the "rated output" of the machine.

(*a*) *I.E.C. Standard of Quality.*—If the rated output of a machine is such that when working under the particular cooling conditions for which it is designed the machine keeps within the I.E.C. limits of temperature, this machine, for its particular application, conforms to the I.E.C. Standard of Quality. This standard is particularly valuable for important individual and special applications. Various machines in this class from different sources would still not be directly comparable, since they would not have an equal temperature rise if primarily intended for different conditions.

(*b*) *I.E.C. Rating.*—If the rated output of the machine is such that when working under the I.E.C. standard conditions of cooling the machine keeps within I.E.C. limits of temperature, the rating of this machine is the I.E.C. rating. Thus the I.E.C. rating establishes the temperature rise as well as the maximum temperature. All machines with I.E.C. rating would be directly comparable amongst themselves, since they would all have the same temperature rise at their rated output.

The Rules adopted at the recent I.E.C. meeting in Berlin establish the I.E.C. standard of quality (as regards temperature) for electrical machinery. Agreement was not reached upon the further question of I.E.C. rating, due to differences of opinion regarding the value for the cooling-air temperature. Before referring further to this feature it may be well briefly to review that part of the work which has been completed by the I.E.C.

These Rules are the outcome of deliberations by the various National Committees and at the meetings of the Special Committee on Rating held in Paris and Zurich, and in Berlin prior to the Plenary Meeting.

The Rules so far adopted are based on considerations of the highest safe temperatures for various insulating materials, the joint effect of time and temperature, also the probable difference between observable temperature and maximum internal temperature. From these considerations an international agreement was reached regarding the permissible limits of temperature for various insulating materials employed in modern electrical machinery. In connection with these permissible temperature limits, rules are provided regarding the proper determination of the temperature of the cooling air, a knowledge of which is necessary to ascertain the temperature rise which must not be exceeded at the rated load of the machine.

Finally, rules are provided dealing with the differences which may exist between the temperature rise on test and under service conditions due to variations in the cooling temperature and the barometric conditions. Thus the I.E.C. standard of quality has now been established as regards temperature, and therefore life, for any machine working under the conditions for which it is sold.

While the hottest internal temperature at any point determines the life of the insulation affected, the I.E.C. does not consider it feasible to make this the subject of ordinary commercial investigation. Information obtained from laboratory investigations with exploring coils and thermo-couples built into specially-prepared machines appears to justify the conclusion that for modern machines, wound for not more than 4,000 volts, or for transformer coils for not more than 10,000 volts, the hottest internal spot will not exceed the temperature observed by ordinary methods by more than 10° C. Accordingly, the limiting observable temperatures permitted, which are shown in the table below, apply to measurements by the rise of resistance of the winding (wherever practicable), together with the use of thermometers, the highest reading found being always considered. Electrical thermometers and thermo-couples applied to any accessible part of a completed machine are classed with thermometers.

A great deal of confusion exists between different countries at present concerning the relation between the so-called "full load" rating of a machine and the highest load it is actually expected to carry. Further, the various overloads are rated for different lengths of time, and in some cases are not allowed at all when the machine has been heated up by its ordinary "full load."

The I.E.C. has decided that any machine intended for continuous service should be ordered, designed and rated for the highest load it is expected to carry, and that it should be capable of carrying this rated load continuously without exceeding the temperature limits of the table. No overloads are permissible beyond this rated load.

In the case of a machine subject to peak loads in excess of the ordinary load, if the peak endures for more than a short time it must be included in the rating. But if the peak load is to be endured for brief periods only, the rating must be sufficiently above the ordinary load to give a continuous thermal capacity equivalent to that required on the brief peak loads without exceeding the permissible temperature limits.

A machine for intermittent service may for the purpose of test have either a continuous rating which is thermally equivalent, or a "short time" rating which when starting cold and running at a rated load for a specified time, shall not at the end of that time attain temperatures in excess of those shown in the table.

Permissible Limits of Observable Temperature.

Upon these considerations the I.E.C. decided to standardise limiting values for temperature which should apply to "observable temperatures" measured by the means and methods specified, and which should be set with due allowance for such excess internal temperatures above those "observable" as would be associated with the approved methods of test. The temperatures were to be such as might be endured continuously without prejudice to a reasonably long life, but there were to be limits which must not be exceeded. Accordingly, values have been standardised, as shown in the following table:—

Limits of Observable Temperature Adopted by the International Electrotechnical Commission, September, 1913.

Non-impregnated cotton	80° C.
Impregnated cotton or paper (general) ...	90° C.
„ single layer field coils, stationary or moving	95° C.
„ stationary coils solidly impregnated throughout	95° C.
„ rotor and stator windings having the slot portion solidly impregnated or moulded	95° C.
Enamelled wire (without cotton)	105° C.
Mica, micanite, asbestos (general)	115° C.
„ single layer field coils, stationary or moving	120° C.
„ stationary coils solidly impregnated or moulded	120° C.
Windings permanently short-circuited—	
Insulated	100° C.
Non-insulated	110° C.
Commutators, slip-rings	90° C.
Bearings...	80° C.

Note.—When the insulation is composed of several different insulating materials, the lowest of the temperatures corresponding to the various insulations employed must be taken as the temperature limit. The insulation even when forming a support is always considered as part of the winding. (Material employed in small quantity in the construction and not relied upon continuously as a support for the insulating material is not regarded as part of the insulation under this rule.)

Permissible limits of temperature are useless to the designer except in conjunction with information regarding the cooling-air temperature, since the difference between these two values is the "temperature rise" which the machine may create when carrying its rated load. Hitherto in the I.E.C. *Proceedings*, as well as in the various National Rules, the value mentioned as cooling-air temperature has been the "ordinary" or average value. Obviously such value cannot be used directly in connection with a table of limiting temperatures "which must never be exceeded."

The corresponding value of air temperature employed must be the highest which is likely to occur. The British and United States Committees agreed in recommending that in future 40° C. should be taken as the reference air temperature, instead of 25° C., as hitherto indicated in the National Rules. (Unfortunately, some confusion arose because the reason for this sudden jump from 25° C. to 40° C. on the part of the British and United States Committees was not explicitly given.)

The I.E.C. Rules now require that the maximum, and not the average, temperature of the cooling air shall be stated, but agreement was not reached regarding an International Standard reference air temperature. This will be referred to again.

Extended investigations made by the United States National Committee show that the variation in temperature rise with a given load when tested with cooling air at different temperatures is a small and uncertain quantity, sometimes positive, sometimes negative, according to the characteristics of the particular machine. The I.E.C. decided that no correction shall be made in practice for such difference between the conditions of test and of final service.

No correction is to be made for variation in the cooling properties of the air at a given temperature at altitudes not exceeding 1,000 metres. For higher altitudes it is recognised that a correction is necessary, but the I.E.C. is not yet in a position to furnish an official correction factor.

"I.E.C. Rating" for Machines.

Although the I.E.C. states that "wherever possible the temperature of the cooling air should be stated and the machine constructed for this cooling condition," it is also proposed to establish a value which shall be taken as the maximum temperature of the cooling air when no specific information is available. Probably more than 90 per cent. of all the machines sold come under this class, and the establishment of an International reference air temperature in connection with the Table of limiting temperatures already provided would at once fix the temperature rise permissible at the rated load, and in connection with the rulings given regarding overload would completely establish the capacity of any machine sold with "I.E.C. Rating."

With such uniform rating adopted, a buyer of standard machines could compare, without misunderstanding or possibility of mistake, tenders received from the various makers even from different countries. He would know that all the machines offered would carry their rated loads continuously with the same temperature rise (and also with uniformity in other characteristics such as commutation, as far as these might be defined by the I.E.C. Rules).

It is evidently desirable that the I.E.C. Rating shall also be the Domestic Standard Rating of the same machines in the countries in which they are produced. The reference air temperature must then be set at such a value as shall not be exceeded by the hottest conditions likely to occur in service at any time of the year in any temperate climate.

At Berlin a majority of the delegates, including those from Great Britain and the United States, desired to set this reference temperature at 40° C., but a minority desired 35° C.

Examination of the meteorological records for various temperate countries, including Great Britain, Germany, and the temperate part of the United States, shows that 35° C. is not sufficiently high to cover even the highest outdoor shade-temperatures which are occasionally recorded, so that with a temperature rise based on the 35° assumption, the limiting temperatures of the I.E.C. Table would certainly be exceeded at times. But such is contrary to the express conditions under which the limiting temperatures were adopted by the I.E.C.

In order to justify a *nominal* "maximum" temperature for cooling air which would exclude the highest peaks occasionally occurring, it would be necessary to reduce all the values shown in the Table of permissible limiting temperatures by a margin sufficient to allow for such occasional peaks. This proposition was suggested at Berlin, but was not accepted by those desiring the lower reference temperature. Finally, this entire question was referred back to the various National Committees, and it is to be hoped that an early settlement will be reached, as upon this question hangs in reality the whole problem of International Standardisation in the rating of electrical machinery.

THE ELECTRICITY SUPPLY OF LARGE CITIES.

By Prof. G. KLINGENBERG, Dr. Ph.

(*Abstract of address delivered before the* Institution of Electrical Engineers, *December 4th*, 1913.)

(*Continued from Vol.* 73, *page* 1062.)

The comparative data have been summarised in Tables I to III. The energy consumption per head of population cannot be compared directly from the figures given, since both in London and Berlin energy is generated in special traction power stations, and in the case of Berlin that generated in block stations must also be included. Unfortunately reliable data in this connection could not be secured; the figures for the years in question may be assumed, however, to be approximately as follows:—

Current consumption in kw.-hours per head of population:—

Chicago	310 kw.-hours.
Berlin	170 ,,
London	110 ,,

These figures show that in the two latter cities the consumption should be capable of a considerable rise.

It is a striking fact that in London the generation of energy is split up amongst a large number of small stations, whereas Chicago stands pre-eminent as regards centralisation.

The proportion of the average peak loads in the different stations is approximately as follows:—

London	1
Berlin	5
Chicago	10

The installation costs per kilowatt are found to be approximately as follows:—

Berlin = 950 shillings per installed kilowatt
Chicago = 1,200 ,, ,, ,,
London = 1,460 ,, ,, ,,

TABLES I and II.

Item.	*Berlin,* 1911-12.	*Chicago,* 1911.	*London,* 1910-11.
Company	Berliner Elektricitätswerke	Commonwealth Edison Co.	Authorities and companies in and around London.
Population, approx....	2,600,000	2,200,000	6,500,000
Power stations:—			
Number	6	6	64
Installed capacity	137,000 kw.	221,700 kw.	298,400 kw.
Average size ...	23,000 kw.	37,000 kw.	4,670 kw.
Assets	160,426,000s.	280,321,000s.	547,060,000s.
Sinking fund, &c. ...	30,380,000s.	14,148,000s.	111,800,000s.
Real value	130,046,000s.	266,173,000s.	435,260,000s.

Cost per kw. Installed.

	Berlin.		*Chicago.*		*London.*	
Power station ...	355·93s.	38%	477·10s.	40%	662·00s.	45%
Distribution system, including meters ...	593·69s.	62%	723·26s.	60%	797·00s.	55%
	949·62s.	100%	1,200·36s.	100%	1,459·000s.	100%

It is impossible to draw any conclusions regarding costs per kilowatt at Chicago. A comparison is, however, possible between Berlin and London, where methods of design and living conditions differ less. From such comparison it will be seen that the total costs per kilowatt installed, with power stations of about 5,000 kw., are approximately 50 per cent. greater than for power stations of about 25,000 kw.; this difference appears to be still greater, namely, 80 to 90 per cent., when the costs of the power stations alone are compared. The proportion of the cost of a power station to that of the network (including meters) is also noteworthy; for Chicago and Berlin it is approximately 40 : 60, and for London 45 : 55. It can thus be seen that the cost of the power station decreases as the size of the plant increases.

TABLE III.

	Berlin, 1911-12.	*Chicago,* 1911.	*London,* 1910-11.
Total peak load	94,600 kw.	199,300	185,500
Peak load per power station	15,800 ,,	33,700	2,900
kw.-hours generated ...	274,000,000	684,000,000	405,000,000
kw.-hours purchased ...	—	32,000,000	—
kw.-hours sold	216,300,000	640,000,000	319,243,000
Comprising—			
Lighting	24 %	19 %	61 %
Power	45 %	12 %	27 %
Traction	31 %	69 %	12 %
Load factor (kw.-hours generated)	33·1 %	41 %	24·9 %
Efficiency of transmisson system— kw.-hours sold / kw.-hours generated ...	0·79	0·894	0·788
Reserve factor	1·450	1·11	1·61
Utility factor (total) ...	0·18	0·33	0·122
Coal—Price per ton ...	17·41s.	Approx. 8s.	Approx. 12·8s.
Consumption per kw.-hour sold	1·38 kg.	,, 1·61 kg.	,, 2·37 kg.
Overall efficiency of plant	9·7 %	,, 7·6 %	,, 5 %
Revenue from kw.-hours sold	34,334,000s.	57,845,000s.	62,400,000s.
Expenses	17,636,000s.	28,881,000s.	27,820,000s.
Profit absolute	16,698,000s.	28,964,000s.	34,580,000s.
Percentage of real value ...	12·83 %	10·87 %	7·85 %
	Centi-shillings.	Centi-shillings.	Centi-shillings.
Selling price	15·856	9·044	19·530
Expenses—			
Fuel	2·393	1·146*	3·051
Oil, stores, &c.	0·039	0·045	0·262
Wages	0·510	0·614	1·047
Repairs, maintenance ...	0·937	0·830	1·482
Rent, taxes, insurance, &c.	0·348	0·605	1·482
General expenses ...	0·840	0·836	1·396
Current purchased ...	—	0·167	—
Municipal participation	3·067	0·271	—
Total expenses	8·134	4·514	8·720
Profit (gross)	7·722	4·530	10·810

* The conversion to kw.-hours sold includes the number of kw.-hours purchased, therefore the actual value is approximately 4-5 per cent. higher.

With regard to the consumption, the three plants can be characterised as follows:—Chicago: Traction load predominating (approx. 70 per cent.); London: Lighting load predominating (approx. 60 per cent.); Berlin: Power, lighting, and traction loads, in a more even ratio. London is considerably below the other two cities as regards the utilisation of its plant, owing to its predominating lighting load. Fig. 2 shows that in London the load factor cannot be improved appreciably by centralisation; what is necessary is to alter the nature of the consumption.

The load factor should not largely influence the percentage of reserves. What affects the spares most is the size of the whole plant. The following reserve factors (r) appear to meet the normal requirements of large cities:—With a maximum load on individual stations of 30,000 kw., $r = 1·25$; 15,000 kw., $r = 1·4$; 3,000 kw., $r = 1·6$. It being assumed that each power station is equipped with at least one complete generating set as a stand-by.

The utility factors differ to a greater extent than should be expected from the nature of the consumption alone. The ratios are shown in round figures as follows:—London: Utility factor, 12 per cent.; load factor, 25 per cent. Berlin: Utility factor, 18 per cent.; load factor, 33 per cent. Chicago: Utility factor, 53 per cent.; load factor, 41 per cent. These results, together with the remaining items in Tables I and II, enable their dependence upon the utilisation to be determined, and by means of the costs characteristic thus found, the working conditions can be compared on an equal basis.

The results of these calculations are shown graphically in fig. 3, which shows the total costs characteristic of the plant. All costs include the capital charges, and in all three cases the normal rate of 10 per cent. referred to above has been taken.

The actual utility factors, Table III, are indicated in fig. 3 by a circle. They therefore represent the "normal price" of the current, *i.e.*, the price at which the works should earn a gross interest of 10 per cent. on their capital, neglecting any special sums to be paid to authorities.

The prices indicated in fig. 3 by a horizontal line represent selling prices actually obtained by the works during the year in question (after deducting special expenses), and therefore permit a direct comparison with the normal value. I have based my calculations upon the average selling prices throughout, and have ignored the division of the same into various classes of consumption, as this involves the question of tariffs, which does not come within the scope of the present subject.

From these costs characteristics it will be seen that as regards total costs the Berlin works, notwithstanding their smaller power stations, work more economically than those in Chicago, while the costs of the London works are the least favourable. Nevertheless, the actual energy prices (based on equal utilisation for all three plants) are approximately the same. The reason for this is that the selling price in London is about 13 per cent. lower, and in Berlin about the same percentage higher than the "normal" value.

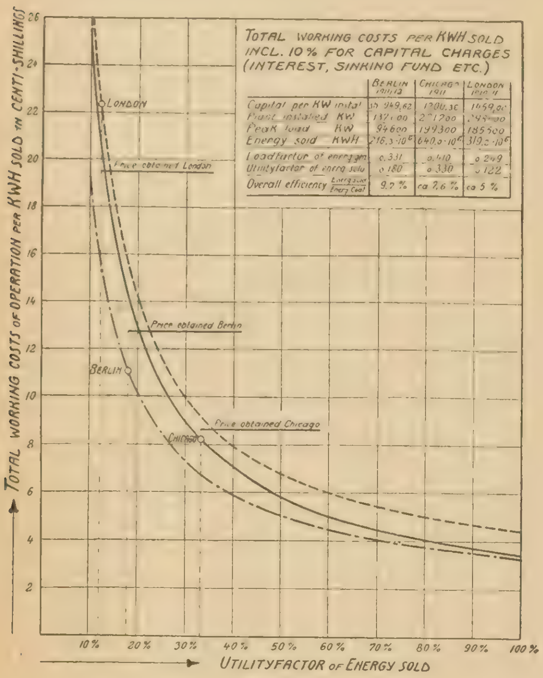


FIG. 3.

The relatively high working costs in Chicago, as compared with those in Berlin, are due, in my opinion, chiefly to the higher costs of the plant (Table II) and the higher wages and salaries. Moreover, the Berlin plants show a decided superiority in fuel consumption, although this is counterbalanced by the appreciably higher prices for coal (Table III).

The importance of the utility factor for all three plants will be recognised from the form of the costs characteristic. The curves show that within the values for this factor of 10 to 30 per cent., the selling price can be reduced by more than 3 per cent. for each advance of 1 per cent. made in utilisation, without necessitating extensions or other alterations to the existing plant.

Comparison of the actual values obtained with those obtainable with modern plant, using machines of 20,000 KW., shows that with the same utility factor, the generating costs in London, for example, could be reduced to less than half of what they are now. Combination of the supply, and particularly a conversion to a pure alternating-current system, enables the costs of losses and distribution to be reduced considerably.

The working costs for the network differ only slightly and form a relatively small part of the total working costs. The saving to be expected here is small, because the greater part of the working costs consists of capital charges. An effective way of improving the conditions would be to replace the existing power stations by large modern plants. This procedure together with better utilisation would mean a saving of 30 per cent. with a relatively small extra capital expenditure.

If, for example, all the existing power stations in London were shut down and large new stations took their place, a saving could be effected of about 40 per cent. on all working costs, at an increase of the total capital now invested of less than 20 per cent.

At this point a further possibility of reducing the working costs should be mentioned which specially applies to large power stations and is dependent upon the site. This consists in a saving of coal costs by building the station in the immediate vicinity of coal-pits, and transmitting the energy through overhead lines or cables. This measure promises advantages wherever high coal freights prevail and where it is possible to use poor coal and obtain a good utilisation of the transmission line. Instead of firing the boilers with the coal direct, advantage may be taken under certain circumstances of the experience in the extraction of its valuable by-products such as nitrogen, tar, oils, &c.

During 1910-11 some 25 electricity works in and round London supplied alternating current at 50 periods, and represented altogether an installed capacity of 126,000 KW. Amongst these there are three concerns with more than 13,000-KW. capacity, totalling 46,000 KW.

These three stations, which are probably of a later date, show a relatively high economy; their immediate replacement is therefore unnecessary. The first step would then consist of providing a new power station having a capacity of 80,000 KW. to replace the 22 smaller stations, and connecting their systems to a common network.

The interconnecting system would be laid out in a manner similar to the system adopted in Berlin for the recent extensions. Several ring mains would be run concentrically round the centre of the city, and the distance between rings would vary according to the density of consumption. These ring mains would be duplicated in case of extensions and connected to one another by diagonal feeders.

In order to obtain an idea as regards the length and the costs of the cables, I have drawn in a system of this kind (fig. 4) diagrammatically on a map of London, making due allowances for the increasing density of supply (shown by the closeness of the hatching) and the possibility of connecting up all the existing companies to the system. On the assumption (that the total output of about 80,000 KW. is to be distributed) I consider that three ring mains, each consisting of one single three-phase cable, 3 × 150 sq. mm. (3 × 0·235 sq. in.), capable of transmitting 10,000 KW., should be sufficient. With this arrangement each of the stations belonging to the outer ring will be fed by at least two cables, while the cables laid diagonally provide for the necessary cable reserve in the interior of the city. I estimate that a ring system in accordance with the diagram shown in fig. 4 will suffice for the distribution of 150,000 KW., showing that there is ample provision for further connections.

The total length of the cables would be approximately 250 km. (155 miles), allowing 15, 20, and 30 per cent. for deviations from the straight line.

Twenty-five stations with an installed transformer capacity of 80,000 + 25 per cent. = 100,000 K.V.A. would be connected to the ring mains.

The new generating station is assumed to be situated within a distance of 15 km. (10 miles) from the centre of the city on a site of 50 ha. (130 acres).

Ten 20,000-volt cables, with the same dimensions and carrying capacity as the ring mains, would connect the latter to the power station. If the average length of the cable between the power station and the feeding points is assumed to be the same as the distance of the power station from the centre of the city, an additional allowance of 20 per cent. being made for following streets, the total length of the cable would be 180 km. (110 miles).

The maximum losses in this cable would be approximately as follows :—180 KW. dielectric losses, 3,240 KW. copper losses. On the above assumptions the costs work out as follows :—

A. *Estimate*—

	Shillings.
1. Power station, 83,000 KW., including transformers, switch-house and auxiliary buildings, at 170s. per KW. (extra for site, pile foundations, pumping plants, labour, &c., at 40s. per KW.) ; total	17,430,000
2. Feeder cables, 180 km., 20,000-volt 3 × 150 sq. mm. section, including laying, at 27,800s. per km.	5,000,000
3. Ring cables, 250 km., 20,000-volt 3 × 150 sq. mm. section, including laying, at 31,000s. per km.	7,750,000
4. Sub stations: 25 with stationary transformers. Total capacity, 100,000 K.V.A., allowing for the partial use of existing buildings and sites, at 40s. per K.V.A.	4,000,000
Total cost	34,180,000
Per KW. 127·25s.	

B. *Operating Costs for the New Plants*—

Capital charges—Power station and sub-station, 10 per cent.; cable, 8 per cent.

Coal—Price per ton, 10s. 6d.; calorific value per kg., 7,000 cal. (12,600 B.TH.U.).

Utility factor for all parts based on full load, 80,000 KW.

I have further assumed that in view of the high proportion of the lighting load, the new power station can deal with the entire supply without assistance during a considerable part of the year, and that the three old power stations need be operated for not more than an average of eight months in the year.

The utility factors are to be based as regards capital charges on the existing plant of 126,000 KW., and as regards operating costs on the capacity installed in the three old stations of 46,000 KW.

The figures obtained from the comparative calculations are combined in Table IV. The results of these calculations may be summarised in the following statement. The plan proposed permits payment of interest and amortisation of the old capital in the same manner as hitherto, and leaves a reasonable sum for capital charges on the new capital and a surplus of 5,200.000s. This profit is secured without making any alterations in the existing distribution system. The increase from 135,000,000 KW.-hours, to 172,000,000 KW.-hours would meet the natural increase in the consumption during the construction period.

We will now consider the effect of the above scheme on concerns supplying continuous current. In 1910-11 there were 29 companies under this heading with an installed capacity of 116.000 KW. If the largest of these stations with outputs of 10,000 KW. might at first remain in commission (there are three of these works with a total output of 54,000 KW.), the others would be shut down, and as the ring mains have still an ample reserve, the only alteration would be the installation of 62,000 KW. of converters and transformers, the laying of about seven additional feeder cables, and the extension of the new power station by three generating sets. This alteration should be carried out at a cost of about 310s. per kilowatt installed. After this alteration about 80 per cent. of the existing plant will have been combined and transformed into an efficient supply system. The conversion of the remaining concerns with non-standard systems would probably no longer offer great difficulties.

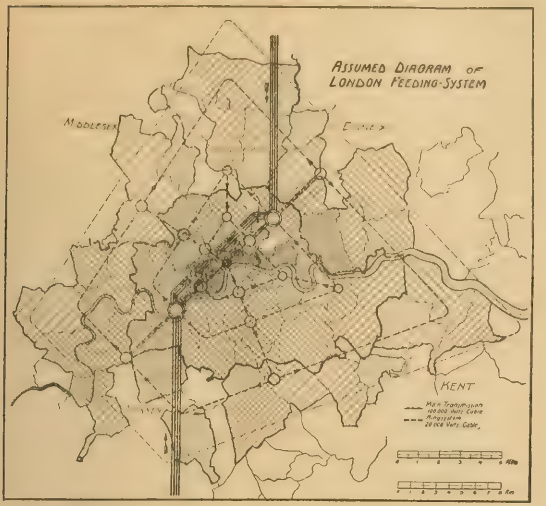

Assumed Diagram of London Feeding-System
Middlesex
Essex
Kent
Main Transmission 100 000 Volts Cable
Ringsystem 20 000 Volts Cable
Miles
Km

Fig. 4.

(To be continued.)

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

FRANCE.—The French Customs Authorities have decided that electric lamp brackets fixed on cables for chains of lights are to be dutiable as electro-technical apparatus, the electric cables to be dutiable separately according to class.

The Board of Trade are in receipt, through the Foreign Office, of information to the effect that a proposal to reduce from 5 per cent. to 1 per cent. the margin allowed for error in Customs declarations for goods imported into France is contained in Article 22 of the Bill which is being considered by the Budget Committee of the Chamber of Deputies. The Article in question proposes that Article 16 of the Law of the 28th December, 1895, shall be abrogated, and that Article 18 of Chapter II. of the Law of the 6th/22nd August, 1791 ("*Code des Douanes*"), shall read as follows:—

If the goods presented (for clearance) exceed by more than *one* per cent. the weight, the number or the measure declared, the provisions of Article 21 of the present Chapter shall be applicable. With regard, however, to goods other than metals, dutiable by weight, at 10 francs or less per 100 kilogrammes, the penalties will be incurred only if the excess weight is over 10 per cent. of the declared weight.

The amount of the excess is to be calculated in relation to the weight, the number or the measure set out in the declaration, or in a note annexed thereto, for each article, group of packages, or packages comprised in one declaration (*dans un même article*), or for each class of goods contained in one and the same package.

In forwarding this information, H.M. Ambassador at Paris reports that in the preamble to the Bill it is stated, with reference to this proposal, that the adoption of measures more restrictive than those now in force is rendered necessary by the desire of the Customs authorities to reduce the number of their examinations of consignments and also to prevent a special kind of fraudulent practice which consists in grouping a number of packages under one declaration and taking advantage of the margin allowed for error.

[*Note.*—Article 16 of the Law of the 28th December, 1895, (which it is now proposed to abrogate) provides that if the goods presented (for clearance) exceed by more than 5 per cent. the weight, the number, or the measure declared, the excess shall be subject to the payment of quadruple duty. As regards goods other than metals, dutiable by weight at 10 francs or less per 100 kilogrammes, quadruple duty shall be exacted only if the excess weight is over 10 per cent. of the declared weight.]

Article 21 of Chapter II. of the 6th/22nd August, 1791, provides that in the case of false declarations in regard to the quality or the kind of the goods, the latter shall be confiscated and a fine of 100 francs shall be imposed if the duty which would be evaded by the false declaration amounts to 12 francs or more. If the duty sought to be evaded amounts to less than 12 francs, the goods shall not be confiscated, but only the fine of 100 francs exacted.

In this connection we note that the British Chamber of Commerce is protesting against the imposition of this further disability on trade between the two countries.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

28,853. "Automatic electric music-turner." M. Koopman. December 15th.

28,854. "Electric conduit fittings." R. W. Perry. December 15th.

28,887. "Apparatus to be used in connection with testing electrical potential differences in the earth." E. Ryan. December 15th.

28,894. "Vacuum lightning-arresters." Western Electric Co., Ltd. December 15th. (F. T. Woodward, Belgium.) (Complete.)

28,898. "Arrangements for automatically regulating the voltage of dynamo machines." Fried Krupp Akt. Ges. December 15th. (Convention date, January 11th, 1913, Germany.) (Complete.)

28,903. "Holders for electric glow lamps." H. Leitner. December 15th.

28,915. "Electric lamp holders." A. H. Brackensieck. December 15th.

28,932. "Electric water-heaters and the like." R. Weaving & Ferranti, Ltd. December 15th. (Addition to 9,930/13.)

28,933. "Reversing and braking alternating-current motors." Akt. Ges. Brown, Boveri et Cie. December 15th. (Convention date, December 27th, 1912, Germany.) (Complete.)

28,935. "Electric glow lamps and methods of manufacturing and operating the same for illumination, heating and other purposes." C. O. Bastian. December 15th.

28,939. "Apparatus for perforating tape for the automatic transmission of telegraphic signals and for other like purposes." Eastern Telegraph Co., Ltd., A. Fraser and K. L Wood. December 15th.

28,950. "Magnetic balances." R. W. Paul. December 16th.

28,952. "Telegraph receiving-apparatus adapted to split up incoming signals into their components, and to actuate a transmitter or analogous device, or to perforate a tape according to either the Wheatstone, cable, or other systems of working." Eastern Telegraph Co., Ltd., A. Fraser and K. L. Wood. December 16th.

28,956. "Electric signalling-systems for mines." A. W. Brown and I. H. Parsons. December 16th.

28,963. "Insulated railway van." W. Hunt. December 16th. (S. T. Gresham, India.) (Complete.)

28,966. "Collectors used in connection with dynamo electric machines." W. P. Thompson. December 16th. (Aktiebolaget Ljungstroms Angturbin, Sweden.) (Complete.)

28,967. "Rotary field magnets." W. P. Thompson. December 16th. (Aktiebolaget Ljungströms Angturbin, Sweden.) (Complete.)

28,977. "Electric signalling and train-control systems for railways." W. J. Mackenzie. December 16th.

28,999. "Thermo-electric generators." P. Ferra. December 16th.

29,003. "Flexible connections for electric conductors." Siemens Bros. Dynamo Works, Ltd. December 16th. (Siemens-Schuckertwerke Gm.b.H., Germany.) (Complete.)

29,007. "Means for the electrical treatment of toothache and the care of the teeth generally." E. L. Peck and T. N. Atkinson. December 16th.

29,028. "Method of covering or armouring electric conductors with metal." F. Chase. December 16th. (Complete.)

29,046. "Selective electric signalling." New Phonopore Telephone Co., Ltd., and A. H. Nicholson. December 16th.

29,049. "Circuit arrangements for telephone systems." Siemens & Halske Akt. Ges. December 16th. (Addition to 12,651/13. Convention date, December 18th, 1912, Germany.) (Complete.)

29,059. "Sparking plugs." C. Spada. December 16th. (Convention date, February 25th, 1913, Italy.) (Complete.)

29,063. "Regulators for electric transforming apparatus." British Thomson-Houston Co., Ltd. December 16th. (General Electric Co., United States.)

29,070. "Electrically-heated utensils." W. F. Perry and Credenda Conduits Co., Ltd. December 16th.

29,098. "Electric lamps." R. S. Ballantine and J. Lizars. December 17th.

29,099. "Mains for collecting and conveying gases from electrolytic cells and the like." A. E. Knowles. December 17th.

29,106. "Electrical alarm clocks." R. Williams. December 17th.

29,108. "Plug connection adapted to fit into a wall switch." R. D. Binney. December 17th.

29,113. "Dynamo-electric machines." J. G. Cunliffe and R. G. Cunliffe. December 17th.

29,118. "Renewable electric elements suitable for self-contained electric kettles and other apparatus." G. H. Clarkson. December 17th.

29,165. "Telephone transmission systems wherein reinforcing repeaters are employed." A. S. J. van Kesteren. December 17th. (Convention date, December 19th, 1912, Holland.) (Complete.)

29,182. "Electric clocks." F. T. Reid and F. Knight. December 18th.

29,195. "Production of alkali metal by the electrolysis of fused salts or mixtures of salts." R. J. McNitt. December 18th.

29,203. "Ventilation of dynamo-electric machinery." Siemens Bros. Dynamo Works Ltd., and E. O. Kitter. December 18th. (Complete.)

29,216. "System of electrical distribution and control." F. B. MacNab. December 18th. (Convention date, December 26th, 1912, United States.) (Complete.)

29,221. "Receiver for submarine sound signals." Signal G.m.b.H. December 18th. (Addition to 2,185/13. Convention date, December 18th, 1912, Germany.) (Complete.)

29,225. "Dynamo-electric generators." F. L. Hollister. December 18th. (Addition to 27,356/12.)

29,233. "Insulating compound." E. Jones. December 18th.

29,237. "Method of removing air from incandescent lamp bulbs." R. Bell. December 18th.

29,239. "Method of and means for reducing the influence of the line capacity in actuating electric apparatus at a distance, by means of pulsations obtained from a source of continuous electric current." E. H. Widegren and K. A. Widegren. December 18th. (Convention date, December 30th, 1912, Sweden.) (Complete.)

29,240. "Method of and means for effecting a diplex action in actuating electric apparatus at a distance by means of pulsating electric currents obtained from a source of continuous electric current." E. H. Widegren and K. A. Widegren. December 18th. (Convention date, December 30th, 1912, Sweden.) (Complete.)

29,241. "Transmitter of electric writing telegraphs." E. H. Widegren and K. A. Widegren. December 18th. (Convention date, December 30th, 1912, Sweden.) (Complete.)

29,242. "Electric writing telegraphs." E. H. Widegren and K. A. Widegren. December 18th. (Convention date, December 30th, 1912, Sweden.) (Complete.)

29,245. "Telephonic connections." S. G. Brown. December 18th.

29,250. "Electric cells or batteries." C. K. Bamber. December 18th.

29,259. "Method of protecting the electrodes in electric arc furnaces." J. I. Bronn and W. Schemmann. December 18th. (Convention date, December 18th, 1912, Germany.) (Complete.)

29,260. "Electrically-insulated fish-joints for railway rails." W. R. Sykes Interlocking Signal Co., Ltd., and G. H. Sykes. December 18th. (Complete.)

29,270. "Commutation arrangements for electric rotary converters coupled to alternating current boosters." Siemens Bros. Dynamo Works, Ltd., and J. C. Wilson. December 18th. (Complete.)

29,274. "Current carrying coils for electro-magnetic apparatus." J. W. Ewart. December 19th.

29,284. "Electric lamp for advertisements, signals, or the like." S. Klein. December 19th. (Convention date, December 20th, 1912, Germany.) (Complete.)

29,341. "Electric tumbler switches." Geb. Jaeger. December 19th. (Convention date, November 27th, 1913, Germany.) (Complete.)

29,344. "Pendant switches." Geb. Jaeger. December 19th. (Convention date, November 27th, 1913, Germany.) (Complete.)

29,346. "Devices for correcting the difference of phase in telegraphic receiving-apparatus." A. C. Baronio and K. L. Wood. December 19th.

29,361. "Dynamo-electric machines for combined electric lighting and engine starting." B. Brooks and W. Holt. December 20th.

29,366. "Limit switches employed to control the movements of electrically-operated cranes, hoists, freight and passenger elevators, winches, turntables, and the like." Craven Bros., Ltd., F. Garner and A. E. Horrocks. December 20th.

29,389. "Apparatus for perforating tape for automatic telegraph transmitters and the like." A. C. Baronio and K. L. Wood. December 20th. (Divided Application on 29,416/12. December 20th.)

29,418. "Cathodes for electric furnaces." G. B. Ellis. December 20th. (Sodium Process Co., United States.) (Complete.)

29,425. "Globes for electric arc lamps." T. Stave. December 20th. (Convention date, December 23rd, 1912, United States.) (Complete.)

29,426. "Circuit arrangements for automatic or semi-automatic telephone systems." Siemens & Halske Akt. Ges. December 20th. (Addition to 18,498/12. Convention date, December 20th, 1912, Germany.) (Complete.)

29,434. "Relays for telegraphy." J. Tucker and C. G. E. Milne. December 20th.

29,447. "Apparatus suitable for use in wireless telegraphy and telephony." J. Schiessler. December 20th. (Convention date, October 16th, 1913, Austria.) (Complete.)

29,448. "Electrical relays." Kemp & Lauritzen. December 20th. (Convention date, February 27th, 1913, Denmark.) (Complete.)

29,449. "Oscillating electric fans and the like." A. Bergtheil. December 20th.

29,452. "Preparing aluminium or its alloys for electro-plating." H. D. Cunningham. December 20th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

19,257. Electrical Driving-gear for Clocks and the like. L. J. Aron, C. Wiener, and X.L. Electric Co. August 22nd. (Patent of Addition not granted.)

24,254. Resinous and Wax-like Condensation Products and Process of Making the Same. British Thomson-Houston Co. (General Electric Co.) October 23rd. (Samples furnished.)

26,680. Electric Rotary Converters. British Thomson-Houston Co. and F. P. Whitaker. November 20th.

26,912. Starting Switches for Electric Motors. V. G. Middleton and others. November 22nd.

26,961. Electric Protective Systems. F. G. Waters. November 23rd.

27,011. Automatic Slip Regulators for Electric Induction Motors. British Thomson-Houston Co., J. J. Ash and A. H. St. C. Watson. November 23rd.

27,236. Electric Control Systems. British Thomson-Houston Co. (Allgemeine Elektricitats Ges.) November 26th.

27,382. Apparatus for the Winding-up and Starting of the Number Switches in Automatic Telephone Subscribers' Stations. Zivnostenská Banka v Praze (firm of). November 28th. (November 28th, 1911.)

27,563. Controlling Device for Electric Motors. A. H. Curtis, A. R. Mackey, and Adams Manufacturing Co. November 30th.

27,609. Permutation Switch Device for Electric Bolts, Alarms, and the like. L. L. Leduc. November 30th.

27,610. Electromagnetic Bolts for Locks. L. L. Leduc. November 30th.

27,624. Control of Electric Motors. British Thomson-Houston Co. (Allgemeine Elektricitats Ges.) November 30th.

27,633. Electric Batteries. W. H. Lowe. November 30th.

27,664. Dynamo-electric Machines. Brolt, Ltd., B. Brooks, and W. Holt. December 2nd. (Addition to 26,880/10.)

27,714. Safety Lamps for Mines. F. Palmer. December 2nd.

27,747. Artificial Illumination for Photographic Purposes. A. C. Adams and M. A. Adams. December 2nd.

27,881. Reduction of Zinc Ores in the Electric Furnace. W. Mc. A. Johnson. December 3rd. (October 17th, 1912.)

28,300. Variable-speed Hydraulic Transmission Gear, Particularly Applicable to the Electric Lighting Systems of Railway Carriages or other Vehicles. Variable Speed Gear, Ltd., and J. Robson. December 7th.

28,605. Control Gear for Electrical and other Machinery. G. H. Rae and Cunard Steamship Co. December 11th.

28,665. Electrically-operated Pulley Block. W. E. Evans. (Deutsche Maschinenfabrik Akt. Ges.) December 12th.

28,953. Salicylate Electrolytes for Use in the Electrolytic Deposition of Metals or Metallic Alloys. P. Marino. December 16th.

29,750. Element for Electrical Heating. H. J. Dowsing and D. Huntley. December 24th.

29,863. Construction of Electro-magnets. Steel, Peech & Tozer, Ltd., and H. E. Bowen. December 28th.

1913.

78. Mechanical Grips for Electrical Wires. S. W. Martyn. January 1st.

759. Electric Water-heaters. Unit Engineering Co. and F. A. Brown. January 10th.

1,299. Selecting Devices for Telephone and other Exchanges. Siemens Bros. & Co., and T. Pettigrew. January 16th.

2,009. Systems for Measuring the Capacities of Electric Circuits. G. A. Campbell, O. B. Blackwell and E. H. Colpitts. January 24th. (April 11th, 1912.)

3,148. Electrical Heating and Drying Apparatus. British Thomson-Houston Co. (General Electric Co.) February 6th.

3,682. Sockets for Incandescent Electric Lamps. H. Hubbell. February 12th.

3,685. Electric Motor Control Systems. British Thomson-Houston Co. (General Electric Co.) February 12th.

4,699. Electric Flash Lamp for Use as a Fog Signal. R. C. Douglas. February 24th.

4,835. Electric Switches. British Thomson-Houston Co. (General Electric Co.) February 25th.

5,029. Apparatus for Exhibiting Pictures, Advertisements, and the like. W. J. Mellersh-Jackson. (Elektro-Reklame Ges.) February 27th.

5,209. Electric Incandescent Lights. H. W. Fuller. March 1st.

5,523. Electric Fuse Plugs. British Thomson-Houston Co. (Allgemeine Electricitâts Ges.) March 5th.

7,221. Telephone Systems. G. Ahlemeyer. March 26th. (December 27th, 1912.)

7,599. Photographer's Flash-lamp. G. R. S. Greenberg. March 31st.

8,665. Electric Switches. L. Rasch. April 12th.

9,769. Automatic Switch Apparatus for Electrically Illuminated Advertisements and the like. M. Langer. April 25th.

10,289. Electric Radiators for Heating. C. Arpin. May 1st. (May 2nd, 1912.)

10,579. Electrically-heated Apparatus. E. C. R. Marks. (Landers, Frary, and Clark.) May 5th.

11,103. Advertising Apparatus. L. Kaufmann. May 10th. (January 10th, 1913.)

11,131. Electric Relays. A. N. Hovland. May 10th.

11,628. Train Communicating-signals. H. A. Robinson. May 19th.

11,990. Electric Ignition Generators. B. Lawrence. May 22nd. (Patent of Addition not granted.)

12,566. Circuit Arrangements for Telephone Systems. Siemens Bros. & Co. (Siemens and Halske Akt. Ges.) May 29th.

13,406. Attachment of the Filaments of Electric Glow Lamps to the Leading-in Wires. J. Pléchati. June 10th.

13,546. Pneumatic-electric Tracker Bars for Automatic Musical Instruments. C. W. Dorricot. June 11th.

14,729. Loud Speaking Telephone Stations. H. Wade. (Elektrizitats Akt. Ges. Hydrawerk.) June 25th.

14,780. Telephone Table Instruments or the like. G. Meyer. June 26th. (August 1st, 1912.)

15,719. Storage Battery Grids. E. F. Wackwitz. July 8th. (July 8th, 1912.)

15,950. Combined Voltage Regulators and Switches for Variable Speed Generators. A. Pollak. July 10th. (July 18th, 1912. Addition to 16,782/12.)

17,137. Electric Relay. Siemens and Halske Akt. Ges. July 25th. (February 12th, 1912. Divided Application on 3,432/13. February 10th.)

17,261. Electric Conductor for Explosive Charges. H. J. von Klaedon. July 28th.

17,775. Electrical Switches or Interrupters for Telephone Circuits. W. A. Logan. August 2nd.

18,102. Process and Apparatus for the Electrolysis of Halogen Alkalis. Siemens and Halske Akt. Ges. August 8th. (February 20th, 1913.)

18,592. Electrically-heated Foodwarmers. A. Jung. August 15th.

19,270. Vibration Damping Device for Meters or like Delicate Instruments. E. F. C. Seignol. August 25th. (September 6th, 1912.)

21,222. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt. Ges. September 19th. (November 9th, 1912.)

22,723. Electric Furnaces. E. Stassano. October 8th. (Addition to 8,901/11.)

22,724. Electric Furnaces. E. Stassano. October 8th.

24,054. Starting Switches for Electric Motors. V. G. Middleton and others. October 23rd. (Divided Application on 26,912/12. November 22nd.)

24,911. Electrostatic Machines. E. Oppen. November 1st. (October 14th, 1913.)

Electrical Exhibition at Barcelona.—In connection with the proposal to hold an International Exhibition of machinery, plant, and appliances, connected with electrical industries, at Barcelona in 1915 the *Glasgow Herald* states that Mr. F. Witty, a member of the Executive Committee of the British Chamber of Commerce for Spain, will come to London shortly with a Spanish colleague in order to work up British interest in the enterprise. The British Chamber of Commerce is taking considerable interest in the scheme in view of the opportunity offered to British manufacturers to get in touch with the Spanish public. A great demand for electrical machinery and fittings is expected during the next two years.

THE

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Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank Newgate Street Branch."

THE CONTINUITY OF SUPPLY.

THE effort of two associated electric power and supply companies in North Metropolitan districts to secure the insertion in their Bill of clauses prohibiting strikes of their employés has naturally been noted with widespread interest. Whether such an attempt is likely to eventuate as those responsible for it desire is quite another matter. The question is one of public interest and importance, for the supply of electricity is to-day the very life-blood of the community, especially where industries are dependent upon it as a driving power. Cut that supply off because of the grievances of, it may be, even a handful of men, and for the time being work comes to a standstill. Plunge a city into darkness, and chaos and confusion reign supreme. But the same thing has to be said regarding the operation of our railways and tramways, the supply of gas, water, telegraph and telephone, and other services, all forming essential factors in life to-day. There is undoubtedly here involved a question far too great to be fought for single-handed. If it affects one electric supply concern it affects all, and if Parliamentary action is called for in regard to one class of public service, it is required for others as well, as we have indicated. This being so, there should be strong united action rather than an isolated move, and those who have interests at stake should adopt organised movement for supporting the North Metropolitan action.

It is just as well thoroughly to weigh the probabilities in an agitation of this kind. We have had many a practical lesson during the last few years of the damaging effects of strikes, and there is a strong desire somehow or other to avoid them in the future. But there is perhaps an even stronger desire to ensure better pay and conditions for Labour, and the political temper must be taken into account in seeking Parliamentary authority. We opine that though a large number of electric supply systems are owned and controlled by municipalities in whose deliberations the Labour and Socialistic influences are sometimes very pronounced, there will be a desire to safeguard the interests of the public—the nominal owners of the undertakings—by ensuring an uninterrupted supply of electric light and power so far as contracts of service can be made to produce that result. Company undertakings will, no doubt, be completely unanimous in support of the idea, they being uninfluenced by such desires and sympathies as dictate so much of municipal policy in handling employés and labour generally.

The clause in question contains the following:—

> Where any person employed by the two companies wilfully and maliciously breaks a contract of service with the two companies, knowing, or having reasonable cause to believe, that the probable consequence of his so doing, either alone or in combination with others, will be to deprive the inhabitants of a city, borough, town, or place within the area of supply of the two companies wholly, or to a great extent, of their supply of electricity, he shall, on conviction thereof by a court of summary jurisdiction, or on indictment, as hereinafter mentioned, be liable to pay a penalty not exceeding £20, or to be imprisoned for a term not exceeding three months, with or without hard labour.

It will naturally be wondered by some of our readers whether this clause is framed as a definite counterblast to the adoption of a militant policy by the recently organised association of station engineers. We have always sympathised with legitimate efforts to improve the status and pay of employés of this class, and we have been gratified to note the better tendency that has prevailed of late. We should be the last to advocate a strike policy for supply station men, but we can, to some extent, understand that when their other efforts to secure redress for their grievances are found to be of no avail, they are tempted, in this age of labour unrest, to indulge in threats. It may be that Parliamentary Committees, before they impose clauses making it penal to withhold service from electric supply undertakings, will require to know something about the conditions, salaries, and rates of wages of those whom it is desired to penalise. If central-station men are underpaid there will then be an opportunity to remedy that deficiency in exchange for the burden of penalty, and so simultaneously there may also disappear the grievance which gave rise to the necessity for seeking Parliamentary prohibition.

Of course in what we have said we are concerned with all electric supply undertakings and not merely with the one which happens to be responsible for the present application. To maintain the continuity of electric supply at all costs is an imperative necessity; but there is a strong moral obligation resting upon those responsible for electrical undertakings to see that remuneration of electrically-trained men is fair and reasonable for the class of services rendered.

Hull Telephones. The Hull City Council at a special meeting on the 5th inst. decided to purchase from the Post Office the plant of the late National Telephone Co. in the Hull area, at a price of £193,000. An application will be made to the Postmaster-General for a licence for 21 years as from January 1st, 1912, and also to the Local Government Board for the necessary borrowing powers.

Comment on the decision of a City Council to extend municipal activities is unnecessary, and the decision to purchase need not occasion surprise. But what is to be said about the Postmaster-General agreeing to the sale of this plant? The wisdom of Governmental management of telephones was always doubted by a large section of the community, and their numbers have increased of late; but there was little difference of opinion on the point that the telephone was not suited to municipal working.

Many opponents of Government purchase were reconciled thereto by the arguments favouring unity of control, local and trunk, throughout the kingdom. And now the Postmaster-General turns his back upon all these arguments, throws over the only principle that had solid weight, and permits an isolated service in a limited area to remain in other hands! And this at a time when it seemed as if there was some enlightenment on the drawbacks of embarking on public service enterprises on a parochial scale! We await with interest the explanations that may be offered. Meantime, we can only congratulate Hull on the pertinacity, or some other peculiar propensity, which has enabled it to bring about such a result. We cannot congratulate it on the result, for we believe that what it assumes to be an advantage is a serious drawback.

The Next Electrical Exhibition. We have received a number of inquiries respecting the date of the next electrical exhibition. Some of our correspondents are erroneously under the impression that there is some rule or other in force requiring that such events be organised by the trade itself every three years. There were many discussions years ago as to the right period that should be allowed to elapse between big electrical displays, and opinion was strikingly divided. Some did not believe in exhibitions at all, others thought once in five years was the correct thing, others wanted the triennial event, while there are yet others who—possibly because of the particular nature of their manufactures—see merit in yearly display.

Now, in order once for all to set the minds of our questioners and others at rest, we have ascertained the official B.E.A.M.A. policy, and we have received due authority to state that the matter has, of course, been under consideration at times during the past year, but it has been resolved not to hold an exhibition during 1914, and possibly not in 1915.

The reader is aware from notices that have already appeared in these pages that a special effort is being made to secure a representative exhibit of electrical manufactures, &c., at the Anglo-American Exhibition at the White City, and that a big exhibition is to be held at Nottingham; there will also, doubtless, be a number of local electrical shows. These will provide opportunities for firms who are anxious to keep themselves and their wares right before the public eye. All we desire to intimate to the trade generally at this juncture, however, is that there will be no big electrical exhibition organised by the B.E.A.M.A. yet awhile.

Lead. After a period of temporary hesitation and a downward tendency in prices a short time ago, which at intervals were rather strongly defined, the market has taken a distinctly better appearance, and there has since last writing been a decided improvement in the demand from certain of the oversea markets, notably Russia. The strength of the demand from this quarter for many months now has been one of the most striking features of the situation, and it testifies to the growth of industrial activity in that country, especially in the iron and steel trades, which continues, regardless of the reactionary tendencies at work in other directions. The general trade demand for lead has also been quite good, especially when the recent all-round slackness is taken into consideration, and the heavy quantities which have been coming forward recently have all been required, the arrivals in consequence passing off without any indications of congestion. There was some little time ago a disposition to take rather a poor view of the market, and this encouraged a fair amount of bear selling, under which prices reacted downwards sharply, but the inclination within the last week or two has been in the direction of covering oversold commitments, a task rendered not too easy by the firm attitude of the leading interests, whose policy has been rather in the direction of supporting prices than of putting metal forward on offer. There is no falling off in the quantities coming forward, but at the same time there is, as has been indicated, no pressure to sell, and the outlook seems fairly good. Of course, these are not times for booms to be initiated, and there is very little chance of prices going back to the best levels of last year, but at the same time there is at present no room for exaggerated pessimism, and the chances are that the metal becoming available will pass into the hands of the trade without difficulty at around to-day's rates. The more acute phases of the 1913 scarcity have passed, and it is clear that when once Mexico assumes a more settled appearance, and shipments are resumed, prices will be liable to undergo a scaling down process. As it is, however, there seems to be not the smallest chance of the Mexican trouble subsiding for months to come, and meantime the lead trade has accustomed itself, to a very large extent, to doing without metal from the scene of civil strife which has temporarily paralysed industrial operations in one of the most richly mineralised countries of the world. An encouraging feature is the steady buying for forward shipment which has been going on.

The extreme prices touched in the past year were £21 10s. and £15 7s. 6d., while the average for the 12 months was £18 6s. 2d., which compares with £17 15s. 10d. in 1912, £13 19s. 3d. in 1911, and £12 19s. 1d. in 1910. The main factor at work in the 12 months was, of course, the restriction of supplies from Mexico, coupled with the generally excellent statistical position, and the good demand from all sections of the consuming industries, notably the electrical trades. There was a persistent scarcity of lead for near and immediate delivery, which always commanded a considerable premium over forward metal. The very fact that there was a substantial premium, however, in this direction, militated against the growth of sufficient confidence to induce consumers to make purchases very far ahead, for they naturally feared a manipulated position, and bought with reserve. The situation in this respect has latterly been modified to a considerable extent, and the position at bottom appears to be quite sound. As has been suggested, however, much turns upon the outcome of affairs in Mexico.

Modernism in the Home.

IT has been said that the most conservative institution in this country is the home. New methods are being tried in business with greater or less success, and new expedients are being applied to our social and economic life, but in many respects the means and methods adopted in the home are very much the same as were to be found in the Victorian era. Whether it is true that our better halves are more conservative in temperament, or whether the absence of the same degree of competition that prevails in business life renders the necessity for alteration in the home life less apparent, we are not prepared to say, but it is certain that in dealing with the sale of apparatus to be used in the home, this element of conservatism has to be reckoned with.

For this reason a salesman for electric cooking and heating appliances for domestic purposes meets with a certain amount of difficulty which is not experienced in other directions, inasmuch as he has not merely to convince the possible purchaser of the advantage of the new, as compared with the old, method and apparatus, but he has to do an immense amount of preliminary work in order to stimulate even that moderate amount of interest which is necessary to originate the preliminary consideration of any question. We referred a week or two ago to the excellent effect of popular lectures in awakening this preliminary interest, but it is feared that much of the other enterprise which has been associated with electrical salesmanship has been more or less misdirected. Electrical manufacturers and salesmen have gone on the assumption that it was only necessary to offer sufficiently convincing arguments as to the relative superiority of electric heating and cooking in order to secure sales, and to this end a good deal of care and attention has been displayed in the preparation of advertising matter and the proper equipment of showrooms. It is necessary to say that it is not intended in any way to depreciate the electrical showroom or the properly prepared advertising pamphlet, or, indeed, any means of advertising which appears to deal comprehensively and fairly with the sale to be effected. It should, however, be borne in mind that behind all this work the great and real difficulty, that of awakening the preliminary interest, is comparatively neglected. Before the argument as to electric heating and cooking in the home can be applied, an acute sense of the need for modernism in the home has to be created, and it is upon this point, we suggest, that the efforts of electrical salesmen should be more especially directed. It is no use having an electrical showroom if you cannot persuade the housewife to enter it. Pages of reading matter in the form of pamphlets, or in the daily Press, and even poster displays of the most attractive description will not induce a single sale if, in the first place, there is not sufficient interest created to make a prospective purchaser pay attention.

For this reason the treatment of electrical apparatus for use in the home should be regarded as an entirely separate market to that commonly associated with electrical enterprise. It must be approached from an entirely different point of view, and the campaign must be pressed forward by different means and methods.

Perhaps one of the best means of getting to work on a problem of this sort is to entrust the matter to a person of the feminine persuasion, inasmuch as ladies, in spite of much experience to the contrary, are still more inclined to trust one of their own sex than the opposite. For this reason it has been found by some electricity supply authorities that the lady canvasser is a most useful auxiliary to the electricity department. She can talk to the lady as "one honest injun to another honest injun," and can inspire more confidence in the subject under discussion than the most polished and persuasive male person. It is, of course, necessary for the lady canvasser to have some rudimentary knowledge of the application of electricity to heating and cooking, but inasmuch as a sale must not be approached from the point of view of technical electricity, but from that of modernism in the home, the technical aspect has to be kept well in the background, and hence a knowledge of the things which appeal to a lady in her home is far more important than a most thorough comprehension of physical laws applied to heating elements.

In spite of the conservatism of the British housewife, she has always sufficient appreciation of comfort and modern method to induce a purchase if the preliminary attention has been aroused, and it is upon the lines indicated above that such attention can be gained.

Electric Power on Warships.

IN view of the greatly extended applications of electricity in ocean-going vessels of recent times, and the generally very satisfactory results which have been recorded in such cases, it is, at first sight, rather disquieting to learn from the *Pall Mall Gazette* that H.M.S. *Invincible* is to undergo a long refit, at a cost of nearly £200,000, principally in the matter of replacing electric by hydraulic power for operating the guns.

One must not forget, however, that the British Admiralty is an institution with historic prejudices, and although these have been very severely shaken in recent years by the evolution of such things as "Dreadnoughts," steam turbines, Diesel engines, wireless telegraphy, &c.—innovations which, in the interests of progress, absolutely could not be ignored—such prejudices die hard. We prefer to regard the *Invincible* refit merely as an incident, which in no way reflects on the adaptability of electric power for all purposes on a naval vessel, such adaptability having, in fact, been demonstrated already in certain vessels of the American, Continental and Japanese Navies, where traditional methods have less influence than in our own. We believe the *Invincible* is the only modern capital ship in the Navy fitted with electric power throughout, and while we regret the unfortunate outcome of the experiment in her case, we feel confident that the difficulties which have been met with will be successfully surmounted in later vessels. The matter is dealt with at some length by a correspondent in our "Notes" columns.

CARBON BRUSH HOLDERS.

By J. O. GIRDLESTONE, M.I.E.E.

It might be expected that the details of continuous-current dynamos and motors, after the experience of so many years, would be perfected, but it is surprising to find what a number of otherwise good machines are unsatisfactory by reason of faulty brush gear. It is constantly found that machines whose defects are sparking and rapid wearing out of commutators can be cured by changing the brush gear supplied with the machine for another type. With the type of holder shown in fig. 1, the defects are :—(1) In a multipolar machine the difference of potential between the point on the commutator under the spindle and the brush is very considerable, and flashing-over frequently occurs; (2) there is the risk that the spring may break or become detached and fall on the commutator; (3) any slight unevenness of the commutator causes the brush to jump and to constantly break contact with accompanying sparking and wearing of the commutator. Cases have occurred in which large machines have been burnt out through the detaching of the spring above mentioned. With this type of holder also the distance between one brush and the next brush spindle is often quite small, with the consequent risk of short circuit and flashing over. Another serious defect is that with the slightest movement of the brush-holder the joint soon becomes loose, and it is no unusual thing to see holders of this sort with the hole ⅛ in. oval.

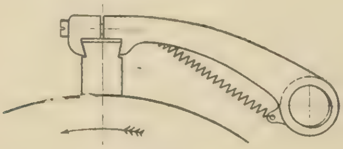


FIG. 1.

The troubles above enumerated can be got over by using a brush-holder as shown in fig. 2. With this holder the brush is kept in intimate contact with the commutator by the spring enclosed in the tubular screw; a light pressure is found sufficient to prevent any tendency to jump even when the commutator is slightly out of truth, a condition which is fatal to the first type mentioned.

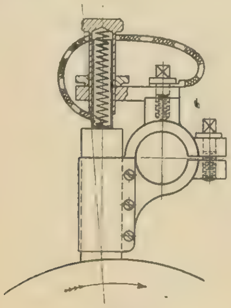


FIG. 2.

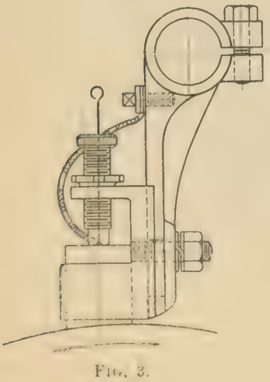


FIG. 3.

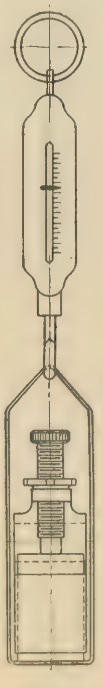


FIG. 4.

In a reversible machine the brush should be set radially, but in a machine running in one direction only it is an advantage to set the brush at a slight angle against the direction of rotation. If the brush trails the other way the tendency is for it to rest on the heel, and sparking may occur under the front of the brush, as in fig. 5. It is found that when placed as first mentioned, it is not necessary for the brush to be a good fit in the box; it takes up its own position and banks firmly against the back of the holder. Of course, this is the well-known reaction principle, but the earlier brushes of this type failed, for one reason, because they were not fitted with copper flexibles to carry the current. Probably the most difficult machines for satisfactory commutation are turbine dynamos, and instances have occurred where new dynamos were practically unworkable owing to flashing over and bad sparking. After removing the original holders, and fitting a set of those shown in fig. 2, these troubles entirely disappeared. Holders for turbine dynamos require to be very strongly made, and fig. 3 shows a type specially designed for the purpose, and in successful use.

It is found that commutator wear is so small with this type of holder, that it is hardly necessary to provide adjustment for reduced diameter, but this can be arranged, if required, as shown in fig. 3, where the box carrying the brush slides on the fixed back in a groove, and is locked by a nut at the back; or the brush rocker may be made with a slot instead of a round hole where the brush spindle is bolted to it. It is advisable for the brush box to be as close as possible to the commutator, allowing the brush to project, say, ⅛ in. only. It does not seem possible to give any fixed rule as to the best working pressure. It depends on so many things, as, for instance, diameter of commutator, type of carbon brush used, current to be carried, and so on, but a very little experience with any particular machine will settle the point, it being understood that the lighter the pressure the better, provided that sparkless commutation is secured. With this holder it is easy to put on too much pressure, but when this is done it soon shows itself by the commutator getting unduly hot. Having decided the best pressure for any particular machine, it can be ensured for the future by weighing the pull of the spring; a stirrup is passed under the brush and an ordinary spring balance hooked on to it, as in fig. 4, and the adjustment is made to suit.

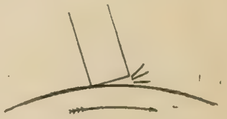


FIG. 5.

The brush-holders here described are made by the Westminster Engineering Co., Ltd., of Willesden Junction, N.W.

INSULATED ALUMINIUM CABLES: CURVES OF COMPARATIVE COST FOR ALL PRICES OF COPPER AND ALUMINIUM.

By J. B. SPARKS.

Quite a number of electrical undertakings, both in this country and on the Continent, are now employing insulated aluminium cables extensively in place of copper cables. A considerable saving in first cost is effected, and in view of the satisfactory operating results obtained, it is surprising that this application of aluminium does not increase at a more rapid rate.

Experience has proved that aluminium cables satisfy all the requirements of underground distribution, and possess certain advantages over copper cables in addition to that of lower first cost. Thus the smaller weight is of considerable importance when transport facilities are poor; the larger section for a given conductance permits of slightly higher current densities without overheating; and even the greater diameter is an advantage in the case of extra-high-tension cables, in that it reduces the dielectric stress on the insulation.

But there can be no better argument in favour of aluminium cables than the fact that a number of responsible authorities, having satisfied themselves by experimental installations, have adopted aluminium cables as a commercial proposition. Amongst the users in this country are included the Corporations of Manchester, Bolton and Ealing, the County of London Electric Supply Co., the Metropolitan Electric Supply Co., and numerous mining and other private companies. The Continental users include the tramway undertakings of Paris, Zurich, Copenhagen, Nuremburg, Geneva, Lyons and Lausanne, the Chemins de fer de Neuilly, France, and the National Tramways and Light Railways Co., of Belgium. These are not small users. Zurich employs nearly 240 miles of aluminium cable, while several hundred tons of aluminium are in use for tramway feeders in Paris.

The saving to be effected by the substitution of aluminium for copper in insulated cables naturally varies with the relative market prices of the two metals, and, on account of the very heavy fluctuations in the price of copper, the difference in cost ranges from a negligible amount to very substantial percentages. This variation in the amount to be saved, and the consequent uncertainty in the minds of engineers as to the economy of a change, are largely responsible for the slow progress in the use of aluminium cables.

The object of the present article is to present groups of curves from which the actual difference in cost between copper and aluminium cables of any required type can be rapidly estimated for all prices of the two metals, and without the trouble of first calculating the equivalent section of aluminium. Fig. 1 shows such a group of curves for paper-insulated, lead-covered cables.

These curves are plotted from cable prices which have been estimated for cables constructed to the specification of the Engineering Standards Committee in respect of thickness of dielectric and lead covering, and are based on average prices for the cost of labour and materials other than the copper or aluminium core. The figures obtained were, of course, carefully checked by comparison with actual tenders and should represent fair average prices. The fluctuations in value of labour and sundry materials are not sufficient to affect seriously the usefulness of the curves, but it will be realised that, owing to these fluctuations, and the very variable percentage profit obtained in the cable business, the "net selling prices" read off from the curves are necessarily approximate.

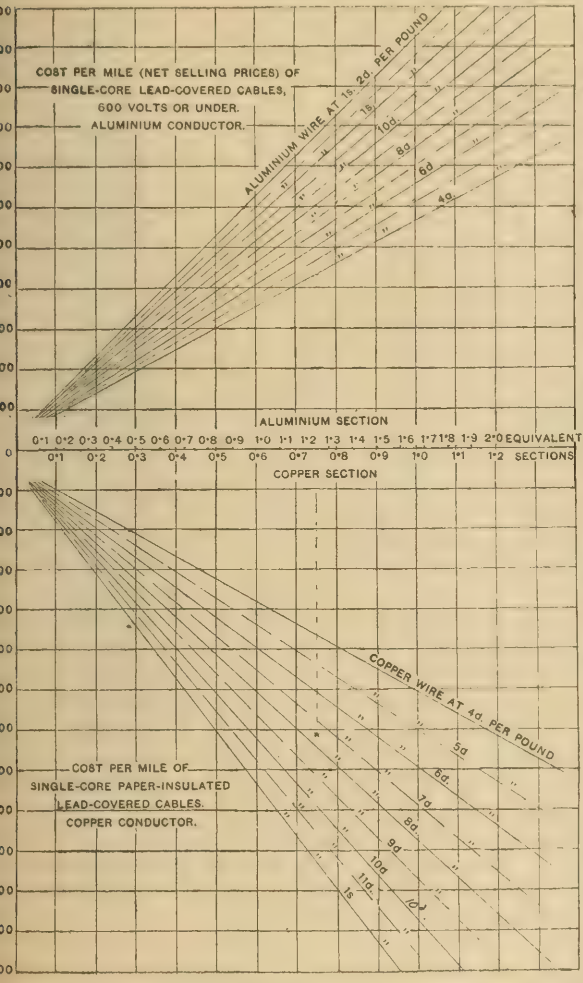


Fig. 1.

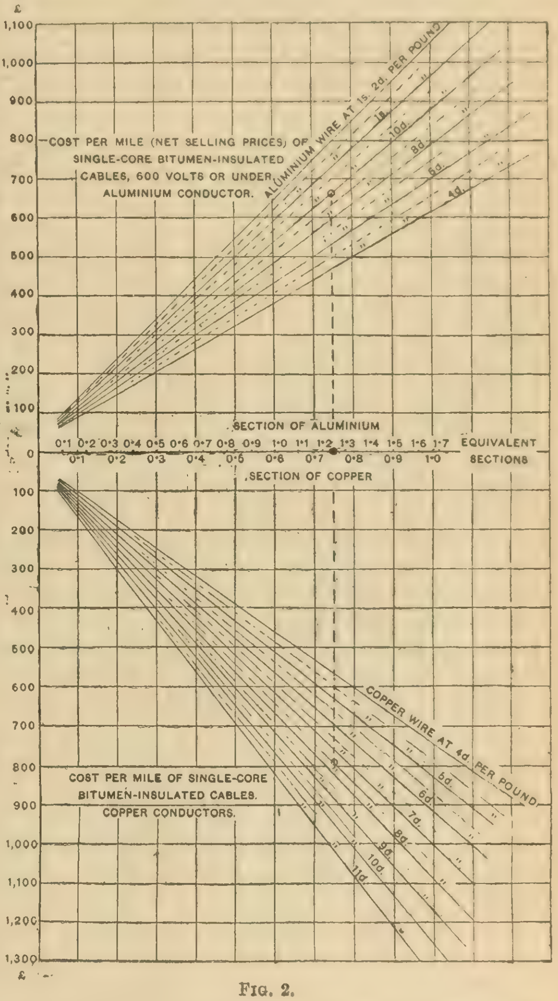


Fig. 2.

As, however, these particular factors affect the total cost of low-tension cables such as these only to a comparatively small degree, and as they will affect both types of cable almost equally, the difference in cost of the two types, and the percentage saving arrived at by a comparison of the figures, will be correct for all practical purposes.

As an example, let us assume that it is necessary to extend the cable system of a given tramway undertaking by the addition of 10 miles of feeders, single-core, paper-insulated, lead-covered, and all of a uniform section of 0·75 sq. in. copper, or the equivalent aluminium section. Let us assume further, that the market prices of the two metals are 10d. and 7½d. per lb. of annealed wire for aluminium and copper respectively. Along the horizontal scale of fig. 1 we find 0·75 sq. in. (noting incidentally that it corresponds with an aluminium section of 1·25 sq. in.). Running up an ordinate from this point, we find that it meets the 10d. per lb. (aluminium) curve at £635, which is the price per mile of an aluminium cable of this section and for this price per lb. Projecting the ordinate downwards, we find that it meets the 7½d. per lb. (copper) curve at £715, which is the price per mile of the copper cable at the given figure for the price of copper. While these figures are approximate only, the difference in cost—namely, £80 per mile—will be practically correct, and thus we may be certain that at these prices per lb. of the two metals we shall effect a saving in first cost of £80 per mile, or £800 for the 10 miles required, if we adopt aluminium in place of copper. As a percentage, this is a saving of over 11 per cent. in the first cost of the cable alone. The effect of the additional expenses incidental to laying the cable, on the percentage saving, is dealt with further on. The reader can easily and rapidly estimate in the same manner the saving for any other section of conductor and for any other prices per lb. of the two metals.

The group of curves given in fig. 2 are for bitumen-insulated cables, and are used in exactly the same manner. Taking the same sections of cable and the same prices per lb. of the two metals, the price per mile of the aluminium cable is seen to be approximately £660, while that of the corresponding copper cable is £790, showing a saving of as much as £130 per mile by employing the aluminium cable, or a percentage saving of nearly 16·5 per cent. The greater saving in this case is due to the absence of the lead covering, which is considerably more costly in the case of an aluminium cable owing to the greater diameter for equal conductivity. The curves, in both cases, cover a wide range of prices per pound of the two metals.

While the saving deduced from the above curves, and expressed in pounds sterling per mile, gives the actual amount of money to be saved by the adoption of aluminium cables in place of copper cables, it must be remembered that the percentages of 11 and 16 per cent. obtained in the two examples taken are the percentage saving on the cost of the cables alone, and that the percentage saving on the complete installation will be somewhat less on account of the cost of laying the cables in each case. The more expensive the method of laying adopted, the less will be the percentage saving effected by the use of aluminium.

For example, let us assume that the lead-covered cable of the first example is to be drawn into earthenware conduit—a single duct embedded in concrete. This conduit will cost about £550 per mile, including materials, excavation and reinstatement. Drawing-in and joints will account for a further £40 per mile, and we may allow £70 for the cost of the necessary manholes. The total cost per mile of the completely laid cable will thus be (£715 + £550 + £40 + £70) £1,375 per mile for a copper cable, and as the aluminium cable costs £80 per mile less than the copper cable, £1,295 per mile for the aluminium cable. The percentage saving on the complete installation is, therefore, only 5·8 per cent. Nevertheless, this represents a sum of £800 on the 10-mile length of feeders as stated above.

If the cable is to be drawn into an existing duct, t percentage saving by the use of aluminium will be alm that estimated from the curves, while if a less expens form of laying is adopted, the percentage saving will something between that and the saving as reckoned in t previous paragraph. In all cases the actual saving in pou sterling per mile is that read off directly from the curves.

APPLICATIONS-FOR-SUPPLY REGISTER.

By A. C. GLOVER.

In all cases an application form should be received and t usual inquiries instituted before any connection to ma is made.

Modus Operandi:—As soon as an application form received it is entered in the register. A new numbe given to every new consumer, and a re-connection, that where the service is already laid and requires a meter o takes the original number. Extensions and transfers numbered in like manner. In small undertakings correspondence may be filed under the registered num given to the application form. Therefore W. Johnso correspondence file would be numbered 1,001, and if fut consumers took over his address this number would alw be retained. After connection it must be noted that every application form received a meter reading sheet sheets must be placed in the reading book unless the ins lation is connected in conjunction with the existing me as in the case of Williams & Son in the illustration.

Additional columns may be made for "Description Premises" and "Occupation," as this information is usu demanded for statistics.

Applications-for-Supply Register.

Left side.

Reg. No.	Name.																									Address.	Installation.	New	Rec.	Ext.
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	Y	Z					
1,001										Johnson, William																97, Queens Rd.	20-55 w.	√		
1,002																				Turner, Philip						6, John St.	8-35 w.	√		
741								Harris & Co.																		Albert Works, Fen St.	1-50 H.P.		√	
309																							Williams & Son			19, Kingsway	125 w.; 20-35 w.			√
412		Browne, James																								24, Atherton Rd	13-35 w.			

Right side.

Date received.	Date ackd.	Inquiry.		Deposit.			Notifications.				Reading sheet placed in book.	Installation report.	Remarks.	Application filed.	
		Boro. treas.	Returned.	Applied for.		Paid.	Mains dept.	Returned.	Meter dept.	Returned.				Date.	
7 11 13	7 11 13	7 11 13	9 11 13	£2	9 11 13	11 11 13	11 11 13	18 11 13	11 11 13	18 11 13	√	191	—	12 11 13	P
Do.	Do.	Do.	Do.	—	—	—	9 11 13	14 11 13	9 11 13	15 11 13	√	190	—	12 11 13	P
Do.	Do.	Do.	Do.	£3	9 11 13								Monthly a/c.		
Do.	Do.	Do.	Do.	—	—	—	9 11 13	14 11 13	9 11 13	15 11 13	Existing meter	192	—	12 11 13	P
Do.	Do.	Do.	10 11 13	—	—	—	—	—	—	—	√	—	—	12 11 13	P

Dublin.—Annual Report.—The Electricity Sup Committee, in an annual report, states that it is considered ad able to recommend the Council to apply to the L.G.B. for sanc to a further loan for extensions. The continued labour trou are held responsible for the delay in providing the additi 3,000-kw. generating set and boiler plant. Including this plant, the city electrical engineer believes that the plant will sufficient to cope with all demands up to 1916.

The principal items of expenditure in 1914-15, due to new nections, will amount approximately to £15,000. The incre demands in the old city area necessitate a considerable expendi on supplemental cables and additions to the sub-stations. An penditure estimated at £3,258 will be required to reconstruct switchboards at the main power station, and the total expendi in connection with the station is estimated at £14,950.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Insurance Companies and Consulting Engineers.

For some years certain insurance companies have been gradually extending what they are pleased to call their "engineering departments"—which means encroaching on work which has hitherto been considered the special sphere of the professional engineer.

If the companies employed properly qualified engineers to carry out the work, there would be less to say against the system, but it is well known that they do not offer sufficient monetary inducement to obtain good men. Further, properly qualified engineers will not take service alongside the clerks whom the insurance companies employ in their engineering departments.

Young men who have spent all their working lives at the desk are pitchforked into the surveyor's engineering department and sent out on inspecting work to value machinery, &c. Their principal qualifications are bluff and cheek, for they have no engineering or electrical knowledge. Occasionally, one of them feels so grossly ignorant of the duties, that he attends a class at a Polytechnic, with the idea of picking up a few scraps of information, to enable him to bluff a little more successfully.

It is such men as these who go to swell that great army of "engineering impostors" existing in this country. It has grown to an alarming extent owing to the engineering profession not having legal protection, as in the legal and medical professions.

The following are typical examples of the type of men whom the insurances companies dub "electrical inspectors":—

Individual No. 1 has the status of electrical resident inspector, and his duties comprise visiting owners of electric plant, advising them to have the same insured against breakdown, and fixing an inclusive premium which will cover loss through stoppages, and so on. He admitted to a teacher of electrical engineering that he had no electrical knowledge, and, when asked what the insurance covered, he could not say. Amongst other details, he was completely ignorant of what was meant by a "burnt-out armature coil," and had no knowledge of how such an accident could occur.

Individual No. 2 is in the surveyor's department of an insurance company, and his duties comprise the inspecting of electrical installations pointing out defects, and suggesting what must be done to remedy them. His electrical knowledge consists solely of a few hints gleaned from an elementary book on "Wiring." After a motor starter had been described to him, he said that he had always wondered what "those things with little round pieces of brass across them were."

"Earthing" was quite a mystery to him, and he asked if he was correct in stating to a client that "The ends of the pipe where the wire comes out should have bushes."

It is known in the electrical contracting business that hundreds of installations are passed by such men as these, when the installations do not comply with the rules which have been officially framed with the object of obtaining safety, and so raising the status of electric work in the public estimation.

But in addition to electric lighting, some insurance companies also pretend to give advice regarding complete installations of motors in factories and works.

Usually, when a manufacturing firm decide to go in for electric driving, it is because they have been led up to this decision by meeting engineers and reading articles written by engineers. Directly the insurance company hear of it, they say to the secretary of the company: "We will advise you as to size and type of machinery, motors and switchgear, &c., to use, will specify and see the work carried out, &c., and will insure the whole installation at a lower premium than we will accept if it is carried out by a professional engineer."

Now, without any beating about the bush, the indictment of insurance companies includes the following:—

They employ men who have little or no knowledge of the theory and practice of engineering. They advertise in the most brazen manner, and they deliberately cast reflections on professional engineers. Generally they do all those things which ordinary manners, to say nothing of etiquette, forbid the professional engineer.

Being a corporation, the councils of the Engineering Institutions cannot get at them, and, truth to tell, the Institutions, which should have acted in defence of the profession of engineering, have been content to allow the members to look after themselves. Some of these Institutions employ men as secretaries who are not engineers, and who are, therefore, not able to see things as they appear to engineers.

The question is—How long is this scandal going to continue, and what can qualified engineers do to show it up, and perhaps stop it? One thing that occurs to the writer is that engineers as a body might deliberately boycott those insurance companies that run these bogus engineering departments. Most men are insured nowadays, and also insure their houses, furniture, &c. Why not have a black list of those insurance companies which are deliberately acting contrary to the interests of engineers?

Tyke.

December 31*st*, 1913.

Protection or Tyranny?

I have, up to the present, refrained from openly criticising the actions of the B.E.A.M.A. whilst the question of "general conditions of tender" was still the subject of negotiation between the various interests concerned, although very little negotiation can be possible, in view of the attitude adopted by the dignitaries at their palatial offices in Kingsway. Their latest action, however, is one which shows the Association up in an even worse degree than could be possibly imagined.

My Council recently invited tenders for new plant; specifications were in the hands of the manufacturers by December 15th, and the tenders were to be delivered by December 31st. The B.E.A.M.A. sought for an extension of seven days on account of Christmas holidays (two days) intervening, but this not being acceded to, the Association took it into their own hands, and their members were not permitted to send in their tenders by the date specified. I have it on authority that a number of firms were prepared and desired to send in their tenders as requested, but the B.E.A.M.A. resolved not to allow this to be done, and that my Council must wait until January 7th.

A more vicious form of protection one could not imagine, and it far surpasses anything that our professional politicians could achieve at Westminster.

The humorous side of the matter has been the many varied excuses each firm has offered for not returning its tender, but none of them had the courage to state the proper reason, viz., their helpless individuality as members of the B.E.A.M.A.

When we consider that the Association, through its members, is forcing upon the purchasers "general conditions of tender," which individual members of the Association would not accept in connection with contracts in which they were the purchasers, and now ruling as to when tenders are to be returned, we shall soon be told what plant we can or cannot have; perhaps we shall be ordered as to how much load we shall connect up and the price we are to charge for the same.

What with the Cable-Makers' Association, the Tungsten Lamp Conference, the minimum prices for meters and motors, and last, but not least, the B.E.A.M.A., it seems as if the electrical industry has the worst monopolies of any, and is doing more to hinder the advancement of electricity in this country than political parties can ever do; in fact, we shall have to look to the latter to free us from the fetters of combination which eliminate competition and increase dividends at the expense of progress.

F. W. Purse,
City Electrical Engineer.

Carlisle, *January* 5*th*, 1914.

Concerning a Review.

My attention has been called to Mr. Rankin's letter in the current issue of your valuable paper, and as the author of the book referred to, I will be pleased to have, either through the Press or privately, any criticisms Mr. Rankin may have to make on the subject matter incorporated. I am rather of the opinion that there are no incorrect diagrams or technical details, but there may be "sins of omission" due to the limited space available in so small a book, and I should so judge such criticisms as Mr. Rankin puts forward, on which there appear to be no details, more under the class that explanatory notes are omitted for the above reason. I think this is explained in the preface, and the complement matter of such a broad subject has, of course, had to be considerably curtailed.

A. G. Collis.

Brentwood, *January 2nd*, 1914.

After reading Mr. Rankin's letter in the current number of the Electrical Review, I am not at all surprised at his first one. He states that it is poor justification for one reviewer to point out that a book has been favourably reviewed by another man in another periodical. I think precisely the reverse. After carefully considering everything Mr. Rankin has said to the contrary, I am still of the opinion that Mr. Collis's book is well worth the price asked, and I have pleasure in recommending it.

The Reviewer.

January 6th, 1914.

Jumping Arc Lamps.

Suppose a line of arc lamps is jumping and flickering in consequence of one lamp being out of order, what is the best and quickest way to find out which one is the offender?

Lowering them in succession and cutting out one by one, with an interposed resistance or otherwise, is a terribly long and tedious business, as the fault may not be always on, and to make the test accurate might need many nights of work, yet this is the only remedy I have been advised of so far by friends, or even by a noted engineering paper in which I asked for information. Surely there must be some better and quicker way. What do the electricians in charge of street, dock and big railway station arc lamps do?

E. P. C. C.

Not an Electric Fire.

The obscure origin of the fire which recently destroyed a large portion of the famous castle at Schwerin has led to the propagation of the usual rumours regarding short-circuits. The official investigation has completely disproved them, and it has, moreover, been established that the salvage work was enormously assisted by the electric lighting installation. On the discovery of the outbreak all lamps were lit, and they were left to extinguish themselves as the branch fuses melted. In many cases the lamps burned long after the fittings were cracked and broken and until the ceilings fell.

It is stated that without the help of the lighting it would have been impossible to save many of the portions which have been preserved.

J. S. Messent.

Berlin, *January 4th*, 1914.

The Ignorance of Home Office Requirements.

Mr. Frank Broadbent's lecture to electrical manufacturers and contractors may be well deserved, but it is certainly not far-reaching enough.

If electrical apparatus of any description is unsafe in the workshop, why not so in the mansion?—or, in other words, why is the faulty material authorised by other recognised regulations? Bearing in mind the extra cost that Home Office pattern material usually involves, this anomaly operates very harshly against the well-informed contractor when in competition.

L. E. Wilson.

Manchester, *January 3rd*, 1914.

Association of Mining Electrical Engineers.

Chatting with a friend during the holidays, he inform me that he had ignored this Association for three yea but that he regularly receives notices of meetings, and intimation now and then that his subscription for t current year is unpaid.

It would be interesting to know how many of the 1,1 members which the Association is said to have, have pa the subscriptions for the current year, last year and t year before. If my information is correct, in April, 191 only about 65 per cent. of the names on the register h paid the subscription due in July, 1911.

Mr. J. Glynn Williams's analogy of the little boys w hide round corners when snowballing is capable of a litt further amplification—there is always one little boy w comes out and says: "Please, Sir, it wasn't me, Sir."

Outis.

London.

Sulphate of Ammonia Manufacture.

We have noticed in your issue of the 19th ult., article by Mr. Georges Dary on "The Production Nitrates by the Direct Electrolysis of Peat Deposits."

In the course of the article the writer refers to the "Buck process," which is the property of the International Nitrog and Power Co., Ltd.

We shall be glad if you will allow us to correct the ve inaccurate statement as to the cost of the "Buckle process made by Mr. Georges Dary.

Without going into any details of the process, which not solely concerned with the manufacture of sulphate ammonia, we may say that, with the aid of the abo process, and with suitable peat bogs, sulphate of ammon can be made at less than one-half the price stated by M Dary. The process, also, is self-supporting, inasmuch as it do not depend on any extraneous supply of power, such as th provision of a large amount of water power, which is nece sary in the process which is described by Mr. Dary.

Trusting that you will bring this statement to the noti of your contributor.

The International Nitrogen and Power Co., Ltd.
Saml. C. Formleu, *Secretary*

London, S.W., *January 5th*, 1914.

The Position of Railway Electrical Staffs.

In reading through "Nemo's" letter I think he has don well to bring to the Metropolitan Railway Company's notic the fact of the electrical staff's loyalty during the last rai way strike.

The electrical staff must be considered a big factor in th running of railways of the future in view of the electrifica tion of the different lines that is in progress.

During the past year the Metropolitan Railway hav increased the plant at several sub-stations, including plan for automatic signalling, which all means more respons bility on the engineer in charge of each station.

Therefore, I think the company might with advantage d something to raise the standing of the electrical staff an promote a feeling of contentment among the staff whic would ensure greater efficiency. Dissatisfaction gives lo efficiency in great or small concerns.

Dum Vivimus Vivamus.

With reference to your correspondent "Nemo's" lette under the above heading, I should like to add that th electrical staff of the Great Western Railway are in a exactly similar position to that of the staff of the Metro politan. We also have sent in petitions, and similarly, we ge no replies.

I fail to see, however, that any material advantage woul accrue if the electrical staff were placed on the permanen staff, for, as a body, we should still be without representa tion. As we are classed with the uniform staff, it i obvious that the only way to secure recognition of ou grievances is to join their society. By this means only sha we ever be able to speak with a voice that will make itsel heard.

Synchroscope.

Jerry Wiring.

I should like to draw your attention and that of the exercising authorities and the electrical trade generally to the nature of the electrical wiring for carcass work and the way in which it is being installed in the suburbs of London; in a house in its carcass state, fitted with between 9 and 14 lights, in some cases the casing is used without capping, reversed to the joist, leaving the wires at places absolutely uncovered; the wires that drop to the switches are encased in slip-joint tubing, buried behind plaster, leaving generally a gap between the end of the tube and that of the casing, the wires not being encased; other places being a little awkward, the wires are run behind the laths without casing or tubing. Now, I think the time has come when this sort of work should be condemned and those that are responsible for it, as it is not only dangerous but detrimental to the electrical trade generally. This kind of competition should be stopped, as it is both ruinous to the ignorant, and unfair to the contractor who is trying to get a fair living as the result of doing good work for bad prices.

Observer.

American Methods.

I have been much interested in the articles on "American Methods" in your issues of November 14th and 28th.

When I finished reading Mr. Seabrook's article, I felt that he had written on a subject that has often tempted me. I congratulate him on it and the Electrical Review on publishing the same.

After a perusal of the article by "F. W. D." I feel compelled to write and say that your contributor is either prejudiced against Americans and their methods, or ignorant, or else has happened across an isolated instance where he has gained a false impression. He does not write the truth. Maybe your contributor has only met Americans of the tourist variety, on the other side—one can hardly credit his ever being employed over here.

Some Americans are self-assertive. That is not a bad fault for some Englishmen to have, it seems to me. I will not deny they are sometimes boastful over here, but they certainly do have some things to boast of in the electrical industry compared with those at home. I have never experienced any overbearing manner among those of the American electrical fraternity.

If any man has ambition, he naturally hopes to attain a position of authority, or as your contributor prefers it, "to be a boss."

As regards co-operation, what about the members of the N.E.L.A.? I know for a positive fact there is certainly no lack of co-operation between the electrical interests on this side. I, myself, am called upon, almost every day, to co-operate with others, and not exactly for the sake of the mere dollar or two there may be in it. Do not the slogans of the Society for Electrical Development and of the Sons of Jove offer evidence of the spirit of co-operation?

I have not been able to discover in almost seven years' residence in the United States any evidence that "a workman cannot be relied upon to work his hardest except under pressure" in so far as this does not apply to England as well. When your contributor refers to workman (presumably mechanic and labourer) it must not be overlooked that the majority of the rough work and the less skilled machinists' work is done in America, not by Americans, but by the immigrant from Southern and Eastern Europe. To get satisfactory work out of Greeks, Slavs, Poles, Hungarians, Bohemians, and the like, especially when all the races are represented in one shop, needs different treatment to what those at home might deem desirable or necessary.

Most American enterprises do pay a dividend, in spite of attractive prospectuses that might be issued from time to time. I believe I have read in the Electrical Review comments on the small returns British companies make in comparison with those in America.

Monopoly is not such a bad thing as it may seem to many. At any rate the day of the isolated small manufacturer is almost done. The requirements to-day are on so large a scale, and the development costs so high, that only large and sound concerns can successfully undertake the work.

The immense field now covered by the electrical industry demands specialisation. Specialisation does not eliminate all personal interest; it stimulates it. It is obvious that any man who is not interested heart and soul in his work is a failure at the start. Without a specialised system in a large plant there would be chaos.

I really believe your contributor, when writing on welfare work, deliberately misinterpreted Mr. Seabrook's remarks. It is surely advantageous to the work-people that sanitary conditions should prevail in the works; that their mid-day meal, which is often provided in restaurants in the factories here, is wholesome, well cooked, and as low in price as possible. The location of a factory in a good, open, healthy place; adequate lighting, both by day and night; warmth in the winter, and so on, are all a part of "welfare work," which your contributor apparently so purposely overlooks that your readers might almost judge him a man of very narrow experience.

Regarding salesmanship, I believe this to be the most important problem that a merchant has to handle. Order taking is not to be confounded with salesmanship. The latter is certainly recognised in this country as a worthy and desirable branch of the profession to follow, and the electrical engineer salesman is generally a well-paid employé.

A man from Mexico recently told me that there were only two countries that had electrical manufacturing concerns worthy of note, namely, the United States and Germany. He stated that the British electrical manufacturer was very poorly represented, both by men and machinery, in Mexico.

I know that Britain can be represented, if her manufacturers will wake up. It may be true, to some extent, that American methods do not suit the industrial conditions at home, and that the temperament of the people there is somewhat adverse to change, but if Britain expects to progress with the rest of the world, she must use methods that can successfully combat those of her competitors, not go to sleep.

English.

Newark, N.J., *December 19th*, 1913.

St. Marylebone New Turbine Plant.

In your issue of December 5th last appeared a somewhat glowing description of the two high-speed turbo-alternators which have recently been supplied to St. Marylebone by Messrs. Oerlikon. Interesting though the article was, it would be still more instructive if you could obtain for the power plant users some definite and authoritative information as to the actual performance of the machines in question.

All sorts of reports have been passed round; indeed, it is common talk that at the very moment we shift dogs were reading the article over our evening cup of tea, the much-vaunted foreign machine burst one of her L.P. wheels, and is now a total wreck. The same small bird keeps on whispering about similar, but less serious, trouble with the second set. Can you obtain some definite information to appease the thirst for knowledge of

Three Shift Dogs.

January 5th, 1914.

[We have made inquiries and find that the reports referred to are very greatly exaggerated. About a month ago the 10th rotor wheel in No. 1 Oerlikon turbine fouled the stator disk, and the damage which ensued necessitated the return of some of the parts to the makers for repairs. Mr. Seabrook expects that the turbine will be running again about the end of this month. The cause of the mishap is somewhat obscure, but it is thought that the lubricating oil used for the thrust bearings was not of the right consistency, a thinner oil being preferred by the makers. There was nothing in the nature of an explosion.

As regards No. 2 turbine, a slight contact took place between the rotor and stator, but on examination it was found to be of a trivial nature; the turbine was set to work again and has since been running day and night quite satisfactorily. Mr. Seabrook points out that similar incidents occur almost invariably on starting up a new set, of whatever make.—Eds. Elec. Rev.]

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Crystal Fittings.

The General Electric Co., Ltd., have just issued a catalogue of 40 pages in which they give excellently-executed illustrations of a full range of electric light fittings constructed wholly or partially of crystal glass, a type of fixture which is stated to be becoming increasingly popular amongst those interested in general decorative and illuminating schemes for dancing-rooms, halls, restaurants, theatres and like places. In many cases crystal glass pendants or lustres are found to be the only electric light fittings which will harmonise with and fully accentuate the beauty of the architecture. This new list is entitled "Electric Fixtures in Crystal Glass," and should be useful to electrical contractors.

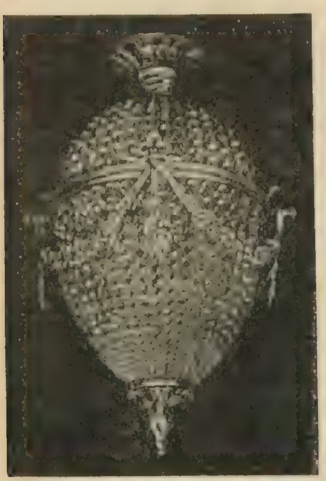


Fig. 1.—G.E.C. Crystal Pendant.

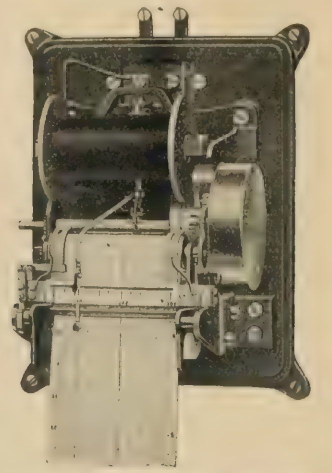


Fig. 3.—Siemens Small Recorder, Cover Removed.

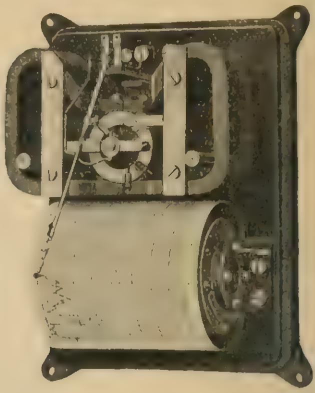


Fig. 4.—Recorder with Drum Chart, Cover Removed.

With most of the pendants and electroliers spare crystal drops are included to replace possible damage. We understand from the General Electric Co., Ltd., that no general distribution is to be made of this catalogue, but they will be pleased to forward a copy to those interested on application to the head office, at 67, Queen Victoria Street, E.C., or to any of the provincial branches. A couple of the designs are shown in the accompanying illustrations.

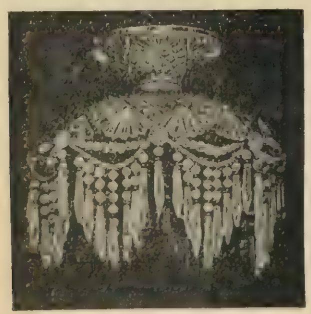


Fig. 2.—G.E.C. Crystal Fitting.

Portable Electric Grinder.

Messrs. H. W. Butler & Co., of Craven House, Kingsway, W.C., have recently introduced a handy little electric grinder—the H.B.—which can be fixed to a tool-holder on the lathe, milling or shaping machine, and is useful for grinding dies, reamers, cutters, &c. The device weighs 5½ lb., and consists of a $\frac{1}{12}$-H.P. motor (operating on either direct or alternating current) running at 10.000 R.P.M. Dust-proof bearing caps are fitted; the motor is air-cooled and accurately made, and will operate from an electric lamp socket, through a flexible cord and plug which is supplied with the apparatus.

Recording Instruments.

Some new patterns of recording instruments have been introduced by Messrs. Siemens Bros. & Co., Ltd., of Woolwich. One of these is shown in fig. 3, a small and inexpensive instrument with a simple movement, and chart 70 mm. in useful width. The movement is provided with a vertical spindle, and the paper passes through guides which cause it to assume a curve surface corresponding with the circular arc described by the recording point, becoming flat again some 6 in. from the pointer, thus the chart is ruled with straight lines, and can be divided according to the same law as the natural scale of the instrument. The vertical spindle works with less friction than a horizontal one. The instrument is made for both A.C. and D.C.

Another type of instrument is provided with a straight-line motion consisting of an ingenious link mechanism which guides the pen, and the control spring can be so arranged that the deflections on the chart are proportional to the quantity being measured, so that the scale is uniform and the records can be integrated. The link motion above mentioned is used in the recorder illustrated in fig. 4, a D.C. moving-coil instrument which can be made as an ammeter, voltmeter or wattmeter. The movement is well damped, and the insulation is tested with 2,000 volts alternating, all metallic parts that can be touched being earthed to prevent shock to the user. Recorders of the induction and spark types, and instruments for recording frequency, time, &c., are made.

The "Robj" Lighter.

Messrs. Best & Lloyd, Ltd., of Cambray Works, Handsworth, Birmingham, are placing on the market the "Robj" cigar lighter, consisting of a special type of resistance and porcelain insulator with spring contacts, fitted with a torch containing cotton wool saturated with benzine. The torch is ignited by simply withdrawing it, and does not ignite when replaced. The wick is of indestructible material, and the torch is perfectly insulated. The ordinary resistance is suitable for use on 200 to 240-volt circuits.

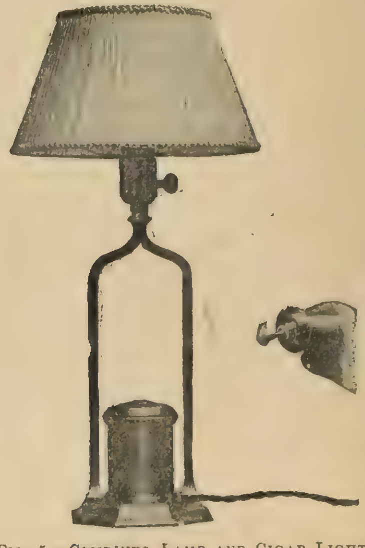


Fig. 5.—Combined Lamp and Cigar Lighter.

Fig. 5 shows a combined lamp and lighter made by the firm.

The Railophone.—We learn from Messrs. International Railophones, Ltd., that they have just received a third trial order from the Swiss Federated Railways for "K.K." detectors. This instrument has been used to transmit telegraphic messages through the St. Gothard tunnel.

PHYSICAL SOCIETY EXHIBITION.

(*Continued from page* 11.)

Isenthal & Co.

Sliding rheostats in a number of patterns, and the new "Condenser" influence machine, were the principal features of this firm's exhibit, but perhaps a still more attractive item on the stand was a collection of Pladuram products—ore, and compressed sticks, bars, wires from 0·5 mm. to 0·015 mm. in diameter, contact disks and spiral springs, all made of pure tungsten—shown for the first time, we believe, in this country.

The condenser electrostatic machine, fig. 11, is that devised by Dr. Wommelsdorf, and so called on account of the arrangement of interleaved fixed and rotating disks which, being influenced on both sides, generate twice as much current as in the ordinary type of influence machine. Thanks to this and other new features, the machine is able to give out a current 20 to 50 times as great as an ordinary machine of equal size, and the machine also excites itself with facility, even in damp weather. The current is collected at the periphery of the rotating disks by a device which eliminates the capacity effects and leakage of the older collectors, and a spark can be obtained of a length equal to two-thirds the diameter of the rotating disk; the collector is made of steel wires running in a groove in the periphery. The metal sectors are vulcanised into the mass of the rotating disks, and similarly the exciting plates are vulcanised into the insulating supports. The superiority of ebonite disks over glass is diminished by the deteriorating effect of ozone and daylight upon their insulating properties, but this drawback is completely eliminated by coating the disks with a film of Bakelite, which permanently protects the ebonite and has very excellent insulating properties of its own. The Leyden jars are similarly covered with Bakelite, and various mechanical improvements in design have been made.

While half the output of an induction coil has to be suppressed when generating Röntgen rays, the condenser machine generates unidirectional current only, the whole of which is useful; this is advantageous also in other applications of the machine, and simplifies the apparatus required. While an ordinary influence machine, with two rotating disks, 26 cm. in diameter, gives a maximum spark length of 100 mm., and a current of 15 micro-amperes through 1,000 ohms, the condenser machine with one rotating disk of this size gives a spark length of 175 mm., and a current of 130 micro-amperes: an ordinary machine, with 12 rotating disks 55 cm. in diameter, gives a spark of 220 mm., and a current of 140 μa, while the condenser machine, with one rotating disk of 55 cm., gives a spark of 330 mm., and a current of 600 μa. The superiority of the new machine, therefore, is clearly manifest. A more detailed description appeared in our issue of August 29th, 1913.

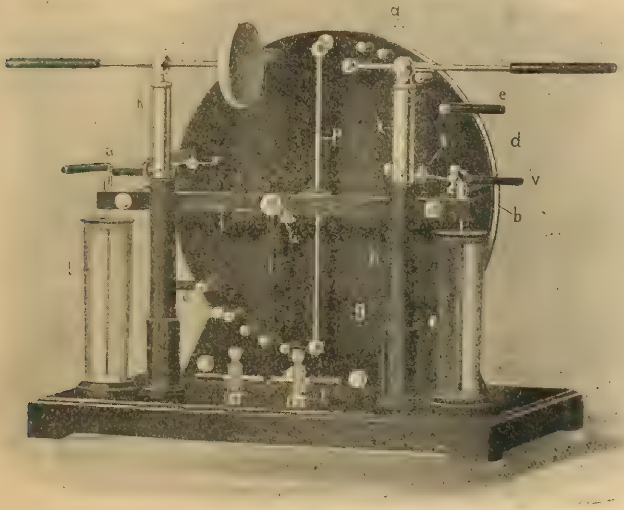


Fig. 11.—Wommelsdorf Condenser Machine.

Gambrell Bros., Ltd.

Amongst a variety of electrical measuring apparatus, a new plug and galvanometer shown by this firm were of special interest. The former is described as the independent plug contact (T. E. Gambrell's patent), and is illustrated in figs. 12 and 13. In this device all parts are interchangeable, and exceptionally large surface contact is provided with all types of resistance-boxes and switches. This, it is claimed, is a great advantage, as all plug apparatus in the testing-room can now be made to one standard cone. This was impossible with the old type, as, to give anything like large surface contact, heavy brass blocks were necessary. With these plugs there is, of course, no fear of slackening the adjoining contacts when one plug is withdrawn.

The following are a few of the advantages claimed for this device:—The plugs are independent of each other; each unit is self-assembling; there is larger surface of contact; there are no plug-heads to go wrong; high insulation is obtained, and the parts are easily cleaned.

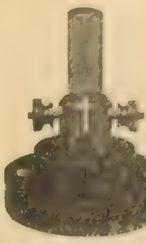


Fig. 12.—Independent Plug Contact.

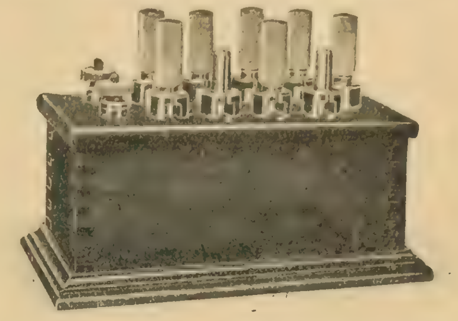


Fig. 13.—Resistance Box with Gambrell Plugs.

The new moving-coil galvanometer is the invention of Mr André Onwood; its construction is shown in fig. 14. The circular coil *a* has a small tube *b*, fixed radially to it, down which passes the suspension *c*, from point *h*, at the centre of the iron core *j*, to the cross pin *g* fixed in tube *b*. The coil and tube are kept in a vertical position by means of the weight *e*, on the lower end of rod *f*, the top end of which is rigidly fixed in the base of tube *b*.

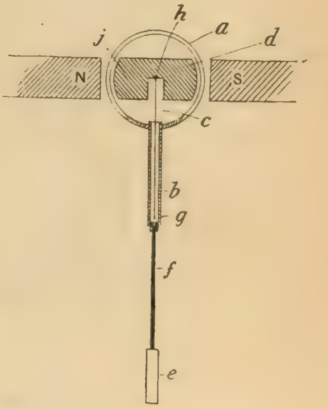


Fig. 14.—Suspension of Onwood Galvanometer.

The coil thus being suspended from its centre, the point *h*, it will always oscillate about that point, and never come into contact with the magnet poles or core, however much the instrument is out of level. This frees the instrument entirely from levelling and attendant troubles, and allows of the use of a very narrow gap which increases the field strength enormously, and therefore the sensitivity in practically the same proportion (pointer instruments give a full-scale deflection of 70° for 1 micro-ampere, reflecting galvanometers 2,500 mm. per micro-ampere at 1 metre). The narrow gap also increases the stability of the magnetic field, thus rendering the instrument less liable to alterations in calibration due to variations in field, and less affected by external fields, while the uniform distribution of the field gives an evenly-divided scale.

In ordinary suspended galvanometers the gap is large, causing bad and uneven distribution of field. This makes the constant and zero vary considerably, even with very small variations in tilt from the position of previous calibration, as it is impossible, with the ordinary methods of levelling, to bring the coil to the same position in the field; the constant must be taken, and the zero adjusted, very time the instrument is moved. In pivoted galvanometers the readings are liable to vary with the tilt, as it is impossible to balance the moving system perfectly.

It is almost impossible to break the suspension, a small spring being placed between the top of the suspension and the iron core at point *h*. In the event of the instrument receiving a blow, the coil drops slightly, and the coil former rests on the iron core before the stress on the spring is enough to break the suspension. This makes the instrument very robust, much more so than any pivoted galvanometer, whose delicate hard pivots, turning in very hard jewel bearings, are easily damaged by shock.

The movement of this galvanometer will always swing about a vertical axis, whatever the tilt of instrument, therefore the pointer will always move horizontally over a scale which lies at an angle to the horizontal by the amount of slope of the instrument, and it might appear that the scale readings would increase from this cause, as the deflection of the pointer divided by the cosine of the angle of tilt, but the magnet and core will also be sloping at the same angle as the scale, thus rotating the field round the coil and reducing the torque as the cosine of angle of tilt; obviously, therefore, the scale readings will be constant at any level for the same current.

The constant of the reflecting galvanometers will vary as the cosine of angle of tilt, but this decrease is very small; these instruments are used on surfaces varying very slightly from the level, and for a surface 2 or 3 degrees from level, the error will only be 5 in 10,000. An ordinary galvanometer could not be worked at all at this tilt: a table 2 or more degrees out of level would be a monstrosity. For precision work a square or other parallel-sided coil can be fitted, the gap being slightly larger; then the constant will not vary at all, however much the instrument is out of level.

These instruments are robust, very sensitive, high speed, the coil being very light, and the balance weight being so narrow that it possesses very little inertia, therefore a high figure of merit results.

MUIRHEAD & CO., LTD.

The Heurtley patent magnifier for use in telegraphy, and Col. Squier's "wired-wireless" patent field apparatus were the chief novelties of this exhibit. The former is employed to magnify the effect of very small mechanical movements in cable or wireless telegraphy.

The principle of the instrument is as follows:—Two very fine wires with high electrical temperature coefficient are mechanically connected to a recorder coil which is acted upon by the incoming current. These wires form two arms of a Wheatstone bridge circuit, the other two arms being fixed resistances. In place of the galvanometer in this Wheatstone bridge circuit is placed a recording instrument, such as the ordinary siphon recorder. The Wheatstone bridge is supplied with current from a local battery, of sufficient intensity to heat the fine wires considerably above the temperature of the surrounding atmosphere. These wires are so positioned that when no signals are being received they lie theoretically half in and half out of blasts of air which blow continuously in a plane at right angles to the plane of movement of the wires. On the latter being moved in one direction or the other by the incoming current, one is inserted more into its blast of air and the other is inserted less. Thus, one wire, as a whole, becomes more cooled, and the other wire is less cooled by the air-blast, so that the total resistance of the cooled wire is reduced and that of the other increased.

As the two wires are arranged on the adjacent sides of the Wheatstone bridge local circuit, these changes in the balance are additive, with the result that a current passes through the siphon recorder coil, which reproduces the movement of the primary coil in magnified form, the degree of magnification depending upon the strength of the blast and the intensity of the current passing through the wires. Suitable means of adjustment are provided. The magnifier produces an increase of speed on duplex cable working of from 40 to 50 per cent., and has been adopted by many of the cable companies.

The "wired-wireless" system allows both telegraphy and telephony to be accomplished simultaneously over the same wires, and is intended for military purposes. The ordinary methods are adopted for telephoning, but telegraphing is effected by means of a current having a frequency of about half-a-million cycles per second, impressed upon the wire by an oscillatory circuit inductively coupled to the line. As the "radiation" is guided by the wire to its destination, very little power is required. At the receiving end the line is inductively coupled to a tuned circuit, and a detector of carborundum and steel is employed. The apparatus is very compact and easy to operate, and enables a great economy of wire, &c., to be effected, by using one wire for the double purpose. No antenna is required, and an iron spike driven into the ground affords an adequate earth. There is not the slightest interference between the two methods of communication.

(*To be continued.*)

LEGAL.

WATKINS *v.* HARROD'S STORES, LTD.

ON Thursday last week, at the Brompton County Court, before his Honour Sir W. Lucius Selfe and a jury, Mr. F. A. Watkins, of Stroud Green, N., an electrical engineer, sued Harrod's Stores, Ltd., for £157 6s., which he claimed as compensation in respect of an injury which he had received on the defendants' premises. Dr. Kingsbury appeared for the plaintiff, and Mr. Patrick Hastings represented the defandants.

In opening the case, COUNSEL said that it was brought under the Employers' Liability Act by the plaintiff, who was an electrical engineer of considerable experience in his profession. For nine years he had been in the employ of the Hornsey Corporation as their senior engineer in charge of the power station. Prior to that he had been employed by the Ipswich Corporation. Last May plaintiff answered an advertisement which was inserted in one of the electrical papers, and as the result of an interview was engaged as assistant to the chief engineer, Mr. Howes, at Messrs. Harrods. At first plaintiff asked for £3 10s. a week, but as he had his meals on the premises he accepted a salary of £3 cash. In the afternoon of August 26th, Mr. Howes had to go out, and he asked the plaintiff to keep special watch on the deep-well pump. One of the most essential duties the plaintiff had to perform in connection with that pump was testing, from time to time, the temperature of the cranks, which, as in other pumps, had a tendency at times to get over-heated. In order to test the temperature, it was necessary for the plaintiff to mount from the floor on to a wall which surrounded the bed in which the pump was working. The wall was only about 7 in. wide, and the crank came within an inch of the wall. While the plaintiff was carrying out his instructions in testing the crank it came down upon the toes of his right foot and crushed them. The result of the injury was that plaintiff was incapacitated from work for some considerable time. The accident happened in mid-week, and the defendants at the end of the week sent Mr. Watkins a cheque for 30s., saying that that was what he was entitled to according to the time book. Plaintiff thereupon wrote for an explanation. For several weeks afterwards he received a postal order week by week for £1 from Messrs. Harrod's, who said that it was compensation under the Workmen's Compensation Act. As the plaintiff did not come under that category, he returned those payments, and brought the present action. His (counsel's) contention was that the pump, working in the position it occupied, should have been fenced, and if it had been so protected there would have been no danger whatever to the plaintiff in carrying out his instructions. The plaintiff had obtained another position, but only at £2 10s. a week. There was great competition in the electrical profession, and people had to take what post they could get and work themselves up. Therefore his position was very much worse, and, in addition, he lost his salary of £3 10s. during his illness, and, of course, had had to bear the heavy expenses of that illness.

MR. F. A. WATKINS, the plaintiff, bore out counsel's opening statement. He had to stand on the bed-plate, which was 2 ft. 6½ in. high, and feel the crank as it revolved. He had to stoop to feel the crank, and whilst he was so engaged the crank came down on his foot. The crank could have been guarded, and inspection could have been carried out with the guard on, and this would have prevented any accident.

In cross-examination by MR. HASTINGS, Witness said his duties were general supervision and acting as chief assistant to Mr. Howes. It was not correct that September 30th was the first date on which he or anyone else suggested that the machinery should be fenced. In the August Bank Holiday week he suggested to Kerr, the foreman fitter, that the machinery ought to be fenced. He had been instructed to try the pump to see if it was satisfactory before it was taken over from Messrs. Isler, the contractors who erected it. Witness admitted writing a series of reports dealing with the working of the pump, and said that from August 18th it was out of commission for repairs, and remained so until his accident. He agreed that on the day of the accident he was testing Messrs. Isler's work to see if it was satisfactory. The pump never was satisfactory. He knew that under the provisions of the Factory Act there was no need to fence machinery under repair, but he did not agree that that applied to the present case. He submitted that the pump ought never to have been allowed to run at all without guards. When Mr. Howes went for his holidays on July 11th, plaintiff was in full control, but the pump at that time was not sufficiently completed to fix a guard. He did not suggest guards in his reports, because he looked on Mr. Howes as a qualified engineer, and in the engineering profession, if an engineer continued to be worried with suggestions, he was apt to get annoyed. In addition, when the foreman fitter went for his holidays he handed him a plan of a proposed guard for the pump, and this was seen by Mr. Howes, and afterwards given back to the foreman fitter. The reason why he declined to go back to Harrod's was because they offered him an inferior position, and he would have had men under his charge getting more salary than himself.

DR. G. W. H. FRENCH gave evidence as to the injury suffered by the plaintiff. JOHN CLUTTON, foreman to Messrs. Isler, who supplied the pump, was also called by Mr. Hastings.

MR. W. HOWES, chief electrician for the defendants, said that the electrical station of the defendants was an important one, as it supplied all the services of the stores and light and power to the flats around. All the defendants undertook in connection with the pump was the electrical connections. They did not erect the motor. He admitted that there was danger in testing the crank. They could not erect the fence, however, until the pump was taken over, and at the time of the accident the pump was in Messrs. Isler's hands.

Mr. Hastings submitted (1) that plaintiff was not a workman within the meaning of the Employers Liability Act ; (2) that under Sec. 10 of the Factory Act, 1901, this was a machine which was not required to be fenced, "being under repair or under examination in connection with repair", (3) that plaintiff admitted that he knew of the danger, made no complaint, and undertook the risk ; and (4) that plaintiff was guilty of contributory negligence in putting his foot where he did.

Dr. Kingsbury contended that the nature of the plaintiff's work made him a workman, and that there was no repair of the pump in the sense that it would exonerate Messrs. Harrod's from their responsibility to fence it.

The Judge, in addressing the jury, said the case had taken up a great deal of time, and was somewhat important, but it really resolved itself into a small compass. In this case the negligence alleged was against Mr. Howes in not having the pump fenced. If the jury found that plaintiff was not a workman within the meaning of the Act, he had no remedy. They had to decide whether he came within the definition of "artificer, handicraftsman or otherwise engaged in manual labour." If they found that plaintiff was one engaged in manual labour, they had to consider the liability of Messrs. Harrod's. They had to decide whether the pump was used in connection with defendants' business, and to consider whether defendants were negligent in not erecting a temporary fencing. Further, they had to consider whether plaintiff, who was a man of intelligence, and had occupied a responsible position at Hornsey, was aware of the danger and undertook the risk.

After consultation in private, the jury held (1) that defendant was a workman under the Act ; (2) that the pump was under examination at the time of the accident ; (3) that it was a defect that the pump was not fenced ; (4) that the defect was due to the negligence of Mr. Howes ; (5) that the plaintiff knew and appreciated the risk of the machine being unfenced, and undertook the risk ; (6) that the plaintiff was not guilty of contributory negligence ; and (7) that the damages (if any) should be assessed at £114 1s.

Mr. Hastings asked for judgment on the finding of the jury that the plaintiff undertook the risk.

A consultation took place between the parties, and Mr. Hastings having admitted liability under the Workmen's Compensation Act, it was agreed that plaintiff should receive £16, and that each side pay its own costs.

BUSINESS NOTES.

Consular Notes.—Zanzibar.—The British Consul in Zanzibar, in a recent report, states that a power station has been installed at a cost of £4,000, which supplies current throughout the day and night. The question of fuel presented considerable difficulty owing to the rise in price of both Welsh and Natal coal, and it is possible that petroleum will be adopted. The total number of new lights added during 1912 was 760. Some important changes and improvements have been made in the street lighting of Zanzibar Town, the chief among them being the installation of metallic-filament lamps in the main street. A considerable amount of extension work has been done in the town telephone system. At the end of 1911 there were 54 instruments in all ; this system was increased during 1912 to 76 ; an average number of 380 calls are dealt with during each 24 hours. There are wireless telegraph stations on Pemba and Zanzibar Islands, and the German Government have recently erected a wireless station on the mainland at Dar-es-Salaam, 42 miles from Zanzibar. The range of a new plant is 250 miles under ordinary, and 400 miles under very favourable, conditions. The total number of messages transmitted was 5,312 in 1911, and 4,718 in 1912.

German E. Africa.—The British Vice-Consul reports that there is a double line of telephones between Dar-es-Salaam and Tanga and Dar-es-Salaam and Kilwa, the ordinary telegraph wires being used for purposes of telegraphing and telephoning. Telegrams take precedence over telephone calls. At present there are 3,000 km. of line and 3,000 km. of wire in use ; 15 towns have a local telephone service. The local radius is 5 km., and the charge is 150 rupees (£10) per annum, the number of calls being unlimited. For trunk line connection the annual charge is 180 rupees (£12). For night trunk line calls the charge is from 1 to 3 rupees, according to distance, and the line may be held for five minutes, except in the case of Tabora, where the fee is 3 rupees, and the time allowed three minutes. German East Africa is connected with the international cable system by the cable of the Eastern and South African Telegraph from Dar-es-Salaam to Zanzibar *viâ* Bagamoyo. There are 29 telegraph offices in the Protectorate. In March, 1911, Bukoba and Muanza were connected by wireless. The range of the Muanza station is about 900 km., and of the Bukoba station 200 km. A far more powerful installation has now been erected at Dar-es-Salaam, with which it is hoped connection will be established with Guardafui and Delagoa Bay, and with ships at sea at even greater distances than these points. It is hoped that Muanza will be within call from Dar-es-Salaam, at least during the night. The height of the antenna is 100 metres. The Telefunken system is employed. The installation came into operation in March, 1913.

Japan.—The British Consul at Yokohama in a recent report states that hydro-electric plant still continues to be imported in large quantities but as the various parts such as turbines, Pelton wheels, dynamos, &c., are not given under separate headings in the trade returns it is difficult to ascertain the actual amount imported. Hitherto practically all cables imported have been overhead, but underground cables are becoming more popular every year, partly because they are less liable to interruption from atmospheric disturbances, and partly because they eliminate the necessity of the countless criss-cross wires which disfigure so many towns in Japan. As long as the change over from overhead wires to underground cables continues, there is likely to be a large yearly import of insulated cables. Although a considerable amount of insulated cable is made in Japan, there is still a very large import from abroad, as the Japanese appear to find difficulty in manufacturing cable suitable for high-tension current, for which there is a large demand by hydro-electric works.

Germany.—The Consul at Hamburg reports that the electric railway which encircles that city, partly as an underground and partly as an elevated railway, was opened for traffic in 1912, and has proved a great success, the number of passengers carried being far in excess of what was ever hoped for. Nor, it is understood, has the railway in any way taken away from the number of passengers who use the street tramways, notwithstanding that the trains run more frequently, more quickly and with fewer stoppages and delays than the tramways.

Russia.—The British Consul at Moscow reports that electrical business made great strides in Russia during 1912, in fact, the year created a record. Never before have so many and so large orders been received. These were both private and municipal. All branches of industry gave large orders, and electrical machinery was more in demand than steam. The Government has also begun to give orders for electric power. A sign of the increase of business was that during the year many electrical companies found it necessary to increase their capital, some of them by very large amounts. The Germans are greatly interested in electrical works, and the German banks readily assist in disposing of the new shares. Most of the capital in these companies is non-Russian, and is presumably German.

Honduras.—In a recent report on the trade of Honduras, the British Consul calls attention to the increase of foreign competition which has recently been witnessed. American merchants and manufacturers have been showing a still more active interest in the Honduranean markets during the last year, and commercial travellers have visited the capital frequently and, it is said, with very good results. German commercial travellers have visited Honduras with their usual frequency. Italy is awakening to the possible outlets for her manufactures offered by Honduras, and lately a large departmental store, stocked principally with dry goods and provisions, exclusively of Italian manufacture, has been opened in Tegucigalpa. It is as yet too early to judge of what the results of this venture will be ; but if successful there is no doubt that the Italians will take a share of British trade.

British merchants have not much to fear if they will take an interest in the Honduranean markets. As a general rule their prices exclude competition, whereas the qualities continue to enjoy the reputation of being unequalled.

A good deal of correspondence has been received at the Consulate from British manufacturers in regard to trade. Nearly all this correspondence is of a circular letter form, and seldom exceeds a few lines asking if there is an opening for this or that article, and rarely contains any information which would enable a Consul to know just where to look for information that would be of value. If British manufacturers would state more precisely and in a concise form the substance and quality of their goods, and give a few prices of their special lines, it would enable the Consul in making inquiries to ascertain from local merchants their cost prices of the particular articles in which British manufacturers are interested—information which they withhold unless for purposes of comparison. Again, British manufacturers show a marked lack of originality in their printed letter headings. In a great number of instances absolutely no information is to be gathered from these as to what the nature of their business is, and in some cases the references made in the communications are so technical as to be scarcely intelligible. In not a few instances letters have been returned to the Consulate marked "not to be found," due to insufficient address on the letter headings. American and German manufacturers seem to have made a special study of these matters, and from their letters, which are occasionally received at the Consulate, they appear to be very explicit in stating their requirements. In other words, there is a close co-operation between American and German manufacturers and their Consuls, which might with advantage be imitated by British traders. It will be gathered from the tables of imports and exports that the business of Honduras is small, and in a great number of cases it would not be worth the while of British manufacturers to send out commercial travellers to a place so inaccessible as Tegucigalpa, unless such travellers could represent four or five industries.

Formosa.—In a recent report the Consul states that various extensions of electrical power plant are under way. The establishment of a second power plant to serve the capital is contemplated, partly as a reserve against interruption of the original plant by floods, and partly to provide for the continually increasing use of electricity in the vicinity ; the cost is estimated at £25,500. A contract has been made for the supply of 4,000 H.P. of turbine machinery for the electric plant in South Formosa, at a cost of £26,000

Catalogues and Lists.—Mr. C. H. Blume, The White Building, Sheffield.—Priced leaflet respecting "Megomac" and "Insulac" insulating varnishes.

Messrs. Ozonair, Ltd., 96, Victoria Street, London, S.W.—New 10-page pamphlet discussing the therapeutical applications of Ozonair apparatus, and illustrating apparatus for hospitals and private sick rooms.

Messrs. Crompton & Co., Ltd., Chelmsford.—Thirty-two-page list in their uniform style, containing a fully illustrated account of their potentiometers and accessories therefor. Half-tone views and many line diagrams accompany the descriptive matter and particulars of tests are given.

The Mica and Standard Insulation Co., 166, Dalston Lane, London, N.—Eight-page price list of Micanite sheet insulation, Micanite tubes, washers, and various standard insulating materials.

Messrs. A. P. Lundberg & Sons, 477 to 489, Liverpool Road, London, N.—Illustrated leaflet No. S36, giving descriptive particulars, dimensions, &c., of standard pattern switchboards for automobile lighting.

Mr. E. J. Gutmacher, 12, Aldgate, London, E.C.—Pamphlet containing particulars of Eastman electric motor-driven cloth-cutting machines, as made by the Eastman Machine Co., of Buffalo, for whom he is sales agent in the United Kingdom.

The Korfund Co., 329, Bank Chambers, High Holborn, London, W.C.—Twenty-page pamphlet concerning the treatment of machine vibration and noise by means of Korfund cork foundation plates. These plates have recently been successfully applied in the insulation of generating sets at many picture palaces where, during performances, silence is, of course, most essential.

The British Prometheus Co., Ltd., Salop Street Works, Highgate, Birmingham.—New catalogue (No. 150) of 60 pages containing excellent illustrations on art paper of a variety of designs of electric heaters. General information regarding the element used, and the power consumption, working instructions, &c., occupy the opening pages, and pictures follow of convectors in copper, brass, cast-iron, plain iron, nickel-faced and other steels for the heating of houses, public buildings, staircases, ships, &c. The lamp radiator section comes next with a number of designs in different styles and finishes for from two to six lamps. Prices, and numerical and code indexes are given.

The International Time Recording Co., Ltd., 151-155, City Road, London, E.C.—Twenty-four page catalogue containing full particulars of their automatic time-recording system, including illustrations of electric time recorders and electric time stamps.

Messrs. Irwin & Jones, London House, New London Street, London, E.C.—Eighteen-page catalogue describing their "Geji" Buffalo belting, belt fasteners, hydraulic leathers, &c. Results of tests are given which show that the average coefficient of friction of the "Geji" belt is 30 per cent. higher than that of double leather, and 42 per cent. higher than that of cotton belts.

Messrs. Walter Newbold & Co., Pearl Buildings, London Bridge, London, E.C.—Forty-four-page illustrated catalogue of machine tools. Full descriptive particulars, dimensions, codewords and prices, and excellent pictures, are given of various lathes, shaping, planing, shearing, screwing and drilling machines.

Bankruptcy Proceedings.—Charles Blake (trading as the Bilston Electrical Co.), electrical engineer, 4, Church Street, Bilston, Stafford.—The first meeting of creditors in this matter was fixed to be held at the Official Receiver's Office, 30, Lichfield Street, Wolverhampton, last week, but only one creditor put in an appearance, and the matter was, therefore, left in the hands of the Official Receiver.

James Clifton Robinson (son of the late Sir Clifton Robinson).—At the Bankruptcy Court, on Monday, the first meeting of creditors was held. The receiving order was made on a money-lender's petition. It will be remembered that debtor's previous failure occurred in 1907, an order of discharge being granted subject to judgment for £2,500. It was stated that in the present instance the liabilities were about £1,100, and that there were no assets. Debtor has lodged a proposal for a cash composition of 10s. in the £. The meeting stands adjourned to January 21st.

The Shipping Exhibition.—We have received a copy of the preliminary list of exhibitors who will be showing at the Shipping Engineering and Machinery Exhibition at Olympia from September 25th to October 17th. The following names appear:—Babcock & Wilcox, Ltd.; Bailey, Sir W. H., & Co., Ltd.; Boby, William; Bonecourt Surface Combustion, Ltd.; British Vacuum Cleaner Co., Ltd.; Coventry Chain Co., Ltd.; Davidson & Co., Ltd.; Electric Appliances Co., Ltd.; Feld Bros. & Co., Ltd.; Hudson Economiser Co. (1907), Ltd.; Jacob, White & Co., Ltd.; Keith, James, & Blackman Co., Ltd.; Kelvin, Bottomley, & Baird, Ltd.; Kennedy, W.; Kynoch, Ltd.; Magic Appliances, Ltd.; Marconi's Wireless Telegraph Co.; Medway's Safety Lift Co.; Ozonair, Ltd.; Parsons Marine Steam Turbine Co., Ltd.; Pinchin, Johnson and Co.; Schmidt's Superheating Co., Ltd.; Stone, J. B., & Co., Ltd.; Stothert & Pitt, Ltd.; Sunderland Forge and Engineering Co., Ltd.; Tackley, W. C., & Co., Ltd.; Telford, Grier & Mackay, Ltd.; Yorkshire Copper Works, Ltd.

Liquidation.—The Grindell-Matthews Wireless Telephone Syndicate, Ltd.—A petition for winding up this company has been presented by Messrs. J. G. Pullen & Sons, of Northampton, creditors, and it is to be heard on January 13th, in London.

Calendars and Diaries.—The Westinghouse Brake Co., Ltd., 82, York Road, King's Cross, N., have circulated a hanging calendar with monthly sheets, on each of which a half-tone illustration appears of the firm's silent rocker-joint chain drives.

Mr. C. H. Blume, of the White Building, Sheffield, has sent us a "Thin" pocket diary for 1914. There is a suitable supply of perforated general memo. pages, followed with a compact diary allowing a month's engagements to the page. There are calendars for 1914 and 1915, an accident insurance coupon, and useful tables of general information.

The Liverpool Electric Cable Co., Ltd., Liverpool, have sent us a calendar with monthly slips for 1914, a view of the works opened in 1912 appearing above the slips.

From the Jandus Arc Lamp and Electric Co., Ltd., Hartham Road, Holloway, London, N., we have received a large and excellent picture reproduced from an original crayon drawing specially prepared for the company by Mr. C. E. Ritchie. Similar in subject to previous souvenirs received from the same company it will likewise be afforded a place of honour. A small calendar is fastened to the top right-hand corner, the name of the firm appearing neatly at the opposite top corner.

The Union Electric Co., Ltd., of Park Street, Southwark, London, S.E., is conveying the compliments of the season to its friends by means of a vest-pocket card and stamp case.

The Nottingham Society of Engineers has issued its diary for 1914. It contains calendars, ample daily spaces, and an accident insurance coupon. It is well bound, with the name of the Society in gilt lettering on the front cover. Particulars of the Society and a list of its members are followed by some 50 pages of engineering advertisements.

Messrs. Twin-Grips, Ltd., 104, Bishopsgate, London, E.C., have issued a delicately got-up little wall calendar for 1914. "Beryl" so absorbs our attention that we almost overlook the little monthly slips at foot.

The White Electrical Instrument Co., of 2 and 4, Gloucester Street, Clerkenwell, E.C., will forward copies of their little celluloid pocket calendars on application.

France.—The French Customs authorities have recently given a decision to the effect that "cables for electrical or other purposes, of iron, steel, copper, &c., wire, insulated or not, rubbered or not, with covering of aluminium, spun or other," are to be classified for purposes of the import duty as "manufactures of aluminium, other," under No. 579 *bis* of the tariff.

Trade Announcements.—To meet the requirements of increasing business in London, the Walsall Hardware Manufacturing Co. are opening a new depôt at Addison Bridge, Kensington Road, W., near Olympia, where communications should be sent. Telephone No. 2461 Western.

With reference to the notice on page 826 of our issue of November 21st, 1913, respecting the firm of Peabody, Rice & Wilson, of Johannesburg, as this is open to misconstruction, we are asked to state that Mr. Wilson, who went out to South Africa in 1896, relinquished his connection with the British Insulated and Helsby Cables, Ltd., in May last year. He subsequently secured the agency of Messrs. Callender's Cable and Construction Co., Ltd., which is now held by the firm of Peabody, Rice & Wilson.

The business of M. K. Cooper & Co., electrical engineers, 27, Oswald Street, Glasgow, has been amalgamated with that of T. C. Smith & Co., electric light, power and motor-car engineers, 21-25, Bon Accord Street, Aberdeen, where all communications may now be sent.

Mr. H. P. Hodge, electrical engineer, of Lower Street, Kettering, has opened a branch business in High Street, Rushden.

New premises in High Street, Chatham, have been opened by Mr. H. Barnes, electric light fitter, late of Watts' Place.

Mr. A. P. Collins, scrap-metal merchant, has removed from New Street to St. Albans Road, Birmingham. Telephone No.: Midland 518; telegrams: "Metalise, Birmingham."

Messrs. Morris & Lister (London), Ltd., of Westminster, announce that their telephone number is now Victoria 7844.

Messrs David Brown & Sons, Ltd, Huddersfield, have acquired the business and patents of John Sunderland, wheel cutter, Keighley.

The telephone number of the Brompton and Kensington Electricity Supply Co., Ltd., is now Western 1531 (three lines).

The telephone number of the British Economical Lamp Co., Ltd., has been changed from Holborn 2285 to Regent 4912 (two lines).

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. 52, No. 225, January 1st, 1914. London: E. and F. N. Spon, Ltd. Price 3s. 6d.—This issue contains the following papers:—"The Employment of Power in H.M. Post Office," by H. C. Gunton; "Electricity Supply of Large Cities," by Prof. G. Klingenberg; "The Magnetic Leakage of Salient Poles," by Dr. R. Pohl.

"*Journal* of the Institution of Post Office Electrical Engineers." Vol. VI, Part 4. January, 1914. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"*Journal* of the Society of Engineers." Vol. IV, No. 12. December, 1913. London: The Society. Price 1s. net.

"*Proceedings* of the Physical Society of London." Vol. XXVI, Part 1. December 15th, 1913. London: *Electrician* Printing and Publishing Co., Ltd. Price 4s. net.

"Science Abstracts." Sections A and B. Vol. XVI, Part 12. December 29th, 1913. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

LIGHTING and POWER NOTES.

Accrington.—The expenditure on the new electricity works plant was £15,536, or £866 more than the loan. The estimate for the Mond gas plant was £9,900, and the actual expenditure £9,549. The estimate for the Clayton transmission, &c., including cable, feeders, transformers, was £4,770, and actual expenditure £4,433.

Algeria.—La Société l'Algerienne Electrique has applied for a concession for electric lighting in the town of Misserghin (Oran).

Argentina.—The Government of the Province of Mendoza has approved the project of the Empresa de Luz y Fuerza for a hydro-electric station on the River Mendoza. The dam is to be 1 km. above Cacheuta station, and there will be a tunnel 2,200 m. long to the turbine station. Instead of a retaining wall, a steel cylindrical dock, 25 m. in length × 4 m. in diameter, will be used. The tunnel will have a capacity of 30 cb. m. per second. There will be four turbines of 4,000 H.P. each. The cost is estimated at $7,000,000.—*Review of the River Plate.*

Barton-on-Humber.—E.L. Agreement.—The U.D.C. has transferred the agreement entered into with Mr. F. Hopper to the E.L. Co. formed to take over the undertaking, and has consented to the use of overhead wires.

Bath.—Sewage Pumping.—The Tramways Co. has informed the R.D.C. that it is prepared to supply electricity to the proposed sewage pumping station at Batheaston at 2d. per unit, plus the cost of the service, the supply to be taken from the trolley wire.

Canada.—According to the *Standard*, the Hydro-Electric Commission has announced a further reduction in the price of electricity, which will now range from £3 1s. 10½d. per H.P. in Hamilton, to £6 12s. per H.P. in Baden. The transmission lines from Niagara Falls to Hamilton, and from Hamilton to London and St. Thomas, are to be duplicated at a cost of £123,000. The municipalities are organising to construct electric railways; one is to be built from Toronto to Port Perry, and another through the counties of Wellington, Grey, and Simcoe, to Georgian Bay.

Electric Ranges.—The *Electrical World*, referring to the question of electric ranges in use in the City of Winnipeg, states that there are approximately 1,000 in use in the city, supplied by the Hughes Electric Heating Co.

Chiswick.—A meeting of the newly formed Ratepayers' Defence Union was recently held, when resolutions condemning the proposed construction of gasworks in the area, and the Council's electricity scheme, were passed, almost unanimously.

Continental Notes.—Spain.—A concession has been granted to utilise the water power of the river Mijares at Toga (province of Castellon), in the generation of electricity.

The new hydro-electric generating station established by the Sociedad Fuerza y Riegos del Elbro, at Pobla de Segur, in the province of Lerida, to utilise the Noguera-Pallaresa falls, has been completed. The current is being transmitted for lighting and power purposes to Barcelona, a distance of 106 miles, and for the operation of the Sarria electric railway. The same company is establishing another large hydro-electric station at Seros, 112 miles from Barcelona. It is expected that one of the four 14,000-H.P. turbines and generators that are being installed will be put in operation by the end of the present month.

Russia.—An electric lighting station is to be established in the town of Petrikau.

Austria.—Plans are being prepard in respect of a scheme to utilise the water power of the River Etsch, near Halzbruck, in the Tyrol, to generate electricity.

France.—The central station in Valenciennes belonging to the Compagnie Générale pour l'Eclairage et le Chauffage par le Gaz, of Brussels, has recently been taken over by a new company, the Société d'Electricité de la Region de Valenciennes-Anzin, which has a capital of £800,000. The company, which has secured the contract for the supply of electricity to the local tramways, is establishing a new generating station, with a capacity of 20,000 KW.

Finland.—It is stated that the committee appointed to investigate the water power of Vuoksen has reported that 90,000 H.P. could be obtained from the Imatra Falls, at a cost of about £880,000. Before the committee could issue a memorandum on the subject, a Franco-Russian company, styled the "Société Sainte Petersbourgeoise de Transmission Electrique de la Force des Chutes d'Eau," applied to the Finnish Senate for permission to survey the territory from Lake Saima to the Kuurmanjoki river, with a view to constructing a channel, and concentrating all the rapids in the Upper Vuoksen into one place. The Senate directed the committee to carry out the survey. The principal power station would be at Kuurmanpohja, where the channel falls 200 ft. The waterfall would afford 300,000 H.P., and would to a very great extent provide power for St. Petersburg, Viborg and the Finnish State Railways. It is estimated that the power station and channel will cost about £4,000,000.—*B. of T. Journal.*

Dartford.—The U.D.C. has approved amended plans for extending the generating station.

Dewsbury.—The T.C. has decided to oppose the Yorkshire Electric Power Co.'s Bill.

Dundee.—New Turbine Plant.—The T.C. has given Mr. Nairn chairman of the [illegible] Committee and Mr. Richardson general manager power to purchase a [illegible] turbo-alternator, either by repeat order or otherwise as they may think fit. The results and reliability of the Willans & Robinson turbines were favourably commented on, but no definite instructions were given to the above gentlemen as to placing a repeat order, this being left entirely to their judgment.

Guildford.—The question of whether shareholders in lighting companies, who are members of town councils, should vote on the reports of the lighting committee was raised at the last meeting of the Corporation. Following a discussion as to the lighting of certain streets in the borough, Alderman Patrick, J.P., asked if shareholders in lighting companies had any right to vote. Councillor W. Shawcross said he had noticed that two or three shareholders in lighting companies had voted. The town clerk said that the section of the Act stated that no member should vote on any matter in which he was directly or indirectly interested. Councillor Froome suggested that the voting (on the question of whether or not the Committee's report should be adopted) should be taken again. The Mayor said he did not know who were shareholders of companies. He could not stop them. He should not take the vote again.

Halifax.—The Corporation has fixed the charges for electricity for lighting purposes at 4d. per unit up to 1,200 units per quarter, and 2½d. per unit in excess of 1,200 units.

Hemsworth.—E.L. Scheme.—The D.C. has decided to support the Yorks. Electric Power Co. in its application for powers to supply electricity for lighting purposes, it being stipulated that by doing this the Council did not grant a monopoly. A letter was read from Mr. T. Charlton, electrical engineer, of South Elmsall, in which he suggested the promotion of a local company, and he was requested to submit his proposals, and to state whether he expected to be granted a monopoly.

Highbridge (Somerset).—E.L. Scheme.—The Burnham D.C. has asked the Highbridge Council to discuss with it the formation of an E.L. Co. for the latter town.

Hove.—The E.L. Purchase.—It is understood that the price to be paid by the T.C. for the purchase of the local E.L. Co.'s undertaking is approximately between £175,000 and £176,000, and that a capital expenditure of £20,000 will be needed to bring part of the plant up to date.

Hoyland.—E.L. Scheme.—A deputation of the D.C. which waited upon the Yorks. Electric Power Co. in reference to its application to supply electricity in the district, was unable to obtain a stated price for the supply, owing to the manager's desire to submit a scheme to the directors before deciding. The deputation gathered that the price would be very favourable, and it would probably be possible to supply cottages with electricity at 6d. per week. The deputation guaranteed to take a minimum of 30,000 units, and stated that if at any time the Council felt that it would be to its advantage to install its own plant it would do so.

Little Boyton.—The Coventry E.L. Committee has consented to the P.C. entering into an agreement with the Exhall Colliery Co. for electricity supply in the parish, which is in the Coventry area.

London.—Islington.—L.G.B. Inquiry.—A private inquiry was held on December 30th into the proposal of the B. of G. to install electricity at several of its institutions. The inquiry resulted from the petition of a minority, the majority of the board having decided in favour of E.L.

Stepney.—The Finance Committee has recommended the B.C. to authorise it to take up a further £10,000 for the purposes of the electricity undertaking, out of the £25,000 for which sanction was obtained in July last year. The Port of London Authority has increased the assessment on the four suction pipes at Limehouse station from £85 to £200 per annum. The Electricity Supply Committee has recommended the Council, subject to the approval of the B. of T. and the L.C.C., to enter into an agreement to give a temporary bulk supply to the Shoreditch B.C. The proposal is for one year from September, 1914, and for an optional supply in the second year. This will temporarily defer the carrying out of the Shoreditch Council's extension scheme pending consideration by the L.C.C. of the report on the whole question of London's electricity supply.

Maidenhead.—Electric Cooking, &c.—The electrical engineer has informed the T.C. that there is a growing demand for electricity for heating and cooking purposes, and advices that during certain hours of the day electricity could be sold profitably at 1d. per unit. The Electricity Committee and the engineer have been asked to recommend contracts for current for domestic purposes other than lighting, and for battery charging, based upon the engineer's figures and conditions contained in his report.

Mutford and Lothingland.—Prov. Order.—The Oulton Broad Electricity Co. has notified the R.D.C. of its intention to apply for a prov. order for E.L. at Oulton Broad and Carlton Colville.

Oldcastle (Co. Meath).—Proposed E.L.—At the last meeting of the R.D.C. it was stated that the estimated initial cost of the E.L. scheme was £2,[illegible]00. The Council decided to advertise for a consulting engineer.

Penistone.—The Yorkshire Electric Power Co. has asked the R.D.C. to support its application to supply electricity for lighting purposes.

Penybont.—Prov. Order.—The R.D.C. has consented to the South Wales E.P.D. Co. obtaining a prov. order for E.L. in its area.

Port Glasgow.—Prov. Order Transfer.—The T.C. has signed the deed of transfer of the E.L. order to the Greenock Corporation, which is establishing two sub-stations in the area.

Rochdale.—New Loans.—The recommendation that sanction be sought for the borrowing of £68,000 for extensions to plant at the electricity works came before the T.C. on January 1st, and was agreed to. Councillor Walker said that since the present growing demand began to be made on the works, the plant had never been able to keep up with it, and the additional capacity now proposed was spoken for. The extensions were to be made on the present site in Dane Street, and, when completed, that site would be fully occupied. Councillor Richmond was informed that there was no likelihood of a reduction in the price of electricity in the near future.

Shipley.—L.G.B. Inquiry.—An inquiry was held by Mr. T. C. Ekin, on Tuesday, into the application of the U.D.C. for power to borrow £27,000 for extensions, mainly in connection with the electricity undertaking. Mr. W. Redman stated that the electricity works could not meet the applications of several firms for a supply, and had no reserve in the event of one unit giving out. It was proposed to supply the outlying districts with A.C., and the centre of Shipley with D.C.

South Africa.—The Prince Albert municipality is to spend £10,000 for various improvements, including an electric light installation.

Boksburg Municipality proposes to spend £100,000 on improvements, including tramways and electric light extensions.—*B. and S.A. Export Gazette.*

South Stoneham.—Proposed E.L.—The R.D.C., having been informed that the Southampton T.C. proposes to supply electricity to Bitterne for public lighting, has arranged for a conference to take place with representatives of the T.C. and the Bitterne P.C., which, it appears, has no power as yet to undertake public lighting out of the rates.

Southborough.—Proposed E.L.—The U.D.C. has asked the Tunbridge Wells T.C. on what terms it is prepared to supply electricity to the district.

Stainland.—The U.D.C. has decided to oppose the application of the Yorks. Electric Lighting Co. in its Bill for powers to supply the district with electricity for lighting purposes.

Todmorden. — Loan Sanction.— The L.G.B. has sanctioned the borrowing of £8,050 for extensions at the electricity works, &c.

Virginia (Co. Cavan). — E.L. Scheme. — The Castlerahan R.C. has passed a resolution that powers be sought to exercise the rights of an urban authority for the purpose of carrying out an electric lighting scheme for Virginia.

Warminster.—Prov. Order.—The R.D.C. on December 30th, considered the application of Mr. J. H. Edwards for consent to a prov. order for E.L. in its area. The chairman said the Council ought to inquire into the prices for current, which seemed to be high compared with other parts of the county, while there was also the question of overhead or underground wires. It was stated that the U.D.C. was taking the matter up. It was decided to fully discuss the matter at the next meeting.

Warrington. — Plant Extensions. — The electrical engineer has been instructed to report upon the provision of additional feeders. A deputation has been appointed to interview the L.G.B. with reference to the loan for the extension of the electricity works and plant.

York.—Electric Cooking.—The Visiting Committee of the City Asylum has decided to install an electric fish-frying apparatus at a cost of £38.

TRAMWAY and RAILWAY NOTES.

Accrington.—New Cars.—The T.C. is being recommended to apply for sanction to borrow £1,600 for the purchase of new cars. It is proposed to invite tenders for three single-deck cars, and two double-deck cars of the radial truck type. Vestibule fronts are to be fitted for a 12 months' trial.

Ashton.—The first year's working of the lease under which the Ashton and Hurst tramways are being operated, shows that it has been the most successful in the history of the Hurst tramways.

Bolton.—The Corporation is promoting a Bill for the construction of tramways, and the conferring of further powers with respect to electricity.

Birmingham.—Omnibus Purchase.—It is estimated that the purchase price to the City Council of the undertakings of the Birmingham and Midland Motor Omnibus Co. and allied companies will be £34,000, viz., £20,600 for the 30 omnibuses, £[illegible] for the garage, and £3,400 for the plant. The Finance Committee does not object to the proposal.

Burnley.—Year's Working.—During the year just concluded 15,949,359 passengers were carried on the Corporation tramways, and the receipts were £79,641. The success of the present tramways has influenced the Committee to go into the question of providing a service in other districts. The Committee favour the present system rather than the adoption of railless traction or motor-'buses.

Continental Notes.—France.—The electrification of the second network of the tramway system of the Société des Paris Tramways, which includes the lines which run to the Madeleine, the Opera, La Trinité, and the Place de la Republique is approaching completion.

Spain.—A company is in course of formation at Vigo, with a capital of £140,000, to construct and work an electric tramway between that town and Mondariz.

Guiseley.—Leeds Tramway Extension.—The U.D.C. has consented to the proposed extension of the Leeds Tramway in the Guiseley area.

Hastings.—The Dolter System. — The B. of T. issued a formal order last week to discontinue running the Dolter tramways along the Hastings-St. Leonards sea-front, the notice to take effect forthwith. The tramways were still running on Monday, according to our correspondent, apparently in defiance of the order, pending instructions from the directors. The latter are expecting a Tilling-Stevens petrol-electric tramcar to be delivered immediately, this being the first of 20 such cars on order, with which the route will be worked in future. The Dolter system has been in use for seven years.

Japan.—The Tokio Muncipal Council has just rejected a scheme for the construction of a suspended mono-rail electric tramway to connect Ueno Park with Asakusa Park.

L. & Y. Railway Electrification.—The directors of this company have decided to electrify the 9½ miles of line from Manchester to Bury, *via* Heaton Park and Radcliffe, and it is expected that the work will be completed in a year. A 10-minute service to Radcliffe is proposed. The trains will be operated on the direct-current third-rail system, as used by the company on its Liverpool-Southport lines. A correspondent states that the company will provide its own power plant.

Liverpool.—Traffic Congestion Report.—In October last the tramways manager (Mr. Mallins) was instructed to report on the question of overcrowding on the tramways. The report, which has now been issued, points out the difficulty of catering for the "rush" traffic at certain times of the day by adding more cars on the already congested routes. He considers that this could best be dealt with by increasing the carrying capacity of all future cars, so as to obviate standing, and points out that the Committee is experimenting with a type of car which he believes will meet the requirements. The congested condition of the two existing routes to the Landing Stage through the central area of the city makes it almost impossible to run extra cars and maintain regularity in service, and he suggests that the Committee might consider the advisability of constructing a third route to the Pierhead through the central area, either through the streets or through a subway, from the Old Haymarket to the Landing Stage, which would greatly relieve the tramways in Lord Street and Dale Street. Either scheme would be costly, but Mr. Mallins states that the congestion problem is becoming so acute that it cannot be much longer delayed.

In connection with this proposal he states that the Tramway Committee may consider the whole question of cross-river traffic, and points out the lack of modern transport facilities between the Lancashire and Cheshire sides, for both passenger and vehicular traffic. A bridge across the Mersey, with connections to Birkenhead and Wallasey, would be 3,450 yards long, and would cost 5 to 6 million pounds, and as the traffic on the Wallasey and Birkenhead ferries only amounted to 30½ million passengers in 1912, and about 850,000 vehicles, he concludes that such an enterprise would not be self-supporting for many years.

As an alternative, a subway or tunnel from the Haymarket to the Landing Stage could be continued under the river to the Cheshire side, to Seacombe, with a branch to Birkenhead. It could be constructed to carry an electric railway or tramway, and provide for vehicular and pedestrian traffic, and a railway could be carried across the Wirral Peninsula to the Dee. Such a tunnel would be about 2½ miles long, costing, say, 3 million pounds.

Mr. Mallins estimates that the financial charges would be met with a traffic of about 45 million passengers at 1d. each, and a million vehicles at 1s. each, and considers that such a scheme would be successful in a few years' time.

Leeds.—The first attempt during the Leeds municipal strike to do serious damage to Corporation property, was made on Tuesday night, when an explosive was thrown at the door of the boiler house at the Crown Point tramway power station. The striker (for it must be a striker), evidently chose his time well and threw the bomb when no one inside the works could have been near. The perpetrator of the outrage has not been traced up to the present.

London.—A system of workmen's "through" fares on the Bakerloo, Piccadilly, Hampstead, Central London and City and South London Railways came into operation on January 1st. The two new tunnels on the District Railway at Earl's Court were brought into use for the first time on Saturday morning last.

Considerable interest attaches to the proposals of the London Fire Brigade for substituting motor appliances for horse-drawn appliances. The proposals involve the use of battery-driven, petrol-electric and petrol vehicles, and the complete cost is put at £160,000. Owing to the superior efficiency of the power driven vehicles, several existing fire sub stations will be abolished

Woolwich.—The B.C. has agreed to a proposal of the L.C.C. to extend its tramways on the overhead system in order to link up with the tramways of the Erith U.D.C. at Abbey Wood

N.W. Railway Electrification.—The Oerlikon Co. is equipping 43 motor coaches, 38 trailers and 38 driving trailer coaches in connection with this scheme; Messrs. Siemens Bros. also have an order for four train equipments.

Northampton.—The Tramways Committee has approved the designs for new tramcars, and instructed the Sub-Committee dealing with the question to obtain tenders for these and also for the generators, battery and other plant, and for the erection of the car shed.

Nottingham.—Tramway Extensions.—The extension of the tramways from Carlton Hill to Newgate Street, and from Sherwood terminus to Daybrook is to be proceeded with. A portion of the work on the Carlton Road section has already been completed. It is also proposed to extend the tramways along Derby Road to the bridge over the River Leen, near the entrance to Wollaton Park.

The newly completed section of the Notts. and Derbyshire electric tramway system between Ripley and Nottingham was opened on Friday last. The villages and townships served are Cinderhill, Kimberley, Eastwood, Langley Mill and Heanor. The company's system connects with the Nottingham Corporation system at Basford, and cars run into the city as far as Parliament Street.

Southend-on-Sea.—Battery 'Bus.—We learn that the Corporation has placed an order for an electric motor-'bus with Edison Accumulators, Ltd.

U.S.A.—A recent return places the number of electric battery vehicles in use in Philadelphia at the present time at 872; of these 480 are of the industrial and 392 of the pleasure type.

Warrington.—Out of the revenue of the tramways undertaking for the year ended March 31st, 1913, £1,500 has been carried to the relief of the rates. The Council has approved the proposed alteration of the track in Knutsford Road, and estimates are to be obtained for the work.

TELEGRAPH and TELEPHONE NOTES.

China.—It is reported from Shanghai that the telephone exchange at Suchou, which has been in operation for some years, but has not proved a paying concern, is to be handed over to the management of the Siemens-Schuckert Co., of Berlin, under a 10 years' concession. It is also stated that this company is arranging to establish trunk telephone lines between Suchou and Nanking, and between Suchou and Shanghai.

Germany.—It is said that an interesting application of the telephone is being made in connection with the electric tramways in Frankfort-on-the-Main. On some of the suburban lines there are no telephone call offices; consequently, to enable the conductors to communicate with the car-sheds, should any breakdown occur, the tramcars are being fitted with telephones, by means of which, through the medium of the overhead conductor, they can call up headquarters.

Hull.—The Corporation on January 5th decided to purchase from the Post Office the telephone undertaking in its own area at a price of £193,000. The licence will run for 21 years.

The rates offered by the Corporation are lower than those of the Post Office; for 15 calls a day the latter charges over £15, and for 20 calls a day £21, whereas the Corporation gives an unlimited service for £8 a year, and an unlimited residential service for £5 10s. a year. Hull will be the only town in the United Kingdom conducting its own telephone service.

Japan.—As a result of negotiations with the Great Northern Telegraph Co., the Japanese Department of Communications proposes, during the current year, to lay a submarine cable between Nagasaki, Japan, and Shanghai, China, at an estimated cost of £150,000.

Railway Signalling.—In his report on the collision at Waterloo Junction Station on October 25th, Major Pringle states that the railway company intends to employ the track-circuit system between Waterloo Station and Waterloo Junction, which will prevent the recurrence of a similar accident in that section; but he strongly recommends the use of the track circuit throughout the viaduct between London Bridge and Charing Cross.

Switzerland.—A considerable extension of the trunk telephone system in Switzerland is contemplated during the current year, a sum of £74,640 having been allotted for the work.

The Telephone Service.—With the New Year a new Victoria exchange was brought into use in Westminster, and within a few months a large exchange called "Museum" will be opened in Bloomsbury.

The existing Holborn exchange, though a modern one, has proved inadequate for the traffic, and the Post Office has purchased the Inns of Court Hotel for the purpose of constructing a new and exceptionally large exchange on the site, in the course of the next year or so

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—Corporation. Three single-deck and two double-deck tramcars of the radial truck type. A sub-committee is to inspect such cars recently supplied to Doncaster

Australia.—Sydney (New South Wales).—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

March 2nd. Sydney Harbour Trust. Circular Quay. Three electrically operated semi-portal travelling cranes for Berths Nos. 1, 2 and 3, Woolloomooloo Bay. Particulars from Engineer-in-Chief of the Trust.

March 25th. N.S.W. Railways and Tramways Department.—Five 1,000-kw. sub-station units to specification No. 121. Particulars at Electrical Engineer's Office, 61, Hunter Street, Sydney.—*Tenders.*

Adelaide.—February 11th. P.M.G. 50 cable terminals. See "Official Notices" to-day.

Melbourne.—January 24th. Corporation. House cut-out boxes and replacement wedges; January 21st, 5 tons, 16 cwt. bare hard-drawn copper cable. See "Official Notices" to-day.

February 17th. P.M.G. Cable boxes. See "Official Notices" to-day.

Austria.—Villach.—January 15th. Supply of an electrically-operated travelling crane, transmission material, &c., to the Knitterfeld Railway machine shops. Particulars (enclosing postage, 20 heller) from the K.k. Staatsbahndirektion in Villach.

Vienna.—January 26th. The K.k. Nordbahndirektion contemplate altering the present steam power working of the two 30-ton cranes on the Vienna goods station, and invite suggestions and tenders for electric, steam or hand working. Plans, &c., from the Abteilung für Bau und Bahnverhaltung der K.k. Nordbahndirektion in Vienna.

Belfast.—January 28th. Electric cables, for the Harbour Commissioners. See "Official Notices" to-day.

Bolton.—The Electricity Committee has decided to invite tenders for the work of bunker construction at Back-o'-th'-Bank.

Bradford.—January 22nd. Corporation. Surface condensing plant for 5,000-kw. live steam turbo-generator. See "Official Notices" to-day.

Brentwood.—January 17th. Petrol-driven electric lighting plant (50 lights) for Branch Asylum, Harold Court, Harold Wood. See "Official Notices" January 2nd.

Croydon.—January 26th. Corporation. Stores for Tramway Department. Tramway Manager.

Doncaster.—The T.C. has decided to invite tenders for tramway rails and accessories as soon as the sanction of the Board of Trade is obtained to the tramway extensions at Brodsworth and Warmsworth.

Dundee.—January 30th. Corporation (*a*) 5,000-kw. steam turbine and alternator; (*b*) condensing plant; (*c*) 750-kw. rotary converter, with transformer. See "Official Notices" Jan. 2nd.

Guildford.—Condensing plant, barometric type, for Guildford Electricity Supply Co., Ltd. See "Official Notices" to-day.

Ipswich.—January 31st. Corporation. (*a*) Three-phase 300 k.v.a., 3,300-volt alternator, rotary converter with transformer, a.c. booster and c.c. exciter, automatic voltage regulator and booster, cable connections. (*b*) Three 50-k.v.a. three-phase transformers. (*c*) h.t. three-phase main switchboard. (*d*) h.t. and l.t. switchgear. (*e*) Two motor or rotary converters, each 250 kw. See "Official Notices" January 2nd.

Italy.—January 23rd. Italian Ministry of Marine. Electric lamps and electroliers. Upset price (£5,200); deposit 10 per cent. Foreign *manufacturers* allowed to compete. Tenders to: Al Sig. Direttore Generale dei Servizi Amministrativi, Ministero della Marina, Rome.

Leeds.—January 15th. Construction of portions of tramway track in Sovereign Street and Swinegate. Mr. J. R. Hamilton, General Manager.

Leigh (Lancs.).—January 23rd. Corporation. One 1,500-kw. turbo-alternator (impulse type turbine), 1,000-kw. rotary converter, transformers and switchgear. See "Official Notices" to-day.

London.—L.C.C.—January 13th. Installation of 130 lighting points at Popham Road Elementary School, South Islington. See "Official Notices" December 19th.

January 20th and 21st. Installations at Vernon Square Elementary School, Finsbury, E.C. (241 wiring points and 318 lights), and at Raneleigh Road Elementary School, Pimlico, S.W. (210 wiring points, 258 lights). See "Official Notices" Jan. 2nd.

January 27th. 584 tons of special section rolled steel bar for magnetic brake shoes. Chief Officer, L.C.C. Tramways, 62, Finsbury Pavement, E.C.

Islington.—January 28th. Corporation. Twelve months' supply of electrical and engineers' stores. See "Official Notices" January 2nd.

St. Marylebone.—February 11th. Corporation. Underground cables, house cables, flexible cords, rubber goods, box compound and insulating materials, &c. See "Official Notices" to-day

KENSINGTON.—January 29th. Board of Guardians. Electric lamps and fittings and other stores. Specification. &c., from Mr. W. R. Stephens, Guardians' Offices, Marloes Road, Kensington, W.

The Edison & Swan United Electric Light Co., Ltd., have been appointed contractors for 1914 for the supply of Royal Ediswan lamps to the British India Steam Navigation Co.

Manchester.—January 9th. High and low tension switchgear.

January 16th. Water coolers at Stuart Street generating station. Specifications and form of tender obtainable from Mr. F. E. Hughes, Secretary. Electricity Department, Town Hall.

January 20th. (*a*) Tramcar trucks; (*b*) motors and controllers for tramcars. Mr. J. M. McElroy, General Manager, Corporation Tramways.

New Zealand.—January 30th. Fielding Borough Council. Two Diesel engines, A C. generators, 2,400 volts single-phase 50 periods, exciters, switchboard, fuel storage tanks, crane, &c. Further particulars are given in the *Board of Trade Journal.*

Northampton.—January 12th. Corporation. Double line of tramways to Far Cotton and doubling of section of Kingsthorpe route, also the necessary overhead equipment, underground feeders, telephones, &c. Specifications (£5 deposit) from Mr. A. Fidler, Borough Engineer, Guildhall.

Plymouth.—January 19th. Corporation. Twelve months' supply of arc lamp carbons, electricity meters, transformers, cables, &c. See "Official Notices" January 2nd.

Pontypridd.—January 19th. Complete electric light, telephone and fire alarm installation, workhouse, for the B. of G. A. L. Thomas and G. S. Morgan, architects, Gelliwastad Road, Pontypridd.

Preston.—The T.C. has confirmed a proposal of the Tramways Committee to obtain tenders for the supply of six new cars.

Rochdale.—Corporation. Engine-room extension, new boiler house, &c., turbo-alternators, turbo-alternator condensing plants, water-tube boilers and boiler house equipment. See "Official Notices" to-day.

Salford.—January 12th. Corporation. Three-phase extra high-pressure and medium-pressure switchgear, also two 300-K.V.A. three-phase transformers. See "Official Notices" January 2nd.

Spain.—January 20th. Municipal authorities of Villarubia de los Ojos (Province of Ciudad Real). Concession for the electric lighting of the town during a period of 20 years.

January 19th. Municipal authorities of Culler Baza (province of Granada). Concession for the electric lighting of the town during a period of seven years.

Tenders have lately been invited by the municipal authorities of Villanubla (province of Valladolid) for the concession for the electric lighting of the town.

St. Albans.—January 14th. Electric light installation, workhouse, for the B. of G. Mr. E. F. W. Hicatt, Clerk, Chequer Street.

Stockport.—January 19th. The Corporation Tramways Committee invite tenders for one overhead equipment motor-driven tower wagon. R. Lomax, tramways electrical engineer, Millgate, Stockport.

Turkey in Asia.—March 14th. Forty years' electric lighting concession for Trebizond municipality. Population 50.000 to 60.000; 12 miles of street lighting. Houses mostly occupied by poorer classes. Water power (Deirmen River) available. An English translation of the conditions may be seen at the Board of Trade Commercial Intelligence Department in London.

West Hartlepool.—January 21st. Corporation. Tramway employés' uniforms, tramway tickets. See "Official Notices" to-day.

Wolverhampton.—January 19th. Corporation. Two water-tube boilers complete with superheaters and mechanical stokers. See "Official Notices" January 2nd.

CLOSED.

Australia.—P.M.G.'s Department, Victoria :—

1,700 magneto bells, £657: 150 micro-telephones, £112; 250 microphones, £62: 160 switches, with 1,000-ohm magneto bells and shutters, £126; 25 magneto wall-pattern switchboards, £817: 400 ditto, common-battery, with extensions and exchange lines, £8,808.—J. Bartram and Sons, Pty., Ltd.

475 switchboards, with extensions and exchange lines, £9,955.—Western Electric Co. (Aus.), Ltd.

2 miles silk and cotton-insulated, light lead-covered switchboard cable, 13 pairs, £124; 8 miles ditto, 26 pairs, £886; 2 miles ditto, 52 pairs, £404; 3 miles switchboard cable, 52 pairs, £594; 6 miles paper-insulated, lead-sheathed cable, one pair, £90: 4 tons H.D. copper wire, 100 lb per mile, braided, £896.—Australian Metal Co., Ltd.

460 electrically-controlled coin collecting devices, £1,822.—Boehme and Owen.—*Tenders.*

P.M.G.'s Department, South Australia :—

Telephone material.—J. Bartram & Son, Pty., Ltd.—800 common battery wall-pattern telephones, £1,837; 200 ditto, with generator, £564.—*Tenders.*

Bath.—Messrs. Chamberlain & Hookham, Ltd., have received the contract to supply the Corporation with D.C. meters for the coming year.

Bedford.—The L.G.B., having refused sanction to a loan for the erection of a new Diesel oil engine plant by a Bedford firm, the Committee subsequently reported in favour of an alternative scheme for the installation of a 1,000-KW. mixed-pressure turbo-alternator with condenser, air filter and accessories. This scheme has since been sanctioned by the L G B., and on Wednesday the Committee reported upon the tenders.

The tenders for No. 1 contract for turbine, alternator, &c., varied from £5,938 to £8,353. The Sub-Committee were of opinion that the lowest tender was satisfactory in every respect, and unanimously recommended it for acceptance. For No. 2 contract, which included the boiler, superheater, mechanical stoker, settings, fittings, and coal-handling plant, the tenders ranged as regards the best combination from £2,116 to £3 833. Between the first and second combinations there was a difference of only £13, and as the latter was superior from an engineering point of view, the Sub-Committee recommended its acceptance, that was to say, as follows :—For boiler with fittings and settings, £1,146; for superheater, £115; for mechanical stoker and coal-handling plant, £868; total, £2,129. Contracts Nos. 1 and 2 would, therefore, amount to :—No. 1, £5,938; No. 2, £2,129; total, £8,067; as against £8,000 allowed for in estimate.

Alderman Kilpin said that the carrying out of these proposals meant the saving on fuel of at least 15 per cent., or £1,000 a year on their present rate of consumption, or a sufficient saving to more than cover the repayment of capital and the interest on the loan.

In reply to questions, Alderman Kilpin said the tenders were advertised, it was open tendering, and they had estimates from all those in a position to tender, and the tenders were remarkably close. Contract 1 has been placed with the British Westinghouse Electric and Manufacturing Co., Ltd., and Contract 2 was divided between three firms, viz., for boiler and settings, Stirling Boiler Co., Ltd.; for superheater, the Superheater Units, Ltd., Swansea; for mechanical stoker and coal-handling plant, T. & T. Vicars.

Belgium.—Three firms—one each Belgian, German and French—submitted tenders last week for the supply of the electrical plant required at Ostend for the operation of a drawbridge at the outer port, of two lock gates and two small bridges at the maritime dock. The lowest offer was that of the A.E.G. Union Electrique, of Brussels.

Bradford.—The tender of Mr. Charles Bell has been accepted by the Guardians, at £33 10s., for the installation of an electric fan in the pump room at the workhouse.

Burnley.—The Corporation has accepted the tender of the British Westinghouse Co., Ltd., for plant for the new station, for £2,864; and that of the B.I. and Helsby Cables, Ltd., to supply 2,100 yards of ·1-in. cable, and 1,050 yards of ·25-in. cable.

France.—La Société du Gaz de Paris has lately placed a contract with the Compagnie Thomson-Houston for the establishment and equipment of two transformer stations at Clichy and Landy, near Paris, to convert H.T. alternating current to L.T. continuous.

Italy.—The management of the Italian State Railways have placed orders for 77 electric locomotives with the following firms :—41 to the Italian Westinghouse Co.; 18 to the Tecnomasio Italiano; and 18 to the Costruzioni Meccaniche di Saronno. Thirty-seven are to be of the type 0-5-0, and the remainder high-speed engines.

Kingston-on-Thames.—The T.C. has accepted the tender of the Crypto Engineering Co. for a 30-ampere motor-generator for charging secondary batteries, at £24.

Merthyr Tydfil.—The B. of G. has accepted the tender of Messrs. J. J. Blackburn & Co., of Cardiff, for lightning conductors at the Cottage Homes and Tydfil Home, at £53 9s. 6d. Other tenders were :—

Dixon & Corbett and R. S. Newall & Co., Ltd.	£75	10	0
Cook, Wretord & Co.	71	5	0
R. Anderson & Co.	70	0	0
Mr. Rhys Lewis	70	0	0
W. J. Furse & Co., Ltd.	64	7	6
Mr. W. Larkins	63	15	0

New Zealand.—The Auckland City Council has accepted the following tenders for electric cables :—Lawrence & Hanson Electrical Co., Ltd., £229; Noyes Bros., Ltd., £167.—*N.Z. Shipping and Commerce.*

Salford.—The T.C. has accepted the tenders of Mr. Bertram Thomas, at £149 10s., for certain extensions in connection with the lighting and power switchboard, and at £65 for the supply of an additional circuit-breaker for the temporary traction switchboard. The tender of the Curnon Steam Meter Co., Ltd., has also been accepted, at £95, for the supply and fixing of three steam meters for the turbines at the electricity station.

Stockport.—The B. of G. has accepted the tender of Messrs. W. A. Shaw & Co., for extending the telephones at the Union offices.

Wimbledon.—The T.C. has accepted the offer of Messrs. E. Bennis & Co., Ltd., for a "Bennis" chain mechanical grate stoker for a boiler at the electricity works for £204. The tender of Messrs. Cory Bros. & Co., Ltd., has also been accepted for the supply of 2,000 tons of 2-in. "Nailstone" slack for the electricity works, at 14s. 9d. per ton.

THE RJUKAN NITRATE WORKS AND ELECTRICAL PLANT.

II.—THE NITROGEN WORKS.

[By our Special Correspondent.]

In our last issue we gave some particulars of the first power plant installed at Rjukan; the present article deals with the utilisation of the electrical energy generated there, in the huge factories which have been erected at Saaheim, for the production of nitrates of lime and soda by the decomposition of air.

Some idea of the progress made in the nitrate industry will be gathered from the fact that the first Birkeland-Eyde plant was completed in July, 1903; the capacity of this plant was 25 H.P., and it employed two men and two officials. In the same year another 150-H.P. plant was ready, and was followed by a 1,000-H.P. plant in 1904. In 1905 the first factories at Notodden, with a capacity of 2,500 H.P., were at work, and these now employ 65,000 H.P., and are to be further extended to 95,000 H.P. In the meantime, the harnessing of the Rjukan Falls was going forward, and in 1911 the factories were brought into use, employing energy amounting to nearly 150,000 H.P. At these works two different types of electrical furnace are employed, viz., the Birkeland-Eyde and the Schönherr-Hessberger.

In the Birkeland-Eyde furnace, of which there are eight in use, as shown on page 60, the arc is formed between the points of electrodes placed close to each other in a strong field produced by electro-magnets on either side of the furnace. With alternating-current, semi-circular arcs are formed alternately on opposite sides of the electrodes due to the action of the magnetic field, the extreme rapidity of making and breaking leaving the impression of a disk of light.

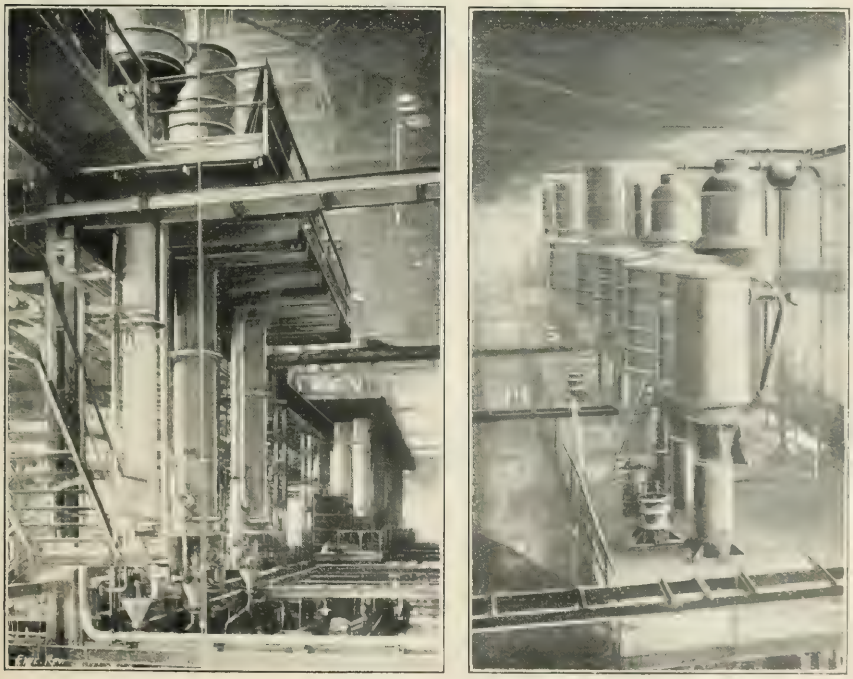
View of Saaheim, showing the Nitrate Works.

The electrodes are of thick copper tubing, water cooled; the furnace is a narrow circular chamber measuring only a few centimetres in width, with a diameter of 3 m.

The furnaces are lined with fire brick, openings being left for the admission of the necessary air. The nitrous gases formed in the chamber, are allowed to escape through a firebrick duct outside the casing of the furnace. Current to each furnace is supplied through a choking coil, which keeps the flame steady and uniform. The results obtained from the working of the Birkeland-Eyde furnaces have been very satisfactory, and they have run for weeks without any noticeable change in the flame or regulation; the maintenance of the furnaces has proved an easy matter, and the repairs have been small. The electrodes require attention every third or fourth week, when small portions of them have to be renewed: the furnace linings are renewed every fourth or sixth month.

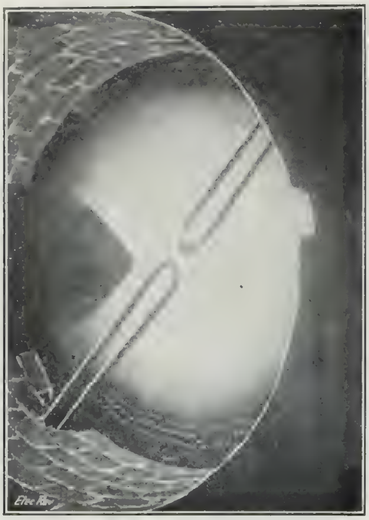
From the very small furnace, consuming only a few horse-power, this type of furnace has been increased in size to the 5,000-H.P. units now in operation at Rjukan I.

The Schönherr-Hessberger furnace is constructed on an altogether different principle. Instead of



Two Views of the Evaporating Plant at Saaheim.

the disk of flame, this furnace utilises a long slender arc in a small-diameter iron tube, through which a current of air is forced. The type of furnace installed at Rjukan I consists of a somewhat slender vertical cylinder of iron plate, 7 m. high; in the interior is a tube, forming a reaction chamber, while other tubes serve for the entrance of the air, and its exit after having come into contact with the flame. The arrangement avoids loss of heat, as the entering air current is heated by the escaping gas. The principal electrode is placed at the lower end of the furnace, and can be moved upwards as it gradually burns away in the flame.



View of Electric Arc, Birkeland-Eyde Furnace.

The reaction tube forms the second electrode, means being provided for striking the arc by bridging over the gap between the lower end of the reaction tube and the first-mentioned electrode. The air current is forced into the lower part of the furnace, and conducted through the channels, entering the reaction chamber through small tangential openings in the sides. In this way the air passes spirally up the chamber, and an arc, some 20 ft. long, is driven up in the centre of the rapidly-moving current of air.

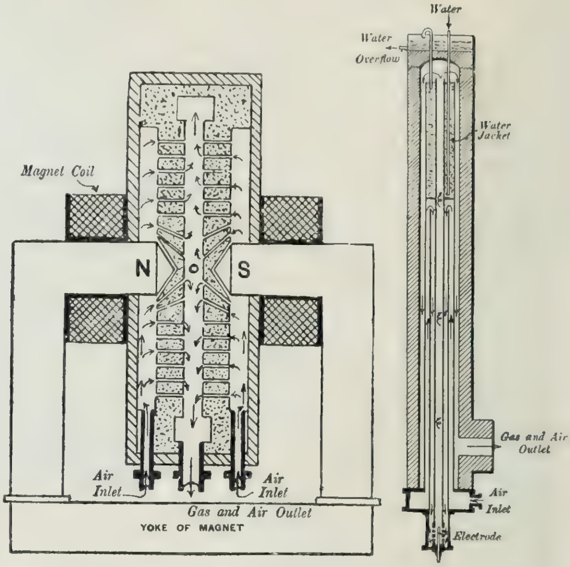
To obtain efficient operation, it is important to secure rapid cooling of the gases, and the upper portion of the tube is therefore water-jacketed. In this way dissociation is largely prevented.

The reaction is identical with that obtained in the Birkeland-Eyde furnace, and the efficiency is, to judge from the results obtained up to the present, practically the same. At Rjukan I there are now installed 96 Schönherr-Hessberger furnaces, each of 1,000 KW.

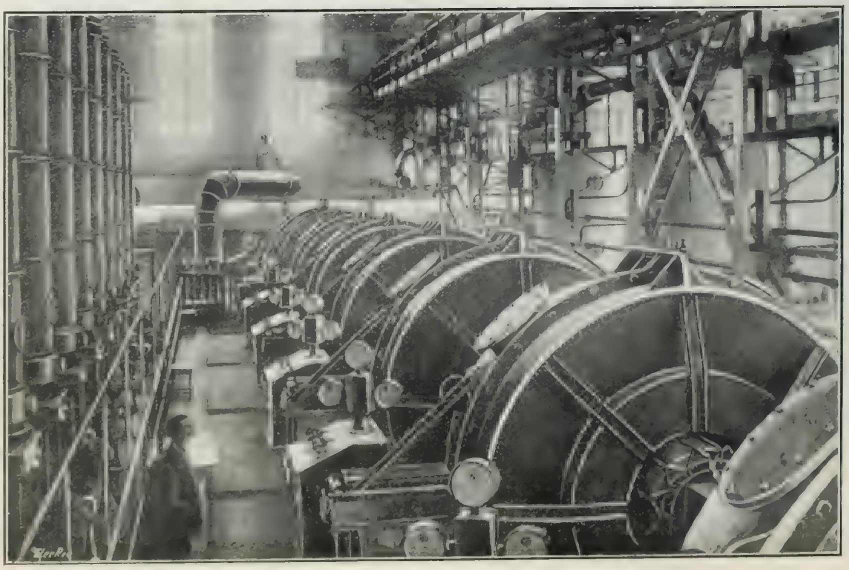
Before turning to the further processes involved, it may be mentioned that the air for the furnaces is delivered by large fans (shown on page 62) through iron pipes, and after being decomposed in the furnaces the nitrous gases formed, which have a temperature of 1,000° C., are passed under boilers, producing steam which is employed for the subsequent treatment of the products.

The steam boilers are shown on page 61, as also another view in the boiler house, with the air compressors, which supply compressed air for the pumping of acid and lye in the various departments.

From the steam boilers the gases pass through iron pipes to the cooling-house, where the remaining heat is extracted; the process consists in passing the gas through numerous aluminium tubes, which are cooled by running water. The gas is subsequently led to oxidation tanks, consisting of vertical iron cylinders, lined with acid-proof stone. The object in view is to give the cooled gases sufficient time for repose so as to allow for the oxidation to take place, the oxygen being present in sufficient quantities in the air which accompanies the gases from the furnaces. From the oxidation tanks the gases are conducted with the aid of fans to absorption towers, constructed of granite. There are 32 of these towers, each



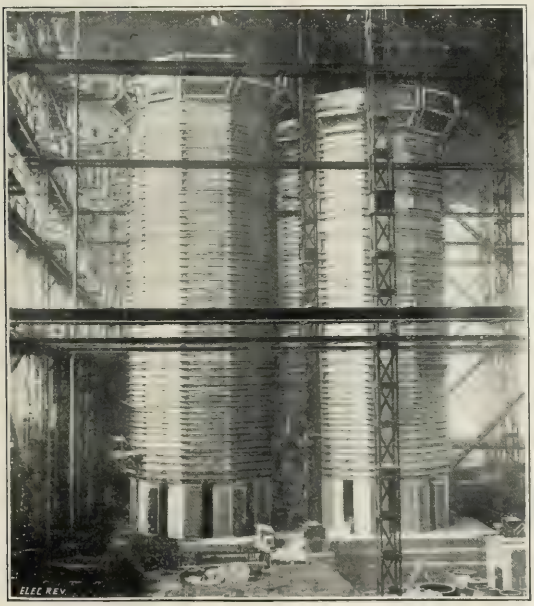
Sectional Views of the Birkeland-Eyde (Left) and Schönherr-Hessberger (Right) Furnaces.



The Birkeland-Eyde Furnaces, Saaheim.

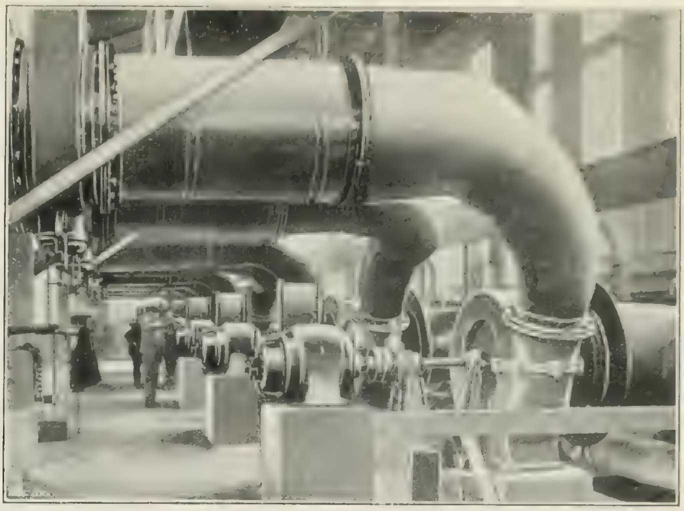
measuring 23 m. high and 7·2 m. in diameter, filled with broken quartz, which is chemically unaffected by nitrous gases and nitric acid ; each row of towers is provided with centrifugal aluminium fans to assist the passage of the gases from the furnaces. The gases pass up and down alternative towers through the whole series, meeting water which trickles through the broken stone and combining with this water to form a weak solution of nitric acid. The gases are passed through a further 17 iron towers, in which a solution of nitrate of soda is produced. The absorbing liquid enters the top of the towers, and is distributed in jets by a series of earthenware pipes, so that the gases are brought into intimate contact with the absorbing liquid.

The acid solution flows to a granite cistern and is pumped to an elevated tank, from which it flows through the towers again until it attains the necessary degree of strength. Apart from the percolation system, the process in the iron towers is practically the same as that in the granite towers. Owing to its far greater power of absorption, the soda solution removes the last remaining traces of nitrogenous gases, about 97 per cent. being absorbed by the passage through the whole system. The finished nitric acid from the granite towers has a strength of about 30 per cent. by volume, and is collected in granite cisterns pending its use in the so-called dissolution works. In the latter are granite vats filled with limestone, over which the acid is poured, carbonic acid being liberated with violent effervescence, while the nitric acid takes its place, combining with the limestone and forming a watery solution of nitrate of lime or calcium nitrate. Any excess acid is neutralised in small towers filled with milk of lime, and the solution is then pumped into vacuum evaporating apparatus, the steam required for the evaporation being obtained from the steam boilers previously mentioned.



The Absorption Towers.

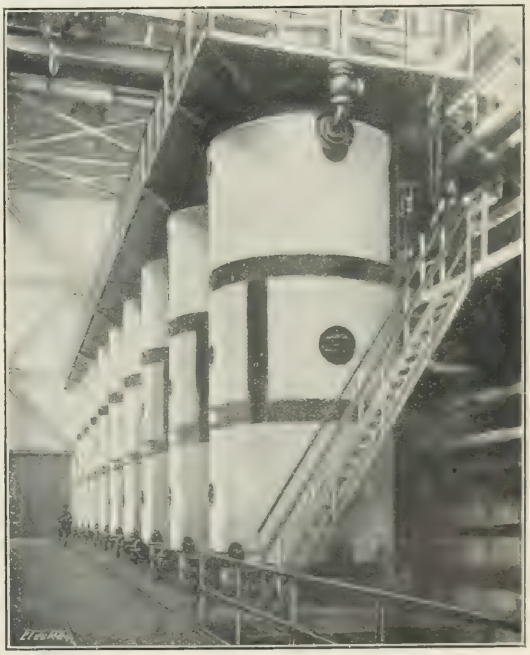
The concentration of the nitrate solution in the evaporating plant is continued until the specific weight of the liquid at an even temperature shows a content of 13 per cent. of nitrogen ; the solution is then pumped up into the solidification chambers, where it is passed over an internally cooled revolving cylinder and rapidly crystallises, being subsequently crushed to a granular state. The coarse powder produced is filled into casks, holding 100 kg. net weight.



Air Compressors Delivering Air for Pumping Purposes.

The gas in the iron towers combines with the solution of caustic soda forming nearly pure sodium nitrate, which is subsequently evaporated, allowed to crystallise and dried in a centrifugal, and filled into paper-lined moisture-proof casks.

The coopers' shop at Saaheim is a huge establishment, and one may get some idea of its size from the fact that about 3,000 casks and barrels a day are made. The furnace house covers an area of 6,000 sq. metres, the boiler-house 1,000 sq. metres, the tower house 7,000 sq. meters, and the barrel factory 2,500 sq. metres.

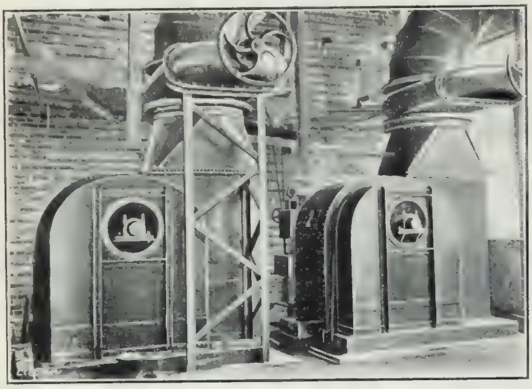


Steam Boilers Heated by Gases from Furnaces.

A visit to the Saaheim factories is very impressive ; their huge size and the quietness which seems to rule everywhere, except in the packing departments and the barrel factory, are very striking. The whole process is worked automatically, and one might easily form a first impression that the establishment was on a holiday.

ELECTRICITY SUPPLY AT MILFORD-ON-SEA.

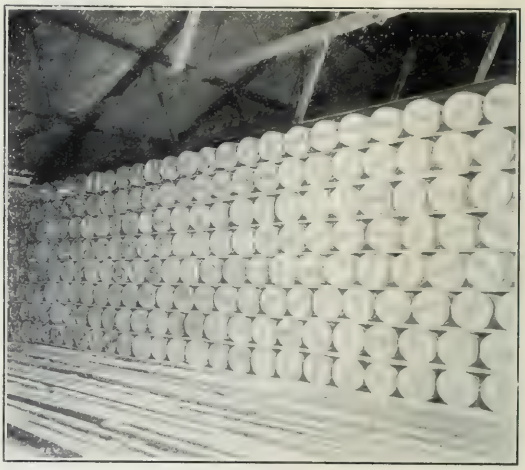
We have in recent years repeatedly drawn attention to the possibilities offered by the supply of electricity in small towns and villages, more especially since the introduction of the tungsten lamp has so greatly improved the competitive position of the electric light. For all such places we have advocated the use of overhead mains as the only means by which the supply can be given on a commercially satisfactory basis, and there is no doubt that the prejudice against aerial wires, for which there is little justification, is rapidly diminishing, many local authorities having adopted the system or assented to its adoption. But that it is possible to carry out a small undertaking and run it at a profit, even when the mains are laid underground, was recently brought home to us by a visit to Milford-on-Sea, a village on the Hampshire coast, where a supply of electricity has been provided by a small local company for the past nine years.


Fans Supplying Air to Electric Furnaces, Rjukan Nitrate Works (page 60).

The proposal to commence the supply originated with Mr. L. Nicholson, one of the proprietors of the Milford-on-Sea steam laundry, who conceived the idea of running the plant in conjunction with the laundry, and discussed the matter with other residents. The advice of Messrs. Christy Bros. and Middleton was obtained, and a company was formed with a capital of £6,000; a provisional order was applied for and duly granted, and operations were commenced in 1903.

The plant consists of two Crossley suction-gas engines and producers, the former driving by ropes two Siemens dynamos of 24 kw. each, which generate direct current at 460 volts, for distribution on the three-wire system at 230 volts. A storage battery of 240 ampere-hours capacity was obtained from Messrs. Pritchetts & Gold, who maintain it in good condition under contract. The plant is housed in a building close to the laundry, which forms a good customer, as will be shown later. Although the producers were amongst the earliest made by Messrs. Crossley Bros., they have been in continuous operation for nearly 10 years with very successful results, giving very little trouble and costing little for repairs. One man is capable of running the whole installation, the battery being used to maintain the supply during the night and at other times of light load.

The mains consisted of vulcanised bitumen insulated cables laid solid in bitumen; more recently paper-insulated lead-covered and armoured cables laid direct in the earth have been employed. In some parts of the district the cables are below the water level, the land being waterlogged, and some trouble has been experienced in this region; for this reason feeder pillars have been employed instead of ordinary disconnecting boxes.

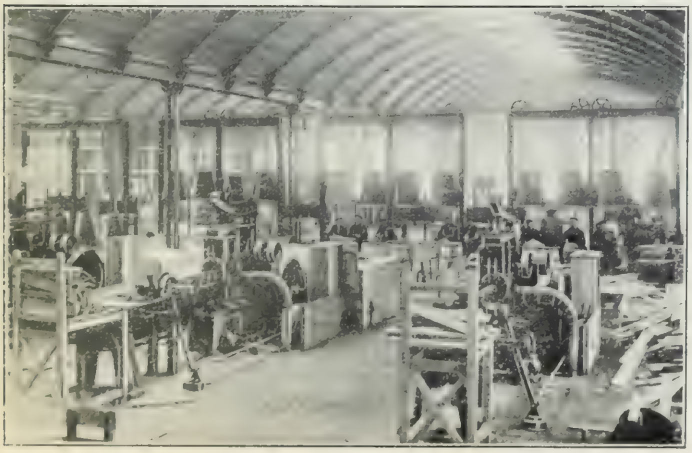

View in the Saaheim Barrel Stores (page 61).

The streets are well lighted with tungsten lamps in simple fittings, usually of 50 c.p., but of greater power at important points. The effect is very good, and marks the little town as very much up to date, few places of the same size being so well illuminated.

The load is mainly lighting, in shops and private houses, as there are no industries in the district except that of agriculture. The laundry, however, forms an exception, most of its machinery being driven by a $7\frac{1}{2}$-h.p. motor; electrically-heated irons and other appliances are also used, the total consumption per annum being some 55,000 units. There is also a builder and contractor at Keyhaven who takes power from the mains.

Hitherto it has not been possible to secure the farmers as power consumers, owing to the convenience and economy of petrol portable engines, which offer very keen and successful competition to the electric motor. Their distance from the mains is also an obstacle to the use of electricity. But progress in this direction is not despaired of; the electric motor is very portable and easily handled on the farm, as we have shown on various occasions, and if some enterprising agriculturist can be induced to lead the way, it is quite likely that others will readily follow the example.

The requests of outlying residents for connection are naturally somewhat embarrassing, as the cost of an underground cable swallows up most of the profits; such cases can only be dealt with commercially by using overhead wires, at least in the outer areas of the district, and there ought to be no objection to this course. It cannot be reasonably alleged that the landscape would be disfigured by them, for,


The Barrel Factory, Saaheim (page 61).

in most cases, they would be hidden by the trees which grow so luxuriantly in this neighbourhood, and telephone wires are already met with in all parts of the district. The suggestion that any danger to the person would result is absurd, in view of the hundreds of miles of 500-volt trolley wires which are suspended over the most densely populated streets in our big cities, and of the numerous instances in which overhead conductors have already been adopted in this country—abroad, of course, they are the rule and not the exception in all small towns.

The crucial test of the success of the undertaking is the question whether it has proved worth while. The capital expended by the company so far has amounted to £7,200, and the dividend during the past few years has been practically 5 per cent. Remembering that the installation was carried out in the days of carbon lamps, and therefore with much more copper in the mains than would nowadays be necessary; that the mains without exception are underground; and that the supply is entirely by meter, this result must be regarded as very satisfactory. During the year 1912 the revenue amounted to £906, an increase of nearly £100, and a profit of £353 was made, of which £290 was available for distribution. The total number of lamps connected was 4,297, an increase of 150, and the amount of energy consumed was 55,192 units, an increase of 3,228. The price of energy was 6d. per unit, apart from contracts and public lighting, and the cost of generation and distribution was 2·4d. per unit.

The plant is in good condition, and appears to have many years of useful life before it; and there are many houses still, it is hoped, to be connected to the mains. There is no gas supply in the district. The prospects of continued success, therefore, appear to be very good, and we trust that they will be fully realised.

REVIEWS.

Dynamo Lighting for Motor-Cars. By M. A. Codd. London: E. & F. N. Spon, Ltd. Price 2s. 6d. net.

In view of the increasing vogue of electric lighting as the means of illumination on motor-cars, it is not surprising to find that handbooks on the subject are beginning to make their appearance. Mr. Codd, who has already published a work on Electrical Ignition for Internal-Combustion Engines, does not preface his new book with any remarks as to its purpose, but we should judge it to be intended mainly for the drivers of cars that are fitted with electric lighting equipments, so that they may be in a position, not only to keep the same in good running condition, but also quickly to diagnose the trouble, should any interruption take place in the regular functioning of any part of the outfit. The use of the book is, however, not limited to this purpose, for a perusal of the preliminary chapter would also be of advantage to any car owner contemplating the adoption of one or other of the many different dynamo car electric lighting systems, as he would then be in a better position to appreciate the respective merits of the various arrangements available for his choice and selection. At the same time, the utility of this section is somewhat curtailed by its brevity, the remarks relating to the choice of bulbs, in particular, requiring expansion, if they are to be of real assistance.

The second chapter relates to fitting the dynamo, and will be of use when such devices are to be fitted to existing cars. No doubt, when the author penned the lines to the effect that "most car manufacturers do not provide suitable provision for fitting the dynamo," the remark was perfectly true. Now, however, that particulars of the 1914 models are available, the statement does not apply to the same extent, as in a large number of cars a dynamo for lighting purposes is now being included as a standard portion of the equipment, due provision being made for the installation and driving of the dynamo in designing the petrol motor. The author draws attention to the effect of gearing on the output of the generator, amd his views on this subject, especially with regard to gearing in relation to the use to which the car will be mainly put—town work or touring—are worthy of careful study by all interested in furthering the employment of electricity for lighting purposes on automobiles. Although we notice Mr. Codd does not express any views as to the respective merits of the 6 and 12-volt lighting systems, he shows a preference for the single-insulated, or earth return, system of wiring over the double-insulated method. A good deal of the success, or otherwise, of an electric lighting system on a motor-car depends on the care taken with the wiring, and his suggestions in this connection are well worth following.

Six of the subsequent chapters are devoted to a description, with illustrations, of about fourteen of the principal dynamo systems at present on the market. Although not perhaps the author's fault, it would have been better if the blocks could have been better arranged, for it is somewhat fogging to lay readers to find an illustration of one dynamo interposed amidst the descriptive matter of another machine. This section, too, will probably need early extension, for there are now quite as many systems on the market in this country that are not included as are described, and, although it is not to be expected that any work should include particulars of every machine offered for sale, yet a would-be purchaser of the book naturally, first of all, looks to see if it deals with the particular machine in which he is interested or which he has to take care of.

On the whole, however, Mr. Codd's book should serve a useful purpose, for it will give both chauffeurs and motor repairers an insight into the principles underlying dynamo electric lighting on cars, and put them in a position to deal promptly with any derangements or interruptions in the working which may, from one cause or another, arise.

Formulæ and Tables for the Calculation of Alternating-Current Problems. By Louis Cohen. London: Hill Publishing Co. Price 12s. 6d. net.

Those who are already familiar with Mr. Louis Cohen's work on the capacity and inductance of electric conductors, and with his contributions to the *Bulletin* of the Bureau of Standards, will realise how exceptionally well qualified he is to undertake the laborious task of collecting together those mathematical formulæ and tables published by many independent workers, which are of practical importance in the solution of alternating-current problems.

Except that extracts from the author's earlier work are necessarily numerous in a field where this work must occupy an important place, Mr. Cohen modestly lays no claim to original authorship in the present volume, but is content to let it appear that he is mainly a compiler of the useful formulæ of other writers for handy reference.

The reader who has had experience in first seeking and then unravelling the mathematical investigations which bear on any particular problem with which he may have been faced, will realise that the unpretentious title of "compiler" may, in the present case, represent qualities of originality, insight and judgment—to say nothing of patience—higher than those displayed by the "authors" of many scientific works of greater pretension.

The formulæ are introduced with just that minimum of explanation which is necessary to enable an intelligent use to be made of them. References to the original sources from which they are derived, and indications as to the limits of error involved, are freely given.

The simplification of the formulæ, and their conversion into a reasonably uniform system of symbols, must have in itself involved much painstaking labour. Numerous tables are added to minimise numerical calculation when the formulæ are of an involved character.

The first chapter deals with the resistance of, and losses in, metallic conductors. The range of materials and of forms of conductors, their varying situations and the variety of problems due to low-frequency and very high-frequency alternations, lead to a large number of formulæ, covering ground which belongs to widely separated branches of electrical engineering.

The second chapter, dealing with inductance, is one of special value, on account of the very clear summary which it affords of a subject of the highest practical importance in almost all branches of modern electrical engineering. This is followed by a chapter on the capacity of conductors.

Then follows a very useful series of formulæ concerned with the alternating-current circuit, in which complex waves, various combinations of inductance and capacity, transformers for voltage and current transformation, and similar problems, are considered. In this chapter full use is made of the usual symbolic notation.

This is followed by two chapters dealing with transient phenomena and distributed inductance and capacity, and by a final chapter containing general mathematical formulæ and tables of functions, &c.

Although the book is essentially a compilation of formulæ of practical use for reference, it is really more than this. It forms a highly concentrated summary of the theory of the transmission of alternating currents prepared in such a way that it is adapted at every step for direct application to practical numerical calculation.

To the busy designer who is faced with constantly new problems, the book will prove of the highest value, while the electrical profession, as a whole, will be the richer for a book of reference which can be consulted with advantage in connection with nearly all technical problems involving the theory of alternating-current conduction.

In conclusion, we may commend Mr. Cohen's work to the attention of those who are responsible for the training of the young generation of future electrical engineers. They will find here an excellent summary of the type of mathematical calculations which the advanced student should be able to carry out, and may thus gain valuable insight into the direction along which his mathematical training should be conducted.

Researches in Magneto-Optics (with special reference to the Magnetic Resolution of Spectrum Lines). By P. Zeeman, D.Sc. 1913. London: Macmillan & Co. Price 6s. net.

Macmillan's Science Monographs now occupy an important place in our scientific literature, and this recent addition undoubtedly enriches the series.

Prof. Zeeman is, of course, *the* authority on magneto-optics, for he has spent his career in that realm of physics where magnetism and light appear to meet, and to him are due, in a large measure, not only our experimental knowledge of that borderland, but also many very beautiful theoretical suggestions upon which other fruitful researches have been based.

In dedicating his volume to the memory of Michael Faraday, Prof. Zeeman has, as he remarks in his preface, honoured "the greatest experimental genius the world has produced, and the pioneer in magneto-optics, as in so many things," and it is interesting to note that it was upon this very subject that Faraday was engaged at the time of his death. It is indeed fortunate that the cloak of the pioneer has fallen upon so capable an experimenter as Dr. Zeeman, and that after the lapse of nearly half a century this fascinating subject is receiving the attention it deserves.

This volume follows on the lines of a lecture delivered by Dr. Zeeman to the Royal Institution in 1906, the material having been expanded and more recent researches added. Although a more extensive exposition of the author's own investigations is given, the whole field of magneto-optics is systematically and completely surveyed, and many of the intricate theories connected with Series Spectra are dealt with in detail. The familiarity with which Dr. Zeeman treats of so large and difficult a field of research excites in us something of wonder and admiration, and the multitude of references to work done by other experimenters strengthens the conviction that the author has not only added largely to our knowledge of magneto-optics by his own research, but also has made himself so thoroughly conversant with all the work that has been done on the subject that he is able to view magneto-optics in the true perspective, which is so often lacking in the works of original investigators.

The earlier chapters deal with the "Zeeman Effect" in its well-known forms—the splitting-up of spectrum lines into doublets and triplets in the magnetic field and the magnetic resolution of absorption lines. More complex resolution is then treated of, and the relations existing between the resolution of lines belonging to the same series.

A chapter is devoted to solar magneto-optics, and the final chapter deals with the contributions made by magneto-optical researches to our knowledge of the constitution of the atom. A chronologically arranged bibliography containing references to over five hundred papers on the subject adds considerably to the usefulness of the book.

To appreciate the book fully, the reader must have studied physical optics and spectroscopy fairly completely, and although the first chapter is devoted to an illustrated account of the chief spectroscopic instruments, it is not until one has handled such apparatus and attempted the photography of spectra for oneself that the magnificence of the work done by Zeeman and his co-workers becomes apparent. To obtain the faintest trace of magnetic resolution requires expensive apparatus both in the form of gratings and electromagnets; Zeeman's experiments required, in addition, that touch of genius which has, in the first instance, given to the world the "Zeeman Effect," and more recently has given us this delightful monograph on magneto-optics.—P.H.S.K.

Electricity in the Service of Man. Vol. II, Sec. I. By R. M. Walmsley, D.Sc. London: Cassell & Co. Price 7s. 6d. net.

This book is the first part of the second volume of a "popular and practical treatise on the applications of electricity to modern life." The word "popular" applies only from the fact that the book is not an elaborate mathematical exposition of the principles of electrical engineering, since the volume certainly does not conform to the usual meaning of "popular" as ordinarily understood. It is really far too good to be classed with the somewhat vague and diffuse type of literature known as "popular."

Chapter I deals with continuous-current dynamos, and the treatment is essentially modern. Ancient history is rightly cut down to the absolute minimum, and good illustrations and descriptions of turbo-dynamos and engine-driven machines of recent make by well-known manufacturers are included. The magnetic circuit of D.C. machines is treated at length, good use being made of the Hele-Shaw water-flow diagrams. Armature winding schemes are discussed from an essentially practical point of view, and the reproductions of photographs of actual former-wound coils will undoubtedly be found useful to many students. It is interesting to note that homopolar machines receive a very fair amount of attention, their special points being well put forward. The mechanical construction of many different types of modern machines, *e.g.*, brush gear, armatures, commutators, and bearings for turbo-dynamos are clearly described with the aid of line diagrams and photographic reproductions. The regulation of D.C. machines is next considered, and the construction of a considerable number of field rheostats, including the special Thury brush-shifting device, is carefully analysed. Immediately following we find a number of output-coefficient curves and output formulæ, together with the effects of current and voltage in limiting and modifying these semi-empirical results. This chapter concludes with the discussion of a number of typical and special machines.

Chapter II is devoted to alternators. Practically every type of alternator that is now made is described in considerable detail, *e.g.*, the enormous low-speed, water-wheel driven machines manufactured in America are discussed in a highly satisfactory manner, while turbo-alternators by all the leading English and foreign manufacturers receive the same attention. A short outline of the elementary theory of the alternator is given, and a good deal of information regarding characteristics, the production of harmonics, excitation and regulation is included.

The third chapter, consisting of 150 pages, deals with generating stations, and these important features of modern civilization are described at considerable length. The author, after an introduction, commences with the descriptions of ancillary and special electric supply stations, including the stations recently put down at Immingham

Docks, and the General Post Office, London. The running of D.C. and A.C. generators in parallel, synchroscopes, "hunting" and so on, are next discussed, and the treatment is quite simple and satisfactory. Public supply stations are then considered, and a large number of typical load curves are given. The governing principles of steam, gas, oil and water-driven stations are next examined, and are exemplified by plans and photographs of existing power stations in various parts of the world. Switchgear and switching are treated in detail in the fifth section of this chapter, the illustrations and treatment being quite up to date.

The concluding chapter discusses the lengthy subject of continuous-current motors, their regulators and starters. The treatment is very largely descriptive, and this is quite in order, since the design of continuous-current generators has been fully dealt with in Chapter I. Some space is, however, wasted by including plates and descriptions of motors that are now obsolete.

As a whole, the book is decidedly good, but it would have been better, considering its character, had some idea of costs and prices been given, for some of the plant and apparatus described.

There are 686 pages, and 691 illustrations, including 11 plates, in the volume; it is well bound and printed, and it will be seen from the above review that the book is distinctly cheap. It will, doubtless, be largely used by students and teachers who wish to keep up to date.—H. G. S.

Telephone Erection and Maintenance. A handbook for the contractor and wireman. By Herbert G. White. London: S. Rentell & Co., Ltd. 1913. Price 1s. 6d. net.

Although there exists at present a large number of books on the more important phases of telephone engineering, that portion of the profession which is concerned with domestic and other private installations has hitherto received but scant notice in technical literature.

The present book has been written to fill this gap. No attempt has been made to deal with the details of construction or the theory of action of telephone apparatus, but the various systems which have been devised to meet the special requirements of the private user are described in considerable detail. The ground covered includes telephones fitted to electric bell systems, battery and magneto call telephones, ordinary and secret intercommunication telephones, mining telephones, and the simpler switchboard systems. The last two chapters deal with instrument erection and line construction, and with the testing of apparatus and the localisation of faults.

The book is well illustrated, and the diagrams are very clear. It should be found of great use to all those who are engaged in the special work with which it deals.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued:—

Monday, January 12th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.

Tuesday, January 13th.—"B" Company. Ditto.

Wednesday, January 14th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, January 15th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, January 16th.—"D" Company. Special class on Crossley engine and technical instruction, 7 to 9.30 p.m.

Saturday, January 17th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

Inquiries.—Makers of the C. Beyer electric hair-drying an are asked for; also names of makers of the Le Radiant radiator amp, and the Saunders lamp-locking device

FORTHCOMING EVENTS.

Greenock Electrical Society.—Friday, January 9th. At 7.30 p.m. At Temperance Institute, West Stewart Street. Papers on "[illegible] on Cable Chemistry," by Mr. [illegible], and "Cable Faults and their Causes," by Mr. L. [illegible].

Junior Institution of Engineers.—Friday, January 9th. At 8 p.m. At 39, Victoria Street. Paper on "The Future of the Institution," by Mr. C. H. Woodfield.

Saturday, January 10th. Visit Works in progress at London Docks for the Port of London Authority.

Manchester Association of Engineers.—Saturday, January 10th. At Grand Hotel, Aytoun Street, Manchester. Paper on "Transmission of Power by Chains," by Mr. H. T. Hillage.

Institution of Post Office Electrical Engineers.—Monday, January 12th. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "The Loading of Aerial Lines and the Electrical Constants of Loaded Circuits," by Mr. J. G. Hill.

Institution of Mechanical Engineers Graduates' Association.—Monday January 12th. At 8 p.m. At Storey's Gate, S.W. Paper on "The Arrangement of Modern Engineering Shops," by Mr. H. C. Armitage.

Friday, January 16th. At 8 p.m. Paper on "Commercial Tests of Internal-Combustion Engines," by Mr. W. A. Tookey. Nominations for Annual Election of Officers.

Institution of Civil Engineers.—Tuesday, January 13th. At 8 p.m. At Great George Street, Westminster, S.W. Paper on "Superheating Steam in Locomotives," by Mr. H. Fowler.

(Students' Meeting).—Friday, January 9th. At 8 p.m. Paper on "The Application of Power Railway Signalling in Great Britain," by Mr. C. I. Routh.

Wednesday, January 14th. (Students.) Visit Queen's Park Extension, Baker Street and Waterloo Railway.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, January 13th. At 7.30 p.m. At the University (Physics Lab.) Paper on "British Practice in the Construction of High-tension Overhead Transmission Lines," by Mr. B. Welbourn.

Institution of Electrical Engineers (Scottish Local Section).—Tuesday, January 13th. At 8 p.m. At 207, Bath Street, Glasgow. Paper on "The Employment of Power in H.M. Post Office," by Mr. H. C. Gunton.

Nottingham Society of Engineers.—Wednesday, January 14th. At Welbeck Hotel, Milton Street. Paper on "Brush-Ljungstrom Steam Turbine," by Mr. Lloyd Evans.

Royal Society of Arts.—Wednesday, January 14th. At 5 p.m. At John Street, Adelphi. Juvenile Lecture on "Electric Vibrations and Wireless Telegraphy," by Mr. R. P. Howgrave-Graham.

Association of Engineers-in-Charge.—Wednesday, January 14th. At 8 p.m. At St. Bride Institute. Paper on "Commercial Motors, Steam and Petrol," by Mr. D. J. Smith.

Institution of Electrical Engineers (Yorkshire Local Section).—Wednesday, January 14th. At 7 p.m. At the Philosophical Hall Leeds. Ordinary general meeting.

Illuminating Engineering Society.—Thursday, January 15th. At 8 p.m. At the House of the Royal Society of Arts, 18, John Street, Adelphi. Discussion on Mr. P. J. Waldram's paper "Some Problems in Daylight Illumination, with special reference to School Planning."

NOTES.

Fatalities.—An inquest was held at Coventry on January 1st into the death of George Oliver Randle, assistant electrician at Exhall colliery. Evidence showed that he was splicing a cable when, through some mistake, the current was turned on and he received a shock which proved fatal, despite artificial respiration and medical attention. Mr. William Foster, chief electrician, said he had nine assistants, all of whom, except deceased, had received their certificates, and he would have done so in time. The current used was 300 KW. at 580 volts. There were more than 30 motors underground, varying from seven to 100 H.P. On the night of the accident deceased was moving a cable forward to the coal face in connection with a pump, and, of course, the cable should be dead. The switch was about 320 yards away, and when the current was turned off it was customary for a boy to unscrew the handle and leave it in charge of the man doing the repairs. When witness examined the circuit-breaker soon after the accident he found the handle was on, whereas he expected to find it off. Edward Ford, motor boy, said he was warned not to put the current on until it was rung for. For this the signal was nine, a pause, and then 20. He was away at another motor when he heard some ringing. He went back and rang six, meaning an inquiry as to what was wanted. The signal came back 20, and he switched the current on, having forgotten for the moment it should have been preceded by nine. He did not realise that he had done anything wrong until two or three minutes later, when a signal came to switch the current off again. It then occurred to him he had not received the nine, and that he might have caused an accident. Oliver Orton, chief underground electrician, said it was the custom amongst electricians to take the handle off the switch when repairing the cable, but he could not say it was always done, though he always did so himself. Deceased ought to have seen for himself that the handle was removed before repairing the cable. George Hart, motor boy, gave evidence as to sending the signal from his motor for the current to be turned on, and said he was not aware a cable was being repaired. The jury having found that Randle died from electric shock accidentally received, expressed the opinion that the motor boys, Ford and Hart, had not been properly instructed and were not proper persons to leave in charge of such an important switch; the jury also suggested that instructions be given to the electrician to take the handle off the switch in every case when repairs were being carried out

Our Cape Town correspondent states that H. E. Haworth, a Dundee electrician, was killed on December 12th at the Natal Steam Co.'s mine, Dundee, Natal, where he was engaged in connection with the erection of an electric coal-cutter. Haworth and a native were working together, and it is understood that some heavy timbers fell on them, killing them instantaneously.

D. Heydenrich, who was working on the railless trolley installation at Boksburg, died on December 18th as the result of an accident. Whilst engaged in fixing an overhead wire at the subway on the main road to Boksburg North, he was standing on a long ladder which projected some distance above the parapet of the railway bridge. The top of the ladder slightly overhung the railway line, and a train, in passing, caught the ladder and hurled it aside; Mr. Heydenrich fell to the ground, terribly fracturing the base of his skull, and died on his admission to hospital.

According to the *Manchester Courier*, one man was killed, two were seriously injured, and ten others received minor injuries on Monday by the bursting of a 3-ton fly-wheel of a motor-generator set in the "D" aisle of the testing department at the Trafford Park Works of the British Westinghouse Co.

German Trade and the American Tariff.—On the influence of the new American Customs tariff on the German electrical industry, the *Münchenes-Nachrichten* has the following. On October 3rd President Wilson signed the Underwood Bill, which abrogated the Payne-Aldrich tariff, and inaugurated, in whole or in part, the abandonment of the former high tariff policy. The reductions effected by the Underwood Bill in the tariff previously in force amount, on an average, to 20 per cent. Connected with these proceedings the question arises whether German industry, and more especially the electrical industry, is better able to compete under the new than the old tariff. It may be assumed that the export of German electrical products to the United States must now increase, as the tariff reductions of the Underwood Bill are not inconsiderable. While the average old tariff on electrical products amounted to 40 per cent., the average of the new totals only 28 per cent. This means an average reduction in duties of 12 per cent. When, however, it is remembered that German exports have to bear considerable railway charges to the port of shipment, sea freight, sea insurance and Consular charges, it will be seen that the reduced 28 per cent. tariff really amounts to a prohibitive duty. The American electrical industry may, indeed, always reckon upon being able to sell to home consumers at 30 per cent. less cost than the German competing industry. A striking case in point is furnished by lamp carbons, which have been radically affected by the tariff changes. Hitherto they have been charged duty on the number basis, now the duty is reckoned by value. The apparent duty reduction in consequence works out to a remarkable tariff enhancement, and will be further increased by the projected German taxes on lighting materials. Thus, arc lamp carbons, which have hitherto formed the largest item of export to the United States, undergo the enormous increase represented by the difference between 5·97 per cent. (by the old tariff) and 45 per cent. of the invoice value (by the new tariff). In this way, the competition of the German carbon industry on the American market is as good as annihilated. The electrotechnical export trade between the United States and Germany in the last five years progressed as under:—

	Germany to U.S. (in 1,000 marks).	U.S. to Germany.
1908	1,259	441
1909	1,554	446
1910	1,554	527
1911	1,550	726
1912	2,328	682

This means that in the years 1909 to 1911 the German electrotechnical industry barely held its American goods outlet; but from 1910 to 1912 German exports rose from 1,500,000 to 2,300,000, or about 50 per cent., apart from the considerable exports of carbons. The small United States exports to Germany of under a quarter of a million in the same period may be left out of account. Ground has been won in the American market, in the first place, by carbons, then by glow-lamps, telegraph and telephone apparatus, galvanic cells, medical apparatus and reflectors. Although the totals may not be very large, they are yet evidence of the steady German progress. But for the chief export article, dynamo machines, the duty of 20 per cent. is still prohibitive, as also before and since for other electrical products. To the high tariff is added the hindrance to the import trade produced by the rigorous carrying out of the regulations of the Customs Department by the American Customs officials. The electrotechnical industry of the United States may be strong enough to ensure a continuance of such a rigorous enforcement of the Customs regulations, in which case, notwithstanding the lessened tariff burdens, the German electrotechnical industry can hardly hope for any essential progress in the American market in the future.

A Peculiar Lightning Stroke.—Our Norwegian correspondent informs us that during a recent thunderstorm in Norway a chimney of a factory in the country was struck by lightning. The height of the chimney was 39 m., and it was furnished with a receiving rod of a length of 2·5 m., which was connected with a copper cable having a cross section of 40 sq. mm. The cable was fixed to the chimney by means of staples, at intervals of 1·5 m. from each other. The earth-plate resistance was 4 ohms. When the chimney was struck, the rod was not damaged, whereas the cable was, and also the brickwork on the top of the chimney. The lightning did not pass in the ordinary course into the earth through the plate, but jumped over to the roof of a brick house, which was covered with zinc plates The distance between the house and the chimney was 9 m., and the lightning followed the zinc roof over a distance of 11 m. to a zinc pipe, which served as conductor for another 9 m. At a distance of about 1·6 m. from the earth the lightning left the zinc pipe and passed through the brick wall of the house, which had a thickness equal to the length of two bricks. On the inner side of this wall were some copper rings, which were partly melted, and the lightning then disappeared in the iron skeleton of the building, which was connected with a steam pipe. The water and gas pipes were laid quite near the iron construction, but neither of them showed any traces of having been struck. Measurements were afterwards made, by which it was established that, apart from the resistance of the earth-plate to earth (4 ohms) the iron construction had a resistance of 26 ohms, the steam pipe 21 ohms, the water-pipes 2·1 ohms, and the gas-pipes 0·9 ohm. to earth.

Where the lightning had followed the zinc pipe, the parts o which were connected in the ordinary way by the end of one being put into the other, the interior ends of the pipe had been folded or curled together, while the exterior ends had either burst or been torn up. This may very likely have been caused by the sudden and enormous pressure of air, or possibly by the evaporation o water, which may have been present between the ends of the pipe

It is very remarkable that the lightning, instead of passing t earth through the conductor which offered least resistance, jumped to the roof and followed a path where the resistance was considerably larger.

A further examination of the copper cable showed that in many places it must have been heated up to the melting point, or abou 1,000° C. From this we may be able to get an idea about the strength of the current, provided that a certain time for the discharge is assumed. This may possibly have varied between 0·03 and 0·001 of a second. If now the specific heat of the copper is pu at 0·12, and the specific resistance at 0·05, one will get as a resul about 20,000 amperes on the basis of a discharging time of 0·0 second, and about 100,000 amperes on the basis of 0·001 second.

It is not often that there is an opportunity of following and tracing the path of lightning so closely as has been done in thi case, and it may be regarded as beyond doubt that if many suc observations were made, and it were possible to calculate the effec of lightning by means of figures, this might become of immens importance in showing the way towards mastering one of th most powerful and irresponsible forces of Nature, the electricit of the air.

Copper.—The end of the year finds stocks still holding up against numerical exhaustion. English stocks, as shown b Messrs. Merton's statistical circular, were reduced by 485 tons while French increased by 705 during December. European supplie lost 480 tons, but, on the other hand, if Holland and Germany b included, there is a considerable gain of 2,763 tons, from which i may be inferred that the commercial countries are laying in wha the others give out. Supplies from North America during th month were well up to the average quantity, from Spain the same Chile shipments are high, Australian rather below the average Total deliveries are still a reasonable figure (43,698), representin average business, higher than in the two preceding December American supplies during November increased by the noteworth figure of 6,859 tons. In the face of this, the steadiness of the pric is not astonishing. The world's supply at the end of Novembe was 42,877 tons, an increase of 6,989 tons on the quantity for th end of October.

Educational Notes.—Imperial College of Scienc and Technology: City and Guilds (Engineering) Colleg —Advanced Courses of Instruction will be given in the "Principle Design and Manufacture of Electro-Magnetic Machinery an Transformers, (Including) The Organisation of Electrical Manufactories," by Dr. S. P. Smith; and in "Rotary Converters," b Prof. Miles Walker. Both courses commence in February. Se our advertisement pages.

Battersea Polytechnic.—As already announced, a course o Advanced Lectures on Generating Stations, by Mr. W. H. Patchel has been arranged for Mondays, from January 19th to Februar 16th. Free. Particulars are given in our advertisement pages.

Institution and Lecture Notes. — Nottingha Society of Engineers.—In the syllabus for the 1914 session, th following papers are announced:—January 14th, "Brush-Ljungstrom Steam Turbine," by Mr. Lloyd Evans; February 11th, "Defectiv Boiler Mountings," by Mr. F. W. Sisson; March 11th, "Utilisatio of Exhaust Steam and the Approximate Cost of Producing Electrical Energy therefrom," by Mr. W. C. Mountain.

Wireless Society of London.—A meeting of this society wi be held at the Institution of Electrical Engineers on January 21s at 8 p.m., when an address illustrated by experiments will be give by the President, Mr. A. A. Campbell Swinton.

At the meeting of the Birmingham Local Section on Wedne day, a paper was read by Mr. B. Welbourn on "British Practice i the Construction of High-Tension Overhead Transmission Lines The discussion was closed.

Appointments Vacant.—Engineer-in-charge for Darlington Corporation (£2); works engineer and shift engineer fo Wednesbury Corporation electricity department; mains assistar for Rawtenstall Corporation (35s.). Particulars are given in ou advertisement pages.

Electricity on British Warships. Too late for inclusion in our "Correspondence" columns, the following letter has come to hand on the subject dealt with in one of our leaderettes to-day :—

(*Re* H.M.S. *Invincible.*)

"As one who has for many years tried to get shipowners to appreciate the many vast economies which are to be made by the use of electrical power both for main propulsion and for the driving of auxiliary machinery on ships, and knowing also the difficulties which a shipowner has to meet, in coming to the conclusion to use electric power, owing to statements made against it (for reasons best known to themselves) in the Press, and before the Institution of Naval Architects and other places, I view with alarm the published announcement in the *Pall Mall Gazette* on December 31st last, with regard to H.M.S. *Invincible* to the effect that after five years of devotion of money and time to perfect it, the electrical gun operating gear is to be now replaced with hydraulic. Considering that the experience of electrical gun operation is limited in this country, compared with the magnificant work done on foreign ships with electrical driving, and the fact that the new Russian ships are to be so fitted (with their recent actual practical 'war' experience), if the matter were not so serious for its ultimate effect on the Merchant Marine, this conclusion by British Admiralty officials would be the very height of early Victorian humour.

"I can quite understand the position ; I have no doubt that 'no hits' causes discontent amongst the gunnery men, and there is no love lost between the two competing departments of the Navy, *i.e.*, the torpedo and the gunnery departments. It seems so out of date and fossilised to allow, by red tape Whitehall officialism, the gunnery department's electrical power to come under the torpedo department. Yet when hydraulic power is put in, the whole lot comes under the officers and men of the gunnery department, an arrangement (not the only one) which is the laughing-stock of the naval officers of the European and American Continents, and for which the British people have to pay.

"What is to me so amusing is that a number of early Victorian officials and other things on half-pay (some in Parliament at £400 a year), who know more about dead-reckoning, tar-buckets or marline-spikes, are directing affairs, and even although they have not the slightest knowledge of even the fundamental features of modern electrical power engineering, they condemn or support anything new like 'bulls in china shops.'

"Considering that electrical driving has been found so satisfactory in other Navies, a list of which I give below, it will be seen that with proper design and application electric driving is a well-tried and successful feature of gun and turret operation on ships of war. As far as I have been able to ascertain from official records the following countries have secured the advantages and efficiency that are consequent upon its use :—

United States of America...	32 ships
„ „	E.S. *Jupiter* (main propulsion)
Germany	30 ships
France	36 „
Austria	14 „
Russia	14 „
Japan	18 „
Italy	9 „
Greece	several „
Chile	„ „
Brazil	„ „
China	„ „
Argentine	„ „
Spain...	„ „
Great Britain	4 „

"It will be noticed that progressive France tops the numbers, followed by the U.S.A., and Germany, countries to whom Great Britain can confidently look for acute competition both from a naval as well as a mercantile service point of view.

"Is the dignity of the profession of electrical power engineering to stand this? Are we going to sleep over it? or are we going to do the right thing now we have the chance, *i.e.*, make public protest?

"WILLIAM P. DURTNALL, M.I.MAR.E."

X-Rays and Cancer.—In a paper read before the Röntgen Society on Monday, Dr. Jean Clunet dealt with the "Histological Changes produced by X-rays on Animal Tissues," showing the effects produced respectively by strong and mild doses, and explaining the action of the rays in cases of cancer. The paper was regarded as a valuable addition to knowledge on the subject.

Electricity in Agriculture.—In the *Electrical World* of December 13th, Dr. H. G. Dorsey describes experiments made near Dayton, Ohio, to discover the effect of electricity and artificial illumination on the growth of plants. Plot No. 1 was excited with high-frequency currents from a small Tesla coil, wires being strung over the soil at a height of 15 in. The stimulation was applied for one hour morning and evening at 10,000 volts, and about 200,000 cycles per second. Plot No. 2 was illuminated with a 100-watt tungsten lamp with ruby bulb three hours a day. Plot No. 3 was similarly treated with a Cooper Hewitt mercury-vapour lamp, and Plot No. 4 was used as a control. Plot No. 5 was sprinkled with partly electrolysed water, and Nos. 6 and 7 were traversed by weak alternating and direct currents.

The plot subjected to high-frequency current showed a greater increase in yield than any of the others. Ruby light came second for radishes and violet light second for lettuce. The sprinkling system proved worse than useless. Comparing the high-frequency plot with the control plot, the edible portion of radishes grown was 75 per cent. greater than under natural conditions. Further experiments at the time were interrupted by the Dayton flood but later on wires were erected over a field, 9 ft. high and 15 ft. apart and were charged up to 50,000 volts for some hours daily. Owing to the delay in getting to work only qualitative results were obtained, but these indicated a probable increase in weight of about 20 per cent.

RESULTS OF TESTS IN ELECTRIC STIMULATION OF VEGETABLES.

Radishes (10 plants selected at random):	Plot 1, Tesla.	Plot 2, ruby light.	Plot 3, mercury vapour.	Plot 4 control.	Plot 5, electric sprinkling.
Total plant weight, gm. ..	265·70	137·80	[illegible]	[illegible]	[illegible]
Edible portion, gm.	139·50	57·40	[illegible]	74·40	[illegible]
Tops and leaves, gm. . ..	120·50	75·70	[illegible]	[illegible]	[illegible]
Roots, gm.	9·20	4·70	3·20	[illegible]	6·60
Lettuce (10 plants selected at random):					
Total plant weight, gm. ..	67·00	52·60	56·50	46·10	31·30
Edible portion, gm. . ..	60·70	47·30	50·20	41·80	28·20
Roots, gm.	6·30	5·30	6·30	4·30	3·10

Throughout the article the author makes no reference to prior work, and the fact that he is repeating experiments carried out by Sir Oliver Lodge years ago appears to be unknown to him.

"The Electric House" at Birmingham.—The Electric Supply Publicity Committee are exhibiting "The Electric House" at Birmingham, from January 12th to 16th, the week of the Birmingham and Midland Institute Conversazione. This exhibit is substantially a replica of La Maison Electrique shown with such great success at the recent Ideal Home Exhibition. The Birmingham Corporation Electricity Department, which is interested in this exhibit, is to be congratulated upon its enterprise in adopting this means of popularising the uses of electricity. Birmingham is the first provincial City in which this particular exhibit will be shown. If the popular interest there is anything like that shown at Olympia, we imagine that the house will serve for many other centres too.

An Edison Engine Starter?—The last American mail brings the news that Mr. Thomas A. Edison is interesting himself in the subject of electric engine starters for petrol motor-cars, and that he is at work on a design which will be more an integral part of the car, and less an applied adjunct, than many of those at present on the market.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. F. L. PEDLEY, of Bingley, has been appointed chief engineer for the Bingley U.D.C. electricity sub-station.

The Derby T.C. has appointed MR. W. L. WEBB, as electricity showroom attendant.

Tramway Officials.—The Tramways Committee of the Salford Town Council has adopted the following recommendations of the Special Sub-Committee *re* traffic arrangements : (*a*) That the minimum salary of the traffic superintendent be fixed at £200 per annum, with two advances of £20 and one of £10 at intervals of two years, to a maximum of £250 per annum. (*b*) That MR. W. BLAKEMORE be promoted to the position of traffic superintendent as from January 1st, 1914. (*c*) That MR. C. F. ELLWOOD be promoted to the position of chief clerk of the traffic staff at a commencing salary of £140 per annum, with biennial increases of £15 to a maximum of £200 per annum. The appointment is also to date from January 1st. (*d*) That the salary of MR. W. BILLINGTON, chief clerk of the general staff, be increased from £170 to £190 per annum, with biennial advances of £20 to a maximum of £250 per annum, and that the minimum salary of future holders of this position be fixed at £169 per annum, with four advances of £20 and one of £10, at intervals of two years, to a maximum of £250 per annum. (*e*) That the salary of MR. H. RICHARDSON, permanent way superintendent, be increased from £200 to £220, with advances of £20 and £10 every two years to a maximum of £250 per annum. Minimum amount to future holders, £200, to a maximum of £250. (*f*) That the salary of MR. R. CHADWICK, car depôt superintendent, be increased from £180 to £195, with biennial advances of £15 and £10, to a maximum of £220 per annum. Minimum salary to future holders, £160, with biennial increases of £15 to £220. (*g*) That the salary of MR. H. WESTON, overhead equipment superintendent, be increased from £160 to £175 per annum, with biennial advances of £15 and £10, to a maximum of £200 per annum. Minimum salary to future holders, £160 to £200.

The Reading T.C. on January 1st decided to increase the salary of MR. G. F. CRAVEN, engineer and manager of the tramways undertaking, from £400 to £600 a year, by annual increments of £50. A motion that the salary be raised to £450 only was rejected by 29 votes to 4.

General.—MR. GUY CALTHROP has been appointed general manager of the L. and N.W. Railway.

Last week MR. S. A. BOUSTEAD, of Walkden, near Manchester, retired from the service of the Lancashire and Yorkshire Railway Co., as telegraphs inspector, after being in their service for 44 years. He was presented by his colleagues with a purse of gold and a gold-mounted walking stick, suitably inscribed.

Regret has been occasioned by the retirement of MR. WM. EMMOTT, of the telegraph department at Burnley Post Office, after 48 years' service. Mr. Emmott first joined the old Magnetic Co. before the Government took over the telegraphs. His present official position is superintendent of telegraphs and telephones.

MR A. A. KING, who has been chief representative for the firm of G. Straus & Co., Ltd., 211, Upper Thames Street, London, E.C., for the past 12 years, has been appointed a director of the company, with a seat on the board. He will still continue to represent them in the country.

Obituary.—The death took place on December 31st of MR. ABRAHAM RIDGWAY, electrical engineer, of 126, Hall Ings, Bradford. About 18 months ago the deceased gentleman had a stroke, from which he never fully recovered, and this was the eventual cause of his death. He died at his residence, 91, Greenwood Terrace, St. Margaret's Road, Bradford. Mr. Ridgway was a well-known local electrical engineer, his premises being situated in the centre of the city, and amongst the huge wool warehouses for which Bradford is noted. He had been in business about nine years, and the concern will now be carried on on behalf of the widow by the deceased's three sons.

MR. F. J. BUDD.—The death is announced, after two months' painful illness, of Mr. F. J. Budd, of Little Heath, Old Charlton, S.E., late chief of the O.C. department of Messrs. Siemens Bros. and Co., Ltd., of Woolwich. Deceased was 49 years of age, and was a leading member of the Union Waterloo Lodge of Freemasons

We regret to learn of the death, on the 1st inst., from pneumonia, of Mr. W. W. Alston. Mr. Alston held the position of chief assistant electrical engineer to the West Bromwich Corporation for the past nine years, and previously he had seen service under the Bury, Oldham and Bermondsey Councils.

NEW COMPANIES REGISTERED.

Electric Mirror Publicity, Ltd. (132,987).—This company was registered on December 23rd, with a capital of £500 in £1 shares, to carry on the business indicated by the title, and that of mechanical and electrical engineers, founders, &c. The subscribers (with one share each) are:—G. Reiche, Hendara, Dunoon Road, Forest Hill, S.E., secretary; A. J. Clarke, 127, Abbeville Road, Clapham Park, S.W., secretary. Private company. Table "A" mainly applies. Registered office, 122, Southampton Row, W.C.

Edwards & Armstrong, Ltd. (132,986).—This company was registered on December 23rd, with a capital of £10,000 in £1 shares, to take over the business of electrical and mechanical engineers carried on by J. H. Edwards and A. L. Stephens at 127, Victoria Street, Bristol, as "Edwards and Armstrong." The subscribers (with one share each) are: J. H. Edwards, 127, Victoria Street, Bristol, electrical engineer; A. L. Stephens, 127, Victoria Street, Bristol, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. H. Edwards and A. L. Stephens: qualification, £100. Registered by Jordan and Sons, Ltd., 116-17, Chancery Lane, W.C.

National Wire Manufacturing Co., Ltd. (132,995).—This company was registered on December 23rd, with a capital of £12,000 in £1 shares, to carry on the business of engineers, wire drawers and workers, galvanisers, wire rope manufacturers, cable makers, tube drawers, cycle manufacturers, &c. The subscribers (with one share each) are: R. D. Conner, 5, Neston Avenue, Withington, Manchester, engineer; R. P. Slinger, 33, Smedley Road, Cheetham Hill, Manchester, engineer; J. C. Jones, Redland House, Withington, Manchester, gentleman; W. Royle, Prestwich, Manchester, gentleman; J. B. Jones, Redland House, Withington, Manchester, gentleman; Miss K. F. Jones, Redland House, Withington, Manchester; Mrs. E. M. Conner, 5, Neston Avenue, Withington, Manchester. Private company. The number of directors is not to be less than three or more than seven; the first are R. D. Conner, R. P. Slinger, J. C. Jones and W. Royle, each of whom may retain office while holding 1,000 shares; secretary, R. D. Conner. Registered office, Monsall Road, Newton Heath, Manchester.

Pitter's Ventilating and Engineering Co., Ltd. (132,967).—This company was registered on December 22nd, with a capital of £30,000 in £1 shares (12,000 preferred participating), to carry on the business of ironfounders, mechanical and electrical engineers, &c., and to acquire from Pitter's Patents, Ltd., certain exclusive licences in respect of improvements in the construction of propellers as applied to ventilating. The subscribers (with one preferred participating share each) are: The Hon. Schomberg C. Trefusis, 20, Bishopsgate, E.C., insurance broker; P. G. Clegg, 10, Bishopsgate, E.C., accountant; W. C. Pitter, 43, Nightingale Vale, Woolwich, S.E., engineer. Private company. The number of directors is not to be less than two or more than seven; the first are the Hon. Schomberg C. Trefusis, P. G. Clegg and W. C. Pitter; remuneration, £100 each per annum (chairman, £150). Registered by Francis & Johnson, 19, Great Winchester Street, E.C.

R. Herbert & Co., Ltd. (133,085).—This company was registered on December 30th, with a capital of £1,000 in £1 shares, to take over the business carried on at 6, Station Road, Brixton, and 33, St. Martin's Road, Stockwell, S.W., by R. N. Herbert, as "R. Herbert & Co.," and to carry on the business of electrical and motor engineers and manufacturers of, and dealers in, motor requisites, transformers, arc and metal-filament lamps, bells, fans, &c. The subscribers are:—R. N. Herbert, 33, St. Martin's Road, Stockwell, S.W., electrician, &c.; J. Hall, 78, Devonshire Road, Palmer's Green, N., builder and decorator. Private company. The number of directors is not to be less than two or more than five; the first are R. N. Herbert and J. Hall. Registered office, 6, Station Road, Brixton, S.W.

Fardon & Carpenter, Ltd. (133,073).—This company was registered on December 30th, with capital £2,002 in £1 shares, to take over the business of electrical engineers carried on by G. R. Fardon and C. A. Carpenter, at 4, Maidenhead Court, and 8 and 9, Glasshouse Yard, Aldersgate Street, E.C., as "Fardon & Carpenter." The subscribers (with one share each) are:—G. R. Fardon, 143, Percy Road, Shepherd's Bush, electrical engineer; C. A. Carpenter, 149, Dalmally Road, Addiscombe, Croydon, electrical engineer. Private company; the first directors are G. R. Fardon C. A. Carpenter, and E. J. Sandham (all permanent); qualification (except E. J. Sandham), £300; remuneration of two first-named directors £156 each, per annum. Registered by Lydall & Sons, 37, John Street, Bedford Row, W.C.

Mansfield Engineering Co., Ltd. (133,017).—The company was registered on December 24th, with a capital of £10,000 in £1 shares, to take over the business of mechanical and electrical engineers, machine and engineering tool makers, boilers makers, iron and brassfounders, &c., carried on by J. W. Houfton and C. A. Houfton at Mansfield and elsewhere as the Mansfield Engineering Co. The subscribers (with one share each) are:—J. W. Houfton, Woolerina, The Park, Mansfield, engineer; C. A. Houfton, Parkside, Mansfield, engineer. Private company. The number of directors is not to be less than two or more than five, the first are J. W. Houfton and C. A. Houfton; qualification, 250 shares. Registered office, Recreation Street, Mansfield, Notts.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Coatbridge and Airdrie Electric Supply Co., Ltd.—Charge on the company's undertaking and property, present and future, including uncalled capital and Coatbridge and Airdrie undertakings and benefit of certain agreements, &c., dated December 18th, 1913, to secure £2,500. Holders: County of London Electric Supply Co., Ltd., Moorgate Court, Moorgate Place, E.C.

Ferranti, Ltd. (83,718).—Capital, £130,000, in 60,000 pref., 60,000 ord. and 10,000 def. shares of £1 each. Return dated November 10th, 1913. 53,374 pref., 60,000 ord. and 10,000 def. shares taken up, £123,874 considered as paid. Mortgages and charges: £145,762 10s. 4d.

United Electric Tramways Co. of Caracas, Ltd.—Capital, £200,000 in £1 shares. Return dated November 13th, 1913. 170,000 shares taken up, £7 paid, £169,993 considered as paid. Mortgages and charges: £165,750.

Davis & Clark, Ltd.—Debentures, charged on the company's undertaking and property, present and future, including uncalled capital, dated December 19th, 1913, to secure £235, have been filed. Holder: A. A. Barnes, 20, Hamsell Street, E.C.

Cleveland and Durham Electric Power Co., Ltd. (89,539).—Particulars of £225,000 second debs., created September 29th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

W. A. Stevens, Ltd.—A memorandum of satisfaction in full on November 25th, 1913, of debs. dated August 7th, 1912, securing £5,000, has been filed.

Cleveland and Durham Electric Power Co., Ltd.—A memorandum of satisfaction in full (*a*) on December 15th, 1913, of mortgage or charge dated August 10th, 1907, securing an amount not exceeding £5,000; (*b*) on December 19th, 1913, of deb. dated December 11th, 1913, of deb. dated December 11th, 1907, securing £100,000; (*c*) on same date, of deb. dated March 31st, 1909, securing £10,000; (*d*) on same date, of deb. dated December 11th, 1907, securing £1,000; and (*e*) on same date, of second mortgage debs. bearing various dates, from October 5th, 1908, to July 24th, 1911, securing £225,000, have been filed.

Liverpool District Lighting Co., Ltd.—A memorandum of satisfaction in full on December 24th, 1913, of debs. dated October 13th, 1911, and February 9th, 1910, securing £2,000 and £6,000 respectively, has been notified. Particulars of £15,000 debs., created December 24th, 1913, also filed, pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, including uncalled capital. No trustees.

British Prometheus Co., Ltd.—Particulars of £5,000 second debentures, created September 17th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £3,000. Property charged: The company's undertaking and property present and future, including uncalled and unpaid capital. No trustees.

Keynsham Electric Light and Power Co., Ltd.—Particulars of £1,500 third debentures, created December 15th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £1,000. Property charged: The company's undertaking and property, present and future, including uncalled capital, and four messuages situate at Keynsham, Som. No trustees.

Gosport and Alverstoke Electric Lighting Co., Ltd. (82,693).—Capital, £5,000 in £10 shares. Return dated December 5th, 1913. All shares taken up. £5,000 paid. Mortgages and charges: Nil.

Tramways (M.E.T.) Omnibus Co., Ltd. Particulars of debs., for an amount not exceeding the issued capital for the time being created by resolutions of January 22nd, 1912, and December 16th, 1913, and secured by trust deeds dated March 14th, 1912, and December 24th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £100,000, ranking *pari passu* with £100,000 deb. stock already issued. Property charged: 19s. per share uncalled on 200,000 shares and company's undertaking and other property, present and future. Trustees: Electric and General Investment Co., Ltd., 1 and 2, Great Winchester Street, E.C.

Hampshire Light Railways (Electric), Ltd. (52,564).—Capital, £1,000 in £10 shares. Return dated December 5th, 1913. All shares taken up. £1,000 paid. Mortgages and charges: Nil.

Delagoa Bay Development Corporation, Ltd. (76,099).—Return dated November 14th, 1913. Capital, £166,300 in 10s. shares, 267,400 shares taken up, £88,700 paid, £45,000 considered as paid. Mortgages and charges: £195,200.

CITY NOTES.

Buenos Ayres Port and City Tramways, Ltd.

MR. G. KITCHIN presided at the meeting of this company held at Salisbury House, E.C., on December 15th. He said that last year they had no reason to anticipate so lamentable a report as had been issued, consequent upon the enormous rise in the already heavy rates of working costs. Messrs. J. G. White & Co., Ltd., prepared a bulky report upon the physical and general conditions of the property. The receipts had increased by £5,507, but on the debit side of the revenue account was the enormous increase of £15,186 in maintenance and repairs—permanent way, £2,136; electrical equipment, £673; and cars and car bodies the astonishing amount of £12,361. In the previous year severe inundations injured their permanent way, damaged car motors, and held up the traffic, and they were told that such floods were unprecedented. There seemed reason to suppose that they might be of frequent occurrence. The receipts increase was about 8½ per cent., and the expenses increase 42 per cent. The actual loss on working was £1,148. It was impossible to look at the figures without coming to the conclusion that there must have been grave neglect on the part of the management in Buenos Ayres to have led to such a disastrous result, so different from what they were given to expect if a free hand were given to those in control. It was as yet too early to judge what would be the result of the new management when it should have had time to make itself felt. The current year's returns were showing a distinct improvement on those of the latter part of 1912, but were not such as to hold out any immediate hope of sufficient improvement in the financial circumstances to give confidence in the company's future. The chairman referred to the exceptional difficulties under which the concern was worked. Dr. M. Lacroze and Mr. J. B. White were going to Buenos Ayres to examine into the condition of the property, and to consult with the local committee, and when the shareholders met next June he anticipated being able to put a more satisfactory statement before them.

The report was adopted.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—A dividend of 1¼ per cent. is announced.

Sao Paulo Tramway, Light and Power Co., Ltd.—A quarterly dividend of 2½ per cent. is announced.

Reduction of Capital.—The British Coalite Co., Ltd., reduced a petition for confirmation of the reduction of capital from £2,000,000 to £400,000 has been presented and will be heard on January 13th.

Japan.—The Katsuragawa Water Power Co. reports a net profit of £17,069 for the last financial year. Of this sum, £14,000 is being distributed to the shareholders in the form of a 5 per cent. dividend; £1,710 is being placed to reserve, £782 to a sinking fund; and £500 is being allotted to bonuses, leaving a small balance to be carried forward.—The Kinngawa Water Power Co., which is now supplying 260,000 KW. per day to the Tokio Electric Bureau, is declaring a dividend of 6 per for the last half-year.

Continental.—FRANCE.—The report of the Compagnie d'Electricité de l'Est-Parisien (Est-Lumière), of Paris, for the year ending June 30th last, shows a net profit of £24,327. A sum of £1,217 is being placed to reserve, £710 is being distributed in bonuses, and a dividend of 7 per cent., which absorbs £22,400, declared.

La Compagnie d'Electricité de l'Ouest Parisien (Ouest-Lumière) reports a profit of £117,274, an increase of £35,322 over the preceding 12 months. Of this sum, £40,000 is being placed to depreciation account, £3,850 to legal reserve, and £70,000 distributed to the shareholders in the form of a 7 per cent. dividend, leaving a small balance to be carried forward.

BELGIUM.—La Société des Centrales Electriques des Flandres, in its report for the last financial year, states that it has secured the concession for the electric lighting of 25 communes, and is in negotiation with 15 others in Western Flanders. It has also secured the contract for the supply of current to the works on the banks of the ship canal between Ghent and the Dutch frontier. The company is building a new generating station at Langerbrugge, near the ship canal, and the first part of the plant, to the extent of 4,000 KW., is expected to be put in operation by the end of the present month. Provision is, however, being made for the extension of the same to a total capacity of 10,000 KW.

La Société d'Electricité du Brabant of Oisquercq, which has a capital of £100,000, now controls the electric lighting concessions in respect of no less than 17 communes in the province of Brabant. It has also contracted with the Compagnie Generale du Gaz pour la France et l'Etranger, which owns the gas and electric supply concessions for the town of Hal, to supply all the current required for electric lighting and power purposes during the period the concession runs. The plant at the generating station at Oisquercq comprises two 2,000-KW. steam turbines and dynamos, two 500-KW. steam engines and generators, and one 1,000-KW. set.

RUSSIA.—The Russische Gesellschaft für Elektrische Kraftstationen is the name of a new company which has just been formed in St. Petersburg, with a capital of [illegible], to group and develop the interests in Russian electrical undertakings of the Deutsche Bank and the Elektrische Licht und Kraftanlagen Gesellschaft, of Berlin.

SPAIN.—A meeting of the shareholders of the Hidroelectrica Española has sanctioned the increase of the company's capital from 12,000,000 to [illegible] pesetas with a view mainly, after paying off certain floating debts, to the acquisition of concessions to develop the Dos Aguas and Villora waterfalls on the River Cabriel, in the Province of Cuenca, in order to supply electric energy to Madrid, Valencia, Alcoy, and Cartagena. To develop the Villora falls the Hidroelectrica del Salto de Villora was formed in [illegible], the available forces there being estimated at 9,000 H.P. With the development of the new waterfalls, it will be possible to dispense with a steam-driven station and secure a volume of water sufficient in all seasons, the completion of all the installations creating a revenue sufficient to pay 6 per cent. interest, 5 per cent. dividends and lay by other needful reserves.—*Electron.*

Bahia Tramways, Light and Power Co.—According to a circular issued by the London Committee to the debenture-holders, the municipality has been unable to carry out the terms of the contract of sale. It is proposed to enter into a provisional contract with the municipality, under which the latter will create external gold bonds, to be issued at 84 per cent., bearing interest at 6 per cent., which the company will endeavour to realise, applying the proceeds in payment of the amount due from the municipality.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be quoted in the Official List:—

American Telephone and Telegraph Co.—$29,077,800 additional convertible 4½ per cent. gold bonds.

The Bank Rate.—The Bank Rate was yesterday reduced from 5 to 4½ per cent.

STOCKS AND SHARES.

Tuesday Evening.

THE New Year has brought an increase in business to the Stock Exchange, and a better tone in several of its markets. Gilt-edged securities cannot claim to have led prices in the upward direction, because there has been a fresh outbreak of dulness in Consols consequent upon more new issues, and promises—or threats—of others to come in the near future. The news from Mexico remains conflicting; and notwithstanding rallies in prices of railway stocks connected with that country, the various securities of the utility undertakings are very depressed.

The Electricity Supply market continues quiet and steady. In spite of its placid character, however, keen discussion is raging around the suggested scheme for consolidating the interests of the London electric supply undertakers. The Stock Exchange is not taking any prominent part at present, but, of course, the developments are being watched with keen attention, and those who are interested have fairly decided opinions of their own upon the various points connected with the issue. Kensington Ordinary, with ⅛ rise, are almost the only shares in the list to show any movement.

The Home Railway market should at this season of the year be showing a good deal of activity, consequent upon dividend estimates, to be set at rest shortly by the declarations from the leading companies for the second half of 1913. This year, however, the position is so complicated by reason of the companies having to alter the form of their accounts, that speculation is somewhat at a loss how, and what, to estimate. Dealers complain that, although the so-called reforms may be of much practical use hereafter, they have laid a heavy check upon business at the present time—as they did also six months ago.

The firmest part of the market is that concerned with Undergrounds, Metropolitans in particular having been strong, with a jump to 46¾ upon rumours that the Company is flirting with one of the big lines. This time it is the Great Central which is supposed to be making the advances. From the top price there has been a slight recession, but Mets. are a point higher on the week. Districts have fallen a ¼, there being something of a bull account in the stock, and the market is wondering a good deal how the results of the past twelvemonth will be found to have materialised as regards net profits. The London and South-Western Company has announced sweeping reductions in suburban fares, but the changes are not expected to influence the receipts of the Undergrounds to any unfavourable extent; indeed, it is conceivable they may benefit them rather than the reverse. Underground Electrics are an improving market. London United Tramways Debenture, British Electric Tractions, and London and Suburban issues remain steady.

Amongst Latin Canadians, the falls in Mexicans attract most attention. The common shares of both the Mexican Light and

Power and the Tramways Companies have dropped sharply, while the bonds of each are flat. A bank holiday extending over two months has been proclaimed, and every day brings its own tale of fierce fighting on this border or the other. The Stock Exchange argument runs that the worse the situation gets, the better will it be, inasmuch as it must bring within closer perspective the ultimate settlement, but this is sorry consolation for holders of the securities in companies apart from the railways. Rumour has been toying with the statement that the Mexico Tramways was threatened by the Mexican Government; the shares fell to 62, rallying to 65 upon reported contradiction of the vague gossip.

Monterey Debenture fell 3 points. Canadian descriptions, too, are out of favour, the incessant demands of the Dominion for fresh capital causing a good many people to regard Canadian investments at the present time with a feeling akin to suspicion, while almost every mail that arrives brings with it also statements of the scarcity of actual money which prevails in many parts of Canada. The Shawinigan Water Company has declared its regular dividend at the rate of 6 per cent. on the common stock, and the price thereupon gained a point.

Brazilian things are in little better case than Canadians. Severe shrinkages during the past week or two in shares of the Brazil Railways have unnerved proprietors of other stocks and shares connected with the Republic. It takes little selling badly to disturb prices. Para Electric Preference, for example, fell ⅜ early this week upon the offering of comparatively few shares. The flatness of most things Brazilian is connected in some measure with the default recently made by the Para Improvements Company, but there has been a rally from the lowest prices touched in certain of the Brazil issues which fell most severely. Brazilian Tractions fell back to 82½, recovering therefrom to their previous price of 84.

The feature of the Telegraph section is a brisk rise in the price of Marconis. Statements are in circulation to the effect that the Marconi Marine Company is doing excellently, and is likely to extend still further its scope: upon this, the parent shares picked up to 3$\frac{7}{16}$, having been down to 3¼ since our last notes were written. Languid speculation was stirred by the movement, and the subsidiaries—Americans, Canadians and Spanish—hardened a trifle in sympathy. Telegraph stocks and shares have been quiet.

The Manufacturing group is noticeable principally for an advance of ⅜ in British Insulated and Helsby shares, which raised the quotation to 8⅜. The rises of the Brush stocks are well maintained. India-Rubbers are *ex* dividend, both as regards Ordinary and Preference. Willans & Robinson Preference have held the remarkable improvement which they secured at the end of last year, and the Debenture stock is 3 higher. A decided change has come over the rubber share market upon a slight improvement in the price of the product. It is expected that the alteration in selling methods—which, according to gossip, will shortly be put into practice—will help to put the price of rubber on a higher plane; and, in anticipation, the bears are getting back their stocks in Mincing Lane and Throgmorton Street. There is not much public about the movement up to the present, but were rubber itself to move up to half-a-crown per lb. and stop there, outside attention might be reattracted to the market.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Dec. 31	3,166	+ 95	53	50,149	+ 4,695	..	..
Blackpool-Fleetw'd	„ 27	1,196	+ 139	25	30,270	+ 4,928	8	..
Bristol	„ 31	32,884	+ 2,881	..	419,589	+ 54,605	30·5	..
Brit. Elec. Trac. Co.	„ 26	190,354	— 217	..	..	..	429·8	1·25
Chatham and Dist.	„ 25	3,529	+ 129	51	47,453	+ 2,947	14·98	..
Cork	„ 31	1,774	+ 2	52	25,980	+ 716	9·89	..
Dublin	„ 26	20,995	—1,784	..	281,263	− 17,398	54·25	..
Hastings	Jan. 1	3,213	+ 7	..	..	+ 3,787	19·3	..
Lancashire United	Dec. 31	6,255	+ 541	52	81,543	+ 10,197	42	3
Llandudno-Col. Bay	„ 26	567	— 10	4	567	− 10	6·5	..
London United	„ 26	23,747	+ 549	..	325,298	+ 6,772	..	..
Tyneside	„ 24	1,928	− 219	26	12,931	+ 518	11	..
Anglo-Argentine	„ 31	253,990	+ 16,032	52	2,917,249	+ 209,088	..	..
*Auckland	..	.	.	..	..	..	25·42	1·81
Brisbane	Nov.	27,053	+ 2,743	..	287,071	+ 58,650	..	..
Calcutta	Dec. 27	17,959	+ 861	52	..	+ 10,909	..	..
Kalgoorlie, W.A.	Nov.	2,504	..	18	31,603	..	20·5	..
‡Madras	Dec. 31	3,858	+ 505	52	42,946	+ 3,074	15·25	..
Montevideo	Dec.	33,309	—1,174	4	68,839	267	..	..
Cen. London Rly.	Dec. 27	20,795	—1,000	52	254,195	+ 4,322	6·78	·4
City & S. Lon. Rly.	„ 27	11,592	1,472	52	144,982	−14,184	7·26	..
Dublin-Lucan Rly.	„ 31	625	+ 34	26	3,859	+ 18	7	..
L'pool Overh'd Rly.	„ 28	6,653	+ 318	52	88,979	+ 6,645	6·6	..
London Elec. Ry. Co.	„ 27	58,430	+ 245	52	711,595	+ 970	21·25	..
Mersey Railway	„ 27	8,950	245	52	110,063	+ 4,457	4·5	..
Metropolitan Rly.	„ 28	72,611	+ 5,965	52	902,258	+ 35,507	29·25	3·5
Met. District Rly.	„ 27	52,439	+ 1,147	52	675,747	+ 18,890	25	..

‡ Two weeks. * No returns available owing to strike.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, January 7th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	3d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£22 10	..
a Lead, Nitrate	„	£29 10	..
a „ White Sugar	„	£28	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	89/-	3/- dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %)	„	£10 5	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£90	£6 dec.
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£116 13 4	£4 13 4 dec.
b „ Sheet, in ton lots	„	£112	£14 dec.
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c „ Tube (brazed)	„	9⅝d.	⅛d. inc.
c „ „ (solid drawn)	„	8⅜d.	⅛d. inc.
c „ Wire, basis	„	7⅝d.	..
c Copper Tubes (brazed)	„	10⅜d.	⅛d. inc.
c „ „ (solid drawn)	„	10⅜d.	⅛d. inc.
g „ Bars (best selected)	per ton	£83	£1 inc.
g „ Sheet	„	£83	£1 inc.
g „ Rod	„	£83	£1 inc.
d „ (Electrolytic) Bars	„	£68 10	£1 10 inc.
d „ „ Sheets	„	£86 10	£1 10 inc.
d „ „ Rods	„	£74	£1 10 inc.
d „ „ H.C. Wire	per lb.	8⅞d.	..
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/-	..
h India-rubber, Para fine	„	3/1½	½d. inc.
i Iron Pig (Cleveland warrants)	per ton	50/1	1d. inc.
„ Wire, galv. No. 8, P.O. qual.	„	£14	.
g Lead, English Pig	„	£19	10/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10⅜d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£169 10 to £170 10	£1 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Mexican Northern Power Co., Ltd.—The company announces that in the present disturbed condition of Mexico it is necessary to defer payment of bond interest due January 1st. It is not possible yet to make definite plans for the resumption of work or for raising funds to complete the development of the undertaking. No direct damage has been caused to the company's property by the military operations.

Holophane, Ltd.—At the meeting of this company held at Caxton Hall, S.W., on December 30th, Mr. A. O. Mygatt said that the business had increased by 50 per cent. in the net sales during the year, but sales had fallen off towards the end of the year by the competition of new lines of cheaper white glass. The year's operations had been accompanied by internal disputes, litigation, &c., which had prevented sufficient attention being given to technical developments.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 6th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	23/32 — 25/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11½ — 13½	..	..
Do. Do. Deferred ..	100	..	..	4½ — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 90	+2	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	8	..	52 — 55	..	5 9 1
Do. 5 % Perp. Deb. ..	100	5	5	92 — 95	..	5 5 5
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 80	..	5 12 6
Central London Railway, Ord. ..	100	8	8	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 8
Do. Def.	100	[illegible]	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	93 — 95	−1	5 5 0
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2¼	..	6 18 4
Do. 4 % Deb.	100	4	4	71 — 76 xd	..	5 5 8
Lancashire United, 5 % Deb. ..	100	5	5	75 — 79 xd	..	6 6 7
London and Suburban, Ord. ..	1	..	..	¼ — 15/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	19/32 — 23/32	+ 1/32	6 18 9
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	72 — 77 xd	..	5 17 0

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 6th.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	88 — 90 xd	..	4 9 0
London United Trams, 4 % Deb.	100	4	4	57 — 61 xd	..	6 11 2
Metropolitan Railway Consol. ..	100	1⅝	1¼†	46½ — 47	+1	3 9 2
Do. Surplus Lands	100	2¾	2¾†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan District Ord. ..	100	Nil	..	31½ — 32	— ½	Nil
Do. 6 % Deb.	100	6	6	133 — 136 xd	..	4 8 3
Do. 4 % Deb.	100	4	4	90 — 92 xd	..	4 7 0
Do. 4 % Prior Lien	100	4	4	94 — 96	+1	4 3 4
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	80 — 84 xd	..	5 7 2
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70 xd	..	5 14 4
Underground Elec. Railways ..	10	..	..	3¼ — 3½	..	Nil
Do. "A"	1/-	..	..	⅜ — 7/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 — 114	+1	5 5 2
Do. 4½ % Bonds	100	4½	4½	97 — 99 xd	..	4 11 0
Do. 6 % Income	100	6	6	90 — 91	+1½	6 11 10
Yorkshire (West Riding), Ord. ..	5	Nil	..	¼ — ½	..	Nil
Do. 6 % Pref.	5	3	4	3¾ — 4	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	79 — 84	−1	5 7 2

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 11/16 — 4 15/16 xd	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16 xd	..	6 3 11
Do. 4 % Deb.	100	4	4	88 — 90 xd	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Do. 5 % Deb.	100	5	5	97½ — 99½	+ ½	5 0 6
Auckland Trams, 5 % Deb. ..	100	5	5	100 — 102 xd	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	92 — 94 xd	..	4 15 9
Do. 5 % 2nd Deb.	100	5	5	95 — 98 xd	..	5 2 0
Brazilian Traction, Light and Power	$100	[illegible]	6†	83 — 85	..	7 1 2
Brisbane Trams Invt., Ord. ..	5	8	8	7¼ — 7¾	..	5 3 8
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	96 — 99 xd	..	4 11 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	104 — 108	+1	7 8 10
Do. Pref. Ord.	100	6	6	102 — 106	..	5 13 2
Do. 5 % Pref.	100	5	5	102 — 105	..	4 15 3
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 — 104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	92 — 95	..	4 9 6
Calcutta Trams, Ord.	5	7½	5†	6 — 6½	..	5 15 5
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛ xd	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	93 — 96 xd	..	4 13 9
Cape Electric Trams	1	[illegible]	5	21/32 — 23/32	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96 xd	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord. ..	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4⅜d.	[illegible]	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16 xd	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
" Elec. Tr. (1904), Deb. ..	100	5	5	99 — 101 xd	..	4 19 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	79 — 82 xd	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	63 — 66	−2	10 15 4
Do. Gen. Con. 5 % Bonds ..	..	5	5	76 — 80	−1½	6 5 0
Do. 6 % Bonds	100	6	6	75½ — 78½ xd	−1½	7 12 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	5½ — 6	..	8 6 8
Do. 6 % Pref.	5	6	6	4⅛ — 4⅝	— ⅜	6 9 9
Do. 5 % 1st Deb.	100	5	5	93½ — 95½	−1	5 4 6
Perth (W.A.) Elec. Tr., Ord., ..	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½ xd	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94½ — 96½ xd	..	4 13 3
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97½ — 99½ xd	..	4 19 6
Do. 5 % Mort. Bonds	100	5	5	90 — 92	..	5 8 9
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 — 100	..	5 0 0
Singapore Trams, 5 % Deb. ..	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	[illegible]	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video ..	5	7	7	4⅜ — 4⅞	..	7 3 7
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

	*	1912.	1913.			£ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9 — 10	..	4 14 9
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	6 0 0
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96 xd	..	4 13 9
Brompton & Kensington, Ord. ..	5	10	9†	8⅝ — 9⅛	..	4 9 9
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3½ — 4 xd	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 8 0
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97 xd	..	4 12 9
City of London, Ord.	10	9	6†	16½ — 17½	..	5 2 10
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	114 — 118 xd	..	4 4 9
Do. 4½ % Second Deb. ..	100	4½	4½	97½ — 99½ xd	+ ½	4 10 6
County of London, Ord.	10	6	5†	11¾ — 12¼	..	4 18 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	101 — 103 xd	..	4 7 5
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	5/16 — 7/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1½ — 1⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	[illegible]	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0

Hove	5	8	8†	8¾ — 9¼	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	8†	7¾ — 8¼	+ ⅛	4 17 0
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12
London Electric, Ord.	3	2½	..	1⅛ — 1⅜	..	4 12 7
Do. 6 % Pref.	5	6	6	4¾ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4	4†	3¼ — 3¾	..	5 6 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	95 — 98 xd	..	4 11 10
Do. 3½ % Mort. Deb.	Stock	3½	3½	78 — 81 xd	..	4 6 5
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10¼ xd	..	5 11 [illegible]
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord. ..	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref	5	7	7	6⅝ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	81 — 84 xd	..	4 3 4
South London, Ord.	4	5½	..	2⅝ — 3¼	..	6 15 4
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99 xd	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 5/32 — 1 7/32	..	5 14 9
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	1/16 — 3/16	..	..
Do. 5 % Cum Pref.	5	3	..	2⅜ — 2⅞	..	5 4 4
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	+1	5 8 6
Westminster, Ord.	5	10	10†	8¼ — 8¾	..	5 14 8
Do. 4½ % Cum Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 6 10

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 8s. Cash and 2 % in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 6th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6†	5⅛— 5⅜	..	5 11 7
Calcutta, Ord.	5	8½	5†	7⅛— 7⅝	..	5 11 6
Do. 5 % Pref.	5	5	5	4⅞— 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	88½— 90½ xd	..	5 9 8
Canadian Gen. El. Com.	$100	7	8	102 —107	—2	7 9 7
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	7/16— ⅝	..	7 13 0
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88½— 90½	..	6 12 7
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94 xd	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94½— 96½	..	5 8 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32— 3/32	..	Nil
Do. 6 % Pref.	1	6	6†	15/32— 17/32	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	100½—102½ xd	..	4 17 6
Madras, Ord.	5	Nil	..	1¼— 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104 xd	..	4 16 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	63 — 66	—8½	7 11 6
Mexican Lt. & Power, Common	$100	4	4	35 — 40	—4½	10 0 0
Do. 7 % Cum. Pref.	$100	7	7	74 — 79	..	8 17 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	75½— 79½	—1½	6 5 9
Do. 5 % 2nd Mort. Bonds	100	5	5	62 — 67	—4	7 9 3

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 6th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	55 — 60	—3	8 6 8
Montreal, Lt., H. and Power	$100	9	10†	216 —222	..	4 10 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	101 —106	..	5 13 2
Do. 5 % Deb. Stock	Do.	5	5	98 —100 xd	..	5 0 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital	$100	5½	6†	134 —138	+1	4 7 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103½—105½ xd	..	4 14 9
Do. 4½ % Per. Deb.	Stock	4½	4½	96½— 98½	..	4 11 5
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 — 89 xd	..	5 12 4
Victoria Falls Power, Pref.	1	6	6	25/32— 27/32	—1/32	7 2 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 6th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	9/16— 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	⅝— ¾ xd	..	8 0 0
Babcock & Wilcox	1	16	14†	2⅞— 3	+1/16	5 6 8
Do. Pref.	1	6	6	1 5/16— 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 — 1⅛	..	..
Do. 6 % Cum. Pref.	1	6	6	25/32— 29/32	..	6 12 6
Do. 5 % Prior Liens Debs.	100	5	5	92 — 95 xd	..	5 5 0
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	8†	8⅛— 8⅝	+⅜	5 16 0
Do. Pref.	5	6	6	5¾— 6¼	..	4 16 0
Do. Deb.	100	4½	4½	99 —102	—1	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	5	Nil	..	1 1/16— 1 3/16	..	Nil
Do. Deb.	100	4	4	64 — 67 xd	..	5 19 5
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	⅛— ⅜	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80 xd	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	35½— 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27 xd	..	16 13 4
Callender's Cable	5	15	5†	10¾— 11¼	..	6 13 4
Do. Pref.	5	5	5	4 13/16— 5 1/16 xd	+1/16	4 18 9
Do. Deb.	100	4½	4½	95 — 98 xd	..	4 8 6
Castner-Kellner	1	20	22½	2 21/32— 2 27/32 xd	..	..
Do. Deb.	100	4½	4½	104 —107	..	4 4 1

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 6th.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	66 — 71 xd	..	7 0 10
Dick, Kerr	1	Nil	..	5/16— 7/16	..	..
Do. Pref.	1	6	6	23/32— 27/32	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	55 — 59 xd	..	6 15 7
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	½— ⅝	..	7 5 6
Do. Pref.	1	7	7	15/16— 1 1/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6¾— 7¼	..	9 13 2
Do. Deb.	100	5	5	93 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	9⅝— 10⅛ xd	..	5 18 6
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12¾— 13½	..	5 11 1
Do. Pref.	5	4½	4½	4¾— 5	..	4 10 0
Do. Deb.	100	4½	4½	99 —101	—1	4 9 0
India-Rubber, G. & T.	10	7½	7½	11 — 12 xd	..	6 5 0
Do. Pref.	10	5	5	9 — 9¾ xd	..	5 2 7
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98 xd	+2	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	+3	5 16 0
Do. B 4 % Cum. Pref.	100	..	..	48 — 58	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 6th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	6¼— 6½	..	6 18 4
Do. 5 % Deb. Red.	Stock	5	5	93 — 95 xd	..	5 5 0
American Telep. & Teleg., Cap.	$100	8	8	124 —127 xd	..	6 6 0
Do. Collat. Trust	$1000	4	4	87 — 90 xd	..	4 9 0
Anglo-American Telegraph	Stock	3	3	63 — 66	..	4 11 0
Do. 6 % Pref.	Do.	6	6	105½—106½	..	5 13 6
Do. Def.	Do.	30/-	..	24⅜— 24⅞	..	6 0 7
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7 5/16— 7 9/16	..	5 5 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	78 — 80 xd	..	5 0 0
Cuba Telegraph	10	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	10	10	10	14¾— 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	3¼— 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6¾— 7¼	..	6 18 0
Direct United States Cable	10	4	4†	6¼— 6¾	..	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	96 —98 xd	..	4 11 10
Eastern Telegraph, Ord. Stock	Stock	7	7	124 —127	..	5 10 3
Do. 3½ % Pref. Stock	Do.	3½	3½	75— 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 3 4
Eastern Extension	10	7	7	12 — 12½	..	5 12 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust	10	6	6†	10⅝— 11⅛	..	5 7 10
Do. 6 % Pref.	10	6	6	11¾— 12¼	..	4 18 0
Great Northern Telegraph	10	20	5†	30½— 32½	..	6 2 8
Indo-European Telegraph	25	13	5†	57 — 59	..	5 10 2
Mackay Companies Common	$100	5	5	79 — 83	..	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	64 — 68	..	5 17 8

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 6th.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph	1	20	20	3⅜— 3½	+⅛	5 14 3
Do. 7 % Cum. Partic. Pref.	1	17	..	2⅝— 2⅞	+1/16	5 18 3
Monte Video Telephone, Ord.	1	6	6	⅞— 1	..	6 0 0
Do. 5 % Pref.	1	5	5	21/32— 25/32	..	6 8 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98 — 99	+¾	4 11 0
Oriental Telep. and Elec.	1	10	10†	1¾— 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1 1/16— 1 3/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	85 — 87 xd	..	4 12 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	—1	4 1 8
Reuter's	10	10	10†	8¾— 9¾	+½	10 5 2
Submarine Cables Trust	Cert.	6	6	122½—125½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	94 — 96 xd	..	4 13 9
United River Plate Telephone	5	8	6†	6⅜— 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	4⅞— 5⅜ xd	..	4 13 0
West Coast of America	2½	2½	..	1 5/16— 1 7/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1¼	1¼	2¼— 2½	..	5 0 0
Do. 6 % Cum. 1st Pref.	10	6	6	9¾— 10¼	..	5 17 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	96 — 98 xd	..	5 2 0
Western Telegraph, Ltd.	10	7†	7	12⅝— 13⅛ xd	..	5 6 8
Do. 4 % Debs.	Stock	4	4	90 — 92 xd	..	4 7 0
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 5 per cent., October 2nd, 1913.

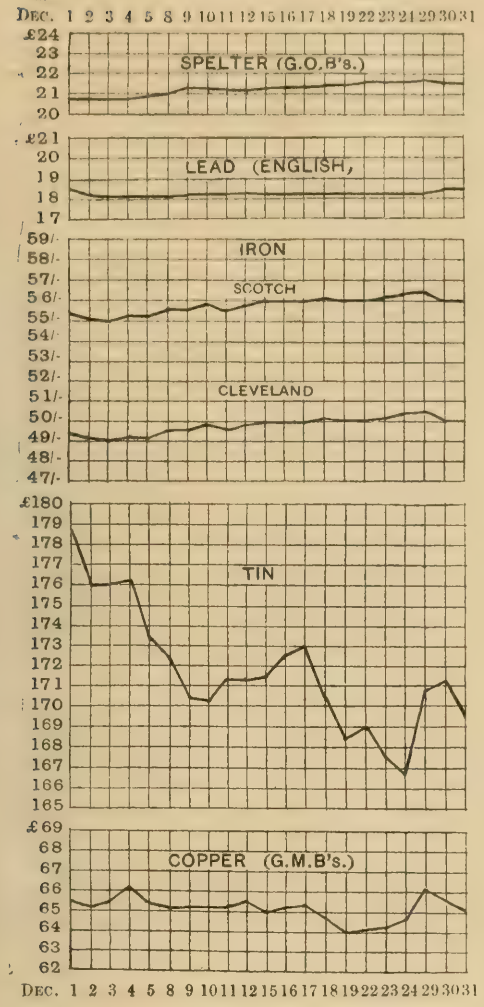
Electric Light Switching Competition.—Those who are interested in the manifold ways of controlling glow lamps by means of tumbler switches, and who wished to improve and afterwards test their knowledge of the subject, would be well advised to consult the issues of our contemporary *Electricity* during this month. This journal is holding a free competition which involves the working of an examination paper; and prizes and certificates will afterwards be awarded to successful competitors.

Works in Canada. — Newspaper reports state that Mr. A. F. Yarrow has purchased eight acres of land and the shipbuilding and repairing plant of Bullen Bros., at Esquimalt, for £60,000, to be a branch of the British firm, and to be known as Yarrows, Ltd.

Patent Application.—Mr. F. H. Tidnam has applied for restoration of Patent No. 4,030, of 1908, for "Improvements in Telegraph Poles."

METAL MARKET.

Fluctuations in December.



Factory Premises in 1913.—In the course of their report on factory and commercial property sales in 1913, MESSRS. LEOPOLD FARMER & SONS state that the sales and letting of factory property, wharves, land, &c., show far better results than was the case in 1912, the continued boom in trade in the industrial world having given a great impetus to the development of the new industries, and the consequent establishment of new works. . . It is difficult to say which branch of any particular manufacture more than any other has progressed in the year 1913. . . Great developments have taken place in . . . engineering, chemical, spinning, motor and rubber trades. The demand for ground floor works largely exceeds the supply, and if capitalists would erect factories and let them as an investment a very good return for their money would be assured, as firms of good standing would willingly pay 8 per cent. on the outlay as rental, and so use the capital in their own business to better advantage. The effects of the Patents and Designs Act are still well to the front, a sum amounting to about £2,000,000 having been expended in the acquiring of land, building of factories, and plant and machinery equipment, and the consequent employment of some thousands of workpeople. Foreign holders of English patents are still on the look-out for factory property to comply with the requirements of the Act, and several areas in and around London and the provinces have been developed in consequence of the establishment of important industries which give employment to thousands, and additional rates to local and other attendant authorities. The outlook ahead for further deals in factory property is good, as there is every likelihood of a continuance of prosperous activity in the industrial world.

SOME NOTES ON ELECTRIC SIGNS.

By G. BASIL BARHAM, A.M.I.E.E.

THE subject of electric signs has recently been attracting considerable attention not only in this country but also in the United States, where signs are used, as everyone is aware, to a much larger extent than they are in England.

Comparatively few electrical contractors appear alive to the fact that the by-laws for the regulation of lamps, signs or other structures overhanging the public way, under the London Building Act, 1894, Sec. 164, made by the Building Acts Committee of the London County Council, deal exhaustively with the subject of electric signs, and whilst there is no doubt that manufacturers of these appliances are acquainted with the regulations, it is more than probable that there are many contractors who are unaware that there have been any recent enactments made regarding their use.

The by-laws are of sufficient importance to warrant their being dealt with at some length. It must be remembered, however, that they only apply to the district governed by the London County Council, and are not in force in the City of London itself, nor in any part outside the area of the Metropolitan Borough Councils.

The first is to the effect that after the date at which these by-laws come into force no person shall fix or fit any lamp or structure supporting or carrying a lamp, or retain any lamp or structure carrying it so as to overhang the footpath at a less height than 8 ft., or nearer to the roadway than 2 ft. 6 in. from the edge of the curb, or projecting more than 5 ft. from the wall or other part of the premises to which it is fixed.

After the date at which these by-laws come into operation no one shall fix any lamp which exceeds 3 ft. in any part when measured in any direction horizontally, including framework and ornaments, or which, including framework and ornaments, exceeds 5 ft. in height, or which weighs more than 84 lb., or retain any such lamp so fixed after such date so as to overhang the public way. Any lamp which may be fixed according to this by-law shall be provided with a second means of support, of sufficient strength to sustain safely the whole weight of the lamp against falling away from its support.

After these by-laws come into operation, no one shall fix any sign or structure supporting or carrying a sign, or retain any sign or structure supporting a sign, so as to overhang the public way so that any part of such sign or structure shall be at a less height than 8 ft. clear above the surface of the footway immediately under such sign or structure, or nearer to the carriage way than 2 ft. 6 in. from the outer edge of the curb or projecting more than 4 ft. from the wall or shop front of the premises or other support to which it is attached.

Further, if any such sign or structure shall extend more than 2 ft. (not including stays or support) along the face of the wall, shop front or support, then it shall not project more than 2 ft.

After these by-laws come into operation no one shall fix any sign or structure which exceeds 2 ft. 6 in. in height, or extends more than 6 ft. in any direction (not including stays or support) along the face of the wall or shop front of any premises, or retain any sign so fixed so as to overhang the public way.

A person shall not fix any lamp or sign until two clear days' notice, in writing, of his intention has been given to the local authority.

The County Council apparently does not wish to act in any arbitrary manner in connection with these by-laws, for it reserves the right, after consulting with the local authority in whose area the case may arise, to dispense with the observance of all or any of these by-laws.

It may be mentioned that any person who commits any offence against any of the foregoing by-laws will be liable to a penalty not exceeding £5, and a daily penalty of 40s. for every day during which such offence continues after conviction.

These by-laws do not apply to any balcony, shelter, covered way or other projection overhanging the public way not being a lamp, sign or structure within the meaning of these by-laws which has been, or shall at any time hereafter, be duly sanctioned by the London County Council, under the London Building Acts, or any other statute in that behalf.

Nor do they apply to any lamp or structure supporting the same overhanging the public way, which may be fixed at not less than 7 ft. 6 in. clear above the surface of the footway, and so as not to project from the line of the window frame of the shop more than 3 ft., nor nearer the carriageway than 2 ft. 6 in. from the outer edge of the kerb, and which is solely for the purpose of illuminating such windows from without, the lamp itself not to exceed 36 in. in height, 24 in. in width parallel to the face of the building, and 24 in. in depth from front to back of lamp, including any ornamentation.

It will be evident from the above that electrical contractors, at any rate those in the area governed by the London County Council, will have to give careful consideration to every order for electric sign work which they receive, to make certain that they are not unwittingly infringing any of the new by-laws. But it must be admitted that the London County Council has not pressed unduly as regards its requirements, and there are few who will refuse to admit that some regulations relating to the fixing of electric and other signs were becoming desirable.

Turning from the contractor's side of the electric sign business to that of the manufacturer, it appears that a situation has arisen which deserves the earnest consideration of both manufacturer and retailer. Manufacturers are, it may be unwittingly, continually asked for sketches and designs for signs for both contractors and central-station men, frequently in cases where there is little or no prospect of business resulting. No maker objects to sending more or less complete drawings for electric signs suitable for business purposes when there is a fair prospect of an order being obtained. It is part of his work, and speculative though it may be, he regards it philosophically, and is quite prepared to run the risk of hearing that the design was unsuitable, or that the order has gone elsewhere. But there are limits, and in the words of one manufacturer published in a recent issue of "Signs of the Times," a great many new-business department managers of lighting companies seem to think that the way to keep busy is to determine in their minds that "Jones" ought to have an electric sign, and then go back to the office and write a circular letter which is sent to every sign manufacturer in the country giving the various details, and asking for sketches, photographs, &c., and when these sketches all arrive, it is possible that Jones will turn down the entire proposition on the first interview. The "new-business" man is aware of the fact that it does not cost him or his company a single dollar to try to wake up Jones, and in the meantime the manufacturer has contributed materially to the apparent activity.

It may be that there is a certain element of exaggeration in the letter quoted, but that there is a great deal of truth in it cannot be denied. Owing to the introduction of the high-efficiency metal-filament lamps central stations are compelled to make every effort to secure new business, but it must be admitted that it is not fair for them to saddle manufacturers with the whole of the expense connected therewith. In many ways the policy is short-sighted and not calculated to make for the best interests of the industry. Every maker penalised in that way is forced to look on the matter from a business point of view, and add the necessary percentage to the cost of those signs which he does sell. In this way the price is unduly inflated, and this affords an opening to those makers who make use of a rival illuminant. Commenting on the position, the *Electrical Review and Western Electrician* points out that in some of the larger central-station companies where electric-sign departments are maintained, preliminary sketches to be used primarily for stimulating business can be worked up by a central-station employé without the aid of the manufacturers. It seems, also, that electric-sign manufacturers could supply central stations with an assortment of designs of signs that have already been installed, covering the usual classes of sign prospects. These designs, of course, would only be used in preliminary soliciting to create an interest in electrical advertising and to gain, if possible, some idea of the requirements to be fulfilled.

When a *bona fide* prospect has been developed the sign manufacturers are certainly willing to furnish sketches and all necessary data, but here, again, a practice has developed that imposes a burden on the manufacturer, and consequently militates against the fullest development of the industry. Sign manufacturers are at one in complaining against the practice of central stations in calling for sketches from every sign manufacturer when only one order can be given. It frequently happens, also, that the lighting company receives from one manufacturer a design that is satisfactory and is accepted by the prospect, and sends this design, or a copy of it, to every other manufacturer, to see if the construction cannot be cheapened. Certainly this is unfair, and central-station companies should co-operate at least in so far as to give the sign manufacturer an opportunity to suggest something that is satisfactory to the prospect without submitting sketches of one maker to his competitors.

With this conclusion everyone will be disposed to agree, and better co-operation between central stations and manufacturers of electric signs would probably end the whole difficulty. Neither party appears to have quite realised the position of the other, and as the desire of both is to stimulate the demand for electric signs, and so improve the revenue of the station, with a resulting profit to the manufacturer, it would seem that there should be little difficulty in bringing about a better position of affairs. There are, of course, a number of central-station men who fully appreciate the position of the sign maker, and do not burden him unnecessarily in the manner mentioned. The manufacturer is, and always has been, ready to engage in what has been called missionary work, but he should not be asked to engage in this to such an extent as is at present the case.

In connection with the electric sign business in the United States, the manufacturers have organised a National Association, and in view of the foregoing remarks it will be interesting briefly to set forth its objects, which have been summarised as follows:—

1. To combat hostile sign legislation, local and general; to change unfair and restricted city ordinances pertaining to electric signs; and to oppose taxes and licences on signs.
2. To disseminate a knowledge of the benefits of electrical advertising. (This will be accomplished by means of advertisements, photographs and write-ups in the popular magazines, trade papers, and through the Press Associations.)
3. Generally to promote the welfare of its members.
4. To obtain a bureau in charge of the secretary which shall guard members of the Association against employing agents or salesmen who have proved dishonest with other companies.
5. To establish an Association standard for high quality of material, workmanship and design, and to impress on the public the merit of "Association standard" goods.
6. To combat the growing evil of stealing sketches and matching prices.

Few will be disposed to cavil at any of these suggestions, and it might well be that some similar organisation in this country would be of lasting benefit to all concerned.

Proposed Liverpool Tube Railways.—A scheme is on foot with a view to solving the traffic problem in Liverpool and district. On behalf of a wealthy American syndicate, the Liverpool Corporation and the neighbouring municipalities, the Mersey Tunnel Railway Co., the Overhead Railway Co. and other interests are being approached with a view to ascertaining what attitude they will adopt towards an extensive scheme for underground railway connection. Though the matter has not yet been "formally" presented to the authorities concerned, the proposal is, in broad outline, that an offer might be made to purchase the Mersey Railway on terms advantageous to all shareholders who might consent to sell their holding. Branch lines connected with the Central (Low Level) Station would be constructed so as to serve a wide area on both the Lancashire and Cheshire sides. As an important link there would be constructed a circular line connecting at low level the L. & N.-W., the Cheshire Lines and the Lancashire and Yorkshire termini. On the Cheshire side of the Mersey, a complete electrification of existing and proposed Wirral Peninsular Lines would be promised if terms of purchase or leasing of the former could be arranged. The whole of Wallasey would gain an electric railway service, while by means of two loop lines West Kirby and Neston would be reached. An electrical extension of the present line from Rock Ferry to Chester would, no doubt, be a natural further development.

TRADE STATISTICS OF CANADA.

The following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ended March 31st, 1913, are taken from the recently issued trade statistics. Figures for the year 1911-12 are given for purposes of comparison, and notes of any increases or decreases have been added:—

	1911-12. Dollars.	1912-13. Dollars.	Inc. or dec. Dollars.
Brass wire, plain.—			
From United Kingdom...	7,000	7,000	—
,, United States ...	31,000	67,000	+ 36,000
Total ...	38,000	74,000	+ 36,000
Railway passenger cars.—			
From United States ...	208,000	303,000	+ 95,000
Tram or horse cars.—			
From United States ...	5,000	2,000	— 3,000
Copper wire, plain, tinned or plated—			
From United Kingdom...	4,000	1,000	— 3,000
,, United States ...	72,000	105,000	+ 33,000
Total ...	76,000	106,000	+ 30,000
Electric light carbons and carbon points.—			
From United Kingdom...	8,000	4,000	— 4,000
,, Germany ...	17,000	24,000	+ 7,000
,, United States ...	29,000	41,000	+ 12,000
,, Other countries ...	2,000	2,000	—
Total ...	56,000	71,000	+ 15,000
Electric apparatus not mentioned—insulators, batteries, telegraph and telephone instruments.—			
From United Kingdom...	544,000	987,000	+ 443,000
,, Austria	6,000	2,000	— 4,000
,, France	8,000	13,000	+ 5,000
,, Germany	29,000	77,000	+ 48,000
,, Sweden	65,000	50,000	— 15,000
,, United States ...	3,975,000	5,849,000	+1,874,000
,, Switzerland ...	2,000	2,000	—
,, Other countries ...	6,000	6,000	+ 10,000
Total ...	4,635,000	6,996,000	+2,361,000
Incandescent lamp bulbs, etc.—			
From Austria	17,000	25,000	+ 8,000
,, United States ...	99,000	111,000	+ 12,000
,, Other countries ...	5,000	10,000	+ 5,000
Total ...	121,000	146,000	+ 25,000
Electric motors, generators, dynamos and sockets.—			
From United Kingdom...	76,000	193,000	+ 117,000
,, France	2,000	4,000	+ 2,000
,, Sweden	30,000	68,000	+ 38,000
,, United States ...	871,000	1,313,000	+ 442,000
,, Other countries ...	4,000	16,000	+ 2,000
Total ...	983,000	1,584,000	+ 601,000
Lamp chimneys, glass shades and globes.—			
From United Kingdom...	4,000	8,000	+ 4,000
,, Austria	13,000	18,000	+ 5,000
,, Germany	30,000	35,000	+ 5,000
,, United States ...	275,000	361,000	+ 86,000
,, Other countries ...	1,000	3,000	+ 2,000
Total ...	323,000	425,000	+ 102,000
Rubber belting.—			
From United Kingdom...	36,000	15,000	— 21,000
,, United States ...	47,000	109,000	+ 62,000
Total ...	83,000	124,000	+ 41,000
Manufacture of india-rubber and gutta-percha, except clothing and similar goods.—			
From United Kingdom...	155,000	218,000	+ 63,000
,, Austria	8,000	12,000	+ 4,000
,, France	4,000	8,000	+ 4,000
,, Germany	48,000	60,000	+ 12,000
,, United States ...	645,000	753,000	+ 108,000
,, Other countries ...	1,000	—	— 1,000
Total ...	861,000	1,051,000	+ 190,000
Locomotives for railways.—			
From United Kingdom...	8,000	2,000	— 6,000
,, United States ...	407,000	784,000	+ 377,000
,, Other countries ...	—	1,000	+ 1,000
Total ...	415,000	787,000	+ 372,000

	1911-12. Dollars.	1912-13. Dollars.	Inc. or dec. Dollars.
Gasoline engines.—			
From United Kingdom ...	189,000	107,000	— 82,000
,, United States ...	1,935,000	3,301,000	+ 1,366,000
,, Other countries ...	15,000	6,000	— 9,000
Total ...	2,136,000	3,411,000	+ 1,275,000
Steam engines.—			
From United Kingdom...	47,000	117,000	+ 70,000
,, United States ...	230,000	459,000	+ 229,000
Total ...	277,000	576,000	+ 299,000
Boilers, Steam.—			
From United Kingdom...	74,000	74,000	—
,, United States ...	162,000	323,000	+ 161,000
Total ...	236,000	397,000	+ 161,000
All machinery not mentioned, except sewing machines, textile machinery, printing machinery, &c.—			
From United Kingdom...	1,713,000	2,015,000	+ 302,000
,, France ...	6,000	7,000	+ 1,000
,, Germany	203,000	209,000	+ 6,000
,, United States ...	13,331,000	17,485,000	+4,154,000
,, Other countries ...	111,000	73,000	— 38,000
Total ...	15,364,000	19,789,000	+4,425,000
Iron and steel wire, single or several, covered with cotton, linen, silk, rubber, or other material, including cables so covered.—			
From United Kingdom...	229,000	434,000	+ 205,000
,, United States ...	426,000	774,000	+ 348,000
,, Other countries ...	8,000	12,000	+ 4,000
Total ...	663,000	1,220,000	+ 557,000
Iron and steel wire not mentioned (except fencing wire).—			
From United Kingdom...	13,000	16,000	+ 3,000
,, Germany	49,000	6,000	— 43,000
,, United States ...	218,000	301,000	+ 83,000
,, Other countries ...	8,000	1,000	— 7,000
Total ...	288,000	324,000	+ 36,000
Lighting fixtures of metal, including electric light fixtures of metal.—			
From United Kingdom...	34,000	51,000	+ 17,000
,, Austria	3,000	4,000	+ 1,000
,, United States ...	562,000	709,000	+ 147,000
,, Other countries ...	10,000	17,000	+ 7,000
Total ...	609,000	781,000	+ 172,000
Asbestos manufactures.—			
From United Kingdom...	43,000	44,000	+ 1,000
,, United States ...	298,000	443,000	+ 145,000
,, Other countries ...	9,000	10,000	+ 1,000
Total ...	350,000	497,000	+ 147,000
Plumbago, ground and manufactured.—			
From United Kingdom...	4,000	8,000	+ 4,000
,, United States ...	35,000	50,000	+ 15,000
Total ...	39,000	58,000	+ 19,000

EXPORTS.

	1911-12. Dollars.	1912-13. Dollars.	Inc. or dec. Dollars.
Mica.—			
To United Kingdom ...	40,000	37,000	— 3,000
,, United States ...	218,000	282,000	+ 64,000
,, Other countries ...	—	2,000	+ 2,000
Total ...	258,000	321,000	+ 63,000
Electrical apparatus.—			
To United Kingdom ...	16,000	12,000	— 4,000
,, Newfoundland ...	5,000	9,000	+ 4,000
,, United States ...	110,000	188,000	+ 78,000
,, Other countries ...	7,000	7,000	—
Total ...	138,000	216,000	+ 78,000
Machinery.—			
To United Kingdom ...	70,000	66,000	— 4,000
,, Newfoundland ...	35,000	112,000	+ 77,000
,, New Zealand ...	3,000	5,000	+ 2,000
,, Argentina	33,000	25,000	— 8,000
,, France	10,000	20,000	+ 10,000
,, United States ...	461,000	806,000	+ 345,000
,, Other countries ...	75,000	68,000	— 7,000
Total ...	687,000	1,102,000	+ 415,000

THE ELECTRICITY SUPPLY OF LARGE CITIES.

By PROF. G. KLINGENBERG, Dr. Ph.

(Concluded from page 39.)

THE foregoing calculations were carried out on the assumption that a new power station would be erected in the vicinity of the city supply area. The question that remains to be examined is whether greater advantages could be obtained by erecting the new power station at coal mines, and transmitting the energy to the city by long-distance transmission lines. A general investigation does not appear to indicate promising results.

TABLE VI.

c.s. = centishillings.

	Before reconstruction.	*After reconstruction.*
Available capacity at sub-stations or outgoing feeders...	126,000 KW.	126,000 KW.
Number of power stations ...	25	4
Installed output of new power station	—	83,000 KW.
Installed output of old power stations	—	46,000 KW.
Feeder cable losses per KW.-hour sold	—	0·041 KW.-hour
Total efficiency of transmission-system = KW.-hours sold ÷ KW.-hours generated	0·788	0·788
Total load factor of power stations	24·9 per cent.	24·9 per cent.
Total reserve factor	1·61	1·25
Total utility factor	0·122	0·156
Energy sold per kilowatt installed and per year	1,069 KW.-hours	1,370 KW.-hours
Energy supplied from old stations, eight months' service, n = 0·156	—	333 KW.-hours
ditto. from the new power station	—	1,037 KW.-hours
Utility factor of old power station, n	—	0·156
ditto. of large power station, n	—	0·186
Working costs per KW.-hour supplied to low-tension network :—		
New power station (incl. 10 per cent. capital charge) ...	—	4·878 c.s.
Old power stations (excl. capital charge)	—	3·820 ,,
Capital charges on the 25 old power stations (8 per cent. as hitherto)	—	3·874 ,,
Average price per KW.-hour supplied	9·440 c.s.	8·510 ,,
Low-tension network losses per KW.-hour sold...	0·268-KW.-hour	0·229-KW.-hour
Costs for losses	2·480 c.s.	1·940 c.s.
Working costs (incl. capital charge, 8 per cent. as hitherto)	7·610 c.s.	5·966 c.s.
Total costs (incl. capital charges) per KW.-hour sold	19·530 c.s.	16·416 c.s.
Capital	183,830,000s.	218 010,000s.
Energy sold per annum, KW.-hrs.	135,000,000	172,000,000
Annual revenue	26,400,000s.	33,600,000s.
,, expenses	26,400,000s.	28,400,000s.
Available surplus	—	5,200,000s.

With regard to the constants, I have taken normal values adapted as far as possible to London conditions.

Basis for the Comparison of Local and Distant Power Stations.—Difference in price of coal delivered free at bunkers, 3s. 6d. per ton; price of coal free at bunkers, distant power station, 7s. per ton. Installation costs of power station—At the mine, 170s. per KW.; near the city, 210s. per KW.; max. output at end of line, 80,000 KW.

There will be no essential alterations in the results of the comparison if, in place of 80,000 KW., two or three times this value is taken, as this merely entails an alteration of the absolute value while the relative figures remain approximately the same.

For the long-distance transmission I have selected three-phase current at 50 cycles, with a line pressure of 100,000 volts, both for overhead and cable transmission.

I would propose purchasing a strip of land 15 metres wide for each line of masts at an average price of 300s. per ha. (= 2·47 acres). It is necessary to provide two rows of masts, to allow for repairs, whereas with single-phase cables one cable per circuit suffices as a reserve, provided it can be put into commission without interrupting the supply. The main step-down station must be placed on the outskirts of the city, unless 100,000-volt cables are used for taking the energy into the city.

The comparison includes the plants up to the feeding points of the 20,000-volt ring mains (see fig. 4, p. 39), as from this point the systems and methods of working are the same for all cases. The distance from the mines is taken as 100 km., 150 km., 200 km. and 250 km. respectively. The costs then work out approximately as follows:—

A. *Local Power Station.*

1. Power station : 83,000 KW.	...	17,430,000s.
2. Feeder cable : 20,000-volt	...	5,000,000s.
		22,000,000s.

B. *Distant Power Station with Overhead Transmission. Installation Cost in Shillings.*

Distance.	Power station.	Overhead transmission.	Main step-down station.	Feeder cable.	Total.
100 KM.	15,640,000	4,700,000	1,700,000	5,000,000	27,040,000
150 ,,	15,980,000	7,050,000	1,700,000	5,000,000	29,730,000
200 ,,	16,150,000	9,400,000	1,700,000	5,000,000	32,250,000
250 ,,	16,320,000	11,750,000	1,700,000	5,000,000	34,770,000

Distant Power Station with Cable Transmission. Installation Cost in Shillings.

Distance.		Power station.	Cable transmission.	Main step-down station.	Total.
100 KM.	...	14,620,000	10,470,000	1,700,000	26,790,000
150 ,,	...	14,960,000	15,915,000	1,700,000	32,575,000
200 ,,	...	15,300,000	21,580,000	1,700,000	38,580,000
250 ,,	...	15,640,000	27,400,000	1,700,000	44,740,000

The results of the comparison for some of the foregoing cases have been tabulated in fig. 5, which shows the comparison between a local power station and a distant power station with overhead transmission, the values including 10 per cent. for the capital charges on the power station and sub-stations, and 8 per cent. for the overhead transmission line and cable. The calculations prove that the working costs with cable transmission are higher than with overhead transmission at low utility factors, and that with the utilisation of about 50 per cent. they are practically equal. The curves further show that under the assumptions made, the local station can be operated more cheaply than the distant station. The operating costs of the former, however, rise towards those of the distant station, and from a utility factor of 30 per cent. upwards, exceed them in succession at 100, 150, 200 and 250 km. transmission distances.

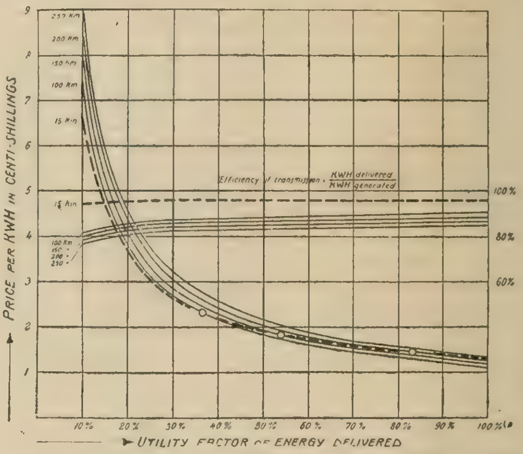


FIG. 5.—COMPARISON OF TOTAL WORKING COSTS BETWEEN LOCAL AND DISTANT POWER STATIONS, WITH OVERHEAD LINE TRANSMISSION.

The comparison has shown that under certain conditions, namely, with coal freight at 3s. 6d. per ton and with a normal utility factor, it would be cheaper to operate a power station situated near the city than one at the coal mines. I do not, however, look upon the difference as sufficient to decide so important a matter as the locality of the power station. There are other considerations of a more general nature that have a considerable bearing on the point at issue.

A Report on Companies.—From the annual report mentioned in our leaderette last week, it appears that two applications for leave to pay interest out of capital during construction, under Sec. 91, were made to the Board of Trade during 1912. In one case the application was sanctioned, and in the other case it was withdrawn. It is somewhat surprising that the powers vested in the Board of Trade under Sec. 112 of the Act of 1908, to appoint an auditor, if an appointment of auditors is not made at the annual general meeting of the company, had to be exercised in seven cases during the year. After allowing for a net increase of 2,926 companies during the year, there were some 52,000 companies on the register for England and Wales. Proceedings had to be taken by the Board in some cases to enforce returns being made to the Registrar of Joint Stock Companies, and against liquidators to enforce the filing of accounts, and in three cases to enforce the payment of undistributed funds into the companies' liquidation account.

THE EMPLOYMENT OF POWER IN H.M. POST OFFICE.

By H. C. GUNTON, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at* {*Manchester, December 16th, and London, December 18th,* 1913.)

UNTIL recently the energy for power and lighting in London and seven of the larger provincial towns has been supplied from small power houses situated in the basements of the Post Office buildings, and some of these stations have been in existence for about 20 years. In the metropolitan area two of these old power houses have recently been replaced by the new electric power system, which at present includes a main generating station on the south side of the river, near Blackfriars Bridge, and three sub-stations in basements at King Edward Building, G.P.O. West, and Carter Lane.*

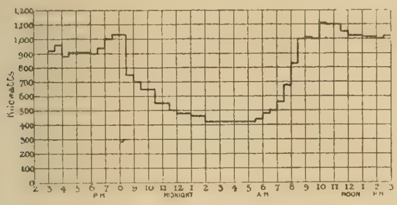
Electric power is generated as three-phase alternating current, with a frequency of 50 periods per second, and at a pressure of 6,600 volts, and transmitted at this pressure to the three sub-stations, where it is transformed down for the supply of the lighting and power circuits.

At G.P.O. West sub-station the three-phase supply is converted to continuous current at 440 and 220 volts, in conjunction with a storage battery; in the event of temporary interruption to the E.H.T. supply from the power house, the battery will for a considerable time not only maintain the supply to the continuous-current circuits, but will also, by running the motor converters reversed, automatically maintain the pressure on the E.H.T. bus-bars at the other two sub-stations, and so enable the transformers to maintain the alternating current supply.

The normal full-load capacity of the main generating plant, including spares at the power house, is 2,500 KW.

Although the present output is small, the extremely favourable character of the load curve (fig. 1) has enabled a supply of energy to be given for all purposes at an inclusive cost of about 1½d. per unit delivered.

As regards the provincial stations, arrangements have been made in several instances to change over to the local municipal supplies. In some instances, to obtain a low price, a battery has been installed to improve the load factor, at the same time providing a standby against emergency.



Load factor = 73·4 per cent. Running plant load factor = 80·1 per cent.
Average power factor = 0·98 lagging.

FIG. 1.—DAILY LOAD CURVE (APRIL 25TH, 1913) OF G.P.O. POWER STATION AT BLACKFRIARS.

Pneumatic tubes, which have been used in London since 1871, have since been installed in almost every telegraph office of appreciable size in the kingdom. Usually, electrically-driven pumps are employed, with automatic regulation, electrically-operated valves devised by the P.O. staff, having given the most satisfactory results. In some cases the air drawn from the vacuum mains is compressed for the pressure service, as, *e.g.*, at the G.P.O.; when this is done, precautions have to be taken against drawing in gas through leaky street tubes. Rotary blowers serve for the house tube systems. About 5 to 5½ H.P. is required to work a 2¼-in. tube 1 mile long continuously at 10 lb. pressure, the time occupied in the transit of the carrier being 2¼-2½ minutes. Vacuum working at 7 lb. below atmosphere requires less power in the ratio of 1·83 : 1. Tubes are in use in London up to 4,180 yards in length, 3 in. in diameter. The power consumed in maintaining the passage of carriers at intervals of 5 to 10 sec. in a 1½-in. tube system of a total length of 650 ft. is only ⅕ KW.

Pneumatic power has recently been employed in a trunk telephone exchange for distributing, between certain points in the exchange, the tickets on which are entered particulars of the trunk connections required. Instead, however, of using tubes of circular section and carriers, the tubes are of rectangular section 2⅝ in. × ⅜ in. and the tickets are propelled through them by means of a folded end at right angles to the remainder of the ticket, which practically serves as a sail. The tickets are conveyed from various operators to a distributing centre by vacuum, and are thence dispatched by pressure to other operators; at the distributing centre the tickets are discharged without destroying the vacuum, by means of two electrically-driven rollers which, except during the passage of the ticket, are kept in contact by springs on their axles. The tickets are also inserted in the vacuum tube by means of an arrangement which reduces the opening to the atmosphere to a minimum. The dispatch from the distributing centre is effected by placing the ticket in a receptacle and afterwards applying the pressure by means of a valve actuated by a plunger which also lights a signal lamp. The ticket on being discharged strikes a lever, breaking a contact which has the effect of de-energising the electromagnet in connection with the pressure valve, and so cuts off the pressure from that particular tube and extinguishes the lamp.

The P.O. Engineering Department has installed and maintains 207 electric lifts of various types, D.C. and A.C., three, two and one-phase. The cost of maintenance of electric and hydraulic lifts is taken to be about the same. The possibility of accident is reduced to a minimum with modern electric lifts, and there has not been a single fatal accident with an electric lift installed by the P.O. By proper adjustment of the controller, material economy in time and energy consumption can be effected. Fig. 2 shows a comparison between the costs of electric and hydraulic lifts, and fig. 3 shows the annual cost with reference to the number of round journeys per annum. The curves show the critical number of journeys per annum, for which the annual charges, inclusive of all costs, are the same for both types of lift, under different conditions of travel.

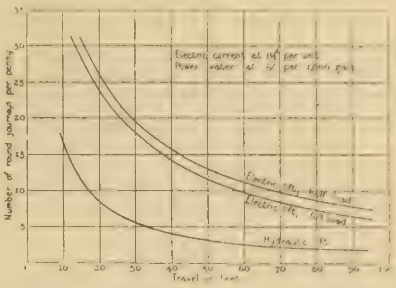


FIG. 2.—COMPARISON BETWEEN ELECTRIC AND HYDRAULIC LIFTS OF 20-CWT. CAPACITY AND SPEED OF 200 FT. PER MINUTE. ELECTRIC SUPPLY THREE-PHASE 50 ~ 440 VOLTS.

In the sorting offices in the larger postal centres electrically-driven ropeways, band conveyors, stamping machines, &c., are employed, and experiments have recently been made with a view to the mechanical transport of correspondence practically right through an office. Trials made at Liverpool indicate that a substantial saving of time will be effected. All the apparatus is electrically driven. In the telegraph instrument rooms at Birmingham an experimental installation of mechanical selective conveyors for telegram forms has been fitted up, with electrical driving.

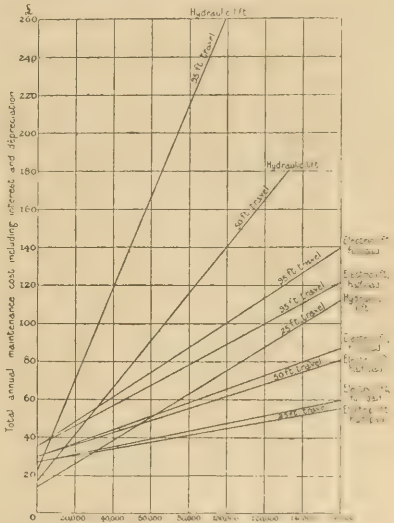


FIG. 3.—COMPARISON BETWEEN ELECTRIC AND HYDRAULIC LIFTS; INTEREST AND DEPRECIATION, 6 PER CENT.

The Post Office engineers have some 600 installations of heating plant to maintain, as well as all the mechanical ventilating systems. In telephone exchange switch rooms, where the high switchboards interfere with the natural circulation of the air, most satisfactory results have been obtained by installing suspended fans of the revolving type between the switchboards to circulate the air, in addition to fans in the windows for the extraction of air. In one particular case where natural ventilation is difficult, an ozone plant has been installed, with successful results.

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* The installation was fully described in the ELECTRICAL REVIEW, November 18th and 25th, 1910.

Several types of machines for cleaning mail-bags have been tried, the most satisfactory results being obtained with the type installed at the King Edward building, which is driven by an electric motor. The charge of bags is rendered completely clean in about 20 minutes, the total capacity of the plant being about 400 bags per hour.

A large amount of plant is in use in connection with central battery telephone exchanges, motor-generators and accumulators being almost exclusively used for this purpose. The generators are specially designed to give silent working when supplying the telephone-exchange circuits direct without any battery in circuit. Their chief features are ring-wound armatures with a large number of commutator segments, uniform distribution of the field, good balancing both mechanically and electrically, good commutator surface and a special type of high-conductivity brushes; large choke coils of special design are also used in conjunction with the machines, which are built in sizes from 1 to 40 KW. Upwards of 40 exchanges had to be equipped very rapidly in connection with the taking-over of the National Telephone Co.'s system.

In 1912-13 850 offices were electrically lighted, using the equivalent in terms of 8-C.P. lamps of 380,439 metallic-filament and 20,345 carbon-filament lamps, an increase of 258 offices and 78,609 8-C.P. lamps on the previous year. An annual saving of £8,000 has been effected by substituting metal for carbon-filament lamps, after allowing for the increased cost of renewals. About 4,300 KW. is used for lighting. Clusters of metal-filament lamps in fittings with opalescent shades have proved very satisfactory, the walls and ceilings having dull white or cream surfaces, and large windows being provided with light blinds. For sorting tables 2-3 foot-candles are necessary, 3 ft. above floor level; somewhat less illumination serves for instrument rooms, 1-2 c.-ft. for offices and trunk telephone exchanges, and 1-1·5 for loading platforms and ordinary telephone exchanges.

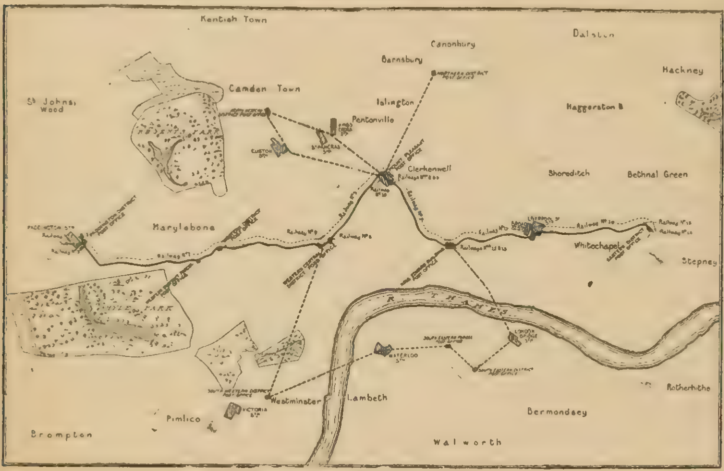

FIG. 4.—POST OFFICE (LONDON) RAILWAY.

Powers have been obtained to construct an electric railway for postal purposes from East to West London, as shown in full lines in the map (fig. 4), the dotted lines showing the ultimate extensions contemplated. The railway will consist of two tracks each of 2-ft. gauge, in a single tunnel 9 ft. in diameter. Mr. Dalrymple Hay is responsible for the tunnelling, and the Engineer-in-Chief of the Post Office for the equipment. The trains will be operated without drivers, on the remote-control system.

The proposed system of control may be briefly described as being generally similar to the power-operated point and signal systems adopted for modern railway undertakings, but with the signal element replaced by the application of current to the track. It is considered that it is only by such a system of complete interlocking that a remote-control electrical railway of this scope can be safely operated

With a view to reducing human labour and the delays connected with double handling, trials are at present being made with an electric truck equipped with an Edison battery (see ELECTRICAL REVIEW, Vol. 73, p. 342). This truck, which weighs only about 25 cwt. including a load of 10 cwt., is intended for use more particularly at offices that are in close proximity to railway stations. The control is sufficiently safe and flexible to meet the conditions of a crowded platform, while slopes as steep as 1 in 10 can be negotiated.

Trials of the truck, which is equipped with 42 B4 cells, have been carried out and the following results have been obtained :—

Voltage before run (half battery)	30 volts
Voltage after run (half battery)	20 "
Total number of journeys	160 "
No. of miles	25 "
No. of units used for charging	7·3 "
No. of watt-hours per ton-mile	225 "

Experiments are also being made with electrically-equipped vans for collecting purposes.

DISCUSSION AT LONDON.

MAJOR O'MEARA, in opening the London discussion, referred to the field of unskilled labour in transportation, with which the paper dealt; much of the plant was not really new, such as might be installed to start now, such as, for instance, the pneumatic tubes, which were rather slow. He complimented the author on the sortation system at the G.P.O.

MR. C. H. WORDINGHAM asked for information on the subject of standardisation, the working of the battery sub-station, lifts and fans employed. He also inquired as to the effect of ozone apparatus.

MR. W. SLINGO referred to the wide sphere of engineering covered by the Post Office administration. The proposed P.O. tube railway would certainly be a remunerative undertaking, otherwise the scheme would not have been proposed. The Post Office did not manufacture anything which it could get made for it; one machine was made and proved, and definite specifications were then issued for it. Cable makers were now carrying out complete contracts for making and laying, and he hoped the results would justify them in contracting for the laying, which used to be done by the P.O. staff.

MR. J. S. HIGHFIELD said it would appear that the cost of electric supply must be a minor proportion of the total cost of P.O. service, and that security was of more importance than cost, in which case isolated plants were really safer than the present arrangement of a distant generating station, with which the battery was the only safeguard.

MR. PERKINS said the Eastern Telegraph Co. had recently leased from the P.O. some 4½ miles of pneumatic tubes, and while these worked very well, it was found that occasionally the observation window in the valve was broken and the air was then lost for some time; the switch also cut the felt of the carriers. The introduction of band carriers for telegrams had greatly facilitated their work.

MR. ROGER SMITH was interested in the figures for electric and hydraulic lifts, which would only be obtained from extended experience. The conveyor was the only lifting machine giving about 100 per cent. load factor (the power did not vary much whether loaded or not), and it should be supplied at a much cheaper rate than was usual. Regarding electric trucks, the great difficulty was to charge them on a commercial circuit. What one wanted was for the ordinary user to be able to plug his cells on to a commercial circuit for any odd quarter of an hour. The batteries were generally some odd voltage, such as 60 or 40.

Another speaker criticised the air system for the pneumatic tubes. The fixed lights and low candle-power employed in lighting seemed awkward, and he thought hydraulic power was more reliable and equally as applicable as electric.

MR. GUNTON, in the course of an extended reply, said efforts were being made to standardise as far as possible. One speaker had asked about electric cooking, and he thought they might make a case for it if the price of energy were lower, say ½d. per unit. Extractor type fans were employed in conjunction with radiators for the ventilation system. The P.O. had been forced to give up the small basement stations referred to by Mr. Highfield.

DISCUSSION AT MANCHESTER.

MR. W. J. MEDLYN said that condensation in pneumatic tubes was a serious difficulty, and had been encountered in a Liverpool street tube where the air was taken in at a temperature of 60° to 70° F. Condensation took place causing the messages and carriers to become damp, and it appeared that the use of air at a much lower temperature should be adopted. The presence of gas in the pneumatic air containers in Liverpool had been traced to a leaky gas pipe in close proximity to a leak in the pneumatic street tube. In telephone exchanges in the South Lancashire district alone there were installations of accumulators varying in capacity from 40 to 6,000 ampere-hours, and absorbing about 200,000 units annually for charging purposes. This consumption was likely to be considerably increased when the conversion of existing magneto exchanges to C.B. working was carried out.

MR. G. H. VAUGHAN referred to the inconvenience caused by condensation in pneumatic tubes, and cited the case of a pneumatic ticket distributor installed in the London trunk exchange. In order to ensure satisfactory working, it was necessary that the tickets, after being folded in a particular way, should be rigid, this rigidity being obtained by drying in an electric oven. In order to eliminate condensation in the rectangular delivery tube, the speaker had suggested the use of calcium chloride filter bags, which device, he understood, was now under consideration.

PROF. E. W. MARCHANT, referring to the author's statement regarding improved efficiency due to improvement in controllers, said that in the case of a motor with constant flux per pole, and running on constant-pressure mains, it would not matter how the current was varied during the process of acceleration, the total energy taken from the mains for accelerating the motor would be constant, but the total quantity of electricity used during the period of acceleration would be greater the longer the period of acceleration. The more rapid the acceleration the less the waste of power.

He suggested the use of the term "Electric battery truck," instead of "electric truck," as in the paper.

The Author, in reply, said that on account of condensation trouble, pneumatic tubes for street work were carried out in lead, and, for indoor work, in brass. Experiments were being carried out along the lines indicated by Mr. Vaughan.

ELECTRICITY SUPPLY STATISTICS FOR GERMANY.

The considerable progress which is being made in the extension of the electricity supply business in Germany, is evidenced by the statistics which are collected by the Verband Deutscher Elektrotechniker, and published in alternate years, those for the two years ended with April 1st, 1913, having just been issued by the firm of Julius Springer, of Berlin. It should first be explained that the information does not apply to power stations which solely serve the purpose of furnishing electrical energy for the operation of railways and tramways, or to stations which supply to blocks of buildings or to individual installations (factory or ironworks' stations), unless they also deliver energy for sale to the public. With these reservations, the statistics deal with all the stations throughout the country which are concerned with meeting the public requirements in regard to lighting, cooking and heating, and power purposes.

The increase in the number of public stations in recent years has been surprisingly large, although many of them are of comparatively small capacity, as will subsequently be shown. For instance, on April 1st, 1909, the number was 1,978; on April 1st, 1911, the number had advanced to 2,526, and on April 1st, 1913, it had further risen to 4,040, so that the stations have more than doubled in a period of four years. The figures also represent an average of nearly 15 new stations per week in the past two years, or about two new works opened daily. The appended table indicates the development of the capacity of the works, including generators and accumulators, in the same term of years on April 1st in each case:—

	Capacity of all works combined.	Average capacity per station.
1909	1,161,609 KW.	587 KW.
1911	1,466,418 KW.	580 KW.
1913	2,095,666 KW.	519 KW.

The reduction in the average capacity of the stations, which had always increased in former years, is attributed to the large expansion in the number of new stations, which nearly always commence on a small scale. But the determining factor in forming an opinion of the development of electricity supply is held to be less in the average capacity of the stations than in the total capacity of the large works capable of dealing with 5,000 KW. This class of works numbered 40 in 1909, and had a combined capacity of 617,672 KW.; in 1911 the number had risen to 53 of a total of 816,746 KW., and in 1913 to 103 of a total of 1,560,752 KW. The proportion which these bore to the total capacity of all the stations was 53·2 per cent. in 1909, 55·7 per cent. in 1911, and 74·5 per cent. 1913, whilst the last mentioned only represented 2·6 per cent. of the total number of stations throughout the country. The principal position is occupied by the Berlin Electricity Works with a capacity of 193,000 KW.; the second place is held by the Dusseldorf Reisholz Works with 65,000 KW., and the third by the Upper Silesian Electricity Works at Gleiwitz.

Coming to consider the capacity of the connections, the statistics show that the total, as represented by lamps, motors, &c., amounted to 1,860,860 KW. in 1909, 2,465,976 KW. in 1911, and 5,725,769 KW. in 1913. As the capacity of the connections has advanced to a greater extent than the increase in the capacity of the stations in the past four years, the conclusion is reached that consumers are utilising their installations in a larger measure. It is now of some interest to inquire as to the division of the connections between the lighting and power supply, the latter including stationary and tramway motors and the slowly growing use of cooking and heating apparatus. On these points the statistics furnish the accompanying figures:—

	Connections for lighting.	Connections for power.
1909	40·7 per cent.	59·3 per cent.
1911	38·2 "	61·8 "
1913	35·8 "	64·2 "

It will be observed from the course of the percentages in the four years that the connections for lighting was relatively declining as compared with the power supply business. The number of localities where public supply is in operation, was 4,700 in round figures in 1909, 11,000 in 1911, and 17,500 in 1913.

It is impossible to state definitely the actual amount of capital invested in the supply works, as the information on the question is incomplete owing to the failure of a number of works to furnish the particulars, but an estimate for the purpose has been prepared. If, for instance, a sum of £60 is taken as the average capital invested per KW. capacity of the station, and as the total capacity of all stations was 2,100,000 KW. on April 1st, 1913, the total capital investment will be found to work out at £126,000,000, excluding the installations on consumers' premises. It is assumed from the development in public supply business that from 4 to 5 per cent. of the increase in the national wealth has found employment in this particular branch of the electrical industry in the past four years.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

MOZAMBIQUE.—The Board of Trade have received information as to a proposed revision of the tariff on goods imported into Mozambique. Goods not specially mentioned in the tariff (no electrical goods are mentioned separately) are to be dutiable under this proposed tariff at the rate of 10 per cent. *ad valorem* in place of the rate of 3 per cent. *ad valorem* formerly levied. In addition, it is proposed to maintain the municipal contribution of 25 per cent. of the amount levied under the ordinary tariff, and other contributions which amount to about 4½ per cent. *ad valorem*.

The *ad valorem* duty for imports will be calculated on the value of the goods at the place of origin or manufacture, with the addition thereto of all expenses of transportation, insurance, commission, landing, &c., incurred before entry into the Customs house in which the clearance is made.

The value of goods imported must be proved by means of an invoice made out by the manufacturer or seller, stating the real price of the goods. This invoice may, however, be replaced by a written statement.

When the invoice does not mention the expenses of transportation, insurance, commission, &c., up to the place of landing, the value thereof will be increased by 25 per cent.

The *ad valorem* duty on goods imported from foreign countries will be paid in the Lourenço Marques and Inhambane Customs in gold when the amount is not less than 2,250 reis, the value of £1 being computed at 4,500 reis both for the payment of the duty and for the declaration of value for clearance.

RHODESIA.—H.M. Trade Commissioner in Cape Town, in a recent dispatch, draws attention to the fact that Customs duty is not required to be paid on British catalogues on importation into Rhodesia. Catalogues imported into the Union of South Africa are dutiable if weighing more than 8 oz., but this duty does not apply to catalogues for Rhodesia.

SOUTHERN NIGERIA.—The Customs authorities have issued a decision permitting the free entry into that Colony of Radio fans.

BRITISH WEST INDIES.—The Board of Trade have been informed by their correspondent in British Guiana that in connection with the recent coming into force of preferential treatment of British goods, numerous proofs of origin are still being received in British Guiana, chiefly from the United Kingdom, which are not in accordance with the regulation certificate, which is uniform throughout the whole of the West Indies in which a British preferential tariff is in operation.

Furthermore, the required certificates of origin have not been furnished within the prescribed period, and as no attestation of certificates is now required in the case of goods shipped direct from the United Kingdom, the Customs authorities see no good reason why proof of origin should not be furnished at the same time as the invoices.

The Collector of Customs adds that if this state of affairs continues there will be no alternative but to insist upon the duty at the "General Tariff" rate being paid on all preferential goods unaccompanied by the statutory proof of origin at the time of importation.

In consequence of the Canadian-West Indian Reciprocal Trading Agreement of 1912, provision has been made for the entry of certain goods—the produce of the United Kingdom, Canada and Newfoundland (*a*)—at Preferential Tariff rates of duty into the following British West Indian Colonies, with effect from June 2nd, 1913:—

Trinidad and Tobago.	Leeward Islands.
British Guiana.	Antigua.
Barbados.	St. Kitts.
St. Lucia.	Dominica.
St. Vincent.	Montserrat.

For the convenience of firms shipping to the West Indies the Board of Trade have published exact forms of the certificates required, in the issue of their Journal dated December 24th.

FINLAND.—The Customs authorities have decided that mechanical apparatus for working electric lifts, not including power engines, is to be dutiable at the rate of 14·70 marks per 100 kg. (Mark = 9·6d., kilog. = 2·204 lb.).

FRANCE.—The French Customs authorities have decided that cables for electric or other purposes of iron, steel, copper, &c., wire, insulated or not, rubbered or not, with covering of aluminium spun or other, are to be dutiable as other manufactures of aluminium at the rate of 120 francs per 100 kg.

ECUADOR.—From January 1st, 1914, it has been decided to admit electric accumulators, also parts and spare parts of the same free of duty into Ecuador.

Ignition of Coal Gas.—A party of electrical and mining engineers, with Mr. Nelson, Home Office Electrical Inspector, last week carried out an experiment at the rescue station at the New Tredegar Colliery, South Wales, by which it was proved beyond question that coal gas or fire-damp could be ignited by sparks from electric signalling cables used underground.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

29,457. "Device, for preventing the clogging of sand-pipes on vehicles electrically or mechanically propelled" F. P. Bourn. December 22nd.

29,460. "Interlocking relays." H Barkes. December 22nd.

29,474. "Construction of the heaters for electric radiators and arrangement of the resistances for display purposes." R. Fifer and D. H. Jackson. December 22nd.

29,504. "Direct current electric engines." H. Pieper. December 22nd. (Convention date, December 28th, 1912, Germany). (Complete).

29,519. "Telephone system of signalling from subscriber to exchange." P. J. Hime and F. M. Green. December 22nd.

29,526 "Device more particularly intended for use on electric light or other switches or controls for displaying reminders, advertisements, notices, and the like." E. Clarke. December 22nd.

29,545. "Electric measuring apparatus." Evershed & Vignoles, Ltd., and S. Evershed. December 22nd.

29,562. "Magneto electric machines." J. F. P. de la Riboisiere and R. le Grain December 22nd. (Convention date, December 23rd, 1912, France). (Complete).

29,566. "Incandescence lamps." J. R. Quain. December 22nd.

29,570. "Scales for galvanometers and the like." R. W. Paul. December, 23rd.

29,581. "Electric bells" W. J. Blenheim. December 23rd.

29,582. "Method of and apparatus for the preparation of electrolytic products for deodorising, bleaching and the like." J. Calvert. December 23rd.

29,590. "Electric cooking ovens and the like" J. P. Annacker. December 23rd.

29,609 "Means for effecting the gas-tight introduction of pipe conduits or electric wires into evacuated vessels or casings." A. Scherbius. December 23rd. (Convention date, December 23rd, 1912, Germany). (Complete).

29,615. "Automatic or semi-automatic telephone exchange systems." Gotthilf A Betulander. December 23rd. (Convention date, December 24th, 1912, Sweden, (Complete).

29,622. "Electrical resistances" J. Collinson. December 23rd.

29,645. "Automatic prepayment telephone apparatus." Ges. Fur Elektrische Industrie. December 23rd. (Convention date, November 19th, 1913, Austria). (Complete).

29,655. "Machines for generating electrical energy." C. T. Mason. December 23rd. (Complete).

29,662. "Electric switches." British Thomson-Houston Co., Ltd. December 23rd. (General Electric Co., United States).

29,688 "Methods of protection of electric distribution systems." F. Ayton and Everett, Edgcumbe & Co., Ltd. December 24th.

29,689. "Electrically actuated mechanism for controlling from a distance railway trains and other apparatus." C. Wirth. December 24th. (Complete).

29,691. "Electric signalling" C. R. Pratt and Orling's Telegraph Instruments Syndicate, Ltd. December 24th.

29,711. "Radio-telegraphic or like receiving apparatus." J. D. L. Bradwell and G. Bradwell December 24th.

29,712. "Transmission of wireless signals." R. C. Galletti. December 24th.

29,714. "Electric cooking stoves or ranges." Siemens Schuckertwerke G. m. b. H. December 24th. (Convention date, December 28th, 1912, Germany). (Complete).

29,720. "Method of rendering non-conducting materials more effective for insulating purposes when they are coagulated for the services to which non-conducting materials are requisite." A. J. Roach-Cuming. December 24th.

29,721. "Electrical switches." A. P. Lundberg, G. C. Lundberg, P. A. Lundberg, and G. Pegg December 24th. (Complete).

29,734. "Dynamo construction." H. Leitner. December 24th.

29,751. "Electric incandescent lamps." V. Terry and E. Terry. December 24th. (Complete).

29,752. "Electric motor control systems for trains and the like." British Thomson-Houston Co., Ltd. December 24th. (General Electric Co., United States).

29,756. "Electric cables" J. F. Watson. December 24th.

29,757. "Manufacture of electric cables." J. F. Watson. December 24th.

29,759. "Electric railway systems and electric motor control systems." K. E. Stuart. December 24th.

29,763. "Rectifier for alternating polyphase currents." Siemens Bros. Dynamo Works, Ltd. December 24th. (Siemens Schuckertwerke G.m.b.H., Germany). (Complete).

29,776 "Couplings or connections for electrical conductors." J. Stone & Co., Ltd. and A. H. Davies December 24th. (Complete).

29,779. "Electric capstans." W. Dixon. December 24th.

29,782. "Suspension for mariners' compasses." Kelvin, Bottomley & Baird, Ltd and M. B Field. December 24th.

29,821. "Electric switches." S. C Davidson. December 27th. (Complete).

29,822. "Electric switches" G Ellison and W. F. Jones. December 27th.

29,824. "Current indicating devices." F. Smith and Ferranti, Ltd. December 27th.

29,826 "Antiseptic linings or covers for the mouthpieces of telephones and the like." Moore Herbert, and Moore. December 27th.

29,831 "Measuring instruments for Rontgen rays." R Furstenau. December 27th (Complete).

29,839. "Insulators for use on electrical circuits." T. U. Frankum. December 27th.

29,844. "Electrical safety and direction indicator for attaching to backs of motor-driven vehicles." I. Moore December 29th.

29,864. "Coin-registering telephones" F. D. Fader, J. Tibb, and J. W. Tibb December 29th (Complete).

29,883 "Automatic selecting devices for telephone systems." Siemens Bros. & Co., Ltd. December 29th. (Siemens & Halske Akt. Ges., Germany). (Complete).

29,890 "Method of soldering metals of high melting point such as tungsten, molybdenum and the like." H Leiser. December 29th.

29,891 "Heating body for electrical-resistance heating." H. Leiser. December 29th.

29,902. "Generation of electrical oscillations." A. F. Sykes. December 29th.

29,935 "Device for controlling the transmission of messages in a printing telegraph system" D Murray December 30th.

29,946. "Transmitting arrangements for wireless telegraphy and telephony." Graf G. von Arco and A Meissner December 30th. (Complete).

29,960 "Telephonic transmitters" A. Toomey. December 30th.

29,980 "Process for the production of alloys of high melting point having ductile properties." Wolfram Lampen Akt. Ges. December 30th. (Convention date, August 19th, 1913, Germany). (Complete).

29,981. "Electric incandescent lamps." H. A. Gill. December 30th. (Wolfram Lampen Akt. Ges., Germany). (Complete).

29,984. "Electrical distribution systems." British Thomson-Houston Co., Ltd., J. Whitcher and E. B. Wedmore. December 30th.

29,987. "Production of sodium and other metals from compounds thereof by electrolysis." R. J. McNitt. December 30th. (Convention date, January 2nd, 1913, United States). (Complete).

29,997. "Sockets or fittings of electric incandescence lamps." A. Heller. December 30th.

30,017. "Electric bells." H. C. Tudor. December 31st.

30,034. "Method of construction of electric heating elements for use in electric radiators and the like." C. E. Turner. December 31st.

30,044. "Electric resistances for dimming electric light." A. Schmidt. December 31st.

30,045. "Means for suspending overhead conductors or contact wires." Siemens Schuckertwerke G.m.b.H. December 31st. (Convention date, December 31st, 1912, Germany). (Complete).

30,066. "Compounds for insulating or non-conducting purposes." A. J. Roach-Cuming. December 31st.

30,074. "Sound operated electric circuit interrupters." T. G. Hodgkinson. December 31st.

30,079. "Illuminated signs." Edison & Swan United Electric Light Co., Ltd., and E. A. Gimingham. December 31st. (Complete).

30,082. "Accumulators and electrodes therefor." Svenska Ackumulator Aktiebolaget Jungner. December 31st. (Convention date, December 31st, 1912, Sweden). (Complete).

30,083. "Electric motor control." British Thomson-Houston Co., Ltd., and H. C Hastings. December 31st.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

20,348. Treatment of Refractory Materials and Apparatus therefor. G. Weintraub and H. Rush. September 6th. (May 28th, 1912).

25,539. Electric Light Wire Casing Particularly Applicable to Ships' Panelling, Partitions, Ceilings and the like. W. G. Wakeham. November 7th.

27,923. Electric Machines. Soc. S.T.A.R. (Systems de Traction Auto-Regulateur). December 4th. (December 4th, 1911).

28,229. Electric Lighting System. Soc. Internationale de Lumiere Froide. (Procedes Dussaud). December 6th. (December 8th, 1911). Patent of Addition not granted.

28,327. Automatic Device for Limiting and Regulating the Speed of Vehicles Propelled by Internal-combustion Engines or by Electricity. C. Robinson. December 9th. (Cognate Application, 4,116/13).

28,350. Luminous Advertisements. C. Nourney. December 9th. (June 12th, 1912).

28,409. Means for Controlling Electric Heating Apparatus. A. C. Hulbert. December 9th.

28,865. Wireless Telegraph Transmitters. G. Marconi. December 14th. (Cognate Application, 28,866/12).

29,104. Vacuum Tubes for Electric Lighting. F. Skaupy. December 17th. (April 13th, 1912).

29,269. High Tension Insulators. Sir O. J. Lodge and L. Lodge. December 19th.

29,409. Method of Diminishing the Electromotive Forces Induced in the Commutation Zones of Commutator Machines. A. Heyland. December 20th. (December 20th, 1911).

29,995. Illuminated Signs. H. L. Nicholls. December 30th.

1913.

1,600. Electric Measuring Instruments of the Mercury Motor Type. British Thomson-Houston Co., and A. P. Young. January 20th.

6,408. Portable Electric Miners' Lamps. P. Wolf. March 14th.

9,179. Electric Switches. J. Leveque-Petit. April 18th.

9,575. Machines for Winding or Covering Electric Cables or the like with Tape or Strip Material. Fried. Krupp. Akt. Ges. Grusonwerk. April 23rd. (April 24th, 1912).

11,208. Devices for Protecting Telegraph and like Wires against Inductive Action from Neighbouring Circuits. O. Moll and P. Kuschewitz. May 13th.

14,310. Electrolytic Meters. W. A. Childs and Reason Manufacturing Co. June 20th.

14,591. Vacuum Tubes for Electric Lighting. F. Skaupy. June 24th. (November 27th, 1912, Addition to 29,104/12).

14,710. Portable Light-projecting Apparatus. J. Y. Johnson (F.I.A.T. Fabbrica Italiana Automobili Torino & Soc. A..on. Officine Galileo). June 25th.

14,940. Vacuum Tubes. H. Green. June 28th.

15,097. Electric Telegraph Receiving Apparatus of the Selective Type. W. J. Lyons. June 30th. (Addition to 10,911/12).

15,360. Process and Device for the Production of Electric Glow Lamp Bulbs with Reflectors. Deutsche Gasgluhlicht Akt. Ges. (Auergees). July 3rd. (November 16th. 1912).

15,523. Polyphase Alternating Current Synchronous Motors. Crompton and Co., and H. Burge. July 5th.

15,824. Manufacture of Electric Glow Lamps. Wolfram Lampen Akt. Ges. July 9th. (July 17th, 1912).

15,909. Primary Galvanic Battery. S. Yai. July 10th.

19,395. Interchangeable, Alternating, and Direct Current Electric Motor. H. Ashdown and F. H. Robinson. August 27th.

19,439. Illuminating and Advertising Devices. G. Claude. August 27th.

19,783 Process for the Preparation of Absorbents to be Used in the Cells of Electric Dry Batteries. P. Rabbidge. September 1st. (September 27th, 1912).

20,318. Railway Electric Signals. E. O. Evans and J. B. Saunders & Co. September 9th.

20,361. Sparking Plugs. O. Freiburg and O. Petzsche. September 9th.

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TRADE UNIONS AND POLITICS.

A MOMENTOUS issue is now before those who belong to, and otherwise support, the great Trade Unions of this country. A ballot is being taken upon the question whether these bodies shall use their funds, or part of their funds, for political purposes. The ballot is the result of the Trade Union Act of last year, by which it was made lawful to apply the funds of a Trade Union to political objects if the promotion of such objects was approved by members voting in a secret ballot.

The results of the ballot, so far as they were known on January 6th, supply much food for reflection. In the first place, most of the Unions affiliated to the Labour party have not yet taken a ballot at all, though nine months have elapsed since the Act became law. Certain Unions have, however, taken a ballot and published the results, and it is, to say the least, astonishing to find how small is the majority favourable to political action. For instance, amongst the miners there was only a majority of 67,000 on a total poll of 470,000. When one bears in mind the results of the great strike in 1912, which may properly be ascribed to the political action of the leaders of these men, this result is the more surprising. No fewer than 194,000 miners cast their votes against the expenditure of money on politics. Again, there is great apathy on the point among some Trade Unionists. Thus, less than a third of the members of the Amalgamated Society of Engineers took the trouble to vote on this question.

It is perhaps too early to draw inferences or indulge in generalities, but the portents would seem to show that the influence and usefulness of the Labour Party are on the wane. Possibly the working man is slowly coming to realise the fact that he is better led and cared for by a Trade Union secretary drawn from his own trade than by a whole-time politician who has laid aside the tools of industry for good and all. Such a man is out of touch with the real needs of the worker. If a grievance has to be ventilated and discussed with the employer, the professional politician cannot make a strong appeal to the sympathy of the employer; if a strike has to be settled, the masters resent what they properly consider to be outside interference between themselves and their men. We fancy that if those who lead the Trade Unions were to devote themselves a little more to the interests of their members and a little less to political agitation the cry of the free labourer would not be so much heard. If the energy of the labour leader is devoted to political propaganda, he has no time left to devote to that legitimate object of all Trade Unions—the amelioration of the condition of the working classes. According as the Union becomes identified with a political party, so will it cease to operate as a means of securing better terms for employés.

We hold no brief for any political body, and should be glad to see the relationship of employer and employed wholly removed from the welter of party strife.

So long as the working man continues to place his trust in the worst kind of politician—namely, the man who makes his living by it—the Trade Union will remain divorced from its legitimate and beneficial objects.

The political Trade Union movement is on its trial, and it is interesting at this juncture to recall some of the arguments generally adduced by those who urge that the Trade Union militant is the one hope of salvation for the working man. They argue that every improvement in the conditions and earning power of the working classes is due to the unions, and that the sooner the power of these bodies is extended by entry into the political arena the better. They do not emphasise the fact that the efficiency of the means of production has improved, and this improvement is very largely due to the impulse which Trade Union methods have given to inventive genius. In every department of industry employers have been compelled to take the fullest advantage of labour-saving machinery. If it becomes impossible to obtain workmen except at a minimum wage which renders production unprofitable, the employer will obviously resort to every device to dispense with labour. Nor is the adoption of labour-saving machinery the only remedy for high wages. Better organisation of labour; the employment of young people; the adoption wherever possible of the piecework system, by which the quantum of wages is made to depend upon efficiency—all these remedies tend to the same result. Each and all of them make a demand upon the intellectual capacity of the employer and those about him who are untrammelled and uncontrolled by the dictates of the Trade Unions. Having adopted and practised the ca' canny policy for the last 50 years, the Union leaders are wont to explain away the inevitable result by a general statement that all the added earnings in every industry are due to the worker. As a means of countervailing the evils of their own policy, they generally suggest the annexation and redistribution of the entire wealth of the country on an equitable basis.

As example is better than precept, we cannot do better than refer in this connection to the strike at Leeds which has terminated so fatally for the strikers. Cherishing the belief that they had only to stand firm for 48 hours and the Leeds Corporation would be at their mercy, these misguided men struck *en masse*. The strike failed, owing to the firm attitude adopted by the employers; but it was not an ordinary failure, because there were certain striking *sequelæ*, which ought to teach those who advocate the down-tool policy a serious lesson. In the first place, the Corporation have been able to dictate terms. They found that they were expending £36,000 a year too much on municipal services, and have decided to effect a number of economies. In the second place, they found that by the use of vertical retorts in the gas works an enormous amount of labour might be saved. They had recourse to labour-saving machinery.

The sensible working man may, if he chooses, learn another lesson from the Leeds strike. It is that no matter how well they are led and organised, it is perfectly idle for unskilled labourers to have recourse to this method of securing better conditions of working. Any able-bodied man can sweep a street or empty a dustbin. He can even act as watchman in a municipal park without using faculties of a very high order. Your miner whose thews and sinews have been developed by a long course of practice underground may demand more wages and get them, because the loafer who is leaning up against the wall of the public house cannot do his work. The skilled mechanic who does a job which he or one of his mates alone can do, may sometimes dictate terms to his employer.

We have no doubt that the municipal workers in Leeds who must have lost a large sum in wages, were largely influenced by the arguments of the political Trade Unionist. Those who counselled these unfortunate men to break faith their employers ran no risk of losing their own jobs if their advice proved to be injudicious.

We trust that the result of the ballot now in progress may be to show that notwithstanding the loud protests of a few, there is a majority of workers in this country who would restrict the activity of the Trade Union to its normal and legitimate sphere.

The Employers' Liability Act.

We published last week the report of a case (Watkins *v.* Harrod's Stores, Ltd.) which presents some features of interest in relation to the Employers' Liability Act, 1881. The plaintiff was employed by the defendants as assistant to their chief engineer at a salary of £3 per week and meals on the premises. On August 26th he was told by his superior to keep a special watch on the deep-well pump, which it was his duty to inspect from time to time, in order to see that it did not get overheated. The pump had not been taken over from the contractors who erected it, and on the day when the pump was being tested by the plaintiff in order to see if it worked satisfactorily, his foot was injured, owing, as he alleged, to the absence of a guard. It was said, on behalf of the defendants, that it would have been impossible to fix a guard until after the pump was completed by the makers, and taken over by the defendants.

As our readers are probably aware, the Factory Act, 1901, does not insist upon the fencing of a machine while under repair or under examination in connection with repair. The jury found that the plaintiff was a workman within the meaning of the Employers' Liability Act; that the pump was under examination at the time of the accident; that it was a defect that the pump was not fenced; that the defect was due to the negligence of the chief engineer; that the plaintiff knew and appreciated the risk of the machine being unfenced and undertook the risk; and that the plaintiff was not guilty of contributory negligence. They assessed the damages at £114 1s. The defendants' counsel having submitted that he was entitled to judgment, a consultation took place between the parties, as a result of which it was agreed that the plaintiff should have £16 under the Workmen's Compensation Act, each side paying their own costs.

As an appeal is possible, we do not propose to comment upon the result of the case. It is legitimate to point out, however, that he who proceeds to make a claim under the Employers' Liability Act must do more than prove the mere occurrence of an accident. It is essential to show a defect in the ways, works, machinery or plant, or to prove that the accident was due to the negligence of the employer or one of his servants, to whose orders the plaintiff was bound to conform. We hope to return to this matter at a future date, and to set forth in simple language the true distinction between claims under the Compensation Act and the Employers' Liability Act.

Senghenydd Disaster.

It is rather unfortunate that the Coroner's inquest on the 439 victims of this terrible disaster and the Home Office inquiry should be going on at the same time. It will mean a great deal of inconvenience and trouble to the witnesses and others who are called to give evidence, and will prevent that concentration which is so necessary at inquiries of this description, and especially so at one relating to the most terrible explosion that has yet occurred in the British coalfields.

From the newspaper reports it seems that the manager, Mr. Shaw, is being harassed by the miners' leaders, and apparently much is being made of the fact that bare wires are used for the signalling apparatus, and are said to have emitted sparks. Undoubtedly it appears from the evidence that the regulations required by the Act have not been rigidly adhered to; anyone conversant with the duties of the colliery manager will not wonder at this, and Mr. Shaw, we know, will have the whole-hearted sympathy of his brother colliery managers. Again, the "leaders" must remember that the men they represent have more power than the manager, and if any of them knew there were breaches of the Act, they could easily have taken action.

As regards the causes of the explosion, Mr. Shaw puts forward three theories. One is that an explosive mixture may have been ignited by sparks from a big fall of stone;

the second, that the explosive mixture was ignited at an open lamp in the relighting station; and the third, that the mixture had been carried on and been exploded at a damaged lamp found in the workings. Of these, Mr. Shaw thinks the second theory gives the real cause of the explosion, as an open lamp was found, and there was a considerable development of force observed at the lamp cabin. Why was there an open lamp? Because the principal failing of the ordinary flame safety lamp is that it easily goes out. Accidentally dropping it, or knocking it over, causes it to go out, and it becomes necessary to re-light it. To do this it was—and we may say is—the custom to send the lamp to a lamp station, where the conditions are such that a lamp may be opened in safety and relighted. Evidently the conditions at the moment when the lamp was opened at Universal Colliery were not favourable, and a terrible explosion was the result. The most dangerous and unreliable thing in a gassy mine to-day is the "safety" lamp, and no amount of testing and approval by the Home Office authorities, or anyone else, will ever make the safety lamp "safe."

In our issue of October 31st, 1913, we dealt with this question, and so far the evidence adduced at this inquiry merely confirms the conclusions then arrived at. Remove the ordinary safety lamp by substituting the electric safety lamp, and 99 per cent. of the risk of colliery explosions is gone. We believe this opinion is strongly supported by Mr. Redmayne, H.M. Chief Inspector of Mines. How many more of these dreadful accidents must take place before the mining community in general begins to recognise this fact?

The suggestion that dangerous sparks are emitted from bare signalling wires, to say the least, remains to be proved. In the article above quoted we referred to the results of the experiments carried out by Dr. Thornton, and the American Bureau of Mines, which we think are sufficient to prove that no explosive mixture could be ignited by the "sparks" from bare signalling wires which derive their potential from a few primary cells such as were used in this pit. It appears that the ignition of gas recorded on page 79 of our last issue was effected with new cells and a short connection offering practically no resistance—conditions quite different from those obtaining in practice. We understand, however, expert evidence is to be called as to this point, and we forbear to make any further comments until the issue of Mr. Redmayne's report of the inquiry.

Rubber.

The past year was not one upon which holders of rubber, or of rubber shares, can look back with any pleasurable emotions, for 1913 saw the price of fine plantation grades about cut in half, owing to the more ample quantities available for the use of consumers, while the depreciation in the case of fine hard Para was about one-third, this particular product being more or less under manipulation. One of the outstanding points of the year was the diminished quantity of Brazilian rubber coming forward, but this is not at all a matter for surprise, since the collection of wild rubber, not only in the Amazon Valley but, indeed, in all parts, must tend to shrink with the enormous fall in the selling prices which has been sustained during the last few years. It is really impossible in many cases now to collect wild rubber if the operation is to return a profit to those undertaking it, and the outlook is directly in favour of a marked decrease in such supplies, while, at the same time, the direction of the plantation trade is towards further expansion, as each year, if not each month, new areas become available for the tappers. The development of the plantation trade has been remarkably rapid. The quantities auctioned in London at the periodical auctions were in 1907 only about 800 tons, while in the following year less than 2,000 tons were submitted. By 1910 the total handled at the sales just exceeded 5,000 tons; the following year it was 9,700 tons; in 1912, 17,600 tons, and last year 22,400 tons. Of the total, about one-fifth is Ceylon rubber, and four-fifths material from Malaya. Of course these figures represent only a fraction of the plantation output, which, for the Middle East, is estimated by competent authorities at not far short of 46,000 tons, and in view of the very rapid growth of the supplies available for the use of the trade, it is remarkable that there should have been such a complete absorption of material. The whole course of the rubber market since the boom days came to an end, and there was a clearing up of some of the aftermath of wreckage, has been towards a steady consolidation of the position, and the increase in the consumption has been phenomenal. An object lesson indeed has been provided of the way in which low costs stimulate consumption, and there is no reason why the extension of the use of rubber should not be continued indefinitely while the prices remain reasonable. There can hardly be any great improvement in them from to-day's level unless there is a radical alteration in trade conditions, of which there is no sign, and the line of advance for plantation owners lies, therefore, in cultivating to the utmost the needs of consumers. Even the prices ruling to-day are not at all satisfactory for the better class of plantation company, although they are, of course, no good to concerns floated at fabulous rates near the top of the boom. These concerns were rotten from the start, and their only hope lies in reconstruction if shareholders can be induced to put further money into them, and even then their future is doubtful. For those concerns prepared to cultivate the needs of users there is plenty of satisfaction to be obtained even yet from the selling prices of the product. There is just a chance of the export duty on rubber from the Federated Malay States being reduced soon. If this occurred, it would be a further aid to growers, who, however, will probably see selling prices slip to a yet lower level during the current year, though there is not much room for any further decline, seeing the extent of the depreciation already sustained. Consumers are likely to buy only in conservative fashion for a long while to come, and it is well that matters should proceed quietly for a time in order that the full possibilities of the situation may be gauged. There is a lot more rubber to come forward from the plantations this year than ever before, and what is needed is a period of sober industrial effort so that the new conditions gradually coming into play may take their course, and render it possible for a reasonable estimate to be made of the rate at which both production and consumption may be expected to expand.

The Half-Watt Lamp.

This week the new lamp, whose birth was announced to the world with justifiable pride some five months ago, has made its appearance on the commercial stage, amid the enthusiastic plaudits of its five supporters. Unlike most new-born infants, the half-watt lamp is too big for domestic purposes, and will be turned into the streets at once; but it is of particularly robust constitution, and may be relied upon to take care of itself in the stress of competition in which it will immediately be engaged. That it will exert immense influence on the future of street lighting cannot be doubted; although even its high efficiency falls short of that of the flame arc lamp, the fact that it needs no attention when once installed is a strong point in its favour. The minimum candle-power at present available is 600 C.P., and the average life is put at 800-1,000 hours, so that for all-night burning the renewals, &c., will cost about the same as trimming and depreciation for the flame arc; at 1d. per unit, energy and attendance will cost the same for both, so that the total costs will work out practically equal. Where energy costs more than 1d. per unit the advantage in point of cost will rest with the flame arc. On the other hand, the half-watt lamp can be advantageously employed in streets where the flame arc would be too large a unit, and by using a larger number of smaller lighting units a saving in total candle-power and energy, as well as a better distribution of light, can be effected.

In competition with even the best and latest method of high-pressure gas lighting, the new lamp will have a walk-over; and for the illumination of large halls, shops, workshops, &c., it will command a very wide market. The electrical industry is to be congratulated upon the splendid weapon now placed at its disposal.

A TRAVELLING X-RAY LABORATORY.

By Dr. ALFRED GRADENWITZ.

While the great importance of X-ray work in military surgery is generally recognized, there is some divergence of opinion as to the kind of apparatus most suitable in warfare. According to some authorities, a light and easily transportable outfit would be preferable, in spite of the unavoidable limitations in efficiency. Others are inclined to prefer a comprehensive high-power installation, though the difficulties of transport in this case, are a decided drawback.

Messrs. Radiguet and Massiot, the well-known French constructors, have made a successful attempt to combine the individual advantages of both schemes, by fitting up an automobile as a travelling X-ray laboratory, containing all the apparatus required for even the most delicate work.

The vehicle comprises a 12 h.p. Lorraine-Dietrich chassis with a 4-cylinder motor (of 75 mm. bore and 120 mm. stroke), a leather cone clutch and a 3-speed gear box. The strength of the springs has been calculated most amply. The body is closed entirely, the roof comprising a light canopy for protecting the driver. Two side doors with red glass panes are provided, and the heavy parts of the outfit are arranged in the large rear compartment, closed by a folding panel.

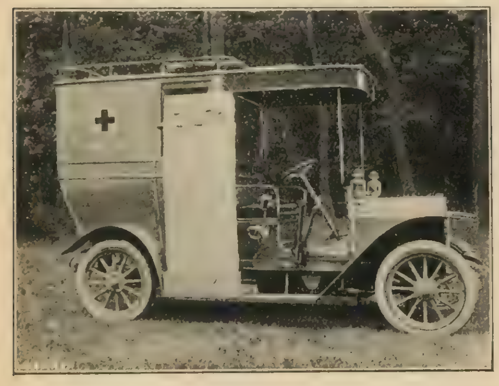


Fig. 1.—Travelling X-ray Laboratory.

The interior appointments of the laboratory car comprise all the various apparatus in a relatively limited space. A large work table has been provided for charging the slides comfortably, allowing the plates to dry, etc. The plates are developed and fixed in a lead-coated trough. Water is supplied from a tank of 30 litres capacity connected to a tap over the developing trough, and which can be filled from outside. Lead and felt-lined casings are provided for protecting the plates, paper and chemicals against jerks and the noxious action of X-rays. A box fitted with special buffers contains the X-ray bulbs.

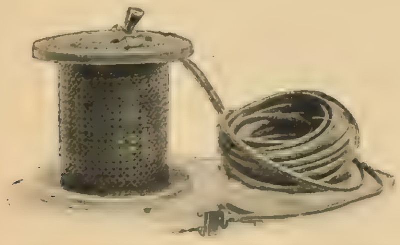


Fig. 2.—Rheostat and Connecting Cable.

The electrical energy required to feed the X-ray outfit and to recharge the accumulator battery (of 40 amp.-hours) of the lighting circuit is supplied by a 110-volt, 15-amp., dynamo, switched on to the motor; a voltmeter serves to check and control the pressure, by varying the speed of the latter. From the dynamo, the current is taken to the switchboard, whence it is distributed to the various apparatus. A searchlight of small weight and a range of 800 metres, fed from the dynamo, may be installed for searching the battle-field for wounded soldiers.

On account of the urgent need for means allowing all parts of the body, inclusive of the thorax and pelvis, to be rapidly examined, a most efficient X-ray outfit had to be provided.

The transformer, the resistances for controlling the intensity of the primary current and the whole of the high-tension circuit, were, for different reasons, placed close to the patient. The operator is thus in a position himself to choose and control the working conditions of the X-ray bulb; moreover, he is able readily to send intermittent low-tension current to any distance desired, whereas great difficulty would have been experienced in transmitting high-tension current from the car to a more or less distant point of utilisation. The transformer comprises two primary windings, for low and high intensities respectively.

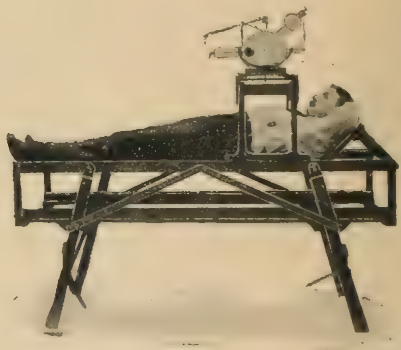


Fig. 3.—Table Arranged for Ventro-Dorsal Radiography

The secondary current is distributed by an instantaneous switch to the various apparatus (rectifier, spark-gap, &c.).

The upper part of the transformer carries a folding switchboard on which the milliammeter and rectifier have been installed. Since the connection plugs are non-reversible, the current always flows in the proper direction. During transport, the transformer switchboard is folded down and the whole is placed in an oaken box fitted with handles.

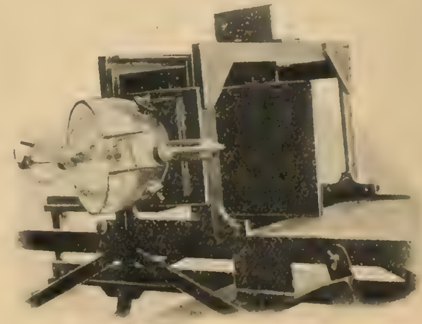


Fig. 4.—Arrangement for Horizontal Exposure.

The intensity of the primary current is controlled by a rheostat (fig. 2), the reel of which carries two windings (for low and high intensities respectively); a switch allows the proper resistance to be chosen. The junction cable 25 metres in length is, during transport, wound on the same reel and fixed by means of two belts.

In order to reduce the number of apparatus to a minimum, while ensuring a maximum of rigidity in the bulb-holder, a special type of operation table had to be devised. Fig. 3 shows this table, as arranged for a ventro-dorsal radiography and fig. 4, for horizontal X-ray exposure. When placing the bulb on the lower frame of the bed, the same arrangement can be used for X-ray examination (radioscopy) of any part of the body. The bulb-holder is readily fitted to any part of the table.

In addition to all essential apparatus, the car also comprises a radioscopic dark chamber for X-ray examination in full daylight, a plate holder allowing a reinforcing screen to be inserted, a pair of protective gloves, a pair of protective spectacles, and a number of accessories, such as photographic plates kept in a lead lined drawer, highly insulated conductive wires, etc.

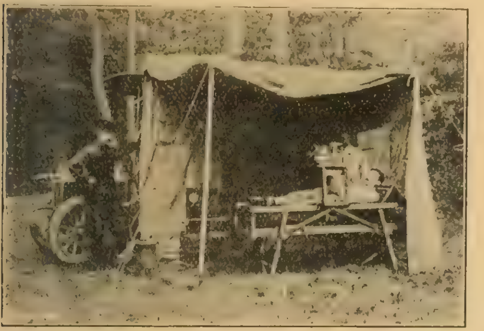


Fig. 5.—Travelling X-ray Laboratory, with Tent fitted up.

The outfit is readily operated without any special training, the car being set working within 5 minutes.

Since all the apparatus are carried on the same vehicle, there is practically no risk of losing any. The outfit is so complete as to allow even the most complicated operations to be readily carried out and therefore is likely to prove of service also in times of peace, *e.g.*, on aviation grounds, in minor military hospitals, &c.

FURTHER NOTES ON ACZOLLING POLE TIMBER.

Some eighteen months ago, some notes were published in these columns concerning the aczolling of pole and other timber. The material employed in this preservative process is, it will be remembered, a mixture of metallic ammoniates with an antiseptic acid containing the essential preservative elements of creosote, viz., phenols and naphthalene. The advantages claimed for this compound are that the powerful preservative action of the phenols is added to the antiseptic value of the metallic salts and that, owing to the solubility of cellulose and vasculose in aczol (see Electrical Review, June, 1912, p. 1060), the surface layers of the fibres and tissues of the wood treated are dissolved and subsequently, by combined chemical and physical action, cemented together by a stable and permanent sheathing. Even more important than the powerful antiseptic and preservative value of the compound is the complete fixation and hence permanence of action of its essential ingredients. In addition to the information already presented, the following data are now available concerning the use of aczol and the results secured by its application.

As sold, aczol contains from 15 per cent. to 30 per cent. of reinforced phenols and the equivalent of 30 per cent. of copper and zinc salts. The results of Malenkovie's experiments show that 0.13 per cent. of phenol or 3 per cent. of copper and zinc salts suffice to sterilise gelatine which is, of course, much more susceptible than wood to fungus or insect attack. The concentrated material therefore represents about 150 times the preservative power actually required to effect sterilisation and, since the characteristic feature of aczol is its ability to form a stable compound with cellulose in which the whole of the preservatives introduced are fixed permanently, it is possible to use it in a very dilute solution. Woodwork not to be buried in soil or exposed continuously to weather can frequently be sufficiently protected by surface painting with a one in five or six solution of concentrated aczol in water. Generally it is preferable to impregnate timber thoroughly, and this should certainly be done in the case of telegraph poles.

Injection may be effected by simple immersion for one or two weeks, but wherever the simple equipment required can be erected, pressure injection should be practised. In any case, the solution is used cold. Though aczol itself is perfectly soluble in water, the compounds which it forms with cellulose are insoluble in hot or cold water and are unaffected by salt water, carbon-dioxide, or its solution or salts. Timber is not rendered oily or in any way unpleasant by the aczolling process, neither is its weight seriously increased. The wood can be painted or even polished after treatment and by varying the proportions of the ingredients of the compound, timber can be rendered waterproof and non-flammable at will. Saturating timber with any oily substance reduces its strength appreciably, but the cementing action of aczol within the timber increases considerably the strength of the latter.

No salts injurious to timber or capable of corroding iron or other metals are contained by aczol or can be formed from it; the insulating value of wood is not reduced by the treatment. Assuming 1.33 gallons of aczol solution to be injected per cb. ft. of timber treated, the life and average annual cost of pole timber compare favourably with the corresponding data for creosoting. In this connection the following table is interesting:—

Treatment.	Cost per cb. ft.		Life of pole years.	Outlay per cb. ft.	
	Treatment.	Pole erected.		In 24 years.	Per annum.
	d.	s. d.		s. d.	d.
Untreated wood ...	nil	1 4½	6	5 6	2¾
Metallic salts... ...	3	1 6	12	3 0	1½
Creosote	6	1 8	24	1 8	¾
Aczol	2½	1 5½	24 (min.)	1 5½	¾

Electric Light on French Railway Trains.—The French Minister of Public Works has issued a circular urging railway companies to adopt electric lighting on their fast trains, pointing out that a recent disaster has again demonstrated that collisions between trains often give rise to fires, and that it is important, as far as possible, to avoid the presence of inflammable material in the coaches. He therefore expresses the opinion that it is desirable to substitute electricity for gas for train lighting, and states that he will not in future approve of any rolling stock for rapid transit that is lighted with gas. He also urges the companies, without delay, to arrange for the speedy removal of gas lighting from such trains as are already equipped with it. Exceptions will be made in the case of coaches used for international service and travelling through foreign countries. The catastrophe at Melun showed how necessary was the change, the mail vans on that occasion having been lighted with gas.—*L'Electricien.*

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Insurance Companies and Consulting Engineers.

In your issue of 9th inst. appeared a very ridiculous and exaggerated letter under the above heading.

As I am on the engineering staff of one of the leading insurance companies in the country, I would like to put before your readers a few facts in contradiction of "Tyke's" statements.

He has hopelessly mixed up the "Inspector" with the "Canvasser,"—two entirely different positions. The posts of electrical inspectors, when vacant, are open to competition, and the men applying must have a good, practical and theoretical experience (and be able to prove it, too) if they wish to stand a ghost of a chance of securing the job.

As an electrical inspector myself, I would inform "Tyke" that I have served an apprenticeship under agreement for three years with one of the best electrical manufacturers in England, and had a further three years on the test bed, in drawing offices, &c. I have also taken a three years' day course in both mechanical and electrical engineering at the University and taken A.M.I.C.E. Would "Tyke" call this "little or no knowledge of the theory and practice of engineering?"

Also I could mention men on these staffs who are D.Sc., A.M.I.E.E., &c., and quite as capable of giving advice on electrical matters as anyone could wish for.

The "fairy tales" about earthing and burn-outs are very amusing reading, but "Tyke" must not imagine that all the inspectors are as ignorant as this.

It is the canvasser's business to interview prospective customers and quote terms and fees, but these men are not looked upon as engineers, or expected to give advice on technical matters, or do any inspecting or testing. They hold similar positions to the everyday commercial traveller. The engineering and the secretarial staffs are absolutely distinct, a point which is evidently not known to "Tyke."

I could quote numerous instances where the insurance companies have saved pounds sterling for millowners, &c., in pointing out defects and shoddy work put in by contractors, which would otherwise have been taken over in ignorance and paid for.

In conclusion, I would point out that the importance of careful periodical inspection and testing of electrical machines and installations by independent electrical engineers has been recognised by the Institution of Electrical engineers.

I hope to see further letters in support of the above from the various insurance companies to show "Tyke" the errors of his statements.

Facts not Fiction.

January 10*th*, 1914.

I read with amused interest the letter by "Tyke," and it may naturally be assumed that certain comments therein will meet with a ready response from inspectors who can conscientiously claim to be initiated in engineering practice, befitting their particular duties and requirements.

I must seriously point out an inconsistency in "Tyke's" remarks, viz., "certain insurance companies," followed by a generalisation thus: "the indictment of insurance companies."

His remarks seem to imply that he has had the misfortune to be enlightened upon some scheme, or on a "knotty problem" by one of his "typical examples," without a further verification by a duly qualified "Inspector."

It is gratifying to find "Tyke" emphasising the qualifications, and the source thereof, of his "electrical dubs," for I beg to assert, it is only too true.

"Tyke" may rest assured that the man, who by dealing with engineering correspondence, becomes designated as an inspecting engineer or surveyor, must necessarily have his sphere of usefulness in engineering circles.

Nevertheless, such men may and do create a profou impression upon commercial managers of manufacturing even engineering concerns. One can well imagine t nature of a discussion between such "types," and, say, borough engineer.

"Tyke" must admit that there are men, not necessari engineers, who can discriminate between "bluff" and t real thing.

If "Tyke," in his remarks, wished to imply that electric installations and electrical plant generally should come und the supervision and examination of "electrical engineers and not "electrical inquirers," then, I, for one, great appreciate his remarks, and cordially invite any suggestio to eliminate the latter from the former.

In conclusion, I trust "Tyke" will eventually meet "Inspector" in whom he can place his confidence.

Inspector.

The sweeping indictment of insurance companies "Tyke" in your issue of January 9th should not be allow to pass unnoticed.

"Tyke's" chief complaint is that "they employ m who have little or no knowledge of the theory and practi of engineering." This cannot, in fairness, be said to app to the well-known insurance companies which specialise boiler, engine and electrical work. These companies ha an electrical department, and the inspectors employed this department invariably have had a thorough traini in electrical engineering, both theoretically and practically

One of the outstanding features in insurance wo last year was the large amount of electrical machine which was insured against breakdown. The owners collieries, shipyards, chemical works, &c., are rapid realising that it is to their advantage to have their electric plant insured against breakdown and carefully inspected regular intervals by a competent engineer.

The reports which they receive serve as a reliable gui as to the condition of the plant, and it is a comparative rare occurrence for a firm to discontinue insuring after has had one or two years' experience of it.

Without doubt there are cases where insurance compani undertake work in a consulting capacity, and if a suitab company get this work to do, the result is usually qui satisfactory.

There is one branch of consulting work which an insu ance company can undertake as well as, and in ma instances more economically to the client than, a consulta could—namely, the examination of second-hand machine prior to purchase.

Most people realise that to purchase a second-ha dynamo or motor, without having it examined first by expert, is a very risky procedure.

For example, a man, perhaps in Liverpool, wishes to b a second-hand electric motor which is in Newcastle. may not know of a suitable consultant for the work, bu by applying to a reliable engine insurance company, he w get, for a small fee, an inspection made by the company electrical inspector in that district.

The writer believes that insurance companies have large helped to popularise electrical machinery, especially in sm works where no electrician is employed, and where, unle the plant is regularly inspected, breakdown and dissatisfa tion are very likely to occur.

A.M.I.E.E.

Cheap Labour.

I should like the various electrical contractors a employers of labour to note that there seems to be a certa class of employers looking through the advertising colum (situations wanted) of this journal, for somebody *cheap* a good. Well, my experience has taught me that if you wa anything good, you generally have to pay a fair price for I should think myself that those who receive replies to t above advertisements, asking for fullest particulars, copi of testimonials, &c., upon receipt of same, with an address and *stamped* envelope enclosed for return of copies of tes monials, might at least have sufficient courtesy to retu same, even if the amount of remuneration asked for is out of proportion to their intentions, as it is unfair and apparently a waste of time to the advertiser who replies to this class of would-be employer; also, it seems to be a forgotten fact that one who is seeking a berth does not wish to spend money to waste informing this particular class, as even penny stamps and paying for typed copies of testimonials tell up eventually.

One Affected.

The Position of Railway Electrical Staffs.

With reference to "Nemo's" letter regarding the above matter, I can quite sympathise with the writer, but am afraid that this state of affairs is met with only too often. I am employed as charge engineer on the L.C.C. tramways, and am only rated on the temporary staff, although many of us have been "permanently temporary" for nearly 11 years, and there seems no likelihood of our being put on the permanent staff; surely this is liable to create discontent. Not only this, but also we are employed on an average of seven days a week and are compelled to work on Christmas Day, Good Friday, and all Bank Holidays, without getting any extra remuneration or having days off equivalent; moreover, we are constantly on duty throughout the shift, even at meal times. Our responsibilities are great inside and outside the station; for outside, we are held accountable for all traffic delays due to failure of current, owing to cable faults, car faults, foreign metals in conduits, or breakages, &c., of trolley wires. Under these circumstances are we, as well as the railway electrical staff, justified in joining some suitable society to look after our interests?

Can the A.E.S.E. do anything to help us? If so, how?

Omen.

I have no wish to join the Railwaymen's Society, but I think that the attitude of the Metropolitan Railway Co. to its sub-station men is driving them into the eager arms of the National Union of Railwaymen. Dissatisfaction has never been so keen as it is now.

A grievance that I think you might legitimately ventilate, is regarding the class of men engaged as sub-station assistant attendants. Recent additions to the staff include two ex-conductors or porter-guards, a chauffeur, a bank clerk, and one or two nondescripts conspicuous by their lack of education. This type of man we are expected to train into efficient sub-station attendants. As well try to turn a sow's ear into a silk purse.

It seems hardly fair to men who have served their time and paid for their training—before serving the "Met." four years to attain the dizzy height of 40s. to 45s. a week of 56 hours and seven days' leave annually as charge engineers—to become kindergarten instructors gratis. Why, it takes all one's time seeing that an "assistant" of that type does not kill himself or blow the plant up. At the risk of being called a snob, I must say that it is hard to spend a third of one's life in the society of a boor, with no means of escape.

The inevitable consequence of having these incompetent men about the job is—bang, two coffins—or two new rotary converters.

Idoneus Homo.

Proposed Higher London University Training.

The able, and no doubt well-meant, article by Mr. G. E. Mappin in your issue of January 2nd has induced me to write this letter.

I am sadly of opinion that Mr. Mappin can have very little knowledge of how the young men who are trained at colleges of the London University and at other institutions throughout the country are treated by the municipal and other employers of the proud country which is supposed to be setting a pattern to every other nation on the earth for fair and square dealings between man and man.

If Mr. Mappin will turn over a few leaves next to the page on which his letter appears in the Review, he will see what I mean; he will read there of the "high" value which the Corporation of Reigate consider the services of an electrical engineer to be worth, the sum being 28s. for eight hours' work on every day of the week—Sundays, of course, included—but not a word is said about overtime and the long hours spent on inside and outside breakdown work, and the double shifts that have to be worked to make up for the extra time that one engineer slaves through long hours of nerve-breaking monotony in order that his friend may have a week-end off to spend at his home, which, in many cases, is a long train journey off.

But the miserable heart-breaking allowance offered by the Reigate Council for the services of an experienced shift engineer is only one case out of scores which appear in the Electrical Review and other papers. In fact, only a short time ago a shift engineer with qualifications was advertised for in the Electrical Review by a borough works in one of the largest towns in Kent, and the wage that is paid to the street sweepers of the town was considered enough to offer to the educated and trained electrical engineer, namely, 25s.

To talk of a higher standard of training and examinations where there are no prospects to follow, except for a few, will be considered as absolute nonsense and mockery by the parents, some of whom have spent the savings of their lives on fees and premiums.

I am only one of the many parents who have made themselves very poor in order that their sons should be well educated and properly trained to fill a post in some profession or occupation in which qualifications should count for something, but is it likely, when it becomes more generally known, that parents will be so foolish any longer as to send their sons to the colleges of the London University, or to any other institution, and into the workshops of engineering firms who demand heavy premiums, to have them trained to follow the most miserable and worst paid of all the occupations in this country at the present time?

The chief engineers are in almost every case to blame for the low wages paid, which they know very well neither they nor the employers would dare to offer to a carter belonging to a Trade Union.

It is rank treachery for a chief engineer who, in most cases, draws good money himself, to let his fellow assistant engineers be taken advantage of by municipal and company employers, because as chief he knows that his assistants have no society to protect them, and are hopelessly at the mercy of himself and the employers. The naked truth is that in nearly every case the chief "sweats" his fellow assistants for the purpose of gaining credit for himself for economical management.

I have not heard that the Institution of Electrical Engineers, which is not above taking a yearly subscription from a 25s. a week man, has ever moved head, hand or foot to protect its members.

I sincerely hope that the indefatigable secretary (Mr. Ebben) of the A.E.S.E. will succeed in getting every electrical engineer in the country and every power-station man to join the newly-formed league without any further hesitation or delay.

I happen to know that a short time ago, in answer to an advertisement for a charge engineer at a weekly salary of £2 15s., which appeared in the Electrical Review, there were 400 applicants. I consider myself that no fairly well-trained man who is employed as a shift or charge hand at any station where there is a large voltage generated, or where the plant to be supervised is considerable, should be paid less than £3 per week.

Interested.

[We have been obliged to abbreviate this letter.—Eds. Elec. Rev.]

"Rodolite" Heating Elements.

We note in your issue of January 2nd a letter from Messrs. Bastian Electric Heating Co., which appears, although our firm is not mentioned in any way, to be a reply to our letter contained in your issue of 26th ult. We must say at once that we have no desire to enter into any controversy with your correspondents. What we are particularly interested in is their introduction as "new" of a heating element styled "Rodolite," the published description of which, together with the illustration of the same in your issue of 19th ult., corresponds with that of a heating element we have now been making for some years. This element is made in precisely the manner referred to in the Electrical Review, October 6th, 1911, page 543, and the *Journal* of the Iron and Steel Institute, June, 1908, viz., "a thin-walled tube of quartz, wound on its outer surface with coil of resistant wire." This construction is so simple that no misapprehension can possibly exist in understand it; we have, however, forwarded a sample element to the Editor for his inspection. We beg to assure your correspondents that this heating element is not an experiment, either "interesting" or otherwise; it is, in fact, an old and well-tried device which is common property, and as such is employed by some of the most celebrated makers of electrical heating apparatus throughout the world, although the Bastian Electric Heating Co. are apparently not aware of this fact, as they refer to it as the product of some "unknown maker."

The only possible modification in the construction that we can assume, would be in the form of the terminals for attaching the resistant wire, but this would not constitute a "new heating element," which your readers will note is the claim made by your correspondents.

Standard Electrical Heating Co.

Newcastle-on-Tyne, *January 6th*, 1914.

What Happened to a Frog.

I enclose herewith a photograph of a frog after it received 10,000 volts from our H.T. line. This frog had evidently dropped from a tree and made connection with the H.T. line and an iron guard which encircles the insulation. The peculiarity is that it remained in circuit, thus grounding the line, and the plant had to be shut down until the fault was localised.

Chas. Udall,

Chief Engineer and Manager, the Nairobi Electric Power and Lighting Co., Ltd.

Nairobi, B.E.A., *December 17th*, 1913.

American Methods.

I have read the flattering criticism of myself and my article by "English," and note his euphemistic pronouncement:—"He does not write the truth!" After this it is not to be wondered at that he should sum me up as being probably "a man of very narrow experience"—mainly on the ground, I suppose, that my ideas do not coincide with his own.

Whether we believe the quality of self-assertiveness to be essentially good or bad, it is certain that in its acute form it is inimical to true co-operation, that is, co-operation not directly stimulated by one's material interests—and, for that matter, to competition also. Its inevitable outcome is a system of monopoly, and your correspondent (evidently realising this) attempts to show that monopoly is not an evil. Really it is the abuse of monopoly that is bad; but, human nature being what it is, it is better not to permit unrestricted monopolies at any rate until men are found who are fit to hold them. It is hard to reconcile the idea that American methods are in any sense co-operative, with the relentless intolerance of competitors—particularly less powerful competitors—usually shown by concerns run on American lines. There are, however, many instances where there is practically no alternative to some form of co-operation, as, for examples, supply companies or authorities having clearly-defined areas of supply which do not overlap, companies whose share capital is held or controlled by the same financial group, and rival concerns whose organisations and financial resources are so nearly matched as to make a fight for the monopoly dangerous for both. To cite such as these as proof that co-operation really has a place in American methods is to beg the question. Your correspondent says that he is "called upon almost every day to co-operate with others, and not exactly for the sake of the mere dollar or two there may be in it," but as he claims to be not an American, what he does or does not do is not evidence, so far as the present discussion is concerned.

His statement that "most American enterprises do pay a dividend" may or may not be a precise statement of fact, though I am inclined to doubt it. A point of greater importance than this is the amount of the average dividends paid during the lives of the companies of which he writes. Again, what is to be said about the wastefulness of American methods—the enterprises crushed out of existence in the relentless elimination of small competitors by the larger concerns? These points should all be considered in weighing up the net result of American methods.

I did not "deliberately misinterpret Mr. Seabrook's remarks," nor did I overlook any of the features of "welfare work" which your correspondent mentions. What I emphasised was that for a man's real welfare his first and greatest need is the consciousness of liberty. To attempt to increase his efficiency by "welfare work," as outlined by "English," whilst expecting him to have the spirit of a slave—meting out to him "different treatment to what those at home might deem desirable or necessary," may be good American practice, but is not likely to prove satisfactory in the long run.

Your correspondent's reference to Mexico is not a particularly happy one, for it would be strange if, with its geographical and political advantages, the United States could not secure the larger share of the trade with that country.

In the concluding part of his letter, "English" incidentally gives us a look through his perspective. His conception of the manufacturers of the United States setting the pace in their methods to the whole world, is, truly, a wonderful picture. His last sentence is a confession of such an abandoned and unquestioning belief in the pre-eminent excellence of American methods, that one feels impelled to stand aside in wonderment, and let it pass for what it is worth.

F. W. D.

January 12th, 1914.

A Peculiar Lightning Stroke.

The case reported in your issue of 9th inst. would be the most remarkable on record if the occurrence was as your Norwegian correspondent suggests; but before condemning this flash as having acted in defiance of the laws of Nature, we ought to make sure that it is the lightning, and not the deduction of the observer, that is at fault. Several explanations suggest themselves, but the details given do not allow one to select the most probable. It would be of interest, and, perhaps, throw more light on the matter, if your correspondent would give the following additional information:—

1. What reason has he for stating that the flash left the conductor and sparked across (presumably through the air) to the zinc roof nearly 30 ft. away?
2. What is the total length of the building with the zinc roof?
3. Height of the highest part of this roof above eaves?
4. Nature of damage to brickwork at chimney top and to cable?
5. Diameter of chimney top, and how much of the 8-ft. rod projected above it?

I have read of other alleged effects of lightning as unorthodox as this, but found them, on investigation, to be simple and quite in accordance with law, and I am not prepared to abandon the axiom that effect is due to cause without very definite evidence.

Alfred Hands.

London, E.C., *January 13th*, 1914.

The Continuity of Supply.

That the North Metropolitan Electric Power Co. think it necessary to secure the insertion of a clause in their Bill prohibiting strikes of their employés, is an education in itself.

Why has no attempt been made before to insert such a clause in electric supply Bills? The answer is simple; the station men were unorganised. At the first whisper of a station engineers' organisation the company fly to the law for protection; it certainly seems as though they had something to fear, which in itself is a compliment to any organisation to which their employés may belong, and emphasises the fact that the conditions of employment are not what they might be.

Perhaps this effort of the North Metropolitan Co. is just a trial on behalf of the 100 or more companies who are members of the British Electrical Federation, Ltd., which represents capital of about £13,000,000 and 10,000 employés, so that the ultimate result may be widespread should the company be successful in their application. Whether the insertion of this penalty clause in electric supply Bills will prevent strikes of the employés in stations is a question of the future, but it is a fact that the temper of the employés of most of the power companies has been anything but docile during the last 12 months. The power companies generally pay very low wages, especially in the sub-stations, and in one or two cases they exact an agreement for one or two years' service with the company, in conjunction with the payment of rates varying from 15s. to 25s. per week of seven days, the company reserving the right to dismiss any employé under these agreements at one month's notice. The majority of the employés of power companies, and also of a few municipal authorities, have a deep impression that their services would be dispensed with should it become known that they had joined an organisation to increase salaries.

No doubt after the direct reference to the "recently formed association of station engineers," with a "militant policy" in conjunction with the strike penalty clause in last week's issue of the REVIEW under the above heading, station engineers will naturally ask: Will such a clause affect the A.E.S.E.?

Up to the present the A.E.S.E. has used peaceful measures to better conditions in electrical stations, except that in one or two instances (which may be described as semi-peaceful) the whole of the running staff handed in their resignations in the legitimate manner and were quite prepared to find other positions, but this was not necessary, as the supply authorities in question found a great difficulty in finding men to replace those who had resigned, even though a larger salary was offered than that they had previously been paying. The conditions were bettered, and the majority of the men withdrew their resignations.

From this the conclusion is obvious as to the effect of the clause in question on members of the A.E.S.E., although it remains to be seen whether it will be advantageous to oppose the clause, so that Parliamentary Committees and others may get some insight into the conditions of hours and wages of those whom this clause will endeavour to penalise (as suggested in the article last week).

Station men are now determined to obtain a 6-day week of employment and reasonable wages for their services, by peaceful means if possible, but failing peaceful means nobody can deny that station men would be fully justified in using other methods to remedy the discreditable conditions that prevail in the generating and sub-stations of Great Britain to-day as regards wages and hours worked.

In conclusion, I must state that the majority of station engineers acknowledge that they have a great duty to the community, and at the same time insist that the community have a duty to them to see that they receive wages comparable with a station engineer's great responsibility, and a weekly rest day. The community generally have to be inconvenienced before they realise any duty, but this inconvenience can be prevented by a reasonable attitude on the part of the "powers that be."

W. J. Ebben,
Hon. Sec., Association of Electrical Station Engineers.

London, E., *January 13th*, 1914.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

B.T.H. Sewing-Machine Motors.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has put on the market a line of small sewing-machine motors for domestic use, suitable for the needs of [illegible] persons. We illustrate in fig. 1 a motor of type D S S form K C as applied to a sewing machine. The power required is about [illegible] watts D.C. or 55 watts A.C. Several patterns are made, to suit various makes of sewing machine, but as a rule forms K and K C, which are built for D.C. and A.C. respectively, are applicable to almost all styles of family machine. Each motor is fitted with a belt-tightener and brake, and the control is effected by means of a connection to the treadle, which releases the brake and tightens the belt, or *vice versâ*. A rheostat is not used to regulate the speed, the motor running all the time at full speed.

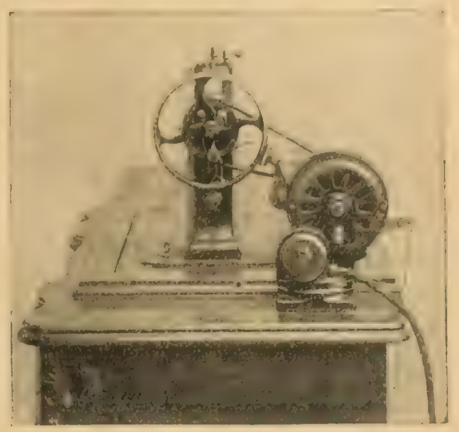


FIG. 1.—B.T.H. SEWING-MACHINE MOTOR.

Automobile Lighting Switchboard.

MESSRS. A. P. LUNDBERG & SONS, of 477, Liverpool Road, N., have standardised two patterns of switchboard for motor-car lighting and similar purposes, of which one of the chief features is compactness, six switches being got into an overall width of 6 in. Fuses with spring-clip fuse-holders are provided, and an ammeter and voltmeter are mounted on the sloped top of the case, with a "Pixy" push-button in circuit with the voltmeter. A plug connection is provided at the side for a portable hand-lamp. As shown in fig. 2, the lower half of the front forms a hinged lid to afford access to the fuses and terminals. The cases are of mahogany or aluminium. Other types of switchboard are also made.

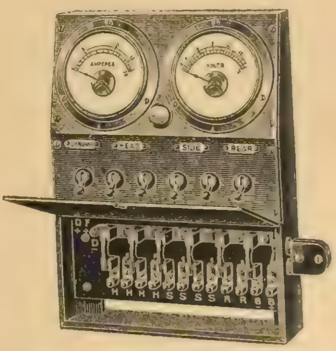


FIG. 2.—LUNDBERG AUTOMOBILE LIGHTING SWITCHBOARD.

Land's Screw-Cutter and Automatic Die.

An attachment has been devised by MR. HENRY S. LAND, of 8 Park View, Old Road, Lee, S.E., by which an ordinary engineer's lathe can be immediately converted into a highly efficient machine for making bright engineers' bolts, studs and other repetition work rapidly and of high-class finish.

The attachment supplied without the cradle H, can be immediately fitted to a capstan lathe and perform all its operations without any turning movements or rotation of the turret, thus enabling, for example, a light capstan for brass work to turn out large steel bolts, screws, &c., from the bar.

The device, as fitted to the back headstock of an ordinary engineer's lathe, is shown in figs. 3 and 4.

The centralising shank B is turned taper to fit the taper hole in the headstock mandril to ensure accurate alignment, while the phosphor bronze clamps A being bolted to the outside periphery of the mandril, take the whole of the working stress and in conjunction with the stay rods support all overhang.

In fig. 3 the screwing die head is shown swung up clear of the hexagonal or other section rod, from which the turned bolts are made. In the centre of head of turning box, marked Z, is a large ball-bearing ring, into which steady bushes are fitted corresponding to the shape of rod being operated upon; this is for the express purpose of supporting the end of rod preparatory to the cutting operation of the tools.

This arrangement of a central revolvable steady in lieu of the old fixed back V or roller steady not only furnishes an absolute central support for the end of the rod prior to the cutter's starting operation, but enables the use of both back and front cutters; consequently the tools retain a keen edge for weeks without grinding owing to the cutting duty of the tools being halved.

The cutters are mounted in axially adjustable boxes, three on each side, which slide transversely to the turning box on T rails. For each diameter two tools are used, one back and one front, so that the work is practically free from up thrust during the whole operation of turning, the depth of cut being regulated by the thrust collar screws marked F, fig. 3.

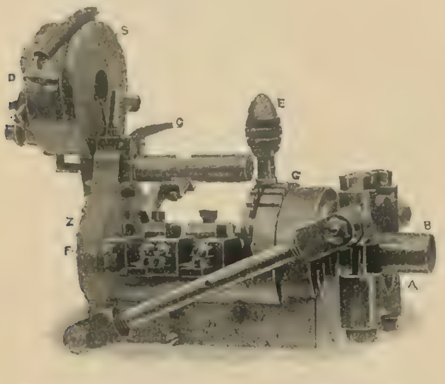


Fig. 3.—Screw Cutting and Die Attachment, Die Head Swung Clear.

The T rails are provided with pins which fit slots in a cam plate recessed in the bottom of the turning box, and by the rotation of this cam plate, which is actuated by the movement of the milled lever E into one of the notches cut in the rack G, the whole of the tools can be simultaneously fed in or out, thus permitting a number of different diameters to be cut without any resetting of tools.

In fig. 4 the die head S is swung down into the working position by pressing the trigger marked C, which secures it when raised clear of the work, as seen in fig. 3, and also when the die head is lowered for screwing. The view shows how the die head is free to slide during the screwing operation.

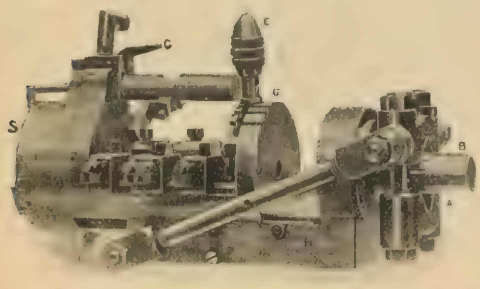


Fig. 4.—Screw Cutting Attachment, Die Head in Position.

The automatic trip motion in the die head is arranged so that a roughing and a finishing cut on any thread can be taken if required by pulling handle marked D, fig. 3, on to the first or second stop, the dies immediately opening when the predetermined length of screwing is reached in either case.

Electrostatic Safety Valve.

For the protection of low-voltage transformer circuits and telephone lines against high pressure, and for use in series lamp circuits, &c., Prof. Steels has designed the "electrostatic safety valve," illustrated in the accompanying sketch. Two screwed metal electrodes B_1 B_2 form a condenser with air dielectric. The distance apart of these blocks and of the pointed and screwed core-rods with which they are provided, can be adjusted with such accuracy that the valve can be employed satisfactorily for pressures as low as 15 volts. The space between the electrodes is hermetically enclosed by the ring A; directly the ionisation of the air in this space reaches a certain degree, spark discharge occurs and the current circuit is short-circuited.—*Revue Electrique.*

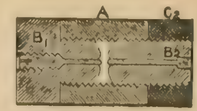


Fig. 5.—Electrostatic Safety Valve.

Varta Ignition Batteries.

The Braulik Engineering Co., of 8, Lambeth Hill, Queen Victoria Street, London, E.C., has lately put on the market the "Varta" ignition batteries, which can be conveyed in the car in a charged but unfilled condition. In case of emergency these cells when filled with sulphuric acid of sp. gr. 1·26, are ready for immediate use. At the first discharge the batteries possess 80 per cent. to 90 per cent. of their guaranteed capacity. They can be stored for any period in an unfilled condition until required, provided that they are kept in a dry place. If practicable, a small charge of the newly-filled battery is advisable before putting into operation for the first time, or at least the duration of operation should be curtailed as much as possible.

The Varta batteries are provided with pasted plates consisting of cakes of active material, and possessing a considerably longer life than grid plates. The plates are rigidly mounted in a celluloid box, and separated from each other by means of ebonite separators, so that a short circuit is almost impossible, notwithstanding the position of the accumulator. The lugs and noses are substantially designed in order to resist shocks. The cells are immovably mounted in sheet-iron or wooden battery cases, thus preventing the pole connections from becoming damaged.

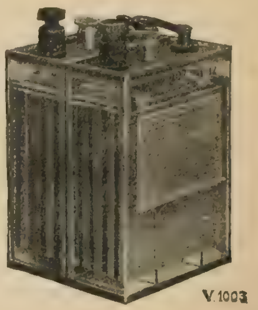


Fig. 6.—Varta Ignition Battery.

The Reception of Radio-Signals.—Experiments were recently conducted by H. Mosler between Norddeich and a receiving station 263 miles to the east of the latter. The strength of the received signals was investigated by aid of a reflecting galvanometer and also by paralleling the receiving telephone with a variable resistance, the latter being adjusted till signals became inaudible. An umbrella aerial 60 ft. high was used for reception, a copper pyrites detector, block condenser, and galvanometer being used in an aperiodic circuit. Observations taken six or eight times a month throughout a year showed that by day no considerable energy variations occurred; the loudness of reception did not appear to depend on the altitude of the sun. In spring and autumn, however, reception was twice as powerful by night as by day, whereas the distinction was much less marked in summer. Atmospheric pressure, humidity, temperature and wind velocity appeared to have no influence on reception, but on cold, starlight nights, the intensity of signals would frequently vary over a range of 6 or 8 to 1 within a few minutes, and according to no regular rule. Nights on which reception was loud but variable were often followed by nights on which reception was normal. Moonlight seemed to have no effect on reception. Similar results were reached using a horizontal earth antenna. In the author's opinion, the variations observed were due to variations in the conductivity and reflecting powers of the upper ionised layers of atmosphere (layers which, according to Heaviside's theory, are at a height of 30 to 60 miles). This would agree with Taylor's observation that night reception is, in these regions, most powerful during spring and autumn when the aurora borealis is most active.

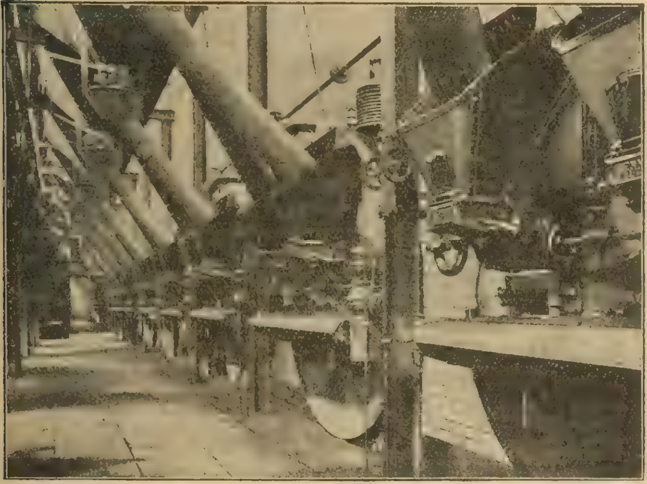
MACHINE FIRING AT FORMBY POWER STATION.

This generating plant, which supplies the L. & Y. Rly. Co.'s electrified lines in the Liverpool-Southport area, is equipped with 16 32 ft. 6 in. × 8 ft. 6 in. Lancashire boilers, each with a normal evaporation of 12,000 lb. per hour. Superheaters and economisers are fitted and two 100-B.H.P. induced draught fans. Recently the whole of these boilers have been equipped with Bennis machine stokers. The order for the first eight "Sprinkler" stokers and self-cleaning compressed-air furnaces was placed under severe guarantees; any or all of the boilers were to be capable of evaporating 14,000 lb. of water per hour for 24 hours on end or 16,000 lb. for short intervals, all the power for boiler auxiliaries being deducted before the evaporation was recognised. The guarantees were more than fulfilled, and Messrs. Bennis were instructed to equip the remaining eight boilers, which with the earlier stokers have been fitted with the double shovel arm gear. The results of the boiler tests, which were witnessed by representatives of both the L. and Y. Rly. Co. and Messrs. Bennis, were as follows:—

3-Hour Test.

Duration of test	3 hours
Number of boilers	3
Draught in in. of water-gauge in main flue	1·37 in.
" " " at chimney base	1·75 in.
Percentage of CO_2 in flue gases leaving boiler	12·8
Temperature of feed-water	
Entering economiser	63·0° F.
Entering boiler	252·0° F.
Steam pressure by gauge	160·0 lb.
Superheat	171·49° F.
Factor of equivalent evaporation as from, and at, 212° F., including economiser ...	1·3027
Coal used...	White Moss (ordinary firing slack)
Total weight of coal burnt	22,960 lb.
Coal burnt per boiler per hour	2,551 lb.
Coal burnt per sq. ft. grate surface per hour	56·69 lb.
Total quantity of water evaporated	161,131 lb.
Water evaporated per boiler per hour ...	17,903 lb.
Water evaporated per lb. of coal	7·02 lb.
Total equivalent evaporation, lb. 209,904	178,208*
Equivalent evaporation per boiler per hour lb. 23,323	19,801*
Equivalent evaporation per lb. of coal lb. 9·14	7·76*

* Not including economiser.



Bennis Machine Stokers, Formby Power Station.

8-hour Test.

Duration of test	8 hours
Number of boilers	8
Draft in inches of water-gauge—downtake ...	·31 in.
Percentage of CO_2 in flue gases—at downtake	15·5
Temperature of feed-water—	
Entering economiser	52·8° F.
Entering boiler	196·4° F.
Steam pressure by gauge	155·75 lb. per sq. in.
Superheat	135·17° F.
Factor of equivalent evaporation as from, and at, 212° F., including economiser and superheater	1·2920
Coal	White Moss (ordinary firing slack)
Cal. value of per lb. (dry)	13,208·9 B.TH.U.
Total weight of coal burnt	88,244 lb.
Dry coal burnt per boiler per hour	1,292·8 lb.
Dry coal burnt per sq. ft. grate surface per hour...	28·73 lb.
Total quantity of water evaporated ...	673,454 lb.*
Water evaporated per boiler per hour	10,[illegible] lb.
Water evaporated per lb of dry coal	[illegible] lb.
Total equivalent evaporation ...	846,710 lb.
Equivalent evaporation per boiler per hour ...	13,[illegible] lb.
Equivalent evaporation per sq. ft. boiler heating surface per hour	11·4 lb.
Equivalent evaporation per lb. of dry coal	10·117
Total thermal efficiency obtained	81·103 per cent

* After deductions are made gauge glass corrections, steam jets, power for stoker.

PHYSICAL SOCIETY EXHIBITION

(Concluded from page 52.)

Foster Instrument Co.

A new pattern of the fixed-focus radiation pyrometer was shown, which can be used, by a simple conversion, either for molten metal (by means of a tube of refractory material with a closed end), or for "black body" furnace work with an open end. The Hoskins alloy thermo-couple pyrometer was another useful device, intended for the direct immersion of the thermo-couple in molten brass or bronze. The nickel-chromium alloys used are of a highly refractory and non-alloying nature, so that the thermo-couple tip deteriorates only very slowly. The instrument is convenient for the rapid measurement of temperature before pouring, and is applicable to metals whose radiating surface is not suitable for use with the ordinary radiation pyrometer. Various other thermo-couple pyrometers using these alloys were shown, as well as a pyrometer alarm attachment which lights a lamp or rings a bell whenever the temperature (which is also recorded on a chart) passes any predetermined limit.

H. Tinsley & Co.

The chief features of this exhibit were mainly of optical interest, but a collection of Dr. Drysdale's A.C. potentiometers, wattmeters, &c., was shown. The A.C. potentiometer, which combines in itself almost a complete laboratory equipment, has been brought up to a remarkably high pitch of accuracy, and is now in use in some of the remotest quarters of the globe.

Record Electrical Co., Ltd.

The Record patent "Cirscale" instruments, with scales subtending an angle of 300°, were shown, including a pattern with the dial illuminated from the front, as shown in fig. 15, the effect obtained being very satisfactory. Another novelty was a laboratory substandard with horizontal dial, reading in millivolts (fig. 16).

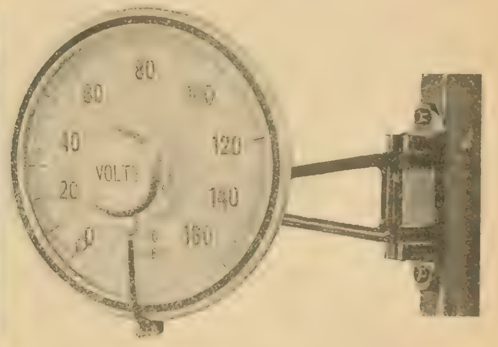


Fig. 15.—Front Illuminated Voltmeter.

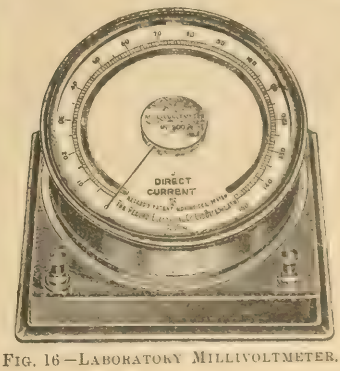


Fig. 16—Laboratory Millivoltmeter.

Weston Electrical Instrument Co.

The Weston stand was a very attractive one, all kinds of the company's instruments being shown, including a number of frequency, power factor and wattmeters in operation with a synchroscope, illustrating the process of synchronising with the supply current from the mains. The new miniature precision direct-current instruments, which we recently described, were shown in great variety, and attracted much attention, their handsome design and finish being worthy of their qualities as accurate measuring instruments.

Marconi's Wireless Telegraph Co., Ltd.

The Marconi crystal receiver (Type No. 16) was shown, which combines in one case an aerial tuning inductance and condenser, coupled to a detector circuit consisting of a variable condenser and an inductance. The detector consists of two carborundum crystals, which can either be used independently or put in opposition, the latter arrangement having the advantage that the effect of strong atmospherics is greatly reduced whilst the received signals are practically unaltered. A telephone transformer with tuning condensers is provided. The instrument is suitable for wave-lengths from 250 to 3,800 m. Another crystal receiver, for use in conjunction with the multiple tuner, and a direction finder were exhibited, as well as an adjustable air condenser of new pattern, designed to give the largest possible capacity in a given space, whilst leaving sufficient gap between the plates to allow a pressure of 500 volts to be safely used with it.

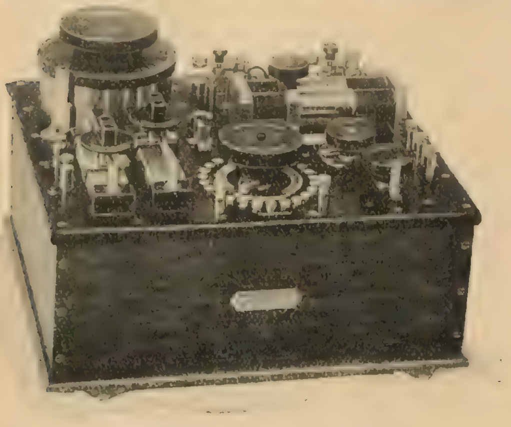


Fig. 17.—Crystal Receiver, Type No. 16.

Demonstrations.

Several interesting processes and apparatus were shown by private exhibitors. Messrs. C. C. Paterson and B. P. Dudding, of the National Physical Laboratory, gave a demonstration of a new device for mitigating the dazzle caused by motor-car headlights, by preventing the emission of any light from the lantern to the right-hand side of the road above the horizontal plane. Full light is given over the rest of the area, amply sufficing for all the requirements of the motorist, while drivers or pedestrians meeting the car, on their own side of the road, are protected from "dazzle," but are clearly visible to the motorist.

Prof. J. T. Morris showed a simple, but effective, apparatus for measuring the pull on a conductor carrying a current in a magnetic field—the design of Mr. L. Murphy. Prof. Morris and Mr. J. F. Forrest also demonstrated the use of the electric arc as a standard of light, on the lines described in our issue of October 24th, 1913.

THE HALF-WATT LAMP.

A very important development in incandescent electric lamp manufacture was announced by the British Thomson-Houston Co., Ltd., towards the end of last August. This announcement referred to the "half-watt" Mazda tungsten lamp, which was then exhibited for the first time in this country, at the company's London branch offices. An account of the demonstration and a description of the new lamp were published in our issue of August 29th.

Naturally great interest was aroused in this new development, and inquiries have rained upon the makers as to when the new lamps would be available. We are now informed that the manufacture of these lamps has been standardised at the B.T.-H. Co.'s Rugby factory, and delivery can be effected to order.

The lamps give two candles per watt, and have an average useful life of 800 to 1,000 hours; the light is much whiter than that of the ordinary tungsten lamp, approximating to daylight, and the intrinsic brilliancy of the filaments is eight times that of the ordinary type, so that for interior lighting it is essential that the lamp be enclosed in suitable diffusing glassware.

The sizes and voltages for which the lamp is available are as follows:—

Volts.	Watts.	Approx. British c.p.
50-65	400 and 500	600 and 1,000
100-130	500, 1,000, 1,500	1,000, 2,000, 3,000
200-260	1,000 and 1,500	2,000 and 3,000

As we have already explained, the bulb of the lamp is filled with an inert gas, such as nitrogen, and the filament is wound in a close spiral and mounted in short loops, making a very different construction from that to which we have become accustomed; the reasons for this procedure were fully explained in the papers by Messrs. Langmuir and Orange, which we abstracted in our issues of October 31st and November 7th, 1913. Both the drawn-wire filament and the half-watt lamp originated with the makers of the Mazda lamps, which are now available in all sizes from 1 to 3,000 c.p. The B.T.H. Co. have also developed a range of special fittings for use with the half-watt lamp, including weatherproof lanterns for the lighting of streets, open spaces and shop fronts, fitted with reflectors and opalescent globes, as well as indoor fittings equipped with their Alba and Veluria glassware. Full particulars are given in the B.T.H. Co.'s price list No. 11,000.

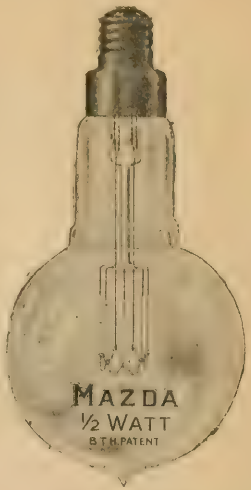


Fig. 1.—Mazda Half-Watt Lamp.

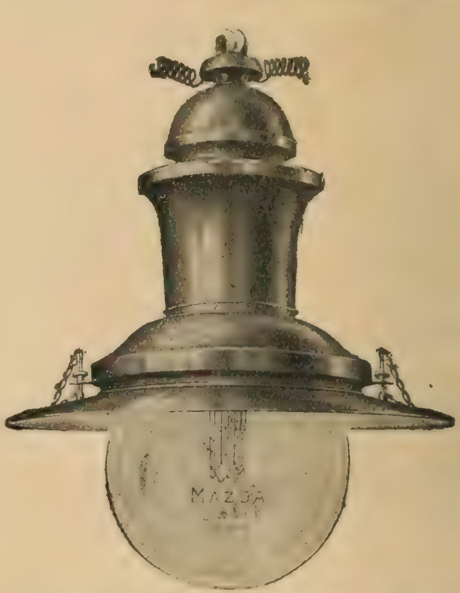


Fig. 2.—Special Weatherproof Fitting for Use with Mazda Half-Watt Lamps for Outside Lighting.

Needless to say, the new lamp lends itself admirably to indirect and semi-indirect illumination, of which the company has made a special study, and fittings for these purposes are available.

The General Electric Co., Ltd., have sent us particulars of their half-watt Osram lamps, one of which is illustrated in fig. 3. We understand that information regarding actual installations of these lamps will shortly be available. It will be seen that the construction of the lamp differs in detail from that above described, but in the main the same description applies. An average burning life of 1,000 hours is claimed, during which period the candle-power is almost constant. The ratio of mean spherical to maximum horizontal candle-power is given as 85 per cent., and the concentration of the filament makes it easy to design reflectors to give any required distribution of light. The filament is in one continuous length, and is stronger than that of the ordinary tungsten lamp. The bulb, on the other hand, is considerably smaller than that of an ordinary lamp of the same wattage, but owing to its special shape there is hardly any loss of candle-power due to discoloration, the deposit being carried up by convection current and deposited on the upper portion of the glass.

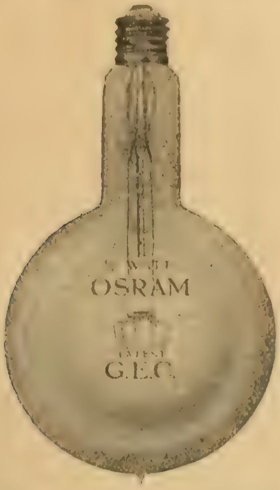


Fig. 3.—Osram Half-watt Lamp.

The "Nitra" half-watt lamp is being introduced by the Electrical Co., Ltd.; it is illustrated in fig. 4, and here again small differences in construction will be noticed. In particular, we may draw attention to the absence of the tip, which is liable to accidental breakage, and to the mechanical method of fixing the socket to the bulb, which renders loosening impossible. Special patent fittings have been devised by the makers to suit the "Nitra" lamp, one of which is shown in fig. 5.

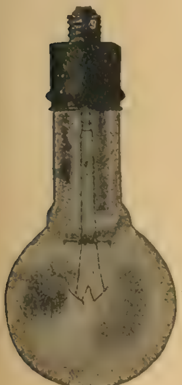


Fig. 4.—Nitra Half-Watt Lamp.

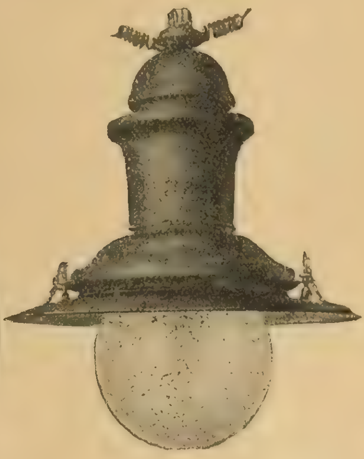


Fig. 5.—Nitra Lamp with Outdoor Fitting and Reflector and Opal Globe.

The "Nitra" lamp has been in commercial use in Berlin for several months with satisfactory results.

The Edison-Swan Co. are placing on the market the Royal Ediswan half-watt lamp, in sizes which include, in addition to those mentioned above, 1,000 and 1,500 watts at 50-65 volts. Special lantern fittings, with reflectors and globes for outdoor lighting, have been designed for use with the new lamp.

Messrs. Siemens Brothers Dynamo Works, Ltd., have brought out the "Wotan" drawn-wire half-watt lamp, which, with some differences in detail, is made on the same lines as the foregoing, and in the same sizes. It may be observed that the Edison screw cap is always used with the half-watt lamp. Weatherproof lanterns and street lighting fittings have also been devised by Messrs. Siemens Brothers, in various patterns.

The era of the half-watt lamps has thus commenced, and we anticipate that the demand for them will tax the utmost resources of the various makers.

Congresses in 1914.—The *Morning Post* has issued a large wall card giving particulars of congresses of learned societies and other bodies that are expected to take place during 1914, 1915 and 1916, and in some cases even down to 1920.

LEGAL.

James Howden & Co., Ltd., v. Powell Duffryn Steam Coal Co., Ltd.

In the Court of Session, Edinburgh, Lord Hunter had before him this claim for payment of the balance of the price said to be due to the pursuers by the defenders under two contracts between the parties. Under these contracts the pursuers agreed to supply and erect certain plant at the defenders' electric power station at Aberaman, South Wales. The first contract was dated July 6th, 1907, and the second, which was substantially a duplicate of the first, was dated February 23rd, 1909. The engineer appointed under the contracts rejected a turbine under each of the contracts. The pursuers said the turbines so rejected were conform to contract, and that the engineer was not justified in rejecting them. Two years ago Lord Hunter sisted procedure in order that the matters in dispute might be settled by arbitration. On Thursday last week, on the motion of counsel for pursuers, his Lordship assoilzied the defenders and found no expenses due to or by either party in terms of a joint minute.

A Scarborough Vibration Claim.

At Scarborough County Court last Tuesday the Misses Malenda and Mary Ross, confectioners, of Filey, sued J. E. Winter, tobacconist and hairdresser, for £50 damages and an injunction in respect of the noise and vibration caused by an engine and dynamo used for generating electricity for the hairdressing business. It was alleged that for the fixing of the dynamo the course of bricks on the defendant's side of the dividing wall between the two shops had been removed, and thus there was only a thickness of 4½ in. of brick between the dynamo and the plaintiffs' living room. The case was fought out at great length and adjourned.

THE TATA HYDRO-ELECTRIC SCHEME.

From time to time we have noted in our pages the progress made in the carrying out of the Tata hydro-electric scheme, which will eventually provide some 100,000 h.p. for transmission to the City of Bombay, where many of the 83 cotton mills are being equipped for electric driving.

The annual report of the Tata Hydro-Electric Power Supply Co., just published, shows that if the pipe line can be completed it will be possible to commence generating and transmitting power to Bombay next month, all sections of the work except the pipe line being well advanced, including structural work at the mills which are being electrically equipped. In view of the near approach of the operating stage, we append a short description of the undertaking, based on particulars which were recently given in the *Electrical World*, to which we are indebted also for our illustrations.

The storage lakes and hydraulic works of the Tata development are near Lonawla, a hill station at the summit of the Bhor Ghat, on the coast range. The precipitation in this area averages some 200 in. annually and is stored in lakes formed by constructing masonry dams across the Lonawla, Walwhan and Shirawta valleys as shown on the map, fig. 1. This water will be used in a power plant some 2,000 ft. below, the rainfall being used direct during monsoon periods.

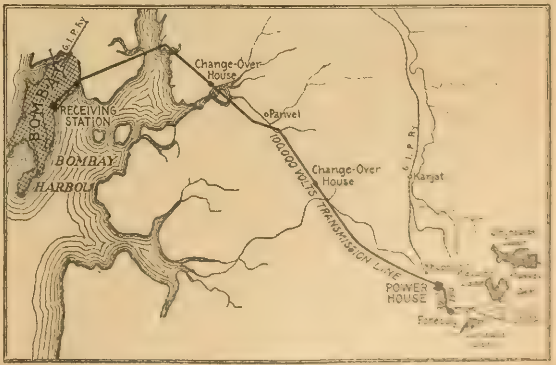


Fig. 1.—Water Storage and Transmission Line, Tata Hydro-Electric Scheme.

The Lonawla lake has a sufficient capacity to cover the largest break of monsoon on record; it is formed with two dams 3,600 ft. and 1,900 ft. long respectively, enclosing an area of 986 acres, and a total capacity of 466 million cub. ft. of water in the 19 ft. range between full supply and outlet levels.

For the remainder of the year the other two lakes will be drawn on, viz., the Walwhan, with a dam 4,500 ft. long, enclosing an area of 1,535 acres with a total capacity of 2,560 million cb. ft between outlet and full levels, and the Shirawata, with a dam 8,000 ft. long, enclosing 3,174 acres and a total of over 7,000 million cub. ft. of water.

The latter lake will be connected with Walwhan by a 5,000 ft. tunnel, and from Walwhan a masonry duct, 4 miles long, leads to the forebay on the edge of the Ghats, being joined en route by the duct from Lonawla lake.

From the forebay the pipe line runs some 13,000 ft. to the power house, giving a static head of 1,727 ft., corresponding to 743 lb. per sq. in. at the turbine. The pipe line is in two sections, the upper portion, 8,200 ft., consisting of two pipes each of a diameter ranging from 82 in. at the top to 77 in. at the bottom, where they each enter a 72 in. dia. distributing pipe; each distributing pipe feeds four pipes forming the lower 4,800 ft. of pipe line. These pipes vary from 42 in. to 38 in. diam.

The pipes are of Siemens-Martin steel, riveted in the upper and lap welded in the lower sections, and laid above ground, with expansion joints and masonry anchorages.

The first half of the pipe line will be capable of supplying four 11,000 H.P. turbines and two 850 H.P. exciter turbines.

The power-house building provides at present for five main and two exciter sets, with five transformer banks and switchgear. The equipment now being installed includes, however, only four main units. The generator room is spanned by a 67-ton electric travelling crane.

Each waterwheel set comprises an 11,000 H.P. Escher-Wyss horizontal impulse turbine running at 300 R.P.M., coupled to a Siemens 8,000-KW. 5,000-volt, 50-cycle, three-phase generator capable of 20 per cent. overload for ten hours. There are two exciter units, each comprising Escher-Wyss 850-H.P. turbines, running at 600 R.P.M. and coupled to 600-KW. 250-volt, shunt-wound, direct-current Siemens generators.

Four banks of step-up transformers will be installed, each consisting of three 3,333-K.V.A. oil-insulated, water-cooled, 5,250/100,000-volt, 50-cycle, single-phase units, connected delta to delta and having 20 per cent overload capacity for ten hours.

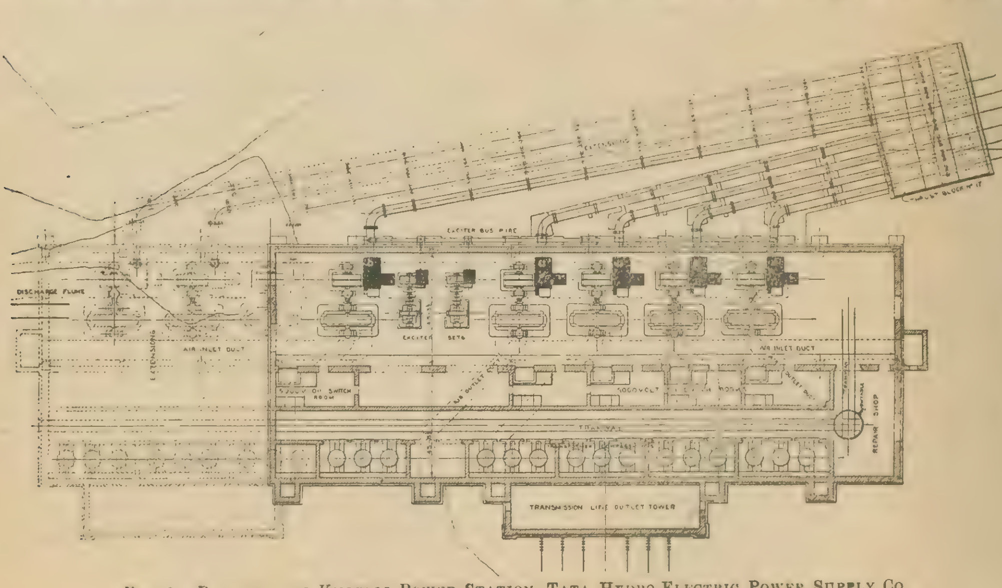


Fig. 2.—Plan of the Khopoli Power Station, Tata Hydro-Electric Power Supply Co.

The turbine wheels have cast-steel disks with cast-steel buckets. The shafts are of Siemens-Martin steel with two-ring lubricating bearings equipped for water cooling. The cast-steel nozzles are of the deflecting type. The governors, which operate by oil pressure, are fitted with hydraulic automatic servo-motor precision gearing which is guaranteed to limit the turbine speed variation to 2.5 per cent., 5 per cent. and 12 per cent. respectively when one-quarter, half or full load is suddenly thrown off. The guaranteed full load efficiencies are 82 per cent for the main units and 72 per cent for the exciters.

The main generators are each of 8,000 K.W. developing 5,000 volts between phases, their regulation at unity power factor is 9 per cent. and at 80 per cent. power factor, 22 per cent. The guaranteed full load efficiency at 80 per cent. power factor is 94.3 per cent. Each transformer bank consists of three G.E.C. (U.S.A.) single-phase oil-immersed water-cooled 5,000/100,000 volt, 50-cycle transformers designed for a full load output of 3,333-K.V.A. at 80 per cent. power factor. These transformers are of the shell type.

All switchgear in the Khopoli power house is electrically operated from a benchboard on the gallery overlooking the generator room at a point which will eventually be the centre of the building. In addition an auxiliary switchboard for station service, exciter control, generator field-switch panels and signal apparatus are located on the generator-room floor.

The six-panel benchboard, built of blue Vermont marble, controls the four main generators with their step-up transformer banks, two exciters and two outgoing 100,000-volt, 36,000 K.V.A. three-phase lines. The generator-field series rheostats, the turbine governors and the air-duct shutters are all operated by 220-volt. motors. The air-duct shutters are interlocked with the generator-field switches so that when the fields are energized the shutters will be open. The low-tension or 5,000-volt buses are of copper-bar section.

In the transformer high-tension circuits to the outgoing lines automatic oil-break switches are employed; each of these switches has a rupturing capacity of 50,000 K.V.A., automatic protection being afforded by means of series inverse-time-limit overload relays.

The 100,000-volt oil-switch room is located on the floor above the transformer compartments; the lightning-arrester equipment is of the indoor type, the horn-gaps and cells being located in the transmission-line exit tower. Each outgoing line is protected with choke coils and 100,000-volt aluminium-cell arresters.

The transmission line terminates at the receiving station on the island of Bombay, with a total length of 43 miles. On the way the line crosses two tidal creeks (one 10,000ft. wide and 42ft. deep at high tide), a railway and several roadways. Ultimately there will be four transmission lines normally working in parallel, and carried on two lines of towers. Two "change-over" stations with disconnecting switches are provided, by which it is possible to divide the line into three sections for cutting out or inter-connecting different sections as conditions demand. The present contract covers, however, only two transmission circuits carried on one set of towers.

Copper conductors are used of 0.095 sq. in. section spaced 10ft. 6in. between wires, and carried on six-unit suspension-type insulators. The towers are built in two sections, a superstructure and a base, rivetted together at the site. In all about 500 towers are used in the line.

The standard towers are 66ft. high and are spaced 500ft. apart. The special crossing towers are spaced 1,175ft. apart, and have a height of 160ft. to comply with the government requirements that no part of the transmission line shall come within 80ft. of the water at high tide.

The receiving sub-station is located about two miles from the docks. It has been designed for an ultimate capacity of 74,880-K.V.A. in eight step-down three-phase transformer banks of 9,360-K.V.A. each.

The present building provides for five such transformer groups, each consisting of three single-phase, oil-immersed, water-cooled, 85,800/6,600 volt transformers, rated at 3,120-K.V.A. The windings are connected delta to delta.

The switch-gear equipment is generally similar in design, arrangement and layout to that in the power house already described, and consists of remote-controlled electrically-operated oil switches and other apparatus actuated from a benchboard.

Each incoming line is protected with choke coils and aluminium-cell lightning-arrester equipment. A ground bus runs the length of the station.

In 1907 after a lengthy inquiry the Indian government granted a licence giving the Tata company the privilege of supplying hydro-electric energy within Bombay to customers whose consumption exceeded 500,000 K.W.-hr. per annum.

A total of thirty-four mills have now contracted for hydro-electric energy from the Tata system.

The terms of the ten-year agreements between the power company and the mill owners cover the supply of energy for purposes of motor drive at 0.55 anna per K.W.-hr. in the case of mills where the electric installation is provided by the power company, and at 0.50 anna per K.W.-hr. in the case of mills furnishing their own motors and equipment, the company providing and maintaining the mill transformers. Energy for lighting will be supplied at 1.25 anna per K.W.-hr. separately metered, up to 20 per cent. of the energy supplied for power. In the mills the group driving system has been adopted, using 50 cycle 3-ph. slip ring 2,000 volt motors in sizes from 50 to 500 H.P.; in some mills 500 volt motors will be used. For distribution purposes the mills are divided into groups, each group having a feeder to each mill, as well as a ring main for all the mills of the group; three-core paper insulated lead sheathed cable, operating at 6,600 volts, and laid solid is used for this service, Messrs Callender being the contractors for the work, while the mill motors, transformers—the latter in 500, 600, 700 and 900 K.V.A. sizes, star-connected on both sides—and switchgear are being supplied by the British Westinghouse Co., and have already been referred to in our pages. The G.E. Co. (U.S.A.) supplied all the transformers and switchgear at both the power house and receiving station in Bombay, while Messrs. Bullers, Ltd., supplied the transmission towers and insulators, and Messrs. Felten and Guilleaume, the copper conductors.

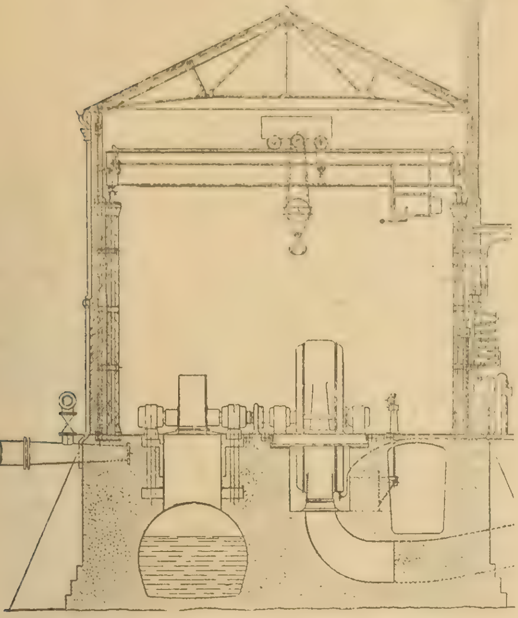


FIG. 3.—SECTIONAL VIEW, KHOPOLI STATION.

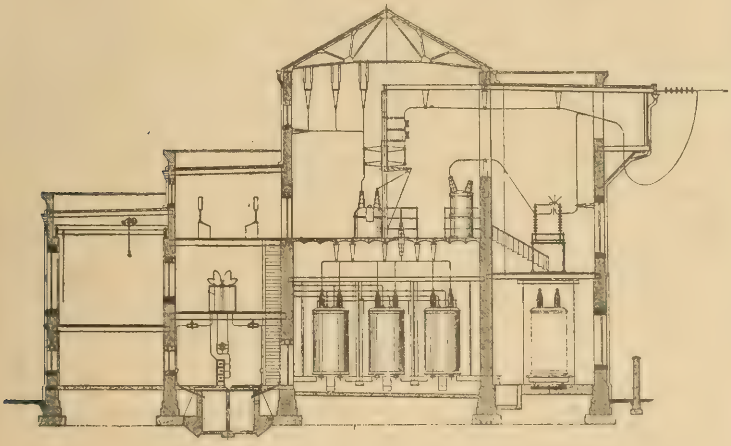


FIG. 4.—SECTIONAL VIEW, BOMBAY RECEIVING STATION.

We may add that Messrs. Alfred Dickenson and Co. are consulting engineers for the whole project.

BUSINESS NOTES.

Consular Notes.—Spain.—In a recent issue of the ELECTRICAL REVIEW certain information was given regarding the extensive use of electricity in Barcelona and the operations of the Canadian company which has undertaken to exploit the electrical resources of the district. The British Consul at Barcelona, in a recent report, makes some interesting comments on the subject. It is estimated that the industries of Barcelona are now using [illegible] H.P. (the bulk of consumers not using individually more than [illegible] H.P.), generated by steam which, owing to the high price of coal, is stated to cost from £15 to £20 per H.P., whereas the company in question has advertised that its electric power will be saleable at a minimum of £6 per H.P., as against an average of £17 per H.P. formerly. If this is so, there can be no doubt that this cheaper power will lead to an enormous extension of the trade of Barcelona and district, as it will enable the manufacturers, on the basis of their present annual cost of working, to increase their production greatly. The company owns all the capital stock of the local power company and practically all the capital of a local railway company, also the major portion of the shares of a local electric light company, and all, or a controlling interest, in the electric light and power companies of some six towns within a radius of 60 miles of Barcelona.

The company had a possible dangerous competitor in a French company already installed there with the same object called L'Energie Electrique, which had constructed a large steam power station and hydraulic plant on the River Flamisell in the Pyrenees, but it is understood that the new company has done away with any opposition by taking a half interest and an option on the balance, with a working agreement to avoid duplication in distribution. The company has also purchased the suburban railway running from Barcelona to some towns in the neighbourhood, and proposes to make extensions. Also the company has leased the existing tramway system here for 60 years, and holds 40 per cent. of the shares. It will thus be seen that it holds in its hands all the undertakings working by electric power to which it will in future supply the said power. The local company owns concessions for the development of various water powers on the River Noguera Pallaresa and River Segre, and is now building plants which will develop a total of some 136,000 H.P. The first of these, which will develop some 4,000 H.P. is located near the town of Pobla, province of Lerida, and is nearly completed. The second is situated near the town of Seros and will have a capacity of some 56,000 H.P.; this will, it is expected, be finished by the end of the year. The third, which will be located on the River Noguera Pallaresa above its confluence with the River Segre, will develop some 70,000 H.P. and is expected to be completed in 1914. The flow of the river for this will be regulated by means of a reservoir situated near the town of Tremp, and the construction of this reservoir will create sufficient storage to ensure a practically steady flow of the river throughout the year. The energy produced will be transmitted to Barcelona and the surrounding region at 110,000 volts, by two transmission lines on steel poles, a distance of 200 km. (about 135 miles). These lines of transmission will end in transformation stations established outside the town, whence the current reduced to a lower pressure will be distributed by a vast system of canalisation. The company has already contracts covering the supply of some 100,000 H.P. for lighting and power purposes, and has also in addition a contract for the supply of a very large amount of power for the manufacture of nitrate in Lerida. It is, of course, still early days to speak as to the effect on Catalonia of this gigantic scheme, and the expenditure in and near Barcelona of many millions of pounds sterling; but if the scheme turns out all that its promoters hope and promise, it will revolutionise this part of Spain, vastly increasing its present wealth and great business enterprises and promoting a general prosperity among all classes. Meantime this influx of millions of money into a comparatively small district and the giving of employment to thousands of workmen and to a large staff of engineers, accountants, managers, clerks, &c., all of whom are liberally paid, has produced a wave of prosperity, and money is plentiful. In conclusion, it is an important fact that this great undertaking is also benefiting British commerce, for independent of orders placed here with the representatives of British houses for various articles required in connection with the hydraulic and railway works, orders have also been given, through the company's buying agent in London, direct to British firms, representing during 1912 some £300,000. Including the orders given to British agents here as before mentioned, British firms have benefited to the extent of about £500,000 already, and it is likely that every year will continue to see good orders placed in the United Kingdom.

In this connection, the Consul states elsewhere in his report that a British firm established in Barcelona has informed him that there has been a fair increase in the machinery trade in recent years, and that the feature of most interest is the importance of British-made electrical machinery, which is now in a fair way to compete with German makes. In spite of this market having up to the present been dominated entirely by German electrical firms, there has been a considerable importation from the United Kingdom of boilers and accessories, general machinery, tubes and electrical machinery; but at the same time it appears that the terms quoted by British firms are not as favourable as those of German manufacturers.

India.—Reporting recently on the market for electric wiring devices in India, the American Consul states that the new houses in Bombay show considerable improvement over the older structures from an architectural standpoint, and are planned more in accordance with sanitary requirements. There are, however, few, if any, fireproof buildings in the city. In the native quarter, or bazaar district, wooden buildings predominate, and in many of the new structures, on account of the increased cost of building material and the high wages of labour, safety and durability have been less considered than a high return upon investment. In the city proper, business structures and residential apartment houses and all public buildings are built of stone. Steel construction has not been introduced, except for warehouses. Lights and fans operate on a 230-volt direct-current, three-wire system. The suburbs of Bombay are supplied with an alternating-current installation of 230 volts. Under the system of electric wiring commonly employed, and found to be most suitable for general installation, the wires are carried over the surface of the walls and ceilings on hard wood cleats; the latter are separated by 2-ft. spaces, and the whole is enclosed in a teak or oak casing. Wire contact with the wall surface must be carefully avoided or the installation will require renewal in about two years. In this heavily saturated atmosphere the trap and porous lime building stone so largely used in Bombay absorbs a great deal of moisture, and the leaching process, which quickly follows, seriously damages electric installations unless the walls are thoroughly protected. Conduit wiring systems that involve burying the wires in the wall or ceiling have been tried, but found unsatisfactory, for general purposes. For the wiring of Government and municipal buildings the contract specifies insulated, steel-armoured conduit, but the work is carried over the wall surface. Non-insulated conduit work has been put into the majority of mills. Dealers state that an improved system that would lower the present cost of wiring would find a ready sale if it met all tests. In this regard mention may be made of the new wiring system recently introduced into Bombay by Henley's. Many public and business buildings have been wired with it, and it is said to work out cheaper than the conduit method both on account of the low cost of material and reduced labour expenses for erection. Conditions in the electric specialty or electric light supply trade are far from satisfactory. There are in Bombay at least 100 dealers, many of whom claim to be electrical engineers, and the overcrowding in this line is partly responsible for an extended system of price-cutting. The most reliable and old-established European firms of electrical engineers are keenly feeling the competition of native firms, and while the volume of trade is large, it is being handled at present on a dangerously low margin of profit. The dealers are steadily reducing the quality of stock carried in order to meet the demand for low-priced material. The United Kingdom furnishes over three-fifths of the electrical supplies imported into Western India. Germany has a small, but slowly growing, share of this trade, while Belgian, French and Italian manufacturers have all lost ground in the last five years. There is practically no direct trade in this line with the United States, and the principal firms among the local dealers manifest very little interest in American-made electric light material. They are inclined to argue that American goods are too high priced for the market, and in discussing the point the Consul was told that the manufacture of British electrical merchandise has been so developed, and the cost of production so reduced, that German manufacturers were finding it difficult to meet their competition. But probably the chief obstacle in the way of American trade development is distance from the market. Goods ordered from London are received at Bombay in 10 or 11 weeks; at least twice that time would elapse before the arrival of goods ordered from America. The sockets in use throughout India are of the bayonet cap type. Rotary and push-button switches are carried in stock, but dealers state that the demand runs almost exclusively to switches of the tumbler type. Pendant switches have a very limited sale.

Book Notices.—*The Electrical Engineer's Diary*, 1914. Edited by J. H. Johnson, M.I.E.E. London: S. Davis & Co. Price 3s. 6d.—As our readers are aware, this volume is much more than a diary; it contains a mass of useful information for consulting engineers, contractors, central-station managers and others concerned in the supply and use of electrical apparatus, under the heads of General Information, the Generation of Electricity, Official Rules and Regulations, the Application of Electricity for Lighting, Heating and Cooking, and the Application of Electricity for Power Purposes. There is also a list of London streets in which electricity mains are laid, stating the authorities concerned in each case, and a list of electricity supply authorities in the United Kingdom. Altogether it is a most useful desk companion.

Fowler's Mechanical Engineer's Pocket Book for 1914 (Scientific Publishing Co., price 1s. 6d. net) is now in its 16th year, and contains an inexhaustible store of information on all branches of mechanical engineering. From a cursory inspection of the contents, which are of too miscellaneous a character for detailed review, we are satisfied that they are kept well up to date, and we have no hesitation in recommending the work.

Fowler's Mechanics' and Machinists' Pocket Book and Diary for 1914 (price 6d. net) is another well-known book of reference, of the greatest utility in the drawing office, machine shop, and tool room, and emanates from the same publishing office, both books being edited by Mr. W. H. Fowler. This book is equally deserving of commendation.

The International Whitaker, 1914. London. 2s. 0d.—We commented favourably on this publication a year ago, when it made its first appearance. In this, the second edition, the information relating to different countries has been revised from official sources, and in these days, when most seriously-minded men are world students, and so many business men are world travellers, we feel that the book meets a need, and that it will be welcomed. Information concerning populations, products and industries, and other main characteristics, of the different countries is brought together, beginning alphabetically with Abyssinia, and going on to Venezuela. At the end many pages are occupied with names, &c., of diplomatic and Consular representatives of the United Kingdom and United States in foreign countries.

The Chamber of Commerce Journal has issued its usual "Annual Trade Review." It consists of 50 foolscap pages, contains numerous articles by experts on the leading trades, including engineering, electrical, building, &c., and on all the more important commercial and industrial centres of the United Kingdom. It is published as a special supplement to the January issue of the *Journal*, and forms very interesting and instructive reading.

We offer our hearty congratulations to the *Railway News* on its bumper Jubilee issue (5s.). It is a wonderful production, telling by pen and picture many parts of the story of 50 years of railway progress. The *News* was founded in 1864 by Dr. Samuel Smiles and Mr. E. McDermott. One of the most attractive features among the contents is a series of most interesting pictures reminiscent of very early railway days. There are numerous articles on railway subjects which have been specially written for the issue by authorities.

"Willing's Press Guide"—issued from 125, Strand, at 1s.—is a most convenient alphabetical and classified guide to the Press. That it meets a real want is evidenced by the fact that it has now reached its forty-first annual appearance.

The January number of the *Hospital Gazette* is a special one, containing a fully-illustrated description of the new King's College Hospital, including the electric installation, which contains an auxiliary electric plant, electric fans, lifts, boiling apparatus, sterilisers, X-ray and electro-medical equipments, telephones, &c. Messrs. Kirkland & Capper acted as consulting engineers for the work.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXIX, No. 10. December, 1913. New York: The Society.

"Annales des Postes, Télégraphes et Téléphones." December, 1913. Paris: A. Dumas. Price 10 fr.

"Coal-Mine Accidents in the United States and Foreign Countries," by F. W. Horton; "Monthly Statement of Coal-Mine Fatalities in the U.S.," September, 1913, by A. H. Fay. Washington: Government Printing Office.

"*Journal* of the American Institute of Architects." Vol. I, No. 12. December, 1913. Washington: The Institute. Price 20 cents.

"Atti della Associazione Electrotecnica Italiana." Vol. XVII, No. 23. December 15th, 1913. Milan: Stucchi, Ceretti & Co.

"*Proceedings* of the Rugby Engineering Society." Vol. X, 1912-1913. Rugby: The Society. Price 10s. 6d.

"Fees for Electric, Magnetic and Photometric Testing." 1913. Washington: Government Printing Office.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol. XXX. December, 1913. Brussels: E. Bruylant. Price 1 fr. 75.

"Revista Tecnologico-Industrial." (Publicacion Mensuel de la Asociacion de Ingenieros Industriales Agrupacion de Barcelona.) Vol. 36, No. 11. November, 1913. Barcelona: The Association.

Fires.—A serious fire occurred on the 10th inst. at the engine works of MESSRS. CLARKE, CHAPMAN & CO., LTD., Gateshead-on-Tyne, one of the power sub-stations being completely destroyed. The plant, which included dynamos, transformers, motors, &c., was burnt and twisted beyond all recognition, and the amount of the damage, it was reckoned, would run into several thousands. As practically all the plant was electrically driven, and the place lighted by the same means, it was feared that a serious stoppage would ensue, but fortunately the management were enabled to install such plant as was essential so quickly that this was obviated.

The premises of MESSRS. TYLER & SONS, engineers, York Road, King's Cross, were partly destroyed by fire on 11th inst.

Bankruptcy Proceedings. — CHARLES HELLYER PEARSON (trading as Pearson & Co. and the B.O.A. Engineering Co., of Manchester and Hyde, electrical, mechanical and sanitary engineer, decorator and plumber).—Last day for receiving proofs for dividend, January 26th. Trustee, Mr. A. Yearsley, 27, Brazennose Street, Manchester.

C. S. NORTHCOTE, electrical engineer, 67, Stanthorpe Road, Streatham, S.W.—Trustee (Mr. E. W. J. Savill, 132, York Road, S.E.) released November 20th, 1913.

Electric Smelting in Sweden.—The output of electric pig-iron in Sweden has grown from 122 tons in 1908 and 870 tons in 1910 to no less than 17,566 tons in 1912. At the end of 1912 there were nine furnaces at work, rated at 14,700 KW., and in 1913 the number was increased to 20, rated at 41,500 KW. In 1911, 2,034 tons of steel were produced with the electric furnace in Sweden—almost as much as with the crucible.

Trade Announcements.—MR. J. PENDREICH has resigned his position as manager with Messrs. Millar & Stewart, Edinburgh, and has started business as the Pendreich Electrical Firm, wholesale agents and factors, at 250-251, Daley Road, Edinburgh. Catalogues and lists are desired.

MR. LIONEL ROBINSON has been appointed sole agent in this country for the electrical trade by Messrs. Showell & Son of Stirchley, Birmingham, and will handle business in turned, screwed and stamped repetition work. Messrs. Showell, who for some years have been located in Birmingham, recently erected an up-to-date factory on one floor, outside the city, at Stirchley. It is equipped with modern machinery for automatic and turned parts, and repetition stamped work made by up-to-date combination tools is a speciality.

MR. CHARLES LANG has removed from Finsbury Pavement to No. 4, Mincing Lane, E.C. "Telephone, London Wall, 1459." Mr. Lang is London agent for the Cable Accessories Co., Ltd., of Tividale, Tipton, Staffs.

With reference to our notice of last week regarding the WALSALL HARDWARE MANUFACTURING CO.'s new depôt in London, we understand that Mr. C. G. Maisey, late of Messrs. J. & H. Grevener, is acting as London manager of the company, and he will in future be devoting his entire attention to that business. The Walsall Co. last year took two acres at Walsall for extensions, and a new foundry has now been completed, with the result that at the new depôt in London very large stocks of steel conduit and fittings will be carried.

MESSRS. WALTER NEWBOLD & CO. announce that their telephone numbers are now "City 3718 and 5098."

MESSRS. ROSE BROS., of 38 and 39, Beech Street, Barbican, London, E.C., have been appointed sole British agents for the Cie. F.A.C. Da and Dutilh of Paris. Circulars have been received of specialities for wireless telegraphy and of the "Wescoscope" home cinematograph.

THE RADIUM ELECTRIC CO., 82, Hatton Garden, London, E.C.—Illustrated price list of the "Pioneer" combined electrical beauty massage and manicure machine, also the Rapid and Monsoon hot-air douches.

MESSRS. G. W. GOODCHILD & MACNAB, of Eagle Street, W.C., announce that their new telephone number is "Holborn 6405."

MESSRS. WOOLLETT, AIREY & CO., LTD., shipping agents, ask their electrical friends to take note of their change of address from Lime Street, E.C., to 47-51, King William Street, London, E.C. Telephone numbers, "City 6,934 and 5."

Catalogues and Lists.—THE ELECTRICAL CO., LTD., 122-124, Charing Cross Road, London, W.C.—The first number of the "E.C. Journal," which it is intended to issue monthly, has been received. Particulars appear of the different A.E.G. factories, their floor space, and tool and motor equipments, motors in stock, half-watt "Nitra" lamps, prepayment meters, and other matters. There are also comparative curves of the prices of raw materials used in electrical manufacturing for last year and the year before. A separate motor stock list, a circular describing the "Auto-ray" sign, and a 4-in. metal rule giving English and metric measures have also been received.

BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, London, E.C.—Illustrated leaflets relating to aluminium insulation for magnet coils, aluminium netting and gauze, aluminium in the automobile chassis, and aluminium mandrils for rubber manufacturers.

THE ELECTRICAL SUPPLIES CO., 41, Cheapside, London, E.C.—Illustrated folder giving prices of a number of designs of electric fires and radiators, including the Ensign and the Calor fires, hot-bar radiators, also luminous and convector types.

MESSRS. W. CANNING & CO., 133 to 137, Great Hampton Street, Birmingham.—Section 1 D of their catalogue (32 pages) contains very fully-illustrated information, with tabulated details and prices of low-voltage dynamos, motor-generators, shunt regulators and electrical accessories, &c., for electroplating, electrotyping, electro-chemical processes, &c. Directions are given for fixing and working the electroplating dynamos and for charging motor-car accumulators from plating dynamos.

MESSRS. SIMPLEX CONDUITS, LTD., 116, Charing Cross Road, London, W.C.—Supplementary sheet T 5 is a four-page list giving illustrated particulars and reduced prices of their Universal conduit boxes.

WESTINGHOUSE COOPER HEWITT CO., LTD., 80, York Road, King's Cross, London, N.—Illustrated list No. 66 describes a continuous-type blue-printing outfit (Everett McAdam system) and tabulates sizes, weights and prices of same.

Liquidations.—THE ORO LIGHT AND GENERAL SUPPLY CO., LTD.—A final meeting for the winding up of this company is called for February 11th, at 36, Cock Lane, London, E.C., by the liquidator, Mr. C. Harris.

PRESTON ELECTRIC CO., LTD.—A meeting will be held at 12, Bennett's Hill, Birmingham, on February 16th, to hear an account of the winding-up from the liquidator, Mr. T. L. Rawlins.

GRINDELL-MATTHEWS WIRELESS TELEPHONE SYNDICATE, LTD.—In the Companies' Winding-up Court on Tuesday, Mr. Justice Astbury, on the petition of J. G. Pullen & Sons, made a compulsory order for the winding up of this syndicate. The petition was unopposed, and the company did not appear. Mr. M. M. Macnaghten appeared for the petitioners.

Portsmouth Dockyard Fire.—At the Coroner's inquest last week evidence was given showing that the fire could not possibly have been due to electricity, as the current was off the circuit at the time when the fire broke out.

Calendars and Diaries.—THE BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, have again issued one of their large and useful wall calendars for 1914. As before there are three months' dates shown very clearly on each of 12 sheets, the preceding and the following months being printed less conspicuously than the current month. Half-tone views of electrical equipments for collieries and industrial works, also the firm's arc and incandescent lighting and other specialities are appropriately worked into the design. Addresses and telephone numbers of the different branch offices and departments of the company in the United Kingdom appear.

From the GENERAL ELECTRIC CO., LTD., we have received a set of refill engagement slips for 1914, for use on their desk calendar received a year ago.

From MESSRS. MAWDSLEYS, LTD., of Zone Works, Dursley, Glos., we have received a pictorial wall calendar with monthly date slips. "When Autumn Breezes Blow," (W. H. Margetson), comes as a very cheering subject in these days of wintry blasts.

MESSRS. FLOWERDEW & CO., technical translators, of 14, Bell Yard, Temple Bar, W.C., have issued a small wall calendar with monthly slips.

From MESSRS. SIMPLEX CONDUITS, LTD., we have received a pocket diary—one of the most practical that we have seen—and a desk fitting built up of Simplex conduit, to hold pencils, rubber and compasses, all of which are included, making a very convenient device; as the pencils are supported in a vertical position, they can be seen at once, and need not be groped for under loose papers, &c.

Exhibition at Lyons.—An International Urban Exhibition will be held at Lyons from May 1st to November 1st, to which, probably, a Colonial exhibition will be joined. The exhibition will be divided into 52 sections, those of interest to electricians being the following:—Section III, Transport; Section IV, Mines, metallurgy, machines; Section XVIII, Light and lighting; Section XIX, Ventilation, heating, refrigeration; Section LI, Electricity; Section LII, Posts, telegraphs, telephones. Section LI is subdivided as follows:—Class 281, "White coal," rivers, reservoirs, weirs, canals, tunnels, high-pressure channels, &c., *i.e.*, all works relating to the utilisation of waterfalls. Class 282, Hydraulic motors and heat engines, dynamos, alternators, exciters, switchboards, accumulators, &c., *i.e.*, all equipment plant for power houses. Class 282 *bis*, Transmission of electricity, cables, conductors, posts supports, insulators, lightning conductors, transformers, &c., *i.e.*, all apparatus relating to the transmission of electricity from the power house to the consumer. Class 283, Use of electricity in other ways than for lighting—electrometallurgy, electro-chemistry, furnaces, electrodes and sundry tools, electric motors, heaters, apparatus for the use of electricity in agriculture and industries, &c., *i.e.*, all electrical apparatus save those for lighting.

Spain.—The *Gaceta Oficial* (Madrid) of December 30th contains the list, published annually, of the various classes of material which may be required by Spanish Government departments, and in the supply of which foreign competition will be permitted, during 1914. The following are among the items:—Manufactured steel and wire; steel rails; tubes and cables; brass, nickel, aluminium, platinum, bronze and copper goods; steam turbines; locomotives; gas engines exceeding 300 H.P.; steam boilers; tools; metal testing machines; electrical apparatus for medical laboratories; telegraph and telephone appliances; electric searchlights; submarine cables; electric lighting accessories and arc lamps; electric generating machines; scientific instruments. The *Gaceta* containing the detailed list may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

Ship Lighting.—THE EDISON AND SWAN UNITED ELECTRIC LIGHT CO., LTD., have again this year secured a contract for the supply of "Royal Ediswan Lamps" to the Cunard Steamship Co., Ltd., Elder, Dempster & Co., Ltd., and Cammell, Laird & Co. Ltd.

For Sale.—The Sheffield Tramways Department will shortly have for disposal a further quantity of G.E. 52 traction motors (5 or 6-turn armatures). Fulham Corporation has for disposal a 300-KW. two-phase Musgrave-G.E.C. steam alternator. Messrs. Davis & Timmins, Ltd., have for sale two 100-KW. sets, gas engines and direct-coupled dynamos, and two suction producer gas plants, motors, lamps, &c. Particulars are given in our advertisement pages to-day.

LIGHTING and POWER NOTES.

Accrington.—At a meeting of the T.C. last week, it was stated that the total cost of fuel per unit generated at the electricity works was 0·2d., and if the value of by-products was deducted, the figure was reduced to 0·13d., which was the lowest in the country.

Altrincham.—STREET LIGHTING.—The Altrincham Electric Supply, Ltd., has informed the Council that it can supply energy for street lighting at 2d. per unit, and the Council is to obtain a scheme and estimates for lighting George Street.

Aldershot.—VIBRATION COMPLAINT.—A further complaint was received by the D.C. last week of the vibration caused by the Diesel engine at the electricity station. The chairman of the E.L. Committee said the Diesel Co. agreed to indemnify the Council against all actions, but until some action was taken the company would refuse to act. It was decided to send a copy of the letter to the company.

Argentina.—The Tucuman Municipality will shortly be calling for tenders for street lighting, the existing contract with the Eléctrica del Norte Co. having almost expired.—*Review of the River Plate.*

Australia.—The Heidelberg (V.) Shire Council has decided to adopt an electric light scheme at a cost of £10,000.—*Australian Mining Standard.*

Blackpool. — A proposal is on foot to introduce the "rateable value" system of charging with a primary charge of 12½ per cent. on the rateable value of the house, plus ½d. per unit consumed.

The engineer, Mr. Furness, anticipates that the concession will cost the department £600 a year in connection with a section of the consumers, but advantages will be secured.

Braintree.—PROPOSED E.L. SCHEME.—The Committee which has the E.L. scheme in hand has visited the Grays electricity works, but has reported that it requires further information before presenting a definite report.

The U.D.C. has decided to approach the Bocking Council with a view to including that parish in the scheme.

Bradford.—SCHOOL LIGHTING.—The Hanson School Committee is considering the installing of electric light at the school.

Bulkington. — PROV. ORDER.—The U.D.C. has appointed a deputation to confer with the Foleshill R D.C. relative to the application of the Midland Electric Light and Power Co. for a prov. order for electric light in its area, and also in the parish of Bedworth. At the request of the Bedworth P.C., the Foleshill R.D.C. has decided to oppose the application.

Canada.—A by-law was passed at Winnipeg on December 12th authorising the expenditure of $1,000,000 for extensions on the municipal hydro-electric system.—*Canadian Electrical News.*

The Port Arthur, Ont, electricity department shows a net profit of $62,000 for 1913. The city is using 2,100 H.P. from the Hydro-Electric Commission, and 700 H.P. from the Current River station. The storage capacity of the various dams is 1,843,100,000 cb. ft. *Canadian Engineer.*

Cambuslang (Lanark).—SCHOOL LIGHTING.—The School Board has decided to light the school in course of erection at Gateshead, by electricity.

Carlisle.—LOAN SANCTIONS.—The L.G.B. has sanctioned the borrowing by the Corporation of £7,970 for extensions to the plant and buildings at the electricity works, and £4,300 for installing high-tension plant.

Chile.—Decrees have been issued approving the plans submitted by Sres. J. Horde, A. Munoz and others for an E.L. installation in Aranco, and those submitted by Lochnert, Eberhard & Co. for an E.L. plant in Thomé.—*Board of Trade Journal.*

Clyde Valley Extensions.—It is stated that the Clyde Valley Electrical Power Co. is to extend its mains through Dumbarton to the Vale of Leven. Besides the big shipbuilding yards and other works on the line of the Clyde Valley supply, connections are to be made to the Argyle Motor Works in Alexandria and the Dumbarton Tube Works at Dumbuck.

Continental Notes. — PORTUGAL. — The *Diario do Governo* publishes a decree granting to a private company a concession for the supply of electricity in the City of Manguadde. The concession will run for 20 years.

BELGIUM.—The Société des Centrales Electriques des Flandres, of Brussels, has secured the contract for the electricity supply required by the Ostend-Blakenberghe Electric Railway.

Cranbrook (Kent). — PROPOSED E.L. SCHEME. — Messrs. J. B. Saunders & Co., of Westminster, have approached the P.C. with reference to a supply of electricity for the town, intimating that the proposal was to form a small company, and asking whether the R.D.C. would permit overheard wires. The Council has decided to convene a parish meeting to consider the matter.

Crewe.—STREET LIGHTING.—It has been decided to light the road from Merrill's Bridge to Victoria Avenue by electricity.

Cuba.—Sr. A. M. Muller has been authorised to set up an electric generating plant in Campo Florido (Havana), for lighting and industrial purposes.—*Board of Trade Journal.*

Dover.—The Electricity Committee has been asked by the railway company for its terms for the supply of electricity to the new pier station.

The engineer has suggested supplying the workhouse at rates varying from 4½d. per unit for 10,000 units to 3½d. for over 15,000 units per annum. Some discussion took place on the above, it being urged on the one hand that the prices were higher than the Guardians could obtain energy at with their own plant and that a concession should be made, while, on the other hand, it was suggested that the Guardians ought to give preference to the Council's E.L. undertaking.

Dundee.—On Thursday last there was another E.L. failure between 5.30 p.m. and 10.30 p.m. at Broughty Ferry. The cause was said to have been a failure of the main that feeds the Central and West Ferry.

Durham.—SEWAGE PUMPING.—The T.C. has accepted the offer of the Electrical Power Distribution Co. to run cables into the sewage works, charge £24 per annum, and supply current at 1d. per unit for power purposes. The company offered to reduce the fixed charge as the revenue increases.

Gillingham (Kent).—A report on the proposed mains extensions to the Hempstead district shows that with overhead wires the cost would be about £1,200, and the estimated revenue about £100 per annum. The matter has been deferred for further consideration. The Nelson Road district is to be canvassed with a view to the cables being extended.

Heanor.—PROV. ORDER.—The Council is taking steps to have protective clauses inserted in the prov. order for E L which the Derbyshire and Notts. E P. Co. is applying for. The proposed area includes Alfreton, Ripley, Heanor, Eastwood Greasley, Kimberley, Awsworth and Nuttall.

Hereford.—CABLE EXTENSIONS.—Owing to numerous failures of the cable in Broad Street and High Street, the T.C. has decided to renew this cable at a cost of £258. It has also decided to lay an additional distributing cable, 1½ times the capacity of the present one, from High Town to the Cathedral, at a cost of £366 and to apply to the L.G.B. for a loan of £500 to defray the cost.

Hertford.—STREET LIGHTING.—The T.C. has accepted the tender of the N. Metropolitan E.P.D. Co. for the provision lighting and maintenance of nine arc lamps for street lighting, a £10 15s. each per annum for five years.

Holywell.—WORKHOUSE LIGHTING.—The B. of G has arranged with Mr. A. J. Leigh, of Northwich, to report upon the lighting of the workhouse and the new infirmary.

London.—ST. PANCRAS.—The Electricity Committe has had before it a proposal of the chief engineer (Mr. S. W Baynes) for extensions at the King's Road generating station, consequent upon, and in addition to, the installation of the 5,000 KW Ljungstrom turbine. The main features of the proposed extension are :—(*a*) Extension of the engine room : (*b*) of boiler house ; (*c* of stores and provision of men's mess room and electricians' room (*d*) coal storage over boiler stokehole, 2,000 tons ; (*e*) coal-handlin and elevating plant ; (*f*) coal railway siding accommodation int works ; (*g*) ash-handling plant ; (*h*) condensing water circulatin plant and pipe line, &c. The engineer estimated the capital expenditure involved at £51,218, and states that the proposed ne plant will produce a saving of £12,000 per annum, but the maximum advantage of the extension will not be reached until th boiler space is fully occupied, and a further turbine installed, whe the cost of production will fall still further. Dealing with th question of supply, Mr. Baynes states that the St. Pancras work are well established, and the demand is sufficiently extensive t enable the employment of large generating sets of great economy and as a result no offer yet considered for a supply in bulk ca show advantage over that to be secured by the extension of th Council's own works in the manner contemplated. The Committe states that with reference to the annual saving of £12,00 it has been pointed out that such sum is base upon the running of coal in railway trucks dire into the generating station ; if this is found to be impossible, the estimated annual saving will probably be lessened b about £1,200. The Finance Committee of the B.C. reports havin had under consideration a letter from the Comptroller of th L.C.C. in regard to the application for sanction to th borrowing of £15,000 for a 5,000-KW. Ljungstrom turbin proposed to be installed at the King's Road station. Seeing th the new plant will, in a large measure, supersede the old, th Committee considers that the period of repayment of the loans o the existing generating plant, which in most cases is 42 year should be reduced, and the suggestion it makes is that th outstanding period should be reduced by one half or to years from the present time, whichever is the shorter term In its remarks the Finance Committee of the B.C. stat that it has received reports on the subject, and that in an case it is not prepared to entertain the suggestion for th reduction of outstanding periods of loans obtained sin 1906 for electricity generating plant. The Finance Committ agrees with the Electricity Committee's suggestions, and poin out that during the past seven or eight years the B.C. has replace electricity plant to the extent of £16 232 from the reserve fun and £2.075 from revenue, £7,786 of it being added capital whic might have been borne by loan.

The Port of London Authority has accepted a tender for 6 dozen dry batteries for the electric torches adopted for the do police. The torches are found to work satisfactorily.

Marylebone.—The L.C.C. has sanctioned the borrowing by the B.C. of £5,200 for services; £1,325 for plant; and £1,300 for mains. At the last meeting of the B.C. the E.S. Committee reported that the general manager, Mr. A. H. Seabrook, had informed it that the first Oerlikon turbine failed on December 5th last, the makers' explanation being that oiling arrangements were faulty; also that all the four rotary converters are now in service, the whole of the extension being complete with the exception of the condensing plant of the first Oerlikon turbine.

Mr. A. H. Seabrook, writing in Tuesday's *Pall Mall Gazette*, points out that the future development of electricity supply in London is by no means wholly dependent on the erection of bulk supply stations, and that a suitable selling organisation is, in any case, more important, in order to achieve success. He considers that, even under present conditions of generating and supply, with such an organisation the output could speedily be doubled.

Hackney.—The Electricity Committee has recommended the Council to sanction an additional expenditure of £2,568 in respect of extensions to the distributing system.

Battersea.—The B.C. has under consideration a letter from the L.C.C., asking it to consider the desirability of setting up a substantial reserve fund in connection with the electricity undertaking before devoting surpluses to the relief of the general rates.

Hammersmith.—The Law and Parliamentary Committee has recommended the B.C. to oppose the London Electric Supply Bill, 1914, and the Brentford Gas Bill, 1914, which latter includes an application for a prov. order to supply electricity.

It also recommends that the Metropolitan Boroughs' Standing Joint Committee appoint a special Committee to consider the desirability of those City and Borough Councils north of the Thames, affected by the London Electric Supply Bill, 1914, taking immediate steps for the joint provision of a bulk supply; also that Borough Councils, which are not undertakers, take advantage of the present opportunity to endeavour to regain their status as purchasing authorities under the E.L. statutes.

Ledbury.—Prov. Order.—The U.D.C. has consented to the prov. order for which the Ledbury Electricity Supply Co. is applying.

Leigh.—Extensions are to be made at the electricity works at a cost of £11,910.

Lytham.—The E.L. Scheme.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £23,700 for the E.L. scheme. The initial cost would not exceed £15,000, and any deficiency in the first and second years' working would be met out of the balance.

Macduff.—Proposed E.L.—The Lighting Committee has been instructed to inquire into the question of E.L., and to confer with the Banff T.C. on the subject.

Manchester.—Trafford Park Power Purchase.—A deputation from the Manchester Ratepayers' Association has waited on the Lord Mayor with the object of securing the withdrawal of the electricity extension scheme and discussing other proposals in the Parliamentary Bill. It was stated that the E.L. Committee will meet the Association and explain its proposals.

Monmouth.—Proposed Loan.—At a meeting of the T.C. it was decided to apply to the L.G.B. for permission to borrow £1,800 for the purposes of the electricity undertaking. A motion to dispose of the undertaking was defeated.

Nuneaton.—Proposed Loan.—The Electricity Committee has recommended the application to the L.G.B. for a loan of £5,000 for plant extensions at the E.L. works.

Pwllheli.—Proposed E.L. Scheme.—At the last meeting of the Council, it was decided to ask North Wales E.P. Co., whether it would be prepared to undertake an E.L. scheme on its own responsibility, and what the estimated cost would be.

Redcar.—Prov. Order.—The B. of T. has informed the U.D.C. that it has decided to revoke the prov. order for E.L. granted in 1900.

Rickmansworth.—Prov. Order.—The U.D.C. has consented to a prov. order for electricity supply within its area being granted to the Colne Valley E.S. Co.

Rotherham.—New Loans: Plant Extensions, &c.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £15,956 for extensions at the electricity works. The amount is made up as follows:—2,000-kw. turbo-alternator with condensing plant and air filter, £7,350; switchgear and cables, £270; steam and exhaust piping, £1,536; 1,000-kw. rotary converter, transformer and equipment, £2,600; switchgear and cables, £500; buildings and foundations, £2,000; overhead crane, £300; contingencies, £1,400.

Sandwich.—The T.C. has decided to oppose the Deal and Walmer Gas and Electricity Bill so far as it relates to the supply of electricity to the borough.

Skipton.—Proposed E.L.—The R.D.C. has decided to ask the promoters of the proposed electricity supply for Gargrave whether they will favourably consider the question of using underground cables—either wholly or partially.

Sheffield.—The Yorkshire Electric Power Co. has objected to the Corporation Bill on the grounds of non-compliance with the Standing Orders.

South Africa.—The Cradock Municipality will shortly put forward a proposal to raise a loan not exceeding £10,000 for the purpose of installing E.L. in the town.—*Board of Trade Journal.*

The Paarl (Cape Province) T.C. has approved the plans for the proposed E.L. installation, and tenders will now be invited for the work, which is estimated to cost £35,000.

Southport.—A sub-committee has been appointed to consider a report of the electrical engineer containing suggestions for making the electricity estate more remunerative.

Stone (Staffs.).—The U.D.C. has decided to oppose the Stone Gas and Electricity Bill.

Tenby.—Prov. Order.—The T.C. has decided to oppose the prov. order for E.L. for which Mr. J. H. Edwards, of Bristol, is applying.

Wakefield.—L.G.B. Inquiry.—At an inquiry by Mr. T. C. Ekin into the proposed borrowing by the Corporation of £13,034 for electricity extensions, it was explained that additions were to be made to the works to meet the rapidly increasing demand, and to secure increased economy in operation. Tenders for the work have been provisionally accepted. The amount is made up as follows:—Boiler house plant, £2,613; engine room plant, £8,251; switchboard extensions, £323; and h.t. distributing sub-stations, £1,721. The electrical engineer stated that it was not intended to discard any of the plant at present in use, but to add another set, consisting of a turbine-driven alternator, condensing plant and filter. There was no opposition.

West Hartlepool.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £3,000 for electricity mains and services during the next three years.

Wrexham.—Prov. Order.—The T.C. has resolved to apply for a prov. order to include the garden village at Acton within its area of supply for electricity purposes.

West Yorkshire.—E.L. Proposals.—In connection with the decision of the Yorkshire Electric Power Co. to apply to Parliament for powers to supply current for lighting purposes in various districts, the following decisions have been come to by municipal authorities who have been appealed to for their support to the application:—The Batley Corporation has appointed a sub-Committee to take what action it thinks best in the interests of the Council; the West Riding District Councils' Association has resolved to hold a conference to discuss the Bill; the Queensbury District Council has decided to protest against the monopoly which the Bill would set up and to further consider the matter later; the Thorne District Council has referred the matter to Committee without having the letter from the company read; the Clayton District Council has instructed its clerk to write to the company to ascertain the time in which it would guarantee a supply of electricity, and on what terms, there being a suggestion that further application should be made for a supply from the Bradford Corporation; the Southowram District Council has passed a resolution referring the matter to the Special Street Lighting sub-Committee for consideration, because of the serious inroad which would be made into the rights of District Councils if the company was granted a monopoly in the matter of electricity supply in those areas where the Councils had not provisional orders for the supply of current themselves; the Shepley District Council has instructed the clerk to ascertain whether the Council committed itself to any liability in giving its support; the Newmill Council has not decided upon any action: the Thurstonland District Council has passed a resolution favouring the application by the company for lighting powers; the Skelmanthorpe Council has resolved to support the company; the Normanton Urban District Council has decided to allow the letter from the company to lie on the table; the Royston District Council has instructed the clerk to obtain further information on the matter; the Horbury District Council has appointed a sub-Committee of six to deal with the matter; the Monk Bretton Council has informed the company that the Council had no objection to the application; the Darfield Urban District Council has decided to let the letter lie on the table, though an opinion was expressed that the powers sought by the company would provide it with a monopoly of supply in the district; and the clerk to the Ardsley District Council has been instructed to obtain further information for submission at a future meeting.

Middlesbrough.—Arrangements have recently been concluded for the establishment by Tarmac, Ltd., of Wolverhampton, of new works at Middlesbrough, on land belonging to the North-Eastern Steel Co., Ltd. These new works will commence with an output of 2,000 to 2,500 tons per week of tarred slag, manufactured from slag produced at the North-Eastern Steel Co.'s blast furnaces; the new machinery will be electrically operated, current being taken from the supply network of the Cleveland and Durham Electric Power, Ltd.

Portrush.—The U.D.C. has decided to advertise for an engineer for the proposed E.L. scheme

Penmaenmawr.—E.L. Scheme.—The North Wales P. and T. Co. has intimated to the U.D.C. that it would be prepared to supply electricity on contract for seven years, the Council to have the option of renewing the contract for a further five years.

The charge would be a flat rate of 1½d. per unit up to 24,000 units, and 1d. per unit for all above that amount, with a minimum of £120 per annum for the first two years, and £150 for the remaining five years. The Council decided to consider the matter at its next meeting.

Walsall.—The Electricity Committee has recommended that subject to the approval of the L.G.B. and B. of T., land be purchased in Green Lane, Birchills, as a site for the proposed generating station, and that Mr. E. M. Lacey be appointed consulting engineer.

Sunbury.—Proposed E.L. Scheme. — The U.D.C. has considered the plans of an E.L. scheme for the district, proposed to be carried out by a private company. The Clerk expressed the opinion that the proposed area of supply was very large, embracing as it did two urban districts and six other parishes, and that it was inexpedient that so large an area should be embraced in one order. He added that the compulsory area was exceedingly small, while the prices for energy mentioned by the promoter were rather high. The Council decided to consider the matter further.

TRAMWAY and RAILWAY NOTES.

Blackpool.—The Tramways Committee has sanctioned the introduction of ½d. fares for children on the Corporation cars.

Bradford.—Renewals of tramway track in various parts of the city, estimated to cost nearly £29,000, are to be carried out. The equipment of the railless traction route to Oakenshaw is to be commenced forthwith.

Railless Traction Extensions.—The Tramways Committee has decided to recommend the City Council to purchase 28 railless traction vehicles, which will be mainly used for extending the existing route to Bankfoot.

Burley-in-Wharfedale.—The U.D.C. has passed a resolution opposing the proposal of the Leeds Council to run a system of railless traction to Burley.

Burnley.—The T.C. has rejected a proposal to run motor-'buses in certain parts of the town until the electric tramways could be extended into those localities.

Chile.—Decrees have been issued approving the plans submitted by Sr. Antonio Bellet for the construction of an electric railway to join up Villa Alegre station with Villa Alegre town, in the province of Linâres ; by the Torras Tramways Co., Ltd., for an electric tramway in Valparaiso ; and by the Buenos Aires, Villasana and Lo Prado Districts Tramway and E.L. Co., Ltd., for electric tramways and lighting in the districts named.

A concession has been granted to Sr. Roberto Araya for the establishment of electric tramways for the transport of merchandise and goods in Valparaiso.—*B. of T. Journal.*

Continental Notes.—Germany.—The Senate of Lübeck has introduced a Bill for the expenditure of £97,900 on the construction of an electric railway between that city and Travemünde, a distance of 18 km., which, notwithstanding some opposition on the part of a section of the citizens, is expected to be passed.

Italy.—La Société des Tramways Toscans has secured a concession for the construction and working of an electric tramway between Carrara and Marina.

Work is about to be commenced on the electrification of the railway between Milan and Gallarate.

Spain.—It is announced from Madrid that a company is being formed to construct a system of electric tramways in the province of Tarragona.

Plans are being prepared in respect of an electric railway between Vinaroz and Benicarlo.

Russia.—It is reported from St. Petersburg that a project for the construction of an electric railway between that city and Miedny Sawod is at present under consideration.

Dewsbury.—The B. of T. has sanctioned the borrowing of £1,000 for laying a double line of tramways in Wakefield Road. The Corporation has decided that it cannot entertain the terms quoted by the Yorkshire (W.D.) Electric Tramways, Ltd., with respect to the laying of tramways to Dewsbury Moor.

Gateshead-on-Tyne.—The Town Improvement Committee has reported that the N.E. Railway Co. intends to promote a Bill for powers to run trolley vehicles across the high-level bridge between Gateshead and Newcastle-on-Tyne, and to the Gateshead West Station. The Committee is to report to the T.C. on the matter.

Halifax.—The T.C. has approved of an increase of wages of tramway drivers and conductors ; the estimated cost is £900 per annum.

Kearsley.—The Clifton P.C. and the Barton-upon-Irwell R.D.C. have informed the R.D.C. of their willingness to support the Council in the suggested appeal to the Swinton and Pendlebury D.C. with reference to the connecting-up of the South Lancashire Tramways Co.'s tramways and the Salford tramways at Newtown, Clifton.

Lancashire Tramway Arbitration.—Arbitration proceedings have taken place in London, before Mr. Ram, K.C., in connection with the claim by the Colne and Trawden Tramways Co., amounting to £171,586, for the sale of their undertaking to the Colne Corporation. Mr. Harry England intimated the total value of the undertaking at £168,840.

Leyton.—The tramways manager has provisionally arranged with the manager of the West Ham tramways to terminate the existing arrangement as to the running of cars in Forest Road and Dames Road, and for a new arrangement to be entered into. The receipts earned are to be pooled, West Ham to have 9·6d., and Leyton 7·75d. per car-mile.

Liverpool.—Mersey Traffic Facilities.—The receipt of the report of Mr. C. W. Mallins in regard to tramway traffic problems gave rise to a discussion at the meeting of the City Council on the proposal for providing increased facilities for cross-river traffic. Sir Harmood Banner, M.P., moved that a committee be appointed to confer with representatives of Birkenhead, Wallasey and Bootle, the rating authorities and the Mersey Docks and Harbour Board, with a view to adopting a joint contribution by rates for the purpose of improving the means of transit across the Mersey, either by bridge or tunnel. He expressed the opinion that the bridge or tunnel would have to be worked without, at any rate, anything in the shape of a toll. The rateable value of the whole of the districts which, in his opinion, ought to contribute was about £7,000,000. After considerable discussion, the resolution was approved in the following terms :—"That a committee be appointed to confer with representatives of the adjoining boroughs, rating authorities and the Mersey Docks and Harbour Board, to consider the question of improving the means of transit across the Mersey, either by bridge or tunnel." A special committee was appointed, and the Wallasey T.C. has also appointed three members to attend the conference.

London.—The South-Western Co.'s locomotive men at a meeting on Sunday last passed a resolution deploring the decision of the company not to guarantee exclusively for locomotive men the positions of motor men in connection with the forthcoming electrification scheme, and pledging support to the demand, if necessary, by withdrawing labour.

Electric P.O. Vehicle.—Some trials are being made by the G.P.O. with an Edison battery van for delivery purposes in the London area.

Morocco.—A company has been formed with the title La Sociedad Anglo-Franco-Espanola, with the object of constructing electric tramways in Tangiers.

Nelson.—Railless Traction Proposals. — The T.C. has appointed a Sub-Committee to consider the question of the provision of railless traction for the higher portion of the town.

Northampton.—New Cars, Plant, &c.—The Corporation has decided to adopt a new design of car, with covered top and vestibules. A Sub-Committee is to obtain tenders for these and also for the generators, battery and other plant and the erection of the car-shed. The revenue from the tramways for November 24th to December 15th, 1913, was £1,605. The traffic return from April 1st to November 7th showed the receipts to be £20,402, as compared with £19,033 in 1912, an increase of £1,369.

Pontefract.—The Wakefield and West Riding Tramways Co. proposes to double the whole of its track between Normanton and Pontefract.

South Shields.—Tramway Extension Proposal.—The Tramways Committee has submitted a report on a proposal to provide a riverside route at an estimated cost of £17,260. It is pointed out that this would mean two parallel routes, and it is suggested that a motor-'bus service for the district be adopted. Three 'buses would be required, at about £800 each. The Committee recommended the T.C. not to entertain the proposal to extend the tramways, and this was confirmed.

Tasmania.—The report of the Launceston municipal tramways for the year ended July 31st, 1913, shows that the total number of passengers carried was 2.169,645 ; the car-miles run, 327,565 ; and the total revenue, £17,127, an increase of £2,344 over the previous year's figures. The working expenses, after payment of interest, sinking fund, &c., were £10,383, or £2,191 above the previous year. The total revenue of the lighting plant for the year amounted to £21,666, an increase of £1,590. The net profit, after making all allowances, was £5,676.—*Commonwealth Engineer.*

U.S.A.—Electric Vehicle Charges.—From an investigation recently made by the American Electric Vehicle Association, it appears that the average charge for the supply of energy for charging the batteries of electric vehicles in 91 towns in the United States is 1·5d. per kw.-hour in the case of public garages, and 2·6d. for private (single-car) garages.

Wallasey.—Proposed Loan.—The Council has been recommended by the Tramways Committee to apply for sanction to borrow £10,000 for the erection of tramway workshops and the provision of the necessary machinery.

Westhoughton.—The U.D.C. has informed the South Lancashire Tramways Co. that it would be glad to confer with the company, with a view to connecting the tramways from Hindley to Hulton Lane Ends through Westhoughton.

TELEGRAPH and TELEPHONE NOTES.

India.—Wireless telegraph stations are approaching completion at Peshawar and Quetta. One is also in course of construction at Madras

Portsmouth.—On Tuesday the T.C. adopted a recommendation that the Corporation telephone undertaking be transferred to the Government for £35,000. The system was started in 1903, and now comprises 1,899 subscribers and 2,528 telephones. The Post Office has undertaken that there shall be no increase in cost to the subscribers until there is a revision of the whole of the traffic. It has also agreed to take over the staff.

Spain.—The P.M.G. has agreed to grant a licence for wireless commercial service between England and Spain by way of the Marconi station at Poldhu

Telephone Messages.—The Postmaster-General is said to be considering the feasibility of adopting an arrangement by means of which a telephone subscriber, on payment of a small annual charge, may have messages from callers who ring up during the subscriber's absence from home taken down by the operator at the exchange and forwarded on his return. The system is in operation in France.

Wireless in Geodesy.—As the result of protracted observations conducted between the Eiffel Tower in Paris and the Government station at Arlington, U.S.A., it has been ascertained that the difference in longitude between those stations is 279 ft. greater than had been supposed. The stations are 6,175 km. apart, and the time occupied by the wireless signals in traversing this distance twice is estimated at 0·063 second.

Wireless Telephone Frauds.—The *Times* correspondent in New York states that James Dunlop Smith has been sentenced to 18 months' imprisonment and a fine of £1,000, and Elmer Burlingame to 2½ years' imprisonment and a fine of £2,000, for conspiring to swindle investors in the stock of the Radio-Wireless Telephone Co. on a large scale.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—January 31st. Corporation. Four double-deck tramcars. See "Official Notices" to-day.

Accrington.—Corporation. Two double-deck top-covered tramcars, and three single-deck tramcars, complete. See "Official Notices" to-day.

Australia.—Sydney (New South Wales).—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

February 2nd. Municipal Council. Transformers and weatherproof switch fuses. Specifications (10s. 6d. in each case) from the City Electrical Engineer.

March 2nd. Sydney Harbour Trust. Circular Quay. Three electrically-operated semi-portal travelling cranes for Berths Nos. 1, 2 and 3, Woolloomooloo Bay. Particulars from Engineer-in-Chief of the Trust.

March 25th. N.S.W. Railways and Tramways Department.—Five 1,000-KW. sub-station units to specification No. 124. Particulars at Electrical Engineer's Office, 61, Hunter Street, Sydney.—*Tenders.*

Adelaide.—February 11th. P.M.G. 50 cable terminals. See "Official Notices" January 9th.

Melbourne.—January 24th. Corporation. House cut-out boxes and replacement wedges.—January 21st. 5 tons, 16 cwt. bare hard-drawn copper cable. See "Official Notices" January 9th.

February 17th. P.M.G. Cable boxes. See "Official Notices" January 9th.

April 7th. For the Postmaster-General. Relays, non-polarised, Stores Schedule 996. See "Official Notices" to-day.

Hobart.—March 2nd. For the Postmaster-General. Telephones, common battery, wall pattern, and table pattern, Schedule T 104. See "Official Notices" to-day.

Belfast.—January 28th. Harbour Commissioners. Electric cables. See "Official Notices" January 9th.

Belgium.—January 20th. The municipal authorities of Farciennes (province of Hainaut). Establishment of a central electric lighting station and a network of mains in the town.

February 17th.—The Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Sciencè). Armoured underground and sub-river feeders required in connection with the Brussels-Haecht local electric railway.

Bradford.—January 22nd. Corporation. Surface condensing plant for 5,000 KW live-steam turbo-generator. See "Official Notices" January 9th.

The Principal of the Technical College (Prof. G. F. Charnock) is to obtain tenders for driving motors for the engineering workshop, mechanical laboratory and testing rooms. Prof G. F. Charnock, Principal, Technical College, Great Horton Road, Bradford.

Brentwood.—January 17th. Petrol-driven electric lighting plant (50 lights) for Branch Asylum, Harold Court, Harold Wood. See "Official Notices" January 2nd.

Canada.—Winnipeg.—January 29th. The *Canadian Engineer* states that tenders are invited for electrically-operated switching apparatus and accessories for the King Street sub-station. Plans, &c., from the Light and Power Department, 51, King Street, Winnipeg.

Cheltenham.—January 31st. Corporation. Twelve months' supply of electric light fittings, and other stores. Particulars from Mr. J. S. Pickering, Borough Engineer, Municipal Offices.

Croydon.—January 26th. Corporation. Stores for Tramway Department. Tramway Manager.

Dundee.—January 30th. Corporation. (*a*) 5,000-KW. steam turbine and alternator; (*b*) condensing plant; (*c*) 750-KW. rotary converter, with transformer. See "Official Notices" Jan. 2nd.

France.—January 15th. The French State Railway authorities (Service Electrique) in Paris (43, Rue de Rome.) Establishment of an electricity generating station at Dieppe.

Ipswich.—January 31st. Corporation. (*a*) Three-phase 300-K.V.A., 3,300-volt alternator, rotary converter with transformer, A.C. booster and D.C. exciter, automatic voltage regulator and booster, cable connections. (*b*) Three 50-K.V.A. three-phase transformers. (*c*) H.T. three-phase main switchboard. (*d*) H.T. and L.T. switchgear. (*e*) Two motor or rotary converters, each 250 KW. See "Official Notices" January 2nd.

Italy.—January 23rd. Italian Ministry of Marine. Electric lamps and electroliers. Upset price (£5,200); deposit 10 per cent. Foreign manufacturers allowed to compete. Tenders to: Al Sig. Direttore Generale dei Servizi Amministrativi, Ministero della Marina, Rome.

Kirkcaldy.—The Corporation Tramways and Electric Lighting Committee has decided to purchase four additional tramway cars.

Leeds.—The City Council has decided to extend the tramway overhead equipment from Moor Top, Farnley, to the city boundary at Drighlington, and to obtain tenders for the work; also to purchase eight trolley vehicles for the purpose of enabling it to carry out the agreement with the Morley Corporation as to the running of through trolley vehicles.

Leigh (Lancs.).—January 23rd. Corporation. One 1,500-KW. turbo-alternator (impulse type turbine), 1,000-KW. rotary converter, transformers and switchgear. See "Official Notices" Jan. 9th.

London.—L.C.C.—January 20th and 21st. Installations at Vernon Square Elementary School, Finsbury, E.C. (241 wiring points and 318 lights), and at Raneleigh Road Elementary School, Pimlico, S.W. (210 wiring points, 258 lights). See "Official Notices" Jan. 2nd.

January 27th. 584 tons of special section rolled steel bar for magnetic brake shoes. Chief Officer, L.C.C. Tramways, 62, Finsbury Pavement, E.C.

Islington.—January 28th. Corporation. Twelve months' supply of electrical and engineers' stores. See "Official Notices" January 2nd.

St. Marylebone.—February 11th. Corporation. Underground cables, house cables, flexible cords, rubber goods, box compound and insulating materials, &c. See "Official Notices" January 9th.

Kensington.—January 29th. Board of Guardians. Electric lamps and fittings and other stores. Specification, &c., from Mr. W. R. Stephens, Guardians' Offices, Marloes Road, Kensington, W.

Manchester.—January 20th. (*a*) Tramcar trucks; (*b*) motors and controllers for tramcars. Mr. J. M. McElroy, General Manager, Corporation Tramways.

January 27th.—The Corporation Tramways Committee invites tenders for extensions and alterations at the Hyde Road car-shed. J. Gibbons, architect, 4, St. Mary's Parsonage, Manchester.

Plymouth.—January 19th. Corporation. Twelve months' supply of arc lamp carbons, electricity meters, transformers, cables, &c. See "Official Notices" January 2nd.

Pontypridd.—January 19th. Complete electric light, telephone and fire alarm installation, workhouse, for the B. of G. A. L. Thomas and G. S. Morgan, architects, Gelliwastad Road, Pontypridd.

Sheffield.—February 3rd. Corporation. Contract No 111. Structural steelwork for carrying coal shoots, coal bunkers and railway sidings over same at Neepsend. See "Official Notices" to-day.

South Africa.—The current issue of the *British and South African Export Gazette* refers to the following openings for electrical business:—"Orders for plant and other equipment may be anticipated in view of the proposal to establish a power station and chemical factory on the property of Henderson's Transvaal Estates Co. Valuable contracts for electrical machinery and material will shortly be given out by the Graaff-Reinet Town Council in connection with the electric lighting scheme now authorised. The Pietersburg (Transvaal) Municipality is in the market for material for the new electric lighting scheme. Tenders will shortly be invited by the Municipality of Heidelberg, Transvaal, for machinery and material for an electric lighting scheme. With reference to the call for tenders for gas-electric plant by the Durban Municipal authority, the date for receiving these has been extended to February 4th, and they should be addressed to the Town Clerk, Municipal Buildings, Durban. The London agents for the Municipality are Messrs. Webster, Steel and Co., 5, East India Avenue, London, E.C. Tenders for the supply of 15,794 tungsten filament incandescent lamps are invited by the South African Railways Administration, and will be received up to the 27th inst."

Spain.—The municipal authorities of Bollublos de la Mitacion (province of Seville) have just invited tenders for the concession for the electric lighting of the town during a period of 20 years.

Stockport.—January 19th. The Corporation Tramways Committee invites tenders for one overhead equipment motor-driven tower wagon. R. Lomax, tramway electrical engineer, Millgate, Stockport.

Turkey in Asia.—March 14th. Forty years' electric lighting concession for Trebizond municipality. Population 50 000 to 60,000; 12 miles of street lighting. Houses mostly occupied by poorer classes. Water power (Deirmen River) available. An English translation of the conditions may be seen at the Board of Trade Commercial Intelligence Department in London.

West Hartlepool.—January 21st. Corporation. Tramway employés' uniforms, tramway tickets. See "Official Notices" January 9th.

Wolverhampton.—January 19th. Corporation. Two water-tube boilers complete with superheaters and mechanical stokers. See "Official Notices" January 2nd.

CLOSED.

Aberdeen.—The Board of Trade has offered no objection to the permanent use of the "pay-as-you-enter" type of cars, and having examined tenders received for the construction of six new double-deck cars of this type, the Tramways Committee recommended the acceptance of the offer of the Brush Electrical Engineering Co., Ltd., being the lowest, and amounting to £2,490. The Town Council approved of the recommendation, it being stated in the course of the discussion that the local offerers' tender was £1,000 above the one accepted.

Aldershot.—The U.D.C. has accepted the tender of the British Petroleum Co., Ltd., for the supply of fuel oil (10 to 11 tons) for the Diesel engine at the electricity works, at £3 16s. 8d. per ton.

Australia.—The following tenders have been accepted by the Postmaster-General's Department:—

New South Wales:—

880 cable boxes, £558.—C. Glasson.

Victoria:—

100 cable boxes, £140.—W. T. Henley's Telegraph Works Co., Ltd.

Western Australia:—

30 common battery telephones, with generators, £85: 50 ditto., £121; 150 single translators, £67.—Western Electric Co. (Aus.), Ltd.
20 cordless, 10-line, magnetic switchboards, £170.—J. Bartram & Son, Pty., Ltd.
4 miles silk and cotton-insulated, light lead-covered switchboard cable, £407.

Messrs. Dalgety & Co. have secured contracts for pattern "A" porcelain insulators as follows:—New South Wales (1913 14), 156,000, £3 778; (1914 15), 62 000, £3,923. Queensland (1913 14), 78 000, £1,820; (1914-15), 78,000, £1,920. South Australia (1914-15), 27,000, £672. Tasmania (1914-15), 12,000, £297.—*Tenders.*

Ballater, N.B.—The contract for wiring for electric light installation at the Victoria and Albert Halls, Gordon Institute, Post Office, &c., has been placed with Messrs. T. C. Smith, electrical engineers, Aberdeen.

Belgium.—Six concerns, five German and one Belgian, submitted tenders last week to the Belgian Post and Telegraph authorities for the supply and laying of a quantity of telephone cables in the Brussels district, the lowest offer being that of the A.E G. Union Electrique Co., of Brussels.

Bournemouth.—The T.C. has accepted the tender of the British Westinghouse Co., Ltd., for arc lamps, &c., for lighting the Undercliffe Drive, at £499.

Burnham.—Mr. H. Young, of Brent Knoll, has secured the contract for trench work in connection with the electric lighting system of the town.

Bradford.—The City Council has accepted the following tenders:—

Brown, Muff & Co., Ltd.—Uniform clothing for electricity department inspectors.—30 jackets, £1 8s 11d each 30 waistcoats, 7s. 9d. each; 60 pairs of trousers, 15s. 9d. per pair; 30 caps, 2s. 11d. each.

The Corporation Street Improvements and Buildings Committee has accepted the tender of Messrs. Rawlinson, Ltd, to erect two electric lifts and an electric crane for a new warehouse at Dumb Mill for £775. The Tramways Committee has accepted the tender of the Daimler Co., Ltd., for a 40-h.p. petrol motor lorry, for the Permanent Way Department, at £788.

Bury.—The Corporation has sealed contracts as follows:

J. Baker & Co.—Axles.
Walter Scott, Ltd.—Steel rails.
R. Dempster & Sons, Ltd.—A vaporiser.

Cape Town.—The electric lighting contract for the South African Industrial Exhibition, to be held in Cape Town from February 2nd to 28th, has been placed with Messrs. E. A. Shaw and Co., of Cape Town. The contract also includes wiring for, and erection of, motors for machinery in motion.

Colliery Plant.—Messrs. Johnson & Phillips, Ltd., have in hand for Halls Collieries, Ltd., a 3,000-volt overhead line for transmitting power to colliery, with two sub-station equipments, transformers, shaft cables, &c.

Ealing.—The T.C. has accepted the tender of Mr. W. J. Dickens, at £100, for wiring the Town Hall extension.

Keighley.—Messrs. Clough, Smith & Co., Ltd., have secured from the Cedes Electric Traction Co., Ltd., the contract for the erection of the overhead equipment of the Keighley Corporation trackless extensions, a length of 7 miles, at an average contract rate of £923 per route mile. This firm also carried out the first section of the Keighley trackless system, a route length of 1 mile 1,100 yards.

London.—The Metropolitan Water Board has accepted the tender of the General Electric Co., Ltd., at £339, for the supply of a Belliss & Morcom "Witton" high-speed engine and dynamo, generating panel, fittings, &c., required in connection with the installation of electric light at the Surbiton station.

The Port of London Authority has accepted the tender of the British Westinghouse Electric and Manufacturing Co. for three 1,000 kw. rotary converters. The same authority has also accepted a tender for the supply of 600 dozen dry batteries for the electric torches adopted some time ago for the dock police.

Battersea.—The B.C. has accepted the tenders of W. Morgan, the Alpha Manufacturing Co., and Arthur Newman, Ltd., for the installation of arc and metallic lamps on consumers' premises under the Council's hire scheme.

Hackney.—The B.C. has accepted the tender of Messrs. Rice and Son, of Stockwell Road, S.W., for the erection of three electricity sub-stations at Northwold Road, Dalston Lane, and Balcorne Street, amounting to £9,210.

Lossiemouth.—The T.C. has placed a contract with Messrs. Johnson & Phillips, Ltd., for complete generating station equipment, including dynamos, booster, battery, switchboard and cables.

Manchester.—The Electricity Committee has accepted the following tenders:—

Chloride Electrical Storage Co, Ltd.—Supply and maintenance of a traction storage battery at Dickinson Street station.
Lancashire Dynamo and Motor Co., Ltd.—Reversible booster, regulator, and switchgear for the traction storage battery (switchgear sublet to Mr. Bertram Thomas).
British Westinghouse Co., Ltd.—Two 800-kw rotary converters.
Electrical Engineering and Equipment Co., Ltd – Cable.
Siemens Bros. Dynamo Works, Ltd.—Two 500-k.v a. static transformers.

The Tramways Committee has accepted the following:—

Ransomes & Rapier, Ltd.—Wagon turn-table for Hyde Road Permanent Way Department
Stedman, Crowther & Co.—Block tin.
Tangyes, Ltd—Car wheel tire turning lathe.

For route number boxes:—

Till & Whitehead, Ltd. Metal fittings.
Equipment & Engineering Co., Ltd.—Route number plates.
Drake & Gorham, Ltd—Metallic filament traction lamps.

Northampton.—The Tramways Committee has decided to recommend the Council to expend £25,677 on the undertaking, £20,352 of which is for extensions, &c, and the remainder for new cars. The following tenders were received for the extension to Far Cotton, and for doubling a large part of the Kingsthorpe route:—

Stark, Ltd., Glasgow	£20,353
Pearce, Ltd., Morecambe	20,613
A. Fidler Borough Engineer, Northampton	20,922
Geo. Law, Kidderminster	21,319
G. P Trentham, Birmingham	21,486
Foster, Ltd, Liverpool	22,490
Dick, Kerr & Co., Ltd., Preston	22,571
Clough, Smith & Co., London	23 409
Griffiths, Ltd., London	24 066
A. A. Clarke, Northampton	24 885
R. Finnegan, Northampton	25,408
Wimpey & Co., London	26,208

The tender of Messrs. Stark was recommended for acceptance. The borough engineer was directed to tender, but the Committee was in favour of the lowest tender in preference to direct labour. The Committee recommended that seven new cars be purchased from the Brush Electrical Engineering Co., at £761 each, the cars to have Dick, Kerr & Co.'s electrical fittings.

Middleton.—The Electricity Committee has accepted the tender of Messrs. Adam Lee & Co. for 150 tons of Bulcroft washed slack.

Rathmines.—The U.D.C. has accepted the tender of the British Westinghouse Co. for a dynamo for the electricity undertaking, at £1,003. An amendment to accept another tender for £700 odd was lost. Mr. Beater said that the Committee went very carefully into the matter, and found that the other firm had only manufactured such large machines in one or two instances, and over a period of two years, whereas the Westinghouse Co. had made these machines for over 20 years. The chairman said that the Committee sent the engineer to inspect various machines, and they came to the conclusion that they would be wrong in accepting any other tender than the Westinghouse one. Mr. Standing said that the Committee received between 30 and 40 tenders, rising from £600. Among five or six selected by the engineer was that for £700. The matter which influenced the engineer in his final recommendation was the name and reputation of the Westinghouse Co. He could find no fault with the specification of the other firm. The young firm ought to be given a chance where there was a difference of £300 in £1,000, and a 12 months' guarantee was given with the £700 tender. The amendment was defeated, and the tender of the British Westinghouse Electric Manufacturing Co. accepted.

Rotherham.—The T.C. has accepted the tender of Chadwick & Co., at £6,755, for extensions to the tramcar sheds.

Sheffield.—The following tenders have been accepted by the T.C.:—

R. White & Sons.—Extending coal-handling aerial ropeway at Neepsend power house, £355.
W. Marlow & Sons.—Foundations for three boilers, base of chimney stack, and two fan houses, at Neepsend, £2 403.
J. E. Nadin.—Excavating additional land for storage of coal at Neepsend, £289.

The City Council's contract with Messrs. A. Reyrolle & Co., Ltd., for a supply of 14 panels of E.H.T. sub-station switchgear is to be extended to provide for a further 14 panels at the same price, viz., £1,682.

Southport.—The Electricity Committee has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., amounting to £1,920, for the supply of an alternator.

Stockport.—The Corporation Electricity Committee has accepted the tender of Messrs. John Spencer, Ltd., for wrought-iron steam pipes, at £39 10s.

The Tramway Committee of the T.C. has accepted the tender of the Leeds Steel Co., Ltd., for B.S.S. No. 4 tram rails, at £6 15s. per ton.

Walsall.—The following tenders have been accepted by the T.C. for annual supplies to the Tramways Department:—

Anti-Attrition Metal Co., Ltd.—Trolley wheels.
J. W. Caparn.—Malleable iron castings.
Dyer & Young.—Controller fingers.
A. Goldie Engholm.—P. & B. tape (1 in.) and Blackley tape (1 in.).
Edison & Swan United Electric Light Co., Ltd.—Dry cells.
Electric and Ordnance Accessories Co., Ltd.—Arc lamp globes and carbons.
Fleming, Birkby & Goodall, Ltd.—Strand wire.
J. North Hardy & Son.—Linen frame tape and linen tape.
Glacier Anti-Friction Metal Co., Ltd.—Anti-friction bearing metal.
Heap & Johnson.—Carbon brushes.
National Rail and Tramway Appliances Co., Ltd.—Brake blocks.
Siemens Bros. & Co., Ltd.—Tantalum lamps.
Alfred Wiseman, Ltd.—Pinion wheels, mechanical ears, &c.

West Ham.—The T.C. has made arrangements with Messrs. W. Cory & Son, Ltd., whereby their contract for a supply of coal to the electricity department will be extended for a further year from March next. The estimated amount required during the year will be approximately 60,000 tons.

THE ELECTRICAL ENGINEERS

(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week:—

Monday, January 19th.—"A" Company. Technical instruction, 7 to 10 p.m.

Tuesday, January 20th.—"B" Company. Technical instruction, 7 to 10 p.m.

Wednesday, January 21st.—Recruits only. Infantry drill and technical instruction, 7 to 10 p.m.

Thursday, January 22nd.—"C" Company. Technical instruction, 7 to 10 p.m.

Friday, January 23rd.—"D" Company. Technical instruction, 7.30 to 9.30 p.m.

Saturday, January 24th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, January 17th At 7 p.m. At Royal Technical Institute. Presidential Address. Social evening.

Institution of Electrical Engineers (Western Local Section).—Monday, January 19th At 5.30 p.m. At University of Bristol (Merchant Venturers' Technical College). Paper on "The Employment of Power in H.M. Post Office," by Mr. H. C. Gunton.

Junior Institution of Engineers.—Monday, January 19th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "Modern Gearing," by Mr. H. H. Thorne.

Institute of Marine Engineers.—Monday, January 19th. At 8 p.m. Paper on "The Corrosion of Iron and Steel Structures and their Preservation," by Mr. F. Crosby-Jones.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, January 20th. At 8 p.m. At Rankine Hall, 39, Elmbank Crescent, Glasgow. Ordinary General Meeting.

Institution of Civil Engineers.—Tuesday, January 20th. At 8 p.m. At Gt. George's Street, S.W. Ordinary meeting.
Friday, January 23rd. At 8 p.m. Students' meeting.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, January 20th. At 7.30 p.m. At Municipal School of Technology. Paper on "Electro-therapeutics," by Mr. S. D. Anderson.

Institution of Post Office Electrical Engineers.—Tuesday, January 20th. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "Overhead Wire Construction for Medium and Low Pressures," by Mr. A. P. Trotter.

British Electrical and Allied Manufacturers' Association.—Wednesday, January 21st. At 7 p.m. for 7.30. At Savoy Hotel, Victoria Embankment, W.C. Dinner.

Wireless Society of London.—Wednesday, January 21st. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Presidential Address, by Mr. A. A. Campbell Swinton.

Institution of Mechanical Engineers.—Thursday, January 22nd. At 7.30 p.m. At the Medical Theatre of the University, Edmund Street, "Thomas Hawksley" Lecture on "Water as a Mechanical Agent," by Mr. E. B. Ellington.

Institution of Electrical Engineers.—Thursday, January 22nd. At 8 p.m. At Victoria Embankment. Fifth Kelvin Lecture, by Sir O. Lodge, F.R.S.

Chemical Society.—Thursday, January 22nd. At 8.30 p.m. At Burlington House. Ordinary Scientific Meeting.

Physical Society.—Friday, January 23rd. At 5 p.m. At the Imperial College of Science, South Kensington. Ordinary Meeting.

Manchester Association of Engineers.—Saturday, January 24th. At Grand Hotel, Aytoun Street. Paper on "Power Production," by Mr. E. G. Hiller.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 24th. At 6.30 p.m. At Armstrong College. Reception until 7 p.m. Annual Dinner.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, January 24th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Specifying and Buying Electrical Mining Plant," by Mr. J. P. C. Kivlen.

THE LONDON ELECTRICAL MASTERS' ASSOCIATION.

Mr. L. G. Tate, the secretary of this new Association, has issued the following notice:—

"With reference to the agitation that is now taking place in the electrical industry in Greater London, I beg to inform you that the association of employers called the London Electrical Masters' Association, which comprise companies and corporations supplying electricity, railway companies using electricity, manufacturers of electrical appliances and electrical contractors, is now making a direct appeal to the men by means of the enclosed poster, asking them to appoint delegates to attend a meeting at Caxton Hall on Tuesday, January 27th, 1914, for the purpose of appointing a committee from amongst themselves to confer with the committee of the London Electrical Masters' Association. My Association is extremely anxious that the rights and privileges of men not wishing to belong to any organisation should be strictly preserved, hence the reason of the above proposal. I shall be much obliged if you will give same prominence in your esteemed journal, so as to reach such employers and men whom I cannot get in touch with."

The poster accompanying the letter reads as follows:—

NOTICE.

> The London Electrical Masters' Association, being desirous of improving the status of all electrical workers (whether connected with any organisation or not) and the general terms of employment and wages, desire you to send a delegate or delegates to meet them, each delegate representing about 20 men.
>
> At the meeting, which will be held on Tuesday, January 27th, at 8 p.m., at Caxton Hall, all matters with reference to employment will be openly discussed, when it is hoped that a committee of the men and the London Electrical Masters' Association will be formed to draw up a code of working rules, fix a scale of minimum wages and settle other terms of employment.
>
> The delegates to be electrical workers, and the names and addresses of those selected should be forwarded through the employer to Mr. L. G. Tate, secretary of the London Electrical Masters' Association, 20, Bucklersbury, E.C., not later than Monday, January 19th, when admission tickets for the meeting will be forwarded.

We have also received the following letter from the Electrical Trades Union :—

"Dear Sir,—The Committee of the newly-formed London Electrical Masters' Association, consisting of 11 gentlemen who do not, by any means, represent the electrical industry in the Metropolis, but who were delegated by a meeting of some of the employers held at the Institution of Electrical Engineers on December 3rd last, to confer with the Electrical Trades Union, have decided without consulting their constituents not to carry out their instructions.

"They have issued a notice to the trade, which, to say the least, is entirely novel, though somewhat crude in structure, and is a departure from all accepted principles of negotiating with a workmen's association on questions relating to wages and working conditions. This document must have been conceived in the spirit of determination not to foster that industrial harmony which we are told by the employers is so necessary for the well-being of the electrical industry.

"Our position remains that we have been, and are, prepared to meet the employers at a conference, to discuss all matters pertaining to the relations between employer and employé. Providing we have a fair field, we ask no favours.

"The responsibility now rests with the great body of those who have not been consulted. Whether they will accept the ruling of a non-representative oligarchy, whose methods can only cause endless trouble, or will meet the legitimate desires of their workmen for better conditions, which everyone is agreed is their due.

"Thanking you in anticipation for publishing this and the appended letter, which is being circulated to all the employers in the area of Greater London.

"I remain,
"Yours faithfully,
"J. Potter,
"*District Sec. Electrical Trades Union.*

"32, Chichester Road, Kilburn, N.W.,
"*January 14th*, 1914."

(*Copy of Letter to Employers.*)

"Dear Sir,—Adverting to our letter of November 11th last, in which an application for an advance of wages to electrical grades was made, and in which we stated we were prepared to discuss this question with a body representative of the employers, we have received a communication from the Committee of the newly-formed London Electrical Masters' Association refusing to negotiate.

"The Masters' Association was brought into being on December 3rd at a meeting of the employers as a result of the above application. A Committee was there appointed, with, we understand, definite instructions, to meet representatives of the Trade Union. We have been, and are, prepared to meet a body representative of the employers to deal with any points at issue, providing the questions are discussed on their merits, without any previous conditions being exacted by either side. This decision we have communicated to the Committee of the London Electrical Masters' Association. Apparently at the bidding of a small caucus they have refused to accept these perfectly fair terms, without even consulting the opinions of the general body of employers.

"A number of contractors and others have already conceded the rates we ask ; a still larger number have written that they thought our claims justified. In the circumstances, we have no alternative, representing as we do by far the larger section of the skilled workers in the industry, and having waited two months, but to issue the enclosed working rules card, which will become operative on and after Saturday, January 24th, 1914.

"Trusting we shall hear from you that the new terms have received your favourable consideration.

"I remain, on behalf of the London District Committee,
"J. Potter,
"*District Sec. Electrical Trades Union.*

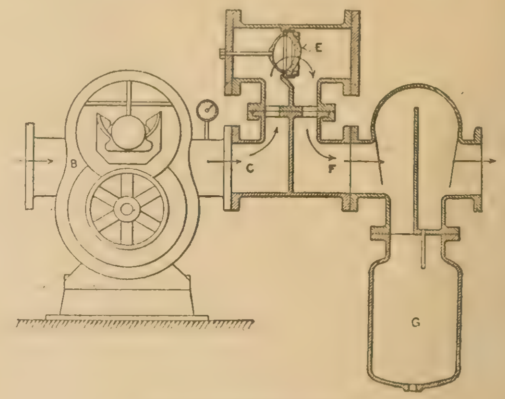
"*January 14th*, 1914."

NOTES.

Fires which were not Electrical.—When quite recently a large fire resulting in damage to the extent of £80,000 occurred in Bradford, efforts were made to put the entire blame upon the electric plant, but Bradford electrical engineers were able to rebut the allegations that the cables were at fault. Now comes another complaint, this time from Harrogate, where a fire occurred on December 31st, and was at once attributed to the fusing of an electric wire which melted the gas pipes in the building. Mr. George Wilkinson, the borough electrical engineer, at once investigated the matter personally, and found that instead of the electric wires being fused, the only effect of the fire upon them was a blackening of the outer covering of the insulated cables. Otherwise everything was intact. Instead of electricity being the cause of the fire, it was found that there was evidence that the fire had been aggravated by gas escaping from the melted pipes, and Mr. Wilkinson suggests that it would be safer in buildings where such a dangerous commodity is used if the Government would insist on the use of wrought-iron pipes in place of lead ones.

New Process of Cleaning Producer Gas.—Mr. H. F. Smith recently communicated to the American Society of Mechanical Engineers a new method of removing the mechanical impurities present in producer gas from bituminous coal. The apparatus is shown below. The gas on leaving the producer is first cooled to a point where the tar vapours are condensed by being passed through a primary cooler or condenser. From this the gas is carried into an ordinary rotary gas pump B which delivers the gas under pressure into the main C; it is then delivered through a porous diaphragm E and discharged from there into the main F. A sump or separator G is provided in which the tar accumulates.

The diaphragm E is made of spun glass in the form of ordinary glass wool (not slag wool) built into the form of a uniform diaphragm and retained between two metal screens. Ordinarily, this diaphragm is made up to a thickness of approximately one-quarter of an inch. About 400 cb. ft. per hour can be handled for each square inch of diaphragm area. No tar is retained in the diaphragm, both tar and gas being discharged together.



Static Scrubber Layout.

In passing the diaphragm an important change in the physical state of the tar occurs. On the entering side the tar exists in a large number of minute particles, ordinarily known as tar fog. In passing the diaphragm these particles are caused to coalesce, so that on the discharge side the tar particles are of relatively large dimensions, so large in fact that they can no longer be carried forward in the gas current and immediately separate out by gravity. All that is necessary for the complete separation of the tar from the gas is to provide a sump, or drip, into which the precipitated tar can drain.

It appears to be possible to secure almost any desired degree of gas cleanness simply by regulating the pressure maintained across the diaphragm. In ordinary commercial operation, it is found that a difference in pressure of from 2½ to 4 lb. will give a degree of gas cleanness that is ample for any commercial requirement; 30 cb. ft. of gas cleaned in this way can be passed through a white filter paper without producing any discoloration.

Good results can be secured only when the velocity of the gas passing through the diaphragm is very high. Nothing whatever remains in the diaphragm.

No water is used in connection with this process except that required to cool the gas. The tar is practically water free.

It is believed that in addition to the effects of mechanical collision which undoubtedly exist, there is some electrical action which is of material aid in causing the coalescence of the particles of tar fog.

The first commercial equipment of this kind has now been in continuous operation for approximately 18 months, handling gas for a producer-gas power plant of approximately 1,000 H.P. capacity.

Foreign Trade in December.—The following are the electrical and machinery figures given in the official returns for December trade, and for the entire year 1913 :—

Imports.	*Month of Dec.*	*Inc. or dec.*	*Twelve months,* 1913.	*Inc. or dec.*
	£	£	£	£
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	155,547	+18,083	1,587,318	+129,675
Machinery	617,884	+ 3,265	7,282,046	+461,363
Exports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	346,464	+ 26,345	5,404,671	+1,063,084
Machinery	2,957,456	+214,122	37,027,582	+3,869,567

Appointment Vacant.—Electrical testing assistant (32s. 6d.), for Salford Corporation. Particulars are given in our advertisement pages.

Inquiries.—Makers of Edison screw lampholders in this country, and makers of Raise's light regulating switches (Patent 5,521, 1911), are asked for.

Electricity Supply Rifle League.—The following are the results of matches shot during December Brompton (Mugford, Willis, Nash, 98), 578, *v.* St. James's (Young, 95), 552; Brompton (Beale, 96), 561, *v.* Shoreditch (Foster, 97), 559; Central (Gaze, Wells, 98), 573, *v.* St. James's (Young, 99), 514; Central (Gaze, 100), 578, *v.* Stepney (Dubbin, Graves, H. A. Mansell, 88), 514; Hackney (Barham, 92), 521, *v.* Ilford (Brown, Haeger, L. and R. Tufnell, 96), 569; Hackney (Hilling, 99), 552, *v.* Stepney (Dubbin, 90), 489; Ilford (Haeger, 97), 561, *v.* Westminster (Partridge, H. Pearman, 98), 571; Poplar (Hogg, 93), *v.* Shoreditch (Weekes, 99), 568; Poplar (Randall, 97), 560, *v.* Westminster (H. A. Pearman, 97), 564. The following is the final position of the clubs:—

	Matches.					Scores.		
	Shot.	Won.	Lost.	Drwn.	Pnts.	For.	Agnst.	Avge.
Westminster	16	14	2	0	28	9,098	8,783	568·62
Central ...	16	12	3	1	25	9,051	8,728	565·69
Ilford ...	16	12	4	0	24	9,033	8,735	564·56
Shoreditch	16	11	4	1	23	9,073	8,792	567·06
Brompton	16	10	6	0	20	8,989	8,766	561·81
St. James's	16	6	10	0	12	8,693	8,895	543·31
Hackney	16	4	12	0	8	8,709	8,748	544·31
Stepney ...	16	2	14	0	4	8,526	8,773	532·87
Poplar ...	16	0	16	0	0	8,027	8,979	501·69

Fatalities.—TRAFFORD PARK.—On Thursday, last week, an inquest was held by County Coroner Sellus into the cause of the death, which occurred at the Westinghouse Works, Old Trafford, Manchester, on the previous Monday, of Thomas Henry Spokes, 42, of 20, Grosvenor Road, Urmston, a fitter.

Mr. Mensforth, the works manager, said there was an electric motor used for driving the fly-wheel, and the object of the wheel was to compensate for irregularities. The winding motor required a heavy current, the supply being taken from the Supply Co. It was a very fluctuating demand, and the Supply Co. objected to such a demand. The fly-wheel was to act as an accumulator and to flatten out this supply from the mains.

Evidence was given to show that the fly-wheel had burst, and deceased was killed and 12 others injured.

Mr. Griffiths said he had worked on the fly-wheel for a week, and had got it to a speed of 1,100 revolutions; it was guaranteed to run at 1,200. It was 8 ft. in diameter and weighed 4½ tons. They were balancing it when it burst.

Mr. H. M. Seal, H.M. Inspector of Factories, said they had sought for a cause of the accident, and they considered the design of the wheel was satisfactory, and that the electrical portion of the machine was mechanically the weaker, and would have shown signs of distress considerably below the point at which the fly-wheel should have burst; but when they considered the strains that might be in the fly-wheel, due either to want of proper annealing or improper cooling in the manufacture, they came to the conclusion that the undoubted reason for the failure was that the rim of the fly-wheel had an initial tension in it due to the fact that it had not been properly cooled.

The Coroner: Do you suggest that there was negligence in the making of the wheel?—Mr. Seal: I would not say that the firm should be certain as to the length of time a wheel was allowed to cool. The Coroner: In your opinion there has been no gross negligence on the part of the firm supplying the wheel?—Mr. Seal: No, I should say there was not. A verdict of "Accidental death" was returned.

An electrician named White, while engaged near the roof of the smelting department in the works of the Clydebridge Steel Co., Cambuslang, overbalanced and fell, receiving fatal injuries.

Manchester Electro-Harmonic Society.—The fourth concert of the season takes place to-night at the Albion Hotel, Manchester, with Mr. Geo. Leyton in the chair. The artistes announced are:—Soprano, Miss Mabel Hirst; bass, Mr. Hamilton Harris; Mr. Ernest Hastings, humour and music at the piano; accompanists, Mr. R. H. Greaves and Mr. W. J. Smith, the hon. musical director. As usual, there will be a number of intervals, and a large attendance is asked for.

Hackney Electric Rifle Club.—A concert promoted by the Rifle Club of the Hackney Borough Council electricity department was held in the Town Hall on Friday evening last, the Mayor (Mr. C. Wimpley) presiding. Mr. F. Heathman, musical director, was presented with a sealskin cigar case in recognition of his services in organising the concert, and Mr. L. L. Robinson, the borough electrical engineer, was awarded a vote of thanks on the initiative of Mr. Beadle, who said that during Christmas week they had to meet a demand of 4,870 KW., with a plant of 4,800 KW., and a staff who could maintain that deserved the thanks of their chief. Cups and prizes were presented for efficiency in shooting.

E.T.B.I.—A circular has been issued by the secretary of the Electrical Trades Benevolent Institution regarding the advantages of membership, who is eligible, &c. The subscription is 10s. per annum, and only those who have been members for at least five consecutive years are qualified to receive pensions. Copies of the circular for distribution among possible subscribers may be obtained from the secretary, Mr. F. B. O. Hawes.

High-pressure Shock.—From Rjukan it is reported that a workman happened to touch a wire from a cable charged with 10,000 volts. The result was a terrible shock, and he lost consciousness, but recovered soon afterwards, and escaped with some burns.

Institution and Lecture Notes.—CITY AND GUILDS TECHNICAL COLLEGE, FINSBURY.—On Monday evenings, commencing on January 26th at 7 p.m., Mr. J. E. Catterson-Smith, M.I.E.E., is to deliver a special course of six advanced lectures on "The Theory, Calculation and Operation of Modern Rotary Converters." The fee for the course is six shillings. The programme may be obtained by applying to the College, Leonard Street, E.C. An announcement will be found among our advertisements.

INSTITUTION OF ELECTRICAL ENGINEERS.—At the meeting of the SCOTTISH LOCAL SECTION, held in Glasgow on Tuesday, the paper by Mr. H. C. Gunton on "The Employment of Power in H.M. Post Office" was read and discussed.

A meeting of the MANCHESTER LOCAL SECTION was held on Tuesday last, when the paper by Mr. B. Welbourn on "British Practice in the Construction of High-Tension Pole Lines" was read. An interesting discussion followed, to which Mr. Welbourn replied.

GREENOCK ELECTRICAL SOCIETY.—On Friday last papers were read on "Cable Faults and their Causes," by Mr. L. Hogg, and on "Thoughts on Cable Chemistry," by Mr. Lowrie Sinclair.

BIRMINGHAM AND DISTRICT ELECTRIC CLUB.—At Birmingham on Saturday, Mr. W. Y. Anderson delivered his presidential address to the members. He said that electricity was perhaps the greatest factor which enabled a nation to find a satisfactory solution to the physical and educational problems which it had to deal with; it had done more to benefit health and conditions of labour than years of legislation.

At the meeting of the YORKSHIRE LOCAL SECTION, on Wednesday last, the paper by Mr. B. Welbourn, on "British Practice in the Construction of High-Tension Overhead Transmission Lines," was read and discussed.

INSTITUTION OF CIVIL ENGINEERS.—At the Students' meeting, on Friday last, Mr. C. I. Routh read a paper entitled "The Application of Power Railway Signalling in Great Britain."

The New Switchgear Rules of the V.D.E.—For the benefit of those who have not had an opportunity to study these Rules (which were discussed in our issue of January 2nd) the following short description is given:—

The title runs as follows:—"Preliminary Standards of the V.D.E. for the Design and Testing of A.C. H.T. Apparatus of a rated Voltage from 1,500 Volts upwards." It is also stated that these Rules are to come into force on January 1st, 1914. There are 32 Rules and an Appendix.

The first seven are general Rules, and deal with the standard voltages and currents, the rating of oil switches, the tables commented on in our article and two or three minor points.

Rules 8 to 25 relate particularly to oil switches, and those which are of special interest are dealt with in the article.

Rules 26 to 28 refer to isolating switches, and contain one unusual provision, viz., that this type of switch is only admissible in oil up to 6,000 volts. There seems to be no technical reason for this.

The next four Rules, Nos. 29 to 32, relate to apparatus for overhead transmission lines up to 35,000 volts, and are set forth in a manner with which we are all familiar.

The appendix consists of numerical examples showing how to select the correct size of oil switch according to the tables given under Rule 5, and it has been attempted in the article to translate these examples into a diagram, as shown in fig. 2.

The following errata occurred in the article:—Page 6, col. 2, line 50, for agreed, read argued; page 7, col. 1, line 5, for number, read numbers.

Under Rule 20.—If the time in which the relay acts is taken at 1½ seconds, the formula becomes $150 \times 1{\cdot}5/t$, and the maximum allowable permanent short-circuit current under the conditions stated is 45 times the normal current.

The author points out that at first sight it would appear that Rule 20 was in opposition to the usually accepted theory by which it is assumed that a time lag increases the breaking capacity of the switch, but this deduction is incorrect, since Rule 20 refers particularly to the effects on the switch contacts of the heat generated by heavy overloads, and the figures presumably are so chosen as to reduce the risk of serious burning or welding. When the current-carrying capacity of a switch is within the limits given above, it should be safe to assume that a switch fitted with a time-lag would have a greater breaking capacity.

Legal.—CITY OF LONDON ELECTRIC LIGHTING CO., LTD., *v.* TILLINGS, LTD.—In the King's Bench Division on Wednesday, Mr. Justice Horridge, sitting without a jury, heard two actions brought by the City of London Co. against Thos. Tillings, Ltd., the well-known 'bus owners, both actions relating to damage done by the defendant company's motor-'buses to the plaintiff company's electric standards. The accident that formed the subject of the first action happened on April 30th, 1913, at a refuge in Bishopsgate Street, the omnibus knocking down the standard and the lamp on it. The second occurrence was on May 23rd, 1913, a 'bus belonging to the defendants knocking down a large lamp standing on the footway in the Minories. The damages had been agreed, and Mr. Justice Horridge was asked to determine the question of liability. Mr. Justice Horridge, in the first case, took the view that the driver was going too fast, that he lost his head and applied his brakes unnecessarily, and therefore the plaintiffs were entitled to succeed. As to the second case, his Lordship held that the driver of the motor-'bus was negligent in putting on his brakes, especially in view of the expert evidence that a 'bus, if properly managed, would not skid 30 yd. Judgment was entered for the plaintiffs in both actions for £54 5s. 10d. and costs.

Annual Dinners, Socials, &c.—The first annual dinner of the Leyton U.D.C electric power station employés' Social and Athletic Club was held recently at the Masonic Hall, a company of 50 being present under the chairmanship of Mr. F. Harman Lewis. Messrs. J. W. Speight and L. O. Cox (vice presidents), and Mr. F. Schofield, tramways manager, were among those present. Mr. J. H. Quicke acted as secretary. The toast of "The Club," proposed by Mr. Cox, was responded to Mr. Whitnell. Mr. W. Matthews proposed "The Presidents and Vice-Presidents." Mr. Harman Lewis, in responding, said that it was 15 years since he first went to Leyton, and with one exception he had seen all the members of the staff come. He wanted to tell them that he did not wish to see any of them go. Rivalry between outdoor and indoor staffs was a good thing if it did not lead to bitterness of spirit. Other toasts followed.

The annual plain, fancy and evening dress dance of the Osram and Robertson Social and Athletic Club is to be held at the Brook Green Works, Hammersmith, W., on Saturday, January 31st, from 7 to 12 o'clock.

Last week the South Lancashire Tramways Co. entertained to dinner at the Leigh Co-operative Hall the whole of their employés, numbering close upon 500. The first party was entertained on the Monday evening, and the second on Thursday. It was announced that a new scale of pay for drivers and conductors, applicable to all except conductors in the first year of their service, had been arranged to come into operation at once, together with other improvements relating to working conditions.

The employés at the Middleton Electricity Works had their annual dinner last week. Councillor Wiggins presided, and others present included Mr. S. Pauls (electrical engineer), and Mr. F. Entwistle (town clerk).

On the invitation of the Hendon Electric Supply Co., Ltd., a dinner was held at Pritchard's Restaurant, Golder's Green, on Wednesday evening, the 7th inst., the chair being occupied by Mr. B. G. Drummond, the manager of the company, supported by Mr. K. A. Scott-Moncrieff, the managing director. After the repast the chairman proposed, and Mr. Harvey, the oldest member of the staff, seconded, a vote of thanks to the company. Mr. Scott-Moncrieff, in replying, paid a tribute to Mr. Drummond, to whom was due the credit of the present position of the company. The party then adjourned to the Golder's Green Hippodrome, where the remainder of the evening was spent. The guests included the following:—Mr. H. M. Sillar, chief assistant engineer, Mr. W. Andrew, assistant engineer, Mr. S. C. Hall, cashier, Messrs. Mason and Clarkson, sales department. On Saturday, the 10th inst., the wives and children of the men were entertained at tea and subsequently enjoyed themselves at the Ionic Theatre, Golder's Green. The arrangements were carried out by Messrs. Hall, Green, Cannon and Stenart, who acted as the Staff Committee.

The staff of the Barnsley Corporation electricity department held their annual charity ball in the Drill Hall, Barnsley, on Thursday, the 8th inst. Coloured electric lamps festooned about the ballroom greatly added to the beauty of the elaborate decorations which had been carried out by the staff. During the evening the Mayor and Deputy Mayoress of Barnsley attended.

Engineering Labour Agreement.—An evening paper says it is officially announced that three months' notice has been tendered on behalf of the Amalgamated Society of Engineers to the Engineering Employers' Federation "to terminate the national agreement for the settling of disputes and the premium bonus system. It is understood, however, that it is not the desire of the men that it shall be cancelled entirely, but that certain amendments shall be effected."

British Tramway Statistics.—The Board of Trade has just issued its tramway returns for the United Kingdom for the year 1912-13. The following figures show the progress made since the previous year's return:—

	1911-12.	1912-13.
Miles open	2,637	2,662
Miles run by cars ...	323.354,389	334,777,515
Passengers carried ...	3,127,318,732	3,219,857,293
Gross receipts	£14,726.068	£14.972,919
Working expenditure ...	£8,924,420	£9,384.798
Net receipts	£5,801.648	£5,588,121
Relief of rates	£488,509	£544,478
Aid from rates	£62,132	£64,988

The undertakings comprise 171 municipal and 115 company concerns. The net earnings of municipal tramways amounted to £4 095 957; £1,299.350 was applied to loan repayments, £544,478 in relief of rates, and £746,749 to reserve and renewals funds. The tramways of four local authorities and seven companies show an excess of working expenses over gross receipts. The lines open cover 2,662 miles, representing a capital expenditure of over 79 millions.

Striking Examples of Resuscitation.—Dr. Chas. A. Lauffer, medical director of the relief department of the Westinghouse Co., recently made some interesting statements regarding the resuscitation of victims of electric shock. Dr. Lauffer states that cases are on record where shocks received from 8,000 to 10,000-volt lines have not proved fatal, and where patients have been declared dead by physicians and yet have been resuscitated by the prone pressure method of resuscitation. He says that because the prone pressure has no apparatus to sell it gets very little advertising, and the general public has too little information of its value. Arc and static discharges from 240,000-volt conductors, and even higher voltages, are not necessarily fatal, if artificial respiration is resorted to at once, as shown by the following instances:—

Case A.—During July, 1913, a patient received some 8,000 volts. He was unable to release himself from a live wire he had inadvertently touched, and which was fastened to a switchboard. He was badly burned in five places. The comrade nearest him, who saw him drop, knocked the line out of his hand. The duration of the dangerous contact exceeded 15 seconds. It required 15 minutes of rhythmic effort at artificial respiration to get him back to normal breathing. For a time he breathed as though every breath would be his last, his diaphragm being in tetanic contraction, but by increasing the elevation of the diaphragm at the rate of 12 times a minute, by the prone pressure method, this spasmodic type of respiration subsided, and normal breathing was restored.

Case B.—The patient opened a live circuit and fell against a steel hose, receiving 10,000 volts, and the contact was of several seconds' duration. He lost two fingers and carries ugly scars on his palm, wrist and back. The honour of this rescue belongs to a man who has resuscitated six men without a failure. Why this man's uninterrupted success? He gets busy at once, for every second is an hour when the action of a man's diaphragm is paralysed. A victim of electric shock, and other conditions requiring resuscitation, needs instant assistance in the way of artificial respiration; few persons are killed outright by electricity.

Case C. This man received 11,000 volts, yet was successfully resuscitated. His palms were so deeply burned that both hands were subsequently amputated.—*Canadian Electrical News.*

Human Cables.—From time to time remarkable "special" articles appear in the Daily Press, describing in glowing terms some new (alleged) discovery, such as "seeing by telegraph," "wireless telephony across the Atlantic," &c.; these sensational announcements are followed later by statements of fact which are put in much smaller type, if they are not suppressed altogether, and which usually knock the bottom out of the sensational specials. In the *Evening Standard* of January 14th such an article was printed, with regard to "a very important physiological discovery"—that "the human nervous system is composed of electrical cables, and that nerve impulses are electrical in their nature." The discovery is attributed to Dr. A. C. Crehore, of the Cornell Medical School, New York, who is said to have calculated the theoretical speed of electrical impulses along nerves, and found his calculation to agree with the actual speed (30 m. per second). He also found that the nerve resembled exactly an electrical cable, consisting of a bundle of fibres with an insulating sheath, and that it "had a capacity per unit length almost coinciding with the capacity per unit length of a cable"; whether electrostatic or current-carrying "capacity" is not stated, nor are we told what "cable" was used for the comparison, which resembles the well-known statement that a certain object was "about the size of a lump of chalk." Moreover, Dr. Crehore calculated the number of fibres there ought to be in the nerve to give the measured velocity, and again found his calculation in exact agreement with the number revealed by the microscope. Prodigious! But how does the velocity of an electrical impulse in a cable depend upon the number of strands in the cable? He constructed an artificial cable which behaved exactly like the nerve when tested with a strong (*sic*) galvanometer. Of course, a "string" galvanometer is meant; but when the reporter does not understand his subject, his imagination is brought into play.

Now, there may be something in the alleged discovery; there often is, in such cases, though it is usually something that has been known to the whole scientific world for months or even years. But before publishing an article of this kind, which reads to an electrician like nonsense, it would be well if the editor submitted the proofs to the inspection of someone competent to weed out technical blunders and absurdities. We may add that this particular subject has been studied ever since the celebrated experiment of Galvani in 1786, and many volumes have been written upon it.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Chesterfield T.C. has been recommended to increase the salary of Mr. Acland, the borough electrical engineer, to £500 per annum, inclusive of rent, rates, fuel and light, the salary to be apportioned as under:—As electrical engineer £350; as tramways manager, £150.

Mr. H. Edmonds recently resigned his position with the Mersey Railway Co. to take up the post of resident engineer at the County Asylum, Chester. Upon leaving he was presented by the staff with a mahogany bookcase bureau, and by the company's Soirée and Athletic Club, of which he was vice-chairman, with a smoker's companion.

The Sheffield Corporation proposes to increase the salary of Mr. Fedden, general manager of the electrical supply department, from £800 to £900, and by annual increments of £25, to £1,000 per annum.

Mr. H. Parker, second engineer in charge at the Dover Corporation electricity works, has resigned.

The chief assistant and other members of the engineers' staff at the Darlington Electricity Works are to receive special allowances in recognition of overtime worked during the preceding 12 months in connection with the extensions. Allowances are also to be given to three of the charge engineers in recognition of the additional work performed by them during the period between the resignation of one of the charge engineers and the appointment of his successor.

After a stout resistance by the "economists" of the Morley T.C. on Wednesday last week, the resolution increasing the salary of Mr. J. E. Ellis, the borough electrical engineer, from £225 to £250, was carried.

Mr. David Tattersall has resigned his position as engineer and secretary to the Ingleton Electric Lighting and Power Co., Ltd., and is taking up, immediately, the post of mains engineer with the Hindhead and District Electric Light Co., Ltd. Mr W. G. Hurst, late chief assistant, Heckmondwike Electricity Supply Station, has been appointed to take up the post vacated by Mr. Tattersall.

Mr. R. W. Klitz has been appointed chief assistant electrical engineer at the Wimbledon electricity works, at a salary of £225 per annum.

Mr. E. Woolgar, of Paisley, and Mr. J S. Gibson, of Dewsbury, have been appointed engineers-in-charge at the Tunbridge Wells electricity works.

The Marylebone Electric Supply Committee have authorised the payment of a special bonus of £10 to Mr. Ratcliffe (generating station foreman) for working a very large amount of overtime, during practically the whole of the year, in consequence of the plant extension scheme.

The salary of Mr. Corson, as city electrical engineer and acting general manager of the light railways undertaking at Gloucester, is to be increased by £100 a year as from the date of his taking over the management of the light railways.

Tramway Officials. — The Manchester Corporation Tramways Committee has decided to recommend the Council to appoint Mr. Henry Mattinson, now permanent-way engineer, chief civil engineer of the department, at the salary of £500 per annum, and to enter into an arrangement with him under which he is to agree to remain in the service of the Corporation for a period of four years from January 1st, 1914. Mr. Mattinson's salary is to be increased on January 1st, 1915, to £525; in 1916 to £550; and in 1917 to £600, which is to be the maximum salary for the position.

General.—We have received a picture postcard from the Maruzen Co., Ltd., of Tokio, Japan, with good wishes for 1914, which we heartily reciprocate.

The *Financial Times* states that Mr. H. J. S. Heather, formerly of the "Corner House" staff, has been appointed Professor of Electrotechnics of the South African School of Mines.

Mr. Roland De Ville, who has for nine years been a member of the staff of Messrs. Siemens Dynamo Works, Ltd., Stafford, and who is having to take up a position with Messrs. Wrigley, of Smethwick, has been presented by the office staff with a dressing case, and by the works employés with a suit case.

The *Globe* states that Mr. W. T. Smith, who has been connected with the Post Office Telegraph service for 44 years, will shortly retire from the position of traffic manager of telegraphs at St. Martin's-le-Grand.

Obituary.—The death occurred suddenly on Friday last of Mr. E. A. Lazarus Barlow, who was a director of the Anglo-Argentine Tramways Co., Ltd., and was interested in a number of other well-known electrical companies, these including, according to the *Financial Times*, the British Thomson-Houston Co., Ltd., and the Chatham and Dublin Electric Tramway Companies.

The *Review of the River Plate* reports the death of Mr. B. W. Bayliss, superintendent of the United River Plate Telephone Co., which occurred on December 15th, of typhoid fever. Mr. Bayliss had only been in the country a few years. He was 35 years of age.

The death occurred on January 7th of Mr. Samuel Potts, who had held the position of electrician at the establishment of Messrs. Boots, Ltd., chemists, at Nottingham. He was only 32 years of age.

NEW COMPANIES REGISTERED.

Waygood Lifts (South Africa), Ltd. (133,322).—This company was registered on January 10th, with a capital of £10,000 in £1 shares, to take over the business carried on by R. Waygood & Co., Ltd., in South Africa, to carry on the business of manufacturers, constructors and suppliers of, and dealers in, lifts, elevators, cranes, hoists and lifting and hauling machinery, contractors, electricians, electrical, mechanical, hydraulic and general engineers, &c. The subscribers (with one share each) are:—H. Harmsworth, 65, Lewisham High Road, S.E., engineer; D. W. R. Green, 18, Tyson Road, Forest Hill, S.E., director. Private company. The number of directors is not to be less than two or more than seven; the first are Henry Claude Walker (chairman), H. Harmsworth, D. W. R. Green and Henry Cecil Walker. Registered by Bristows, Cooke & Carpmael, 1, Copthall Buildings, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

South African Lighting Association, Ltd.—Particulars of £10,000 debentures created May 27th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908: the amount of the present issue being £8,000 (renewals). Property charged: The company's undertaking and property, subject to first charge for £20,000. No trustees.

Electro-Flex Steel Co., Ltd.—Particulars of £[illegible] 7 per cent debs., created December 19th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908: the amount of the present issue being £15,000. Property charged: The company's undertaking and property, present and future, including uncalled capital, without power to create any mortgage or charge in priority to, or *pari passu* with, the debs. without the consent of the holders of two thirds of the outstanding debs. No trustees.

Davis & Clark, Ltd.—A memorandum of satisfaction in full on December 19th, 1913, of deb. dated September 2nd, 1911, securing £[illegible], has been filed.

Pernambuco Tramways and Power Co., Ltd.—Issue on December 18th, 1913, of £100,000 debs., part of a series of which particulars have already been filed.

United Electric Tramways of Monte Video, Ltd.—Issues from May 16th to October 31st, of £50,000 deb. stock, and from November 12th, 1913 to January 5th, 1914, of £16,019, deb. stock, parts of a series of which particulars have already been filed.

Foots Cray Electricity Supply Co., Ltd.—Issue on December 22nd, 1913, of £250 debs., part of a series of which particulars have already been filed.

British Prometheus Co., Ltd.—Issue on December 18th, 1913, of £300 debs., part of a series of which particulars have already been filed.

J. B. Saunders & Co., Ltd. (112,037).—Capital, £20,000 in £1 shares (6,000 "A" and 14,000 "B"). Return dated December 10th, 1913; 6,000 "A" and 12,000 "B" shares taken up; £18,000 considered as paid. Mortgages and charges: Nil.

Isle of Thanet Electric Tramways Co., Ltd. (49,978).—Capital, £300,000 in £5 shares (30,000 pref. and 30,000 ord.). Return dated December 18th, 1913; all shares taken up; £5 per share called up on the pref.; £150,000 paid; £150,000 considered as paid on the ord. Mortgages and charges: £192,000.

Naylorgraph, Ltd.—Debenture, dated December 30th, 1913, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: J. M. Hunt, Fairlawn, Park Road, Southborough, Kent.

Larne Electric Light Works, Ltd. (46,962).—Capital, £4,000 in £1 shares (500 pref.). Return dated November 19th, 1913. 500 pref. and 3,500 ord. shares taken up. £500 paid on the pref. £3,500 considered as paid on the ord. Mortgages and charges: £2,700.

Lithanode, Ltd. (formerly Longstreth's, Ltd.) (61,823).—Capital, £3,000 in £1 shares. Return dated November 17th, 1913. 2,775 shares taken up. £2,340 paid (including £65 on 225 forfeited shares). £500 considered as paid on 500 shares. Mortgages and charges: £1,700.

Juga (Nigeria) Tin and Power Co., Ltd.—Debenture dated January 6th, 1914, to secure £4,000 charged on 60 tons of block tin at company's mine in Nigeria, or in course of transit to England. Holders: P. Bright, 641, Salisbury House, London Wall, E.C.; and H. Scipio Reitlinger, 60, London Wall, E.C.

CITY NOTES.

German Electrical Companies.

The *Continental Telegraphen Compagnie, of Berlin*, after deducting general expenses and making provision for depreciation, reports net profits of £6,380 in the year ended with September 30th, 1913, as contrasted with £6,360 in the preceding 12 months. It is intended to distribute 12 per cent., being the same rate as in 1911-12, on share capital of £50,000.

The liquidators of the *E. H. Geist Elektrizitats Gesellschaft, of Cologne*, whose works were rented by the Colonia Electricity Co. on January 1st, 1912, report that the receipts in 1912-13 were solely derived from the rent paid. The final result for the year was a further loss of £1,000, which was defrayed out of the reserve fund, and the deficiency carried forward remains at £24,000. The option of purchase held by the Colonia Co., which is constantly well employed, still has a currency until the end of 1916.

The *Fabrik Isolierter Drahte zu Elektrischen Zwecken, of Berlin*, which reports an increased turnover in 1912-13, earned gross profits of £52,000, as compared with £50,000 in the previous year. After allocating £7,000 to depreciation as against £6,500, and allowing for other charges, the accounts exhibit net profits of £31,100, as contrasted with £30,600 in 1911-12. A dividend of 13 per cent. has been declared on share capital of £175,000, being the same rate as in 1911-12.

The Siemens Elektrische Betriebe A.G., of Berlin, which own electricity supply works, and are also interested in others as well as in tramways initiated by the Siemens group, record gross profits of £91,000 in 1912-13 on a share capital of £875,000 and loans of £1,053,000. The net profits, after meeting interest charges and general expenses, depreciation (£19,000), and allocation to renewal fund (£10,000), amount to £53,000, as contrasted with £35,000 in 1911-12. It is intended to pay a dividend of 6½ per cent., as in each of the three preceding years.

The Bergmann Elektrizitats Unternehmungen A.G., of Berlin, the subsidiary formed three or four years ago to finance the electrical enterprises of the Bergmann Electricity Works Co., earned gross profits of £6,800 in the third year which ended on June 30th, 1913. As this amount fails to meet the whole of the general expenses the year has closed with a loss of £4,000, thus increasing the debit balance to £36,000 on a paid-up share capital of £300,000. It was stated some time ago by the parent company that the scope of the subsidiary would be limited to the completion of transactions which were then in hand.

The Rheinische Schuckert Gesellschaft fur Elektrische Industrie, of Mannheim, which owns, or is otherwise financially interested in, a number of supply works and tramways, states that the company's own undertakings experienced a normal development in 1912-13, and the business was further extended. The gross profits amounted to £128,000, as compared with £79,000 in 1911-12. After defraying general expenses, interest charges, and placing £38,000 to depreciation and reserve funds, as against £31,000, the accounts indicate net profits and balance forward of £56,000, as contrasted with £29,000. A dividend at the rate of 8 per cent. has been declared, as compared with 7½ per cent. on less capital in 1911-12.

Anglo-American Telegraph Co., Ltd.—The directors have declared the following dividends to the close of 1913, viz. :—A balance dividend of £1 10s. per cent. upon the ordinary consolidated stock for the year; a balance dividend of £1 10s. per cent. upon the preferred stock for the year; a first and final dividend of £1 10s. per cent. upon the deferred stock for the year; all payable on January 31st next, less income-tax. The above dividends, together with those already paid, will amount to £3 15s. per cent. on the ordinary consolidated stock, £6 per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock for the year.

Japan.—Several more reports of Japanese electrical undertakings have just been issued. The Kyushu Electric Co. is paying a dividend of 11½ per cent. for the last half-year, an increase of ½ per cent. over the previous six months. The report of the Hakodate Water-Power Co. shows a net available profit of £11,808; of this sum £1,568 is being placed to reserve, £890 devoted to the directors and auditors, while £6,625 is being distributed to the shareholders in the form of a 10 per cent. dividend, leaving a small balance to be carried forward.

Dublin United Tramways. Ltd.—According to the *Financial Times*, the directors recommend a dividend at the rate of 5 per cent. per annum on the ordinary shares, making a distribution for the year at the rate of 5½ per cent., allowing £7,000 for renewals of rails and £5,000 for renewal of cars, leaving £9,957 to be carried forward. This represents a fall of ½ per cent. in the dividend for the year, and the appropriations to reserve and carry forward are also considerably down.

Consolidated Diesel Engine Manufacturers, Ltd.—The Shareholders' Committee's investigation of affairs having taken longer than anticipated, a circular has been issued deferring until the end of the month the meeting which was to have been held on Wednesday last. Definite recommendations respecting the future of the company will then be brought forward.

Direct United States Cable Co., Ltd.—An interim dividend of 2s. per share, less income-tax, being at the rate of 4 per cent. per annum, for the quarter ending December 31st, 1913, is payable on and after 31st inst.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be quoted in the Official List :—

Bell Telephone Co. of Canada, Ltd.—Further issue of $6,250,000 5 per cent. bonds, 1925.

Electrical and Industrial Investment Co., Ltd.—£100,000 4½ per cent. debenture stock.

Canada.—According to the *Canadian Electrical News*, the Merchants Light, Heat and Power Co., of Quebec, have submitted to the local Legislature a by-law to amend their charter by increasing their capital from $800,000 to $3,000,000.

Kaministiquia Power Co.—A dividend of 1½ per cent. for the quarter ending January 31st has been declared on the common shares.

France.—A new company has lately been formed in Paris (3, Rue Volney), with the title La Société Industrielle de l'Accumulateur Alcalin, and a capital of £24,000.

STOCKS AND SHARES.

Tuesday Evening.

The promise of stronger markets which ushered in the new year has been fairly well maintained up to the present, and the Stock Exchange as a whole is doing a little more business than it was at the end of 1913. The serious trouble in South Africa in connection with the railway strike has had little effect upon markets, so slender is the public interest taken in South African mining matters at present. It is hoped there will be a further reduction in the Bank Rate before long, and the prospect of money becoming still cheaper suffices to buoy the price of Consols and of the many new issues which have recently flooded investment markets.

There is a better tone in English Electricity Supply shares. Several good-sized orders to buy the leading shares have come in during the past few days, and in one or two cases the orders could not be satisfied straight away, so small is the amount of floating supply at present. With the prospect of the electric light merger, shareholders in the best companies, of course, will not part with their shares for the time being, so that any extra demand has a pronounced effect upon the market, although it does not follow necessarily that quotations will be put up, for obvious reasons.

Shares in demand at present are St. James', Bromptons, Westminsters and Metropolitans. Citys are very quiet, and, with the return of Mr. Pierpont Morgan to the United States, possibly the market in them will remain quiescent for the time being. Soon the companies will be declaring the dividends for the second half of their year; and there is some little discussion going on as to whether there is likely to be any improvement in the distributions as compared with those of a year ago.

The Railway market has slipped back into a lethargic state, and had it not been for the Undergrounds, the movements for several days past would have proved very uninteresting. Metropolitans and Districts have been good, though the prices came back sharply, and show losses on the week. The Metropolitan Railway will declare its dividend on January 29th, and the District is expected to make its announcement about the same time or a little earlier. A year ago, the Metropolitan paid 1¾ per cent., making 1⅝ per cent. for the year, and it is expected to do rather better this time, though the dealers are chary of making any confident estimate. The London and Suburban issues are fairly well maintained, but in these, as in other domestic traction issues, business is meagre and public interest slack. Underground Electric Incomes have again advanced. London Electric Railway Debenture stock rose 2, and London United Tramways Debenture improved a point.

Mexico and Brazil continue to be severe thorns in the side of the Stock Exchange, and the securities of practically everything connected with those two countries are the reverse from steady. Mexican Light and Power Common shares fell to 36 and recovered to 40, but the Preferred dropped 6 and failed to rally, while the Second Mortgage bonds shed 4½ points on the top of their previous slump. Lively movements have been taking place in the price of Mexico Tramways. Down to 62 and up to 68 on the same day, they have since returned to the neighbourhood of 65, developing rather more steadiness at that level. General Huerta is supposed to have given an undertaking that private property shall be respected, this announcement referring more particularly to the tramway company, but it is pointed out that the best intentions of a commander in charge of a gang like the Mexican Army, may not admit of fulfilment, and the Mexican Railway Company has already suffered some slight damage. Monterey Debenture is 5 points lower at 52½; while Pachuca Debenture has suffered severely, too, falling back to 72½.

Montreal Light and Power shares are 3 points higher, but this section is dull as a whole, and there are falls in the bonds of the Electric Light Company of Cochabamba, and the Electric Development of Ontario. British Columbia Electric Railway stocks are flat, the report coming as a great disappointment to those who had looked for more expansion in the company's earnings. The Deferred stock fell 6, and the 4½ per cent. Vancouver Debenture lost 4 points at 98; a faint recovery occurred in the Deferred, leaving it at 101.

Brazil issues, of whatever kind, are mostly under a cloud; and depression has seized upon prices in the markets for the Government bonds, municipalities, and utility companies. Brazilian Tractions, however, show no loss on balance. Small falls have occurred in Rio Janeiro Tramway bonds and Sao Paulo Debenture stock. Para Electric Ordinary shares have lost another 10s., and the Preference have failed to recover from their heavy fall. On the other hand, the Argentine group is better. Anglo-Argentine Trams First Preference improved to 4⅞. Southern Electric of Buenos Ayres Debenture stock hardened to 96, a rise of 2. Cape Electric Trams are unaffected by the South African troubles, as are also Victoria Falls Power Preference shares. Brisbane Preference improved a trifle, and Auckland Debenture rose a point.

In the Telegraph market, Anglo-American Preferred and Deferred stocks are a little lower, apparently on the vague idea that the Company's arrangement with the Western Union will have to be modified, in view of the way in which various American trusts are splitting up into their component parts. The Eastern group is firm, and there are rises, too, in Globe Ordinary, Great Northerns and West India and Panama shares. The last-named spurted $\frac{5}{16}$ upon buying that was supposed to owe its inspiration to America. Marconis have lost their ⅛ rise of last week. Oriental Telephones at $1\frac{3}{16}$ are $\frac{1}{16}$ harder, and New York Telephone bonds further improved upon their rise of last week.

The Manufacturing group is steady, with the exception of Castner Kellners, which fell ¼ upon realisations by those who were waiting for the deduction of the dividend and bonus before they sold. British Insulated shares followed up their rise of 7s. 6d. by a similar improvement, which carried the price to 8⅜. Willans and Robinson Preference gained 3 points. Babcocks are a shade better, undisturbed by the discussions current as to the advisability of reducing naval expenditure. The Rubber share market, after being firm, gave way a trifle upon a shaving-off of ¼d. from the price of the raw stuff, which brought about dulness in the leading shares and checked the little demand to cheer the market which was inaugurated at the New Year. Later, however, more resiliency was displayed, and many of the leading shares improved by reason of the Mincing Lane sales on Tuesday realising better prices than had been expected.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 13th.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	13/32 — 15/32	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	12 — 11	+ ½	..
Do. Do. Deferred	100	..	..	4½ — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 90	.	6 18 4
Do. 7 % Non-Cum. Pr'f.	100	8	..	52 — 55	..	5 9 1
Do. 5 % Perp. Deb.	100	5	5	92 — 95	..	5 5 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	..	5 12 6
Central London Railway, Ord.	100	8	8	59 — 64	2	4 13 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 8
Do. Def.	100	2	..	60 — 65	..	8 1 7
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	93 — 95	−1	5 5 0
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	+ ½	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76 xd	..	5 5 3
Lancashire United, 5 % Deb.	100	5	5	77 — 81	+2	6 8 5
London and Suburban, Ord.	1	..	..	¼ — 5/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	19/32 — 23/32	..	6 18 9
Do. Do. 4½ % 1st Deb.	100	4½	4½	72 — 77 xd	..	5 17 0
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	+2	4 7 0
London United Trams, 4 % Deb.	100	4	4	[illegible] — [illegible]	+1	6 [illegible] 2
Metropolitan Railway Consol.	100	1¾	1½‡	[illegible] — [illegible]	−1¼	3 11 0
Do. Surplus Lands	100	2¾	2¾‡	[illegible] — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	.	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	76 — 78	+1	4 9 2
Metropolitan District Ord.	100	Nil	..	31 — 31½	— ½	Nil
Do. 6 % Deb.	100	6	6	133 — 136 xd	..	4 8 8
Do. 4 % Deb.	100	4	4	90 — 92 xd	..	4 7 0
Do. 4 % Prior Lien	100	4	4	94 — 96	..	4 3 4
Do. 4½ % First Pref.	100	4½	4½	81 — 88	..	5 [illegible] 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	80 — 84 xd	..	5 7 2
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	⅝ — ⅞	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	.	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70 xd	..	5 14 4
Underground Elec. Railways	10	..	..	8¼ — 8¾	.	Nil
Do. "A"	1/-	..	..	[illegible] — [illegible]	+ 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 — 114	..	5 5 2
Do. 4½ % Bonds	100	4½	4½	98 — 100 xd	−1	4 10 0
Do. 6 % Income	100	6	6	91½ — 92½	+1½	6 9 [illegible]
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ½	..	Nil
Do. 6 % Pref.	5	3	[illegible]	3½ — 4	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	79 — 84	..	5 7 2

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Jan. 13th.	Rise + or Fall	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4¾ — 5	+ 1/16	5 10 0
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16 xd	...	6 3 11
Do. 4 % Deb.	100	4	4	89 — 91	+1	4 8 0
Do. 4½ % Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Do. 5 % Deb.	100	5	5	97½ — 99½	..	5 0 6
Auckland Trams, 5 % Deb.	100	5	5	100 — 103 xd	+ ½	4 17 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	92 — 94 xd	..	4 15 9
Do. 5 % 2nd Deb.	100	5	5	95 — 98 xd	..	5 2 0
Brazilian Traction, Light and Power	$100	6	6†	83 — 85	..	7 1 2
Brisbane Trams Invt., Ord.	5	8	8	7⅜ — 7⅞	..	5 3 8
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	96 — 99 xd	..	4 11 0
B. Columbia Elec. Rly., Def.	100	8	8†	99 — 103	—5	7 15 4
Do. Pref. Ord.	100	6	6	99 — 103	—3	5 16 6
Do. 5 % Pref.	100	5	5	99 — 103	—2½	4 17 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	96 — 100	—4	4 10 0
Do. 4½ % Con. Deb.	100	4½	4½	91 — 94	—1	4 10 0
Calcutta Trams, Ord.	5	7½	5†	6 — 6½	..	5 15 5
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛ xd	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	95 — 98	+2	4 11 10
Cape Electric Trams	1	5	5	21/32 — 23/32	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96 xd	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	8	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4¾d.	[illegible]	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 8
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16 xd	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
" Elec. Tr. (1904), Deb.	100	5	5	99 — 101 xd	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 82 xd	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	63 — 66	..	10 15 4
Do. Gen. Con. 5 % Bonds	..	5	5	74 — 79	—1½	6 6 7
Do. 6 % Bonds	100	6	6	74 — 76	−2	7 18 0
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5 — 5½	— ⅛	9 1 10
Do. 6 % Pref.	5	6	6	4⅛ — 4⅝	..	6 9 9
Do. 5 % 1st Deb.	100	5	5	93½ — 95½	..	5 4 6
Perth (W.A.) Elec. Tr., Ord.	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½ xd	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94½ — 96½ xd	..	4 13 3
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97 — 99 xd	— ½	4 19 0
Do. 5 % Mort. Bonds	100	5	5	89 — 91	—1	5 10 0
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	96 — 99	—1	5 1 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	+2	5 3 1
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 4⅞	..	7 3 7
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 8 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 13th.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bournemouth & Poole, Ord.	10	6	5†	9 — 10	..	4 14 9
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	6 0 0
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96 xd	..	4 13 9
Brompton & Kensington, Ord.	5	10	9†	8¾ — 9¼	+ ⅛	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3½ — 4 xd	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 8 0
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	95 — 98	+1	4 11 9
City of London, Ord.	10	9	6†	16½ — 17½	..	5 2 10
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	114 — 118 xd	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	97½ — 99½ xd	..	4 10 6
County of London, Ord.	10	6	5†	11¾ — 12¼	..	4 18 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	101 — 103 xd	..	4 7 5
Do. 4½ % Second Deb.	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	5/16 — 9/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4⅛	— ⅛	7 5 5
Do. 6 % Non-Cum. Pref.	5	..	..	1½ — 1⅞	..	
Do. 4½ % First Mort. Deb.	100	4½	4½	81 — 84	+1	5 7 2
Folkestone	5	6	6	4⅜ — 4⅞	..	6 8 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	8	8†	8¾ — 9¼	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	8†	7¾ — 8¼	..	4 17 0
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1½ — 1⅝	..	4 12 7
Do. 6 % Pref.	5	6	6	4¾ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 [illegible]
Metropolitan	5	4	4†	3⅝ — 3⅞	+ ⅛	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	+1	4 10 10
Do. 3½ % Mort Deb.	Stock	3½	3½	79 — 82 xd	+1	4 5 5
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10¼ xd	..	5 14 3
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref	5	7	7	6⅝ — 7⅛	.	4 18 3
Do. 3½ % Deb.	100	3½	3½	82 — 85	+1	4 2 4
South London, Ord.	4	5½	..	2¾ — 3¼	.	6 1[illegible] [illegible]
Do. 5 % First Mort. Deb.	100	5	5	97 — 100	+1	5 [illegible] [illegible]
South Metropolitan, 7 % Pref.	1	7	7	[illegible] — [illegible]	..	5 [illegible] [illegible]
Do. 4½ % First Deb. Stock	100	4½	4½	93 — 96	..	4 13 [illegible]
Urban, Ord.	£3	Nil	..	[illegible] — [illegible]	..	
Do. 5 % Cum Pref.	5	3‡	..	2⅝ — [illegible]	.	5 4 4
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Westminster, Ord.	5	10	10†	8½ — 9	+ [illegible]	5 11 1
Do. 4½ % Cum Pref.	5	4½	4½	4 13/16 — 5 3/16		4 6 10

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 3s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 13th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6†	5⅛ — 5⅜	..	5 11 7
Calcutta, Ord.	5	8½	5†	8½ — 8⅞	+ ¼	5 8 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	88½ — 90½ xd	..	5 9 3
Canadian Gen. El. Com.	$100	7	8	102 — 107	..	7 9 7
Do. 7 % Pref.	$100	7	7	119 — 124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 — ½	..	7 12 0
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88 — 90	— ½	6 13 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94 xd	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ — 95½	— 1	5 4 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	6†	11/32 — 13/32	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	100½ — 102½ xd	..	4 17 6
Madras, Ord.	5	Nil	..	1⅛ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 — 104 xd	..	4 15 0
Mexican El. Lt., 5% 1st M. Bds.	..	5	5	63 — 66	..	7 11 6
Mexican Lt. & Power, Common	$100	4	4	38 — 43	+ 3	9 6 0
Do. 7 % Cum. Pref.	$100	7	7	68 — 73	— 6	9 11 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	73 — 77	— 2½	6 9 10
Do. 5 % 2nd Mort. Bonds	100	5	5	58 — 62	— 4½	8 1 4

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 13th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	50 — 55	— 5	9 1 10
Montreal, Lt., H. and Power	$100	9	10†	219 — 225	+ 3	4 9 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 — 217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	101 — 106	..	5 13 2
Do. 5 % Deb. Stock	Do.	5	5	93 — 100 xd	..	5 0 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 — 101	..	4 9 4
Shawinigan Water, Capital	$100	5½	6†	134 — 138	..	4 7 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103½ — 105½ xd	..	4 14 9
Do. 4½ % Per. Deb.	Stock	4½	4½	96 — 98	— ⅛	4 11 10
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 — 89 xd	..	5 12 4
Victoria Falls Power, Pref.	1	6	6	25/32 — 27/32	..	7 2 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 8

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 13th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	⅝ — ¾ xd	..	8 0 0
Babcock & Wilcox	1	16	14†	2 15/16 — 3 1/16	+ 1/16	5 4 6
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 8 6
British Aluminium, Ord.	1	..	..	1 — 1⅛	..	..
Do. 6 % Cum. Pref.	1	6	6	25/32 — 29/32	..	6 12 6
Do. 5 % Prior Liens Debs.	100	5	5	92 — 95 xd	..	5 5 0
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	8†	8½ — 9	+ ⅜	5 11 1
Do. Pref.	[illegible]	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	99 — 102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	[illegible]	Nil	..	1 1/16 — 1 3/16	..	Nil
Do. Deb.	100	[illegible]	4	64 — 67 xd	..	5 19 5
Do. 6 % Prior Lien	100	6	6	100 — 103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	8/- — 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	⅛ — ⅜	..	Nil
Do. 5 % Prior Lien Deb.	100	5	[illegible]	75 — 80 xd	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	36 — 41	+ ½	10 19 6
Do. 4½ % Second Deb.	100	4½	4½	23 — 27 xd	..	16 13 4
Callender's Cable	5	15	5†	10¾ — 11¼	..	6 13 4
Do. Pref.	5	5	5	4 13/16 — 5 1/16 xd	..	4 18 9
Do. Deb.	100	4½	4½	95 — 98 xd	..	4 8 6
Castner-Kellner	1	20	22½	2 15/32 — 2 21/32	— ⅛	..
Do. Deb.	100	4½	4½	104 — 107	..	4 4 1

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 13th.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	66 — 71 xd	..	7 0 10
Dick, Kerr	1	Nil	..	5/16 — 9/16	..	..
Do. Pref.	1	6	6	23/32 — 27/32	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	55 — 59 xd	..	6 15 7
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	½ — ⅝	..	7 5 6
Do. Pref.	1	7	7	15/16 — 1 1/16	..	6 11 9
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 18 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	9⅝ — 10⅛ xd	..	5 18 5
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	12¾ — 13¼	..	5 11 1
Do. Pref.	5	4½	4½	4¾ — 5	..	4 10 0
Do. Deb.	100	4½	4½	99 — 101	..	4 9 0
India-Rubber, G. & T.	10	7½	7½	11 — 12 xd	..	6 5 0
Do. Pref.	10	5	5	9 — 9¾ xd	..	5 2 7
Telegraph Construction	12	20	5†	37 — 39	..	6 8 1
Do. Deb.	100	4	4	96 — 98 xd	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref.	100	..	..	51 — 56	+ 3	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 13th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	6½ — 6¾	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	93 — 96	+ ½	5 4 0
American Telep. & Teleg., Cap.	$100	8	8	124 — 127 xd	..	6 6 0
Do. Collat. Trust	$1000	4	4	87 — 90 xd	..	4 9 0
Anglo-American Telegraph	Stock	3	3	63 — 66	..	4 11 0
Do. 6 % Pref.	Do.	6	6	105 — 106	— ¼	5 13 2
Do. Def.	Do.	30/-	..	24½ — 24¾	— ⅛	6 1 3
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	..	4 16 2
Chili Telephone	5	8	..	7 5/16 — 7 9/16	..	5 5 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	77½ — 79½	— ½	5 0 6
Cuba Telegraph	10	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	10	10	10	14¾ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8¼ — 8¾	..	5 6 8
Do. 10 % Cum. Pref	5	10	..	6¾ — 7¼	..	6 18 0
Direct United States Cable	10	[illegible]	4†	6¼ — 6¾	..	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Eastern Telegraph, Ord. Stock	Stock	7	7	125 — 128	+ 1	5 9 3
Do. 3½ % Pref. Stock	Do.	3½	3½	76½ — 77½	+ ½	4 10 4
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 8 4
Eastern Extension	10	7	7	12 — 12½	..	5 12 0
Do. 4 % Deb.	Stock	[illegible]	4	94 — 96	..	4 3 4
Globe Telegraph and Trust	10	6	6†	10¾ — 11¼	+ ⅛	5 6 8
Do. 6 % Pref.	10	6	6	11¾ — 12¼	..	4 18 0
Great Northern Telegraph	10	20	5†	31 — 33	+ ½	6 1 2
Indo European Telegraph	25	13	5†	57 — 59	..	5 10 2
Mackay Companies Common	$100	5	5	77 — 81	— 2	6 3 5
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	+ 2	5 14 4

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 13th.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph	1	20	20	3¼ — 3⅜	— ⅛	5 18 8
Do. 7 % Cum. Partic. Pref.	1	17	..	2 9/16 — 2 13/16	— 1/16	6 0 9
Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	⅝ — ¾	— 1/32	6 13 4
New York Telep., 4½% Gen. Bnds.	100	4½	4½	98¼ — 99¼	+ ½	4 10 8
Oriental Telep. and Elec.	1	10	10†	1⅞ — 2	+ 1/16	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1 1/16 — 1 3/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	[illegible]	86 — 88	+ 1	4 11 0
Pacific and European Tel., 4% Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	[illegible]	10	10†	8¾ — 9¾	..	10 5 2
Submarine Cables Trust	Cert.	6	6	122½ — 125½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	+ 1	4 12 9
United River Plate Telephone	5	8	6†	6⅜ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 4⅞ xd	..	4 13 0
West Coast of America	2½	2½	..	1 1/16 — 1 3/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1¼	1¼	2 3/16 — 2 11/16	+ 5/16	5 0 0
Do. 6 % Cum. 1st Pref.	10	6	6	9¾ — 10¼	..	5 17 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	96 — 98 xd	..	5 2 0
Western Telegraph, Ltd.	10	7†	7	12⅝ — 13⅛ xd	..	5 6 8
Do. 4 % Debs.	Stock	4	4	90 — 92 xd	..	4 7 0
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 4½ per cent., January 8th, 1914.

Spark Frequency and Wave Length.—In the course of a recent communication, Count Arco commented on the great increase in spark frequency and wave length employed during recent years in wireless telegraphy. Between 1890 and 1899, the usual spark frequency was from 10 to 20 per second, and the usual wave length from 100 to 300 m. During the next eight years, the frequency increased from 20 to 100 per second, and the wave length to from 300 to 1,500 m. Then, between 1907 and 1912, the spark frequency rose rapidly to 1,000 or 2,000 per second, and the wave length employed increased to between 1,500 and 10,000 m. At the present day, the frequency typical of the largest land stations is 500 per second, and the wave length 15,000 m. (9·3 miles). These remarkable increases in spark frequency and wave length are attributable to the invention of the singing quenched spark, and, on the other hand, the comparatively low oscillation frequency now employed by the largest stations is necessitated by the very great wave length adopted. The generation of long waves, *i.e.*, the generation of comparatively low-frequency oscillations, is a simple matter, but it is difficult to radiate such waves efficiently. The 6,000-m. wave length employed between the Marconi stations at Glace Bay and Clifden (3,200 km. apart) is not sufficient for satisfactory radio-telegraphy over the 6,000 km. which separate Nauen from Sayville (Long Island). Using a 6,000-m. wave over this route, day signals are much more feeble than night signals, hence a 10,000-m. wave is employed. The radiation of such waves requires a tower 500 m. in height if the umbrella type of aerial be adopted, so that there is considerable advantage in employing lofty horizontal aerials.

BRITISH INTERESTS IN CHINA.

Progress of the Hong-Kong University.

By Prof. C. A. M SMITH, M.Sc.

After one year's work it is possible to estimate, in some measure, the probable effects and the general progress of the only British University in the Far East. On October 15th, 1912—just a year ago—the first tangible efforts for influencing British trade in China by technical education began in the Orient. On that date the University of Hong-Kong commenced its career with all the auspices of success. There were 55 first-year Undergraduates, of which number 37 elected to take the Engineering course. There are now in the three Faculties of Medicine, Engineering and Arts 110 Undergraduates, and more than half the number have elected to take up studies in the Engineering Faculty.

Valuable Presentations.—It must be stated at the outset that the chief reason for the success of the Applied Science section of the University has been the magnificent response made by British engineering firms to the appeal for equipment (issued less than a year ago). The Chinese have many opportunities to go to Japan, Europe and America for their technical education, and it was realised in the earliest stages of the development of this British University, that unless the students were offered instruction and equipment equivalent to that obtainable in the "West," they would not attend. Fortunately, everyone in China now realises that the little colony of Hong-Kong has again been true to the traditions which have led to its remarkable development. It has done thoroughly what it promised should be done.

But the promises have only been redeemed through the promptitude of the British manufacturers and shipping companies to grasp this unique opportunity for furthering British trade interests. The practical result is that the newest British university is assured of engineering equipment valued at £12,000. Moreover, the plant is essentially modern, and has been selected solely for experimental and educational purposes.

Undoubtedly the influential support given by the Electrical Review in its leading article of November, 1912, brought the matter to the notice of large firms, many of whom at once wrote to the university mentioning this fact. The *Engineer* and *Eastern Engineering* also generously supported the appeal. The first firm whose offer was received in Hong-Kong was the Chloride Electrical Storage Co., and on November 15th, 1912, we received the cable: "Supplying battery Chloride." Another cable, which will always be remembered in Hong-Kong, was from the Campbell Gas Engine Co., and this was: "Sending gas engine with producer and vertical two-cycle marine oil engine Camgas." There were other splendid offers, especially those of Messrs. Crossley, Babcock & Wilcox, Samuel White and the General Electric Co., Ltd.

However, after four months, it was found that less than half the equipment required had been presented. We were stirred up into taking some action with regard to machine tools by the attempt made in Hong-Kong to build a technical school and workshop equipped with American tools. Therefore the writer proceeded to England during the recent long vacation, reaching London on June 4th, and leaving on August 16th.

During the visit more than 200 manufacturers and a number of public men were interviewed on behalf of the University, and while most of the work was done in London, visits were also made to Glasgow, Birmingham, the Midlands and Cambridge (at the latter place there was a four days' meeting of the Institution of Mechanical Engineers).

In Glasgow a meeting of the British Engineers' Association was held in June, and the writer was allowed to address the same on behalf of the University. He had interviews with many individual members, and addressed the following Committees:—(1) British Engineers' Association; (2) China Association; (3) Manchester Chamber of Commerce; (4) Walsall Chamber of Commerce; (5) British Electrical and Allied Manufacturers' Association. All of these meetings had the effect of producing interest in the work of the University and tangible results. The two outstanding features of the visit were the sympathetic reception accorded to the writer by manufacturers, and the magnificent offer of the British Electrical and Allied Manufacturers' Association to equip the electrical laboratories. Lord Ampthill, the president, Mr. Bruce Anderson, the chairman, Mr. Hugo Hirst, and other influential members of the Association, took a deep and personal interest in the matter. The result was worthy of the British electrical industry.

The Result of the Visit.—It was found that the people who were willing to give tangible support to the University were the manufacturers, and the arguments which appealed to them were:—(1) The humanitarian results to be expected from the introduction of pure and applied science into a land where famine and flood are so frequent; (2) that Hong-Kong is a British Colony; (3) that the University will assist in maintaining British prestige in the Far East; (4) that trade results will follow technical education.

The Eastern Extension Telegraph Co. considered the suggestions that they should subscribe to the funds of the University, and have made a donation of £500. A large number of the manufacturers interviewed offered valuable equipment, and it is believed that further assistance will be obtained. Some makers of scientific apparatus were seen. Messrs. Philip Harris & Co., Ltd., Birmingham, are sending out selected physical apparatus, and Messrs. Pye, Cambridge, mechanics apparatus; Messrs. Negretti & Zambra will present a complete meteorological outfit, and it should be possible to record daily observations of the weather, &c., at the University. The Silent Electric Clock Co., Ltd., presented half-a-dozen clocks, and a master clock, for the electrical control system.

The original plans of the University provided for a workshop and a small experimental laboratory. The present plans provide for: (1) A gas and oil engine laboratory which will also be the electrical generating station; (2) An electrical machinery laboratory; (3) An applied mathematics and mechanics laboratory; (4) A fuel and cement testing laboratory; (5) Strength of materials laboratory; (6) An electrical technology laboratory; (7) An engineers' workshop; (8) A carpenters' shop; (9) A steam engine laboratory; and (10) A hydraulic laboratory. It may be of advantage to mention some of the more important items of the equipment of these laboratories. In the electrical generating station there are two gas engines and producers presented respectively by the Campbell Gas Engine Co., of Halifax (35 b.h.p.), and Messrs. Crossleys, Ltd., Manchester (15 b.h.p.). The Campbell engine drives a dynamo presented by the General Electric Co., Ltd., London; and the Crossley engine drives a dynamo presented by the Lancashire Dynamo Co., Ltd., Manchester. Amongst the other engines in this laboratory is the Gardner oil engine driving an 8-kw. dynamo; Messrs. Gardner presented the whole set. Messrs. Daimler have promised a 25-b.h.p. silent Knight engine, and the Westinghouse Brake Co. one of their Cross crude oil engines. The Griffin Engineering Co. have presented a patent brake. Messrs. E. R. & F. Turner, of Ipswich, presented an oil engine, and a dynamo for the set has been promised. Messrs. Ferranti, Ltd., Manchester, will supply the switchboard for this laboratory. This firm will also supply the resistances, &c., needed.

In the electrical machinery laboratory there will be about 30 motors and dynamos of different varieties. Messrs. Mather & Platt, Ltd., Manchester, have promised boosters, motors, &c., and Messrs. Vickers, Ltd., various dynamos and motors; the switchboard will probably be supplied by the General Electric Co., Ltd.; the British Thomson-Houston Co., Ltd., will supply a rotary converter and various motors; Messrs. Bruce Peebles, Ltd., Edinburgh, will supply an a.c. motor; and the Electrical Construction Co., Ltd., of Wolverhampton, d.c. dynamo and motors. Messrs. Elliott Bros., Ltd., will supply various measuring instruments, and other firms have made promises to the writer, but are referring details to a special Committee of the British Electrical and Allied Manufacturers' Association to prevent over-lapping. Messrs. Callender and Messrs. Henley are supplying all the cables; and Messrs. Miller, Edinburgh, the cast-iron slide rails.

In the Strength of Materials Laboratory there will be a

30-ton tensile testing machine, presented by Messrs. Buckton, of Leeds; this will be electrically controlled by a special motor, built by Messrs. Vickers, Ltd. Arrangements have been made for microphotography.

In the engineers' workshop there will be a 6-in. lathe, presented by Messrs. Lang, of Glasgow; a special reversible planer, with electrical control, presented by Messrs. Craven, Ltd., and the Lancashire Dynamo Motor Co., Ltd., both of Manchester; a shaping machine, by Messrs. Hulse, Manchester; and a radial drill, by Messrs. Archdale, Birmingham. Also a lathe, by Messrs. Buck and Hickman, Ltd.; a sensitive drill by Messrs. Smith and Coventry; and a hacksaw, by Messrs. Herbert, Ltd., Manchester. Messrs. H. W. Ward, Birmingham, will send either a capstan lathe or a milling machine.

A mechanical power hammer was promised by Messrs. Judson-Jackson Co., Ltd., and shafting and pulleys by Messrs. Samuel Platt, Ltd.; Messrs. Brown, Ward, Ltd., will send a light drilling machine, and Messrs. Jones and Shipman, Ltd., a 20-in. high-speed drilling machine. The Selson Engineering Co., Ltd., have promised a 5½-in. lathe, and Messrs. Drummond a 3½-in. lathe, with electric motor complete; Messrs. B. & S. Massey, Ltd., will send a 1-cwt. pneumatic hammer, and Messrs. Reavell, one of their latest types of air compressors. Messrs. Rowland & Co., Ltd., have presented a combined tool and dry grinding machine electrically-driven. A universal grinder and tool grinder have been given by Messrs. Luke & Spencer, Ltd. A number of firms are sending workshop accessories, such as gauges, small tools, &c.

In the carpenters' shop there are wood-working machines presented by Messrs. Thomas Robinson & Son, Ltd., and Messrs. A. Ransome & Co., Ltd. It is impossible to give details of the electrical technology laboratory, but offers are continually arriving, and all of the apparatus will be presented by the chief electrical firms in Great Britain, many of whom very kindly received the writer at their various works. In the hydraulic laboratory there will be the Ruston Proctor oil engine and pump, the Hayward-Tyler hot-air engine and pump, a Venturi meter, centrifugal and other pumps, meters, &c.

Several firms promised presentations of surveying instruments. Messrs. Stanley Bros., Ltd., are sending theodolites, levels, &c., and Messrs. T. Cooke & Sons, Westminster, Messrs. Norton & Gregory, Messrs. Hall and other makers will also send out surveying instruments.

Interviews were obtained with officials of the Colonial Office, the Foreign Office, the Treasury and the Board of Trade. Others who especially assisted were Mr. Douglas Vickers, Sir Frederick Lugard, Mr. Hugo Hirst, Mr. Bruce Anderson, Dr. Hele-Shaw, and Mr. Stafford Ransome.

Future Developments.—When the scheme of the British University of Hong-Kong was first mooted, the patriotic Viceroy of Canton sent a dispatch to the chief officials of the various Government Bureaus under his jurisdiction. He used these words: "The teaching of applied science, including civil, mechanical and electrical engineering and surveying, meets the present and most urgent needs of our country." During the last 18 months, the writer has travelled nearly 35,000 miles—across Canada, through Arizona and California, in Japan, in China, Korea, the desolate wastes of Siberia, Russia in Europe, and the wonderful industrial centres of Britain. The outstanding impression is the remarkable effects of applied science work. Unless a man believes in what he is doing there must be failure. Unless an engineer believes in the humanising results of his work, he will have no faith in it. Some of us think that "the white man's burden" is a thing which is real, a duty which must be cheerfully accepted. The reply to the short-sighted individuals who would stem the tide of scientific progress by the reiteration of the word "Materialism," is the humanising result of the Empire work done by engineers and clean administration in Egypt, India, the Straits Settlements, and other parts of the earth.

After one year we are able to show tangible results in Hong-Kong, but there must be no illusions that all is now finished. The writer will gladly receive further offers and reply very frankly as to whether they are acceptable. It is always possible to send subscriptions—we already find it necessary to extend our beautiful buildings; scientific appliances are also needed. It should be mentioned that Messrs. Matheson & Co., Ltd., 3, Lombard Street, London, have kindly arranged with the leading shipping companies to send all goods freight free. Messrs. Preece, Cardew and Snell are the honorary consulting engineers (London) for the University, and will advise as to details of equipment needed.

It has been possible to give the above record because of the far-sightedness and patriotism of the British engineering firms. It is an unanswerable reply to those who say that there is no enterprise in the old country. Good use will be made of the apparatus because the University is situated in a British colony; students are coming from all parts of the Far East. One man travelled for five weeks from the interior—and proved to be the best English scholar in the first year. He is the son of a wealthy official—in the "back of beyond"; a British Consul and a missionary schoolmaster trained him for years so that he might attend a British University. Six young engineers come from Yunnan—Government students from an interior province. They are seeing the oil engines, the dynamos, the wireless outfit and the machine tools. They will carry back into the interior the message that a knowledge of Science and Applied Science will prove a boon to China. And in Hong-Kong we also are sending a message throughout China—that the British Empire is not a thing decadent, as our trade rivals so constantly assert, but that the little islands in the West are still the nursing home of enterprise, good workmanship and scientific ability.

ELECTRICAL COMMERCIAL LABORATORIES.

Electrical engineering firms of any magnitude who have original work to investigate in the course of the development of their products, find it necessary to establish some form of research equipment which, under ordinary circumstances, would hardly be found on the premises of a manufacturing concern, as it would more usually belong to a college or technical institution. It is only, however, comparatively recently that it has been realised that in order to obtain the best and most accurate work, the research department should not be an afterthought, but should be carefully placed with relation to the commercial testing department and should be thoroughly well lighted, equipped and staffed. The results of such a policy have already been demonstrated in more than one prominent electrical manufacturing firm, as it has been possible to co-ordinate the research department not only with the test-room, but also with the drawing office and management sections. A considerable movement in this direction has taken place in the United States, and without attempting to cover the whole ground, two representative firms may be mentioned who have paid careful attention to this portion of manufacturing organisation.

The General Electric Co., of Schenectady, N.Y., commenced the movement in the direction of adequate research equipment by engaging Dr. Whitney, then Professor of Chemistry in the Massacheusetts Institution of Technology, to organise a department of chemical and physical research. The development and nature of the work carried out in this department have been well outlined in a paper by Christian Dantsizen in the *Journal* of the Worcester Polytechnic Institution for last year. The first laboratory was a small room 50 × 100 ft. long, and by September, 1901, 12 men were at work there. Congestion was acute, and a building 10 times the size was then used. Another change was necessary in 1904, and a third change was made some time later to the first two floors of an office building containing about 40 rooms, each 20 ft. square given to specialised lines of research. Each department was well lighted by windows and incandescent lamps, and piped for water, illuminating gas and hydrogen. Some of the rooms were also piped for nitrogen, oxygen, steam, vacuum and compressed air. Voltages varying from zero to 6,600 volts, currents up to 200 amperes and power up to 150 KW. can be obtained in each room, and for special work higher voltages and currents can be secured. The generator room has a direct-current source of power supplied at 250 volts, converted by about 15 motor-generator sets varying from 5 H.P. to 200 H.P. direct current to different voltages and alternating current of various voltages and frequencies. A well-equipped machine shop and a chemical supply room are available, and the laboratory library has an extensive range of books and takes 64 periodicals dealing with technical subjects. The company also has a main library in one of its other buildings. Moreover, in addition to this special equipment, the laboratory can make use of the equipment of any other of the departments of the company. There is at present a staff of over 100 people in the research laboratory, including Dr. Whitney as director, Dr. W. D. Coolidge, assistant director, and about 50 college men. Not content with this, the company is now erecting a seven-storey red brick building in which the research laboratory and the standardising laboratory will be brought under the same roof. In this there will be an assembly room built after the style of a lecture room, where members of the research staff can assemble to discuss matters under investigation, and to listen to speakers from the various colleges, universities or another company.

The range of investigations has been enormous, including researches on electric furnace and other products, organic and inorganic insulating materials, metallurgical operations, electric lighting by means of incandescent lamps, luminous arcs and vapours. The metal tungsten was first produced in a high state of purity, so that it can be drawn into wire finer than any metal had before been drawn. The tungsten X-ray target, and the tungsten electric make-and-break contact were here invented. The Arsen vacuum furnace and the tungsten resistance furnace, both capable of maintaining a temperature of 3,000° C., are products of the research laboratory. The magnetic properties of iron and its alloys have been investigated, with the result that during the last eight years eddy-current and hysteresis losses in transformer steels have been greatly reduced. At present investigations are in progress as to the preparation and study of alloy systems for such purposes as obtaining high electrical resistivity, resistance to corrosion and definite coefficients of thermal expansion, the replacement of platinum by such metals as tungsten and molybdenum, the production of high-temperature resistance furnaces, the preparation of organic and inorganic insulators and the study of electrical methods of illumination by means of incandescent furnaces, arcs or gases. A capital of over $200,000 is annually spent on this laboratory, and the relation between the company and the investigator is simply that, provided the probable results are commensurate with the expenditure for carrying out a particular investigation, time and money are of no consideration.

Another good example is to be found in the equipment of the Allis-Chalmers Manufacturing Co., of Milwaukee. Without entering into much detail, it may be said that the commercial research laboratories of this company are divided into two divisions, electrical and mechanical. The electrical laboratory is also divided into two departments, one consisting of a general electrical laboratory, and the other a high-potential laboratory for the investigation of the insulating qualities of various insulating materials. The mechanical laboratory is also divided into two departments, one consisting of the chemical laboratory, and the other covering the testing of strength of materials and similar work.

The general electrical laboratory includes a complete equipment for the calibration and repair of all test meters, consisting of current and voltage batteries, standard shunts, standard meters and standard cells, together with the necessary switching apparatus for the calibration of the meters. This laboratory includes an equipment for the measurement of permeability by the ring method, using a ballistic galvanometer, and also apparatus for the measurement of iron losses according to the Epstein method. The insulation laboratory contains equipment for the performance of puncture tests from 800 volts up to 150,000 volts. This equipment consists of a motor-generator set with a specially-designed alternating-current generator giving a true sine wave and two high-voltage transformers, one with a range of 800 volts to 35,000 volts, and the other from 35,000 volts to 150,000 volts. This laboratory also includes an equipment for the measurement of the strength of tapes and webbings.

The chemical laboratory is equipped with all the necessary apparatus for the making of analyses of cast-iron, steel and all the alloys used in the manufacture, together with apparatus for the determination of the quality of different fuels, &c. The strength-of-material laboratory contains a Riehle testing machine of 100,000-lb. capacity, and also a spring-testing machine, transverse testing machine, &c. This covers the laboratory equipment of this company in a general way, and it will be seen that this type of laboratory lends itself to a good deal of original research.

It is not too much to say that equipments of this nature are absolutely necessary for the proper carrying out of engineering manufacture on anything like a large scale. As operations extend, the work becomes more and more differentiated until, as in the case of the General Electric Co., it becomes a paying undertaking to retain permanently the services of research experimentalists devoting their time entirely to the furthering of original developments which ultimately find their place in the patent records of the country. We are indebted to the officials of the companies mentioned for their courtesy in providing us with the information given above.

METER-TESTING RECORDS.

By A. BILLINGTON EALES, Stoke-on-Trent.

In view of the important functions which the supply meter is called upon to fulfil, and the influential manner in which the financial well-being of an undertaking is affected by the inaccuracy of such instruments, it is somewhat surprising that a more systematic method of test record keeping is not insisted upon.

Such a method need neither be cumbersome nor involve any great amount of labour in its upkeep. It is, however, essential that records be kept up to date to attain maximum efficiency with the minimum of labour.

Tests on supply meters are carried out, in the majority of cases, in a less perfunctory manner than obtained years ago, and, in order that the utmost value may be obtained from such tests, it is advisable that the results of observations made be noted in such a manner that reference to them can be made easily and without waste of time.

The system described is one devised by the writer, which has proved of considerable value during the two years or so that it has been in operation.

The results of tests taken on meters are entered in a book which is folioed for reference purposes. The ruling of the book is shown in fig. 1.

.... *Electricity Undertaking.*

METER TEST CERTIFICATE.

Meter No. Make. Amps. Volts. Cycles. Constant.

Load.	Power factor.	Watts.	Secs.	Revs.	Constant.	Remarks.

Meter registers with............watts. Temp. ....

Last test No............

Date.................. 19...... Tested by... ....

Fig. 1

The most useful constant will probably be found when expressed as watt-seconds per revolution of the disk, or ampere-seconds per revolution in the case of the ampere-hour meters so largely used on direct-current circuits.

For continuous currents the second column in the Test Certificate Book should be omitted, and the word "amperes" substituted for "watts" in each case where the latter appears.

On completion of the tests a small label, which serves the dual purpose of identifying the owner of the instrument and carrying the number of the test certificate, is affixed to the meter case. This label may take the form shown in fig. 2,

"This instrument is the property of
the Electricity Undertaking.
Test Certificate No. ."

Fig. 2.

and, if printed on a small piece of thin card, may be firmly held by a piece of celluloid secured to the case with two bifurcated rivets or small bolts and nuts.

This label will enable the previous results obtained, when testing the meter, to be readily found, and also provides the information as to the number of the last test for any subsequent certificate.

In addition to the foregoing, it is often desirable to refer to the performance of a meter without facilities for the immediate inspection of the actual instrument. In order that the history of any particular meter may be traced, some means are necessary of indexing the certificate-books, so that, given the information as to a meter number, its make, size, type, and, where distribution is effected at more than one voltage, the pressure for which it is intended, the last test certificate number can be found. The information above mentioned is usually obtainable from the consumers' ledgers. Probably for this purpose a card system is one of the most useful.

For each meter a card is provided with the following ruling :—

Number.	Make.	Type.	Amps.	Volts.	Cycles.
Test No.	Sent to.	Address.	Date.	Returned.	Reason.

Fig. 3.

The guide cards for such an index should be marked with the standard ampere sizes of meters, separate drawers or divisions in the card index cabinet being provided for different voltages and frequencies. Cards should then be filed in the numerical order of the meters under the guide cards of their respective ampere capacities.

Such a card as that outlined above when read in conjunction with the test certificate book will give the complete history of any meter, with all its ailments from the time it was purchased.

This description is of a system intended to deal with the meter-testing records problem only, and is quite distinct from methods devoted to storekeeping and control of stock. It will be found of value in enabling central-station engineers to determine which type of meter is most suitable for its purpose, and most economical over its useful life.

In practice, it requires very little time for the various entries to be made, and the information provided is well worth the trouble involved.

Engine Starting by Electricity.—What is claimed to be the largest internal-combustion engine so far fitted with an electric engine starter has lately been completed by the Electric Launch Co., of Bayonne, New Jersey. It is a six-cylinder petrol motor of 175 H.P., one of six intended for that number of battleship tenders which that company is building for the U.S. Navy. After experimenting unsuccessfully with two other systems, the Rushmore Co., whose American works are at Plainfield, N.J., were approached, this concern installing on the engine one of their No. 1 dynamos and A 13 electric starters, driving the gear ring on the fly-wheel at a 12 to 1 ratio. The experiment proved so successful that the Electric Launch Co., which is one of the largest motor boat-building concerns in America, has decided to adopt the Rushmore system on all its engines. In the tests, with the engine new and very stiff, the starter succeeded in turning it at a speed of 126 R.P.M., on a consumption of 350 amperes, from a 12-volt 160-ampere-hour battery, corresponding to 4·35 H.P. delivered at the fly-wheel rim, the overall efficiency between the battery terminals and the fly-wheel working out at no less than 84½ per cent. When the engine had been well run in, and was warmed up, the starter was able to run it at 165 R.P.M., with a correspondingly reduced rent consumption.

BRITISH PRACTICE IN THE CONSTRUCTION OF HIGH-TENSION OVERHEAD TRANSMISSION LINES.

By B. WELBOURN, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *January*, 1914.)

In our large industrial centres, where electrical energy is usually conveyed to consumers by underground cables, it is frequently not realised what extensive use of overhead wires is being made in country districts for the same purpose. So far as can be ascertained there are already nearly 1,000 miles of overhead lines in the United Kingdom which are operated at alternating pressures between 2,000 and 20,000 volts inclusive ; and of these there are 115 miles in operation or under construction for 20,000-volt working.

Our longest direct transmission line is only about 20 miles in length, while one of 40 miles is under construction.

The following figures for three-phase transmission illustrate the saving in first cost between underground cables and overhead lines, for work of the highest class. Copper has been taken at £60 per ton, and lead at £20 per ton. The copper conductors comprise three of 0·10 sq. in. section in each case. No buildings, transformers, or switchgear are included.

Voltage.	Cable laid and jointed, including street work.	Overhead line of equal kilowatt capacity.
6,000	£1,400	£900
11,000	1,550	950
20,000	2,100	950

Incidentally, this table shows how little influence the working pressure has on the first cost of an overhead line in this country.

Through this cheapened means of transmission much electrification work is now being undertaken which would otherwise not be commercially possible. The extensive use of overhead lines has thus become of enormous benefit to the manufacturers of electrical plant, cables, and accessories, as well as to the supply authorities and their consumers.

The principal difficulty in pole-line work across country is that arising from the necessity of negotiating wayleaves, and these negotiations are frequently very prolonged.

The author thinks that a strong case has been made out to justify the Council of this Institution in making representations to the Board of Trade for the benefit of the electrical industry and all consumers with a view to removing the inconsistencies which exist in the law. At the same time, efforts should be made to secure a curtailment of the absolute veto on overhead wires by a local authority, and the local authority's refusal of consent should be made subject to an appeal to the Board of Trade. At present such an appeal is only allowed in regard to power companies' wires in *rural* districts.

To secure the best results, it is essential that the engineers should survey and set out the line and then prepare and issue to the constructional engineers a route plan giving all essential details of what is required. Fig. 1 gives a copy of such an actual plan which is a model of lucidity. Another essential is that the clerk of works should know his work and not be hampered by inelastic instructions. In making the survey of the line a useful instrument is Captain Abney's clinometer level fitted with a compass.

The following formulæ and particulars are in regular use in designing overhead lines and give very accurate results.

1. *To Find Current in Lines.*—Let W = watts to be delivered at far end of line ; V = voltage between outer wires at delivery end ; $\cos\phi$ = power factor of the load ; I = current in amperes. Then—

$$I = W/V\cos\phi \text{ for single-phase lines,}$$

$$I = W/\sqrt{3}\,V\cos\phi \text{ for three-phase lines.}$$

2. *Voltage Loss.*—For short lines such as are used in the United Kingdom, capacity may be ignored and the formula $V_g - V$ will give the voltage loss.

$$V_g = \sqrt{(V\cos\phi + V)^2 + (V\sin\phi + E)^2},$$

where V_g = voltage at generator ; V_R = ohmic pressure drop in volts ; E = E.M.F. of self-induction.

In the short overhead lines used in this country the effects of electrostatic capacity may usually be ignored, and no account is here taken of it.

Safe currents for overhead wires are given by Prof. George Forbes's formula, $I^2 = D^3 t \pi^2 H/0{\cdot}96 R$. D = diameter of wire in cm. ; H = coefficient of radiation = 0·0003 ; R = sp. res. of conductor per cm^3 at limiting temperature ; t = temp. rise in degrees C. This is found to be very accurate in practice.

With one important exception, most of the high-tension lines have been built with creosoted wood poles. A representative example of an up-to-date line using wood pole supports is that erected from Scotswood to Burn Pit for the Newcastle-upon-Tyne Electric Supply Co., to the specification of Messrs. Merz and McLellan.

The main particulars of this line are as follows :—

System of working : Three-phase, 40 cycles, with earthed neutral.
Voltage between conductors : 20,000.
Voltage between conductors to earth : 20,000 ÷ √3.
Conductors : Two horizontal circuits employing wires of

0·10 sq. in. section, arranged on the Merz-Hunter split conductor system.

Conductor spacing : 5 ft. horizontally, 5 ft. vertically.

Conductor sag at 60° F. : 5 ft. 6 in.

Average length of span : 85 yds.

Straight line poles : H-poles 32 ft. long and 10½ in. diam. at 5 ft. from the butt ; 3 ft. 6 in. centre to centre of poles.

Channel arms on straight line poles : 10 ft. 6 in. long, 3½ in. × 2 in. × ¼ in. galvanised.

Terminal poles : H-poles 40 ft. long and 11 in. diam. at 5 ft. from the butt ; 12 ft. centre to centre of poles.

Channels on terminal poles : 12 ft. 6 in. long, 5 in. × 2½ in. × ⅜ in. galvanised.

Corner poles : H-poles 40 ft. long and 10½ in. diam. at 5 ft. from the butt ; 3 ft. 6 in. centre to centre of poles.

Channels on corner poles : 12 ft. 6 in. long.

Insulators on straight line poles : Petticoat pin-type well-cushioned from the metal pin by oiled-twine packing ; on corner poles, do., with a second insulator.

Insulators on terminal poles : Suspension type, three in series.

Earthing arrangements : A continuous 7/19 s.w.g. galvanised-steel strand is run from end to end, and is connected to an earth plate every fifth pole. All metalwork on the poles is connected to this wire.

Telephone system : Four-pair telephone cable arranged for superimposed working is suspended from the continuous earth wire. Low-tension telephones are used.

Factors of safety : Strictly in accordance with the Board of Trade requirements of 1913.

Guarding : As shown later.

The most important lines in the United Kingdom on which steel towers are used are those of the Cornwall Electric Power Co., for whom Mr. J. S. Highfield is the consulting engineer. The North Wales Power Co. also have a few miles of lattice steel pole line.

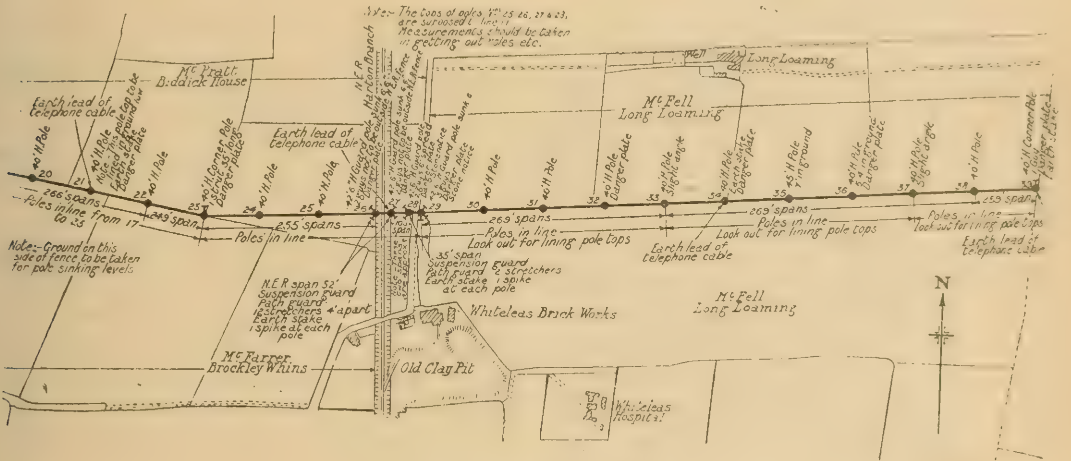


Fig. 1.—Route Map.

The Cornwall Power Co. have used both tubular and lattice steel poles on 11,000-volt lines with spans of 240 ft. and 350-360 ft.

The principal features of these lines are as follows :—

Conductors : Two vertical circuits employing solid hard-drawn copper wire, partly 0·125 sq. in. section, continuing with 0·07 sq. in.

Conductor spacing : Two top phases 9 ft. 6 in. apart ; two middle phases 10 ft. 6 in. apart ; bottom phases 11 ft. 6 in. apart. Distance between each phase vertically 4 ft.

Conductor sag at 60° F. : On the 0·125 sq. in. section 11 ft., and on the 0·07 sq. in. section 10 ft.

Average length of span : 117 yards.

Straight line pole : Total length 50 ft. 8 in. These poles consist of three sections, end base 6 ft. long, and two sections above ground of 19 ft. 4 in. and 25 ft. 4 in., built up of four main angles and braced with similar angles.

Angle poles : Total length 51 ft. 8 in. These poles consist of three sections, one 7-ft. base and two sections above ground 19 ft. 4 in. × 25 ft. 4 in., built up of four main angles forming a 10 ft. 6 in. square at the ground-level, tapering to a 9-in. square at the top.

Insulators : Grey suspension type, two in series.

Earthing : A continuous 7/13 s.w.g. phosphor-bronze stranded wire is run from end to end and earthed at five points on the line.

Road crossings : Four poles are placed in the hedge adjoining the road, from which cross wires are supported so that in the event of the power wire breaking it falls on this net. The net is earthed. Barbed wire is wound round the pole at a height of 8 ft. from the ground.

Danger notices : These are placed on every fifth pole and each pole adjacent to the roadways.

Most of the work already carried out has been done with winter-felled red-fir poles, creosoted by the Bethell process, to the G.P.O. standard of an average of 10 lb. of creosote per cb. ft. of timber. There is good reason to anticipate a life of 35 to 50 years for these poles if they are left undisturbed and if they are erected within a few months after creosoting. The reason for this is that the free creosote drains into the earth around the pole and forms an additional germicide protection.

In the last two years much interest has been taken in poles creosoted by the Rueping process, but naturally there is no experience yet of their life on the few lines which have been erected in this country. The poles have some advantages over Bethell poles in that they are both lighter in weight and cleaner to handle. From these points of view and in face of the experience obtained in other countries, poles treated by the Powell saccharine process must also be seriously considered in future.

To obtain the best results it is essential that all poles should be selected, dressed, slotted, bored, &c., at the maker's works before the creosoting is done. The maker should be supplied with detailed drawings showing the finished result required, and the inspection of the poles should take place at his yard whenever possible. When the poles are built up at the maker's works the key-block of A-poles and the brace-blocks of A and H-poles must be properly marked so as to ensure that they are put together correctly again on the site. Any recess cut in a pole after creosoting should be painted with hot tar. Some engineers have the bottom 9 ft. of the pole covered before erection with a preservative mixture consisting of 1½ parts each of Stockholm tar and slaked lime and 7 parts of well-boiled gas tar.

Steel structures before delivery should be coated with bitumastic solution ; and on that part of the structure which carries the insulators and so normally is inaccessible with safety, the members should also be galvanised before applying the solution.

The choice between steel and wood poles is mainly a question of first cost plus maintenance charges. In the industrial districts of this country there are many reasons why pole lines cannot be run in a straight line, with the result that the spans usually do not exceed 85 yards in length. For such spans it is cheaper in first cost to employ wood poles which require no after-maintenance. Under exceptional conditions, such as in Cornwall, longer spans can be used, and steel poles can then undoubtedly be employed with advantage. In the author's opinion steel poles should not be employed in smoke and fume-laden districts without the most careful investigation, because experience with steel poles on tramway and railway systems has shown that the rate of deterioration is rapid and the cost of maintenance in painting, &c., is high.

On most lines it is best to deal with angles by using H-poles which are, when necessary, braced with trussing tackle, and which are equipped with stays and are erected so as to bisect the angle. On heavy double-circuit lines at severe corners it is sometimes necessary to use well-braced three-legged structures. All corner poles should be erected with only sufficient rake to allow for settlement of the ground, and the whole of the side strain should be taken up by the use of stay wires and kicking blocks. In loose or marshy ground it is often necessary to plant corner poles as well as the kicking blocks in concrete. At corner poles the line wire should be eased round the curve by using two insulators, especially when solid wire is employed.

All channel arms, pins, stay rods, brackets, bolts, &c., should be thoroughly galvanised to the usual standard specification, and where the threads of bolts, &c., are too small to be brushed out while wet in the galvanising process they should be separately sherardised. Sherardised articles sometimes appear to be rusty after some months' use in the open, but this is only a surface effect.

All stay wires should conform with the Engineering Standard Committee's Specification No. 16 for galvanised wire for mechanical purposes. Convenient standard sizes to use are 7/8 and 19/8 s.w.g. galvanised steel strand, which should not, in the author's opinion, have a breaking strain exceeding 38 tons per sq. in., as otherwise the wires will be too hard to be properly workable when nozzling off. The stay wire should be taken three times round the pole or, alternatively, galvanised iron plates should be fitted to wooden poles, at the point where the stay is fixed, to prevent cutting into the wood. The stay should be taken round a galvanised thimble at the stay-rod end. All stay wires should be connected to the general earthing system of a line; but when lines are run in mountainous country, where it is difficult to obtain good "earths," it is advisable to insulate the stay-wire near the pole by inserting in it an insulator of the tramway globe strain type.

Sometimes it is necessary to put fore and aft stays on poles, *e.g.*, where a line is liable to be damaged by aeroplanes. Selected poles should have stays in the direction of the line whenever the line makes any considerable variation in level. On unenclosed land, so as not to cause injury to animals, all stay-rods should be protected by means of wooden cattle-guards securely fixed and painted white to make them easily discernible. It would be better to treat them by the Burnett or Powell processes before painting. The creosoting of cattle guards is a mistake in such cases because they cannot then be painted. In all other cases the cattle guards should be preserved by creosoting them.

The nozzles of all stays should be protected from corrosion by being coated with a high-grade bitumastic paint, and unless the threads of all stay-rods are galvanised they should be painted with a mixture of 45 parts tallow, 45 parts coal-tar, and 10 parts of mineral pitch, as soon as practicable after installation, to prevent them rusting up and becoming useless.

After having erected and watched the behaviour of about 500,000 yards of aluminium conductors (chiefly on low-tension lines), the author is very decidedly of the opinion that this metal ought not to be passed over in favour of copper if the total first cost of a line comes out cheaper with aluminium. There are cases where sulphur products abound, *e.g.*, in the neighbourhood of coke ovens, where aluminium should be preferred to copper because it will not be so readily corroded.

(*To be continued.*)

Discussion.

Dr. C. C. Garrard said that the chief difficulty at present in America was the so-called corona loss; owing to the different conditions prevailing in this country, this subject was not mentioned in Mr. Welbourn's paper. In this country we should not have transmission lines exceeding 20,000 volts pressure, to any large extent. In a certain instance which came under his notice, the insulator pins were not galvanised, and were fixed into the insulators by litharge cement. Continual trouble was experienced due to the insulators cracking, which was finally traced to small quantities of rust forming on the pins. Galvanising got over the trouble. The statement that even at 20,000 volts there was no need to make provision for protection against lightning where a cable was "teed" on to an overhead line was most important, as the opinion had been put forward that some form of protection was necessary here. He agreed that horn lightning arresters could only relieve a surge voltage by 20 per cent. of its value. They were a somewhat crude method of protection, but very cheap. The resistance in series with a horn arrester should be about 50 ohms, which, on a 6,600-volt three-phase line, with neutral earthed, would give a current of 76 amperes. To deal with such a current, a liquid series resistance should be installed preferably to a carbon rod. Steinmetz had shown that with such a horn-gap and series resistance, with a choke coil installed at the transmitting station, a higher pressure than 50 per cent. above the normal could not get into the station. A general condemnation of spark-gaps in connection with arresters was not permissible. The aluminium lightning arrester which had been used extensively in America, although originally invented in this country, had a spark-gap, and very excellent results were claimed for this arrester. The Giles valve, which was made by the same manufacturers that made the Moscicki condenser, also contained spark-gaps, and gave very good results for the protection of machines. Condensers had given satisfactory results where all other systems had failed. A short-circuit current was very much larger in the first instant than it was, say, one second after the short circuit came on. As with the continual increase of size of generating and distributing systems, the breaking capacity of the oil switch became a limiting feature, it was important that an instantaneous disconnection of a short circuit should not be possible.

Mr. F. J. Moffett said the present state of the law regarding wayleaves was a very serious handicap to electrical development generally. It was the duty of the Institution to see that in the matter of legislation, this country should be freed from such disabilities and put on a level in this respect with other European countries. Wooden poles properly treated with creosote were the most suitable for all positions except where appearance was a consideration. A few years ago he examined some poles which had been erected over 40 years, and which were being removed to allow of heavier poles being substituted; they were in very good condition, including the part below the ground. In many industrial districts, such as the Black Country, the air was so laden with acid that the life of iron or steel was short unless care was taken periodically to coat it with some preservative such as coal tar or bitumastic paint. Aluminium was now in respect of corrosion on quite equal terms with copper; the twisted sleeve joint was simple and fairly satisfactory. He had found that the most effective method of tying in the line wire was first to cover it with a lapping of soft copper tape and tie it in with a soft copper binder. He did not agree with the author in his dislike of any form of lightning arrester involving a spark gap. Several years' use of Wurtz multiple air-gap arresters on overhead lines had convinced him that they formed an efficient protection. These lines were erected in Nigeria, where thunderstorms were much more violent and frequent than in this country. No choking coils were used in connection with these arresters, but no damage was ever done to machine windings or switchgear.

Mr. L. F. Mountford was surprised to hear that the author did not believe there was any necessity for placing the aerial earth wire above the power wires as a protection against lightning. He thought it was decidedly useful in this respect, although it should be of the same material as the power wires, not only on account of its longer life, but also on account of its greater conductivity. He regretted that the author had been so severe in his condemnation of spark-gaps. His 6,000-volt lines were protected with arresters of the "multigap" or "low equivalent" type, where they entered the sub-station and choking coils of wrought-iron were placed in each line. This apparatus had given no trouble since its installation, and spark-gap arresters were installed in all the sub-stations on the 2,000-volt system. It seemed probable that the spark-gap arrester found its chief usefulness in systems of moderate voltage—6,000 to 10,000; beyond this the number of gaps required made the apparatus somewhat cumbersome, and it would probably be better to employ electrolytic or other forms of condenser arrester. With regard to the method of protecting the apparatus in the station by placing extra insulation on 10 per cent. of the windings on the line side of the transformers, there did not appear to be any reason why a fixed percentage of the end turns should be reinforced in this way. This would appear to depend upon the voltage of the supply, as a transformer of comparatively few turns would probably have the impact stress of a surge distributed over more of its windings, while one of many turns would only be stressed through a small percentage of its windings. One objection to this method of protection appeared to be that it protected the station, but not the line, and as a punctured insulator generally meant a shut-down, it would seem advisable, in cases where continuity of supply was important, to install some form of protection for the line as well.

NOTES ON INTERNATIONAL STANDARDISATION OF ELECTRICAL MACHINERY.

(*Discussion on paper read by* A. R. Everest *before the* Institution of Electrical Engineers *at Birmingham; for abstract of paper see p. 36.*)

Mr. C. le Maistre said that the industry was to be congratulated upon the public-spirited way in which the manufacturers, through their association, were co-operating in the establishment of satisfactory standards for this country. As regarded the international aspect of the question, he felt quite confident of the ultimate success of this work, for our continental friends had, in just the same manner as the English and Americans, placed their very best men at the disposal of the Commission for the working out of these problems, and the delegates to the special committee, both at Zurich and at Berlin, were all actuated by the highest motives. Whatever standards were adopted by the I.E.C., they must be of a really international character if they were to command the respect of the world, and the interests of those countries which were hotter or colder than temperate climates must carefully be borne in mind. As general secretary of the Commission, he was debarred from entering into any detailed criticism of Mr. Everest's very admirable notes, but he could assure the meeting that the Central Office in London of the I.E.C. would do everything in its power to help forward international agreement on this important subject. To be able equitably to compare different tenders must be of such material advantage to the progress of international trade in electrical machinery, that it was well worth striving for.

Dr. C. C. Garrard could not quite understand the lengthy arguments which had been put forward with regard to the reference, or standard, air temperature. It seemed to him this was only a roundabout, and somewhat confusing, way of fixing the standard temperature rise. It was clear, as it had been granted that the temperature of the cooling air during test was without effect on the temperature rise, that machines could only be compared with each other on the ground of temperature *rise*. Some people had gone to great trouble to make meteorological investigations all over the world, but this was absurd, since much greater variation of temperature might be found in one building, or ship. The idea appeared to be prevalent that having fixed the limits of observable temperature, it was possible to devise a rating which would ensure that this permissible temperature would never be exceeded. This was clearly impossible. The real question was shall the standard temperature rise be say 60° or 50° C.? Having fixed this, all machines built to this rating would be directly comparable, and instead of there being several I.E.C. ratings, viz., temperate zone, torrid zone and arctic zone, there would only be one rating, as of course there must be if it was to be an international rating. The table of limits of observable temperature would then be very useful to the user in determining what machine to use in any given circumstances. It was not possible to fix any standard rating so that the purchaser would be safe to install a machine, purchased as being in conformity with such standard rating, in any position. Such action would have the result that in a hot location, where the factor of safety should be higher, it would be, in fact, lower than in a colder situation. It would be much better to make it quite clear that they were simply aiming at fixing an international standard of temperature rise and that there would not be several I.E.C. ratings but only one.

Dr. T. F. **Wall** said that the most important point under discussion was the question as to the temperature the cooling air was to be assumed to attain in any temperate zone in order that the temperature rise allowed by the I.E.C. might be consistent with the limiting values given in the table. On looking at this table he was struck by the very high values allowed for the limiting temperatures. In view of the data given in Mr. Rayner's paper of 1905, he thought there was not much margin of safety when the values given in the table were adopted, and these values should on no account be exceeded. Certainly the highest temperature likely to be experienced in any temperate climate should be taken in conjunction with the table to fix the temperature rise. If a temperature of 40° C. was not uncommon, then if the value of 35° C. were taken as fixing the permissible value, the temperature given in the table would in some cases be exceeded, and the danger zone would be reached. He approved of the rating of motors in kilowatts instead of horse-power.

Dr. G. **Kapp**, referring to the decision of the I.E.C. not to establish any rules for correction for ambient temperatures or altitude, remarked that the influence of density of cooling medium was exceedingly complex, and this might account for the discrepancies between the experiences of different observers. It was not the volume, but the weight of air and the velocity at which it passed along the surfaces which determined the amount of calories it could take away. It was quite conceivable that no material difference in the temperature rise would be observed, whatever (within reasonable limits) was the density of the air. The adoption of 40° as advocated by the British and American members of the I.E.C. was not unreasonable, when one came to consider the necessity of providing a certain factor of safety. The yield point in the stress of a bar of steel could be found with a fair degree of accuracy, but the thermal yield point of any particular type of insulating material was not so accurately known. That such a point existed had been shown by Mr. Rayner and later by Dr. Steinmetz and the brilliant group of American engineers working on this subject. All experts agreed that 5° to the one side or the other made all the difference between a long and a short life of the insulation. The I.E.C. had agreed on certain upper limits of "observable" temperatures; these values were probably not very far from the yield points, and for this reason they must not be overstepped. It was therefore a wise precaution to agree on an ambient temperature sufficiently high to ensure that these maximum temperatures should not be exceeded even on a hot summer's day. The cost of machines was only slightly increased by adopting the ambient temperature of 40° as a starting point to arrive at the permissible rise, whilst the extra security against breakdown and the consequent possibility to reduce the amount of spare plant was certainly in the interest of the user. Nowadays, when electricity had become so important a factor in all industries, electrical engineers must not run any avoidable risk, and even if the provision of a generous factor of safety should make a machine a few per cent. dearer it was in the long run in the interest of the user to pay a little more for a reliable article rather than a little less for a cheaper and unreliable article. This was the policy followed by the best English and American practice, and they could wish for nothing better than that it should become the policy of electrical engineers of all countries.

Mr. H. R. **Hudson** referred to the employment of fans on the rotating parts of ordinary "protected type" and "enclosed ventilated type" industrial motors. Every designer was familiar with the reduction in cost for a given temperature rise which was obtained by the use of well-designed fans on the revolving parts of motors of normal speeds, and this without appreciable reduction of efficiency. Unfortunately, in five cases out of six, motors were installed in such positions and under such conditions that after a few months' running the ventilating passages and the interstices between the armature coils of a fan ventilated motor were so clogged with dirt, that if a full load test were taken, the maximum temperature rise would be found to be 10 to 15 per cent. higher than when first installed. This was not the case with machines relying on natural ventilation. Hence specifying I.E.C. rating would *not* in all cases establish a standard of quality as regarded temperature or life, unless accompanied by some proviso that the temperature limits should not be exceeded when the machine was tested after a certain period of running under actual service conditions. Such an arrangement would, of course, be commercially out of the question. He thought that in the interests of the buyer and also from the point of view of placing all manufacturers, of whatever nationality, upon an equal footing when quoting for enclosed ventilated machines, it was most desirable that machines with natural ventilation should not be placed in the same category as machines with fan ventilation. The matter seemed to him to be quite as important as discussing whether the maximum air temperature in the temperate zone should be taken as 35° C. or 40° C. He sincerely hoped that the I.E.C. would give the subject of the definition of types of electrical machines its earnest consideration.

Mr. C. T. **Sims** thought it was very much to be desired that some definite rule should be fixed, standardizing the exact method of measuring the temperature rise of various parts of machines. Unless this was done the manufacturer who based his guarantee on a temperature rise by the increase in resistance method would be handicapped in comparison with a manufacturer who based his guarantee on the temperature rise by thermometer. It was to be hoped that the tendency would be towards the use of thermometers for determining temperature rise rather than the increase in resistance method, as thermometric readings were invariably preferred by customers. In the table of limits of observable temperature, commutators and sliprings were bracketed together with a final permissible temperature of 90° C. The mechanical construction of sliprings usually took the form of a bronze ring shrunk on to a mica-insulated cast-iron hub. With such construction, a very high temperature was possible without fear of the rings becoming affected, whereas with commutators of the usual construction it was extremely difficult to obtain anything like equal expansion of all parts, with the result that a high temperature rise on commutators was to be deprecated, as trouble might then be expected with high bars, loosening, etc. The I.E.C. had not made any attempt to define rules for sparking limits of direct-current machines. This was quite as important as the standardization of safe temperature limits, and would be more necessary now than ever, if the overloads at present universally given with such machines were excluded. There were many cases where direct-current machines were called upon to give a very heavy output for such short periods that the temperature rise did not enter into the calculations, the limits being sparkless commutation and mechanical strength. Rating the motors on a kilowatt instead of a brake-horse-power basis would undoubtedly only help to confuse consumers, who very often had a fair idea of the brake-horse-power required but would regard a kilowatt rating as meaningless.

Mr. N. B. **Rosher** pleaded that the rating of machines should be no higher in the future than at present. If the I.E.C. ultimately adopted 40° C. as the ambient temperature, the rating of machines would be considerably higher than at present. His objection to the higher rating was chiefly that a very large percentage of motors used for industrial purposes drove line shafting, to which additional machines were frequently added. If the motors used for these purposes were highly rated there would not be the same margin of power as at present. With regard to the table of limits of temperature, it seemed to him very undesirable that the figure for bearings should be as high as 80° C. in the case of motors installed in out-of-the-way positions or where an inspection was made at only infrequent intervals.

Mr. W. J. **Larke** said it was of the utmost importance that an international agreement should be arrived at in connection with standardization, in the interests of the development of the electrical industry throughout the world, as well as of foreign business in the countries which did not produce their own electrical machinery and apparatus. In these latter countries we had for some considerable time been at a serious disadvantage with our German competitors, due to the adoption in this country of a more conservative basis of rating. But the work of the I.E.C. would prove abortive unless each country represented on it took the requisite steps to ensure that the recognised authorities in that country, controlling the standards of the industry, co-operated with the I.E.C. by changing where necessary the recognised standards of the country to those formulated by the I.E.C., to which their representatives had subscribed. For the United Kingdom this authority would presumably be the Engineering Standards Committee. In America the Institute of Electrical Engineers had already drafted a comprehensive series of rules in which had been incorporated the standards formulated by the I.E.C., so far as these had been established by international agreement. On the question of the temperature of the surrounding air rested the whole problem of international standardization in the rating of electrical machinery. There was no doubt that the attitude of the British and American delegates was correct in supporting such a limit for the ambient temperature as would ensure, under the conditions of climate considered, that the maximum limits of temperature mentioned in the table were never exceeded during any period of the working time, and this was the only logical attitude, in view of the fact that the limits mentioned were the maximum. It was to be hoped that at the next meeting of the I.E.C. the 40° limit would be agreed upon, the arguments in its favour being irrefutable. If 40° C. were adopted for temperate zones, there would arise the difficulty of rating of machines exported to tropical zones. Whereas large machines were almost invariably specially designed and built for the conditions under which they were required to work, a difficulty arose as to the rating of the small machines, which it was desired to deliver from stock for shipment to tropical zones. It seemed evident that in every case the ambient temperature of the locality in which the machines were to be used must be taken into consideration, and the machines re-rated accordingly by the manufacturer supplying them. The suggestion that motors should be rated in kilowatts instead of H.P. was an innovation for which there seemed no reasonable grounds, and one that would be fraught with the greatest possible difficulty and inconvenience. From a considerable experience and acquaintance with users of electrical machinery, it might be definitely stated that the difficulties of introducing electric driving, particularly to small users, would be considerably enhanced by following this procedure. All prospective users of electric power thought in H.P., and the prime mover, of whatever type, which it was proposed to supersede by an electric motor, was invariably rated in H.P.

Dr. M. Kahn said there could not be any doubt that a conservative rating was to the best advantage of all concerned. There was no question that machines sometimes had to run in temperatures of surrounding atmospheres of 40° C. Usually machines would run in temperatures of about 25° C., and the difference of 15° C. could be taken as a certain safety factor. It would be impossible to persuade a customer who had been used up to now to buy a 20-H.P. motor and get a certain load out of it and have something in hand for contingencies, that in future he would have to specify a maximum load, with a certain margin above the normal load. This could be obviated if the rating of the motor were settled in such a way that in case the rating allowed was exceeded by a reasonable limit no harm would be done to the machinery installed.

Mr. H. M. Hobart sent a communication to the following effect:—In the preliminary draft of a pending revision of the A.I.E.E. Standardization Rules, the plan has been followed of adhering to the I.E.C. Rules to the extent to which the latter have now been completed, and to incorporate their spirit in dealing with the classes of machines and the various features for which they do not yet provide. The draft divides rotating machinery into two groups—machines for pressures up to and including 4,000 volts, and those for pressures above 4,000 and not exceeding 14,000 volts. It is assumed that there will be places in these machines where the insulation will be subjected to temperatures exceeding by 10° and 20° respectively the highest temperature which can be "observed" with the methods of measurement recognised in the Rules. For stationary transformers, the internal drop in temperature is assumed to be 10°, irrespective of the pressure for which the transformer is wound. In the preliminary draft the I.E.C. values for the highest permissible limits of "observable" temperature have been adopted. These values represent approved practice for continuous running, if associated with such provisions as shall insure that they are *never* exceeded. For the A.I.E.E. Rules, the prospective International Ambient Temperature of Reference of 40° is adopted. Data of *shade* temperatures from all over the temperate zone afford ample evidence that no lower value could be adopted consistently with the International recommendation that the Standardized limits of "observable" temperature shall *never* be exceeded. This recommendation has already been incorporated in paragraph 18 of the new Standardizing Rules of the Verband Deutscher Elektrotechniker. Since the approved "observable" temperature rises set forth in the V.D.E. Rules are values, which, when added to 35°, give the highest permissible "observable" temperatures, it is clear that when the ambient temperature is greater than 35°, the highest "observable" temperature will be exceeded by an equal amount. In the neighbourhood of electrical machinery, the ambient temperature is frequently between 35° and 40°; to *declare* it to be 35° is futile if (as is the case) it *actually attains* to values several degrees greater, since this will occasion the temperatures corresponding to approved practice to be exceeded at times by several degrees, which conflicts with the International Agreement that the approved "observable" temperatures are to be considered as values which shall *never* be exceeded.

FARADAY SOCIETY.

Several discussions of varied interest were the features of the last meeting of the Faraday Society, held on November 26th, at the Institution of Electrical Engineers. Several of these were of somewhat abstract interest but a few remarks on two or three others will not be out of place here.

The Density of Aluminium. Dr. F. J. Brislee had shown in a paper presented to the Society in May, that contrary to what one would imagine, rolling and otherwise working aluminium reduced instead of increasing its density, the density, however, increasing again when the metal was annealed. Photomicrographic examination showed that the diminution in density was accompanied by a disappearance of crystalline structure, the polyhedra of the cast metal passing into an amorphous or vitreous state. Annealing transformed the amorphous back again into the crystalline state, with the accompanying increase of density already referred to. The changes of volume are a little difficult to understand thermodynamically, and the hope was expressed that the matter would be further investigated. It is necessary to know, for example, whether aluminium gains or loses heat when it is rolled and indeed the whole question of the change of state of aluminium, if there be such change of state, needs systematic investigation before the observations made by Dr. Brislee can be properly understood. Needless to say the question is of technical importance as well as of theoretical interest, particularly in view of the differences which exist in the stability of the hard-worked and annealed metal.

Overvoltage. A note by Professor J. W. Richards of Lehigh University, U.S.A., which appeared in the last issue of the Society's *Transactions* led to a short discussion on this somewhat elusive subject. Professor Richards put forward the novel view that overvoltage was not of the nature of a decomposition voltage and that it did not do chemical work. Calorimetric tests on a voltaic cell led him to believe that it is nothing more than a surface resistance caused by the accumulation of gas on the electrode, so that all the energy absorbed appears as sensible, measurable, heat. This view was strongly opposed by Dr. F. J. Brislee and by Mr. U. R. Evans, who reiterated the orthodox theory that overvoltage was simply due to the fact that the formation of visible bubbles required a considerable degree of supersaturation of the kathode with hydrogen, analogous to what happened when a liquid was superheated.

Nitrogen and the Electrical Discharge. Dr. T. Martin Lowry showed a series of photographs illustrating the formation of an oxidizable variety of nitrogen by the combined action of a so-called "silent" discharge and a "spark" discharge in air at atmospheric pressure. The observations arose out of experiments made with gases for bleaching flour. The new allotropic variety of nitrogen has the property of being oxidised by ozone to nitrogen peroxide. If no ozone is present the gas quickly reverts to the ordinary form. The existence of this allotropic nitrogen may have some bearing on the technical fixation of nitrogen, and it is suggested that the oxidizable variety is first formed by the discharge and afterwards oxidised by means of the ozone formed simultaneously to the oxides of nitrogen. The chemically active variety of nitrogen recently discovered by Strutt under certain conditions of vacuum discharge would appear to be different to Dr. Lowry's variety, as it is not oxidizable by ozone.

TRADE STATISTICS OF SIAM.

The following figures showing the imports of electrical and similar goods into the port of Bangkok during the year ended March, 1912, are taken from the recently issued official trade statistics; the figures for the year ended March, 1911, are included for purposes of comparison and notes of any increases or decreases are given. Imports stated to be from Singapore and Hong Kong are for the most part the products of other countries shipped *via* these two ports.

	1910-11. Ticals.	1911-12. Ticals.	Inc. or dec. Ticals.
Electrical goods and apparatus.—			
From United Kingdom...	197,000	315,000	+ 118,000
,, Germany	151,000	407,000	+ 256,000
,, United States ...	44,000	101,000	+ 57,000
Singapore ...	12,000	15,000	+ 3,000
,, Sweden	—	14,000	+ 14,000
,, Hong Kong ...	—	10,000	+ 10,000
,, Italy	10,000	7,000	— 3,000
,, Austria	2,000	3,000	+ 1,000
,, Holland	10,000	10,000	—
,, France	14,000	4,000	— 6,000
,, Japan	1,000	6,000	+ 5,000
,, Other countries ...	11,000	4,000	— 7,000
Total ...	452,000	896,000	+ 444,000
Hardware, etc.—			
From Singapore ...	251,000	205,000	— 46,000
,, United Kingdom...	197,000	245,000	+ 48,000
,, Germany	248,000	381,000	+ 133,000
,, Austria	104,000	112,000	+ 8,000
,, United States ...	64,000	43,000	— 21,000
,, France	32,000	31,000	— 1,000
,, Switzerland ...	19,000	6,000	— 13,000
,, Other countries ...	169,000	125,000	— 44,000
Total ..	1,084,000	1,148,000	+ 64,000
Lamps.—			
From Singapore ..	71,000	49,000	— 22,000
,, Hong Kong ...	26,000	27,000	+ 1,000
,, United Kingdom...	21,000	36,000	+ 15,000
,, Germany	33,000	69,000	+ 36,000
,, United States ...	63,000	74,000	+ 11,000
,, Japan	56,000	71,000	+ 15,000
,, Other countries ...	7,000	29,000	+ 22,000
Total ...	277,000	355,000	+ 78,000

	1910-11. Ticals.	1911-12. Ticals.	Inc. or dec. Ticals.
Parts of lamps.—			
From Singapore ...	19,000	13,000	— 6,000
,, Hong Kong ...	21,000	7,000	— 14,000
,, United Kingdom...	22,000	17,000	— 5,000
,, Germany	9,000	12,000	+ 3,000
,, United States ...	10,000	3,000	— 7,000
,, Other countries ...	12,000	11,000	— 1,000
Total ...	93,000	63,000	— 30,000
Steam machinery other than milling and marine.—			
From United Kingdom...	53,000	70,000	+ 17,000
,, Germany	8,000	35,000	+ 27,000
,, United States ...	32,000	9,000	— 23,000
,, Other countries ...	5,000	6,000	+ 1,000
Total ...	98,000	120,000	+ 22,000
Machinery other than steam.—			
From United Kingdom...	154,000	156,000	+ 2,000
,, Germany	37,000	56,000	+ 19,000
,, United States ...	81,000	26,000	— 55,000
,, France	6,000	30,000	+ 24,000
,, Other countries ...	17,000	27,000	+ 10,000
Total ...	295,000	295,000	—
Machine belting.—			
From United Kingdom...	81,000	34,000	— 47,000
,, Germany	18,000	27,000	+ 9,000
,, Other countries ...	5,000	1,000	— 4,000
Total ...	104,000	62,000	— 42,000
Brass and brassware.—			
From Hong Kong ...	454,000	255,000	— 199,000
,, United Kingdom...	66,000	71,000	+ 5,000
,, China	34,000	167,000	+ 133,000
,, Germany	11,000	23,000	+ 12,000
,, Japan	3,000	19,000	+ 16,000
,, Other countries ...	24,000	20,000	— 4,000
Total ...	592,000	555,000	— 37,000
Copper and copper ware.—			
From Hong Kong ...	105,000	23,000	— 82,000
,, United Kingdom...	24,000	21,000	— 3,000
,, China	5,000	27,000	+ 22,000
,, Other countries ...	8,000	13,000	+ 5,000
Total ...	142,000	84,000	— 58,000
Iron and steel wire manufactures.—			
From United Kingdom...	35,000	37,000	+ 2,000
,, Germany	12,000	29,000	+ 17,000
,, Switzerland ...	4,000	2,000	— 2,000
,, Other countries...	14,000	20,000	+ 6,000
Total ...	65,000	88,000	+ 23,000
Railway material.—			
From United Kingdom...	205,000	149,000	— 56,000
,, Germany	158,000	236,000	+ 78,000
,, Belgium	316,000	294,000	— 22,000
,, Other countries ...	2,000	3,000	+ 1,000
Total ...	681,000	682,000	+ 1,000

Note: £1 = about 13 ticals.

ELECTRICAL BILLS IN PARLIAMENT.

ESTIMATES OF EXPENDITURE.

The estimates deposited in connection with the Private Bills which will come before Parliament in the forthcoming session give the following amongst other expenditure:—

Reading Corporation (Mr. G. F. Craven, Tramways Engineer)—Construction of tramways, £3,100; provision of trolley vehicles, £6,800; provision of electrical equipment and other works necessary for tramways and trolley vehicles, £6,000; motor omnibuses, £3,500; Depôt accommodation, £2,400	£21,800
Cleckheaton Urban District Council (Mr. Clifton Lund, engineer).—Six motor omnibuses, £4,800; land and construction of buildings, £1,400 ...	£6,200
London County Council (Mr. G. W. Humphreys, engineer).—Tramways, £129,000; street widenings and improvements, £89,500	£218,500
Aberdeen Corporation (Mr. W. Dyack, engineer).—Double tramway, 4 furlongs 1.15 chains, £7,240; double tramway, 6 furlongs 1.42 chains, £12,990; double tramway, 5 furlongs, 0.33 chains, £9,270; street improvements, £5,000 ...	£34,500
Walsall Corporation (Mr. J. Taylor, borough engineer).—Steelworks, £5,634; construction of 1 furlong 8.18 chains of double tramway, £3,062; electrical equipment, £523; tramway rolling stock, £9,000; provision of trolley vehicles, £16,500; electrical equipment, etc., of trolley vehicles, £27,871; motor omnibuses, £19,800; land, £500; building of trolley vehicles and 'buses, £3,000	£85,890
Glasgow Corporation (Mr. J. Ferguson, engineer).—For the construction of twenty-eight sections of tramway	£406,500
Newcastle-on-Tyne Corporation (Mr. W. J. Steele, engineer).—Tramway, 3 miles 1 furlong 4.7 chains. single, £36,180; tramway, 8 chains, single, £1,457; tramway, 1 mile 1 furlong 7.3 chains, single, £15,534; other works, £2,200 ...	£55,371
Bolton Corporation (Mr. E. L. Morgan, borough engineer).—Tramways	£30,242
Leeds Corporation (Mr. J. B. Hamilton, tramways general manager).—Construction of tramways, £60,011; provision of trolley vehicles, £12,000; provision of electrical equipment, etc. for tramways and trolley vehicles, £28,562; land for sub-station and depôt, £475; provision of sub-station and depôt and plant and cables in connection therewith, £42,161	£143,210
York Corporation (Mr. J. W. Hame, electrical engineer).—Provision of trolley vehicles, £9,800; electrical equipment, £8,648; provision of equipment of motor 'buses, £12,000; land and depôt for trolley vehicles, etc., £21,617	£52,065
Birmingham Corporation (Mr. H. E. Stilgoe, city engineer).—Construction of new tramways, £144,209; overhead equipment and electric feeders, £34,917; rolling stock, £18,000	£197,126
Sheffield Corporation (Mr. C. F. Wike, city engineer, and Mr. A. R. Fearnley, tramways manager).—Construction of tramways, £2,055 ...	£2,055
Chesterfield Corporation (Mr. R. L. Acland, borough electrical engineer).—Tramway, 3 furlongs 0.03 chains, £3,900; tramway, 3 furlongs 2.73 chains, £4,100; underground feeding cables, etc., £3,000; six double deck cars, including motor and other electrical equipment, £5,100; extension of car shed, £1,500; alteration to postal telegraph wires on route, £500; contingencies, £400	£18,500
Norwich Electric Tramways (Messrs. I. E. Winslow and T. Hennell, engineers).—Construction of tramways, £30,360; street works, £5,038 ...	£35,398
Newport Corporation (Mr. H. Tremelling, engineer).—Construction of tramways, £7,250; purchase of motor 'buses and provision of depôt, etc., £6,000	£13,250
Deal and Walmer Gas and Electricity (Mr. Percy Griffith, engineer).—Construction of railway and bridge, £2,018	£2,018
Preston Corporation (Mr. J. Barrow, engineer).—Construction of tramways, £26,000	£26,000
Clyde Navigation (Mr. W. M. Alston, engineer).—Diversion of Glasgow Corporation tramways in Renfrew Road, £17,291; diversion of post office telegraph lines and cables, £3,300; construction of dock tramways, £19,295	£39,886
Great Yarmouth Haven Bridge and Tramways (Mr. J. W. Cockrill, borough surveyor).—Tramways	£8,443
London Electric Railway (Mr. H. H. Dalrymple Hay, engineer).—Construction of five subways	£100,276
North and South Shields Railway (Mr. J. Portsmouth, engineer).—Construction of 6 furlongs 6.80 chains of railway under the Tyne	£187,986
Metropolitan and Great Northern Railway Co. (Messrs. W. Willox and C. J. Brown, engineers).—Construction of railways, £711,409 ...	£711,409
Central London Railway (Messrs. Mott and Hay, engineers).—Enlargement of tunnels, £86,140; subways, £68,850	£154,990
Birkenhead Corporation. — Provision of motor omnibuses	£20,000
Bournemouth and District Railless Traction.—Capital powers, £10,000	£10,000
Manchester Corporation.—For land, easements and works for supply of electricity, £50,000	£50,000
Skegness Urban District Council.—For land and erection of electricity station, £1,263; laying of electric mains, £7,471; purchase of motor 'buses, £1,800; car shed and depôt, £900 ...	£11,434
St. Anne's Urban District Council.—Motor omnibuses, £800; land and depôt, £900	£1,700

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

GREECE.—The Board of Trade have received information from H.M. Ambassador in Greece to the effect that a Bill providing for important reductions in the Greek rates of Customs duty has been introduced into the Legislature. The proposed reductions will not take place until the Bill is enacted.

AUSTRALIA.—The Commission which has been appointed to inquire into the working of the tariff has received applications for the extension of preference to British goods in the following lines:—Regulating, starting and controlling apparatus for all electrical purposes, including distributing boards and switchboards, except telephone switchboards (present duty 20 per cent. from all countries); electric fittings consisting wholly or partly of metal, viz., switches, fuses, and lightning arresters (at present free from all countries); telephones, switchboards and appliances (at present free from all countries). These applications have been made in accordance with the proposals to which reference was recently made in a leaderette in the Electrical Review.

FRANCE.—The Board of Trade have received information to the effect that pending further consideration by the French Government, of certain new regulations with regard to the marking of merchandise imported into France, importers may, on application to the French Customs authorities, continue their existing practice in the matter. This privilege does not, however, extend to marks, the illegal character of which has already been determined.

SALVADOR.—The Consul-General of Salvador in London has issued a statement to the effect that from January 1st all Consular invoices must be purchased at Salvador Consular Office at a cost of 10d. per set (four copies). Consequently, no Consular invoices will be certified by Salvador Consuls at London, Liverpool, Birmingham, Glasgow and Southampton, unless the proper official forms have been so procured.

COLUMBIA.—The Board of Trade have been informed that a new Customs Tariff was promulgated on December 18th. Increases of the former rates of duty will begin after the expiration of 90 days from December 6th last by steps of one-tenth during 10 months. The new tariff will consequently not be in full force until January, 1915.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19. "Electrical apparatus for heating and cooking." E. W. Lancaster. January 1st.

20. "Electric heating and cooking apparatus." E. W. Lancaster. January 1st.

38. "Electrodes for alkaline accumulators." Svenska Ackumulator Aktiebolaget Jungner. January 1st. (Convention date, January 16th, 1913, Sweden). (Complete).

53. "Semi-automatic telephone exchange systems." W. Aitken and R. Aitken. January 1st.

65. "Electric torch ray magnifier." T. J. Williams. January 1st.

66. "Electrical apparatus for imparting intermittent motion at predetermined intervals." A. C. Banfield. January 1st. (Complete).

68. "Electric arc lamps." H. J. Booker. January 1st.

72. "Process for restoring the activity of a positive electrode mass for alkaline accumulators." Svenska Ackumulator Aktiebolaget Jungner. January 1st. (Convention date, January 16th, 1913, Sweden). (Complete).

73. "Means for applying electric power to assist or supplement hand power for steering or other purpose." W. H. Scott. January 1st.

83. "Apparatus for converting telegraphic code figures into words." A. W. C. Voigtsberger, H. West, and J. West. January 1st. (Addition to 9,195/12). (Complete).

91. "Means for intermittently establishing an electric circuit for indicating or recording the level of liquids or for other purposes." J. B. Hotham and M. J. Wilson. January 1st. (Complete).

106. "Packing enclosure for the cells of an electric battery." B. Pordes. January 2nd. (Complete).

111. "Instruments for indicating the phase relations of alternating current circuits." Everett, Edgcumbe, & Co., Ltd. January 2nd.

123. "Rising receptacles for electrical accumulator cells." Svenska Ackumulator Aktiebolaget Jungner. January 2nd. (Convention date, January 16th, 1913, Sweden). (Complete).

124. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and A. A. Pollock. January 2nd.

125. "Lighting fixtures." British Thomson-Houston Co Ltd. January 2nd. (General Electric Co., United States).

133. "Electric lamps fed by induction-apparatus driven by irregular actuating-means." F. Esteve. January 2nd. (Convention date, January 4th, 1913. France). (Complete)

134. "Electric safety lamp for mines." W. Kraushaar. January 2nd. (Convention date, January 7th, 1913, Germany). (Complete).

136. "Electric heaters." J. R. Quain. January 2nd.

155. "Holders for electric incandescent lamps and the like." E. H. B. Hughes. January 3rd.

165. "Gas controllers, electric time switches, and the like." E. H Horstmann, G. O. H. Horstmann, A. Horstmann, S. A. Horstmann, and W. T. Edgar. January 3rd.

173. "Machines for generating electrical energy." C. T. Mason. January 3rd. (Complete).

174. "Machines for generating electrical energy." C. T. Mason. January 3rd. (Complete).

183. "Dynamo-electric machines." J. D. L. Bradwell and G. Bradwell. January 3rd.

186. "Metal vapour rectifiers or the like." Akt. Ges. Brown, Boveri, et Cie. January 3rd. (Convention date, March 22nd, 1913, Germany). (Complete).

188. "Apparatus for heating rooms and buildings by electricity." F. Sumner-Smith, E. P. Barfield, and J St. C. Colson. January 3rd.

194. "Detectors for radio-telegraphy or telephony." E. Wilson. January 3rd.

196. "Electrical coupling devices for railway and other vehicles." L. Boirault. January 3rd. (Divided Application on 21,480/13. September 23rd). (Complete).

198. "Apparatus for the control from a distance of a number of guns from a single transmitter." R. Girardelli. January 3rd. (Convention date, January 16th, 1913, Italy). (Complete).

208. "Life-saving device particularly applicable to electric tramways and the like." J. Gyarmati, I. Laky, and J. Laszlo. January 3rd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

21,191. Apparatus for Displaying Advertisements, Communicating Messages or Signalling both during Light and Darkness. J. P. Naylor & Naylorgraph, Ltd. September 17th.

28,634. Electric Current Regulating and Controlling Apparatus, such as Electric-motor Starting and Controlling Apparatus and the like. J. A. Hirst and P. S. Brook. December 12th.

28,748. Machines for Generating Electric Current for Dual Purposes such as Ignition and Illumination. F. L. Hollister. December 13th.

28,864. Electro-magnets. Soc. Anon. des Etablissements L. Bleriot. December 14th. (December 15th, 1911).

28,924. Light Projecting Apparatus for Attachment to Small Arms. Waffen-Technische Ges. "Wespi." December 14th.

28,943. Means for Use in the Quantitative Analysis of Gaseous Mixtures and for Automatically Regulating the State of Gaseous Mixtures. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). December 16th.

28,977. Electric Circuit Closing Apparatus. H. Wade (Protective Signal Manufacturing Co.). December 16th.

29,031. Signs or Devices for Advertising and Danger Signal Purposes. A. Crowden. December 17th.

29,338. Regulation of the Pressure of Electrical Generation Systems Employing Rotary Converters. Siemens Bros. Dynamo Works, Ltd. and Wilson, J. C. December 20th.

29,357. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). December 20th.

29,387. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). December 20th.

29,389. Refractory Materials. British Thomson-Houston Co. (General Electric Co.). December 20th.

29,581. Magneto-electric Machines for Combined Ignition and Illuminating Purposes. F. R. Simms. December 23rd.

30,047. Rotary Electro-plating Apparatus. C. J. Charlton. December 31st.

1913.

88. Electric Switches for Use in Combination with Electro-mechanical Gear-changing Mechanism on Automobiles. F. Beemer. January 1st.

882. Electricity Meters of the Mercury Motor-disc Type. W. Lawson. January 10th.

1,259. Telephone Receiver Attachment. A. O'Hare. January 16th. (May 22nd, 1913).

2,001. Wire Drawing. British Thomson-Houston Co. (General Electric Co.). 24th January.

2,509. Telephone Exchange Systems. Western Electric Co. (Western Electric Co.). January 30th.

2,718. Electric Furnaces. F. C. Wardall and J. Marchant. February 3rd.

2,901. Electric Incandescent Lamps. British Thomson-Houston Co. (General Electric Co.). February 4th.

5,448. Vapour Electric Devices. British Thomson-Houston Co. (General Electric Co.). March 4th.

6,143. Electric Incandescence Lamps. H. Zschocke. March 12th.

6,664. Circuit Arrangements for Semi-automatic Telephone Systems. Siemens & Halske Akt. Ges. March 18th. (March 19th, 1912).

7,348. Telephone Receivers and the like Apparatus. M. S. Conner. March 28th.

9,381. Electro-furnace. P. Eyermann. April 21st.

9,579. Securing of Electric Lamps in their Sockets. R. J. Bott. April 23rd. (Cognate Application, 11,245/13).

10,535. Electric Motors. M. J. Railing and J. Colf. May 5th.

11,267. Regulation of Electric Circuits and means therefor. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.). May 14th.

11,852. Electrostatic Apparatus for Separating and Cleaning Grits, Grain, Seeds, or the like. J. Kraus. May 21st. (April 30th, 1913).

12,235. Electrically-driven Automatic Lathes. H. Kienzle. May 26th.

15,568. Process and Apparatus for Making Mica Sheets. Meirowsky and Co. Akt. Ges. July 5th. (July 22nd, 1912).

15,769. Systems for Supplying from High-pressure Mains Continuous Current at a Lower Pressure. E. A. Graham and W. J. Rickets. July 8th.

16,128. Money-boxes for Apparatus such as Prepayment Telephones, Coin-freed Gas Meters, or the like. H. G. C. Fairweather (Ges. fur Elektrische Industrie). July 12th.

16,998. Electric Resonance Operated Apparatus. H. W. Handcock, A. H. Dykes, and W. Duddell. July 24th. (Addition to 1,395/13).

18,474. Mercury Motor Electricity Meters. Chamberlain & Hookham, Ltd. and S. Holden. August 14th.

19,122. Apparatus for Displaying Advertisements, Communicating Messages, or Signalling both during Light and Darkness. J. P. Naylor and Naylorgraph, Ltd. August 22nd. (Divided Application on 21,191/12. September 17th).

19,190. Reflectors for Search Lights. Optische Anstalt C. P. Goerz Akt. Ges. August 23rd. (August 28th, 1912).

21,965. Indicators, Annunciators, and the like. Sterling Telephone and Electric Co. (Telephon-Fabrik Akt. Ges. vorm. J. Berliner). September 29th.

23,728. Radiating System for Signalling by Electric Waves from Aeroplanes. Signal Ges. October 20th. (November 27th, 1912. Addition to 736/13).

25,073. Arrangements for Connecting Two Electrical Sources in Parallel. Siemens Schuckertwerke Ges. November 3rd. (June 7th, 1913).

27,355. Magneto-electric Machines. F. L. Hollister. November 27th. (Divided Application on 28,748/12. December 13th).

27,356. Dynamo Electric Generators. F. L. Hollister. November 27th. (Divided Application on 28,748/12. December 13th).

27,452. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt. Ges. November 28th. (November 28th, 1912).

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GERMAN TRADE IN 1913.

IT is impossible to say that the principal industries in Germany experienced an unfavourable course of trade when 1913 is regarded as a whole from the standpoint of the volume of work carried out, although the amount of new business transacted in certain trades declined especially in the second half of the year, and prices in some departments also fell onwards from the beginning of April. An examination of the subject has to be prefaced by the consideration that a few branches, particularly in the case of raw or semi-finished materials, are entirely in the hands of legally binding syndicates which control both production and prices, and, as a consequence, those materials or products which are regulated in this manner ensure greater stability in prices to those who are directly interested, than those manufactures which are not subject to any trade combination. As matters now stand, the coal industry is dominated by the Rhenish-Westphalian Coal Syndicate in the West and in certain other parts of the country, and by a similar syndicate in Upper Silesia, while the South-Western district is held mainly by the Prussian State mines in the region of the S'aar, whose sale prices to the public, as a rule, are higher than those charged by private enterprise and whose miners receive lower wages than those paid by the private collieries in Westphalia. The Westphalian Coal Syndicate, controlling an annual output of over 100,000,000 tons of coal, is so financially and commercially strong, that despite the fact that indications existed last March that a reaction was commencing in the iron and steel and other industries, the syndicate brought into operation on April 1st an increase in the prices of coal, coke and briquettes. This lack of consideration for the requirements of consumers was also participated in by the Essen Pig-Iron Syndicate, which holds absolute sway over the whole of the marketable tonnage of pig-iron in Germany. Not only were the prices of pig-iron of all qualities maintained on a high level throughout the year, but in some cases still higher charges were made to the foundries for any tonnage in excess of contracts in force, and also, we believe, to the comparatively few steel works which still have no blast furnaces for producing their own supplies of raw material.

On the other hand, it is of interest to contrast this attitude with that of the Steel Syndicate which now only regulates an annual possible production of 6,500,000 tons of semi-finished steel, railway material, and shapes, whereas, a year or two ago, the output controlled was 12,500,000 tons, the difference being explained by the circumstance that the constituents in 1912 refused to be any longer restricted in their development in steel bars, wire rods, plates and sheets, tubes, and castings and forgings. The Steel Syndicate—alone of the three great combinations for raw materials—gradually took into account the changes proceeding in the industrial situation as particularly affecting consumers of semi-finished steel, owing to the fall in the prices of manufactures. This was first manifested by an increase from 10s. to 15s. per ton in June in the amount of the export bounty granted to consumers of partly-manufactured steel who make finished products for the export market. In the second place, and in order to stimulate the declining demand, the syndicate reduced the prices of semi-finished steel by 5s. per ton in the third quarter, and also by 5s. per ton in the final quarter, so that, including the export bounty, the inland prices for the production of export commodities were really brought down to the values of the lower export prices f.o.b. Antwerp for the same class of material.

It will be understood that under the influence of higher prices in 1913, and of an exceptionally large demand in the first half of the year, the volume of business and the financial results for the whole year were very satisfactory for the colliery owners. Taken as a whole, the iron and steel trades also had a fairly favourable 12 months, but the principal sufferers from the heavy fall in the prices of manufactures and the slackening of new business, particularly in the second six months, were the owners of the finishing mills in Westphalia and the Siegerland, who are absolutely dependent upon trade rivals for deliveries of raw materials. On the other hand, the large works, producing from raw materials to the most highly-finished products—and most of the trade has either been, or is still, in process of being concentrated in the hands of financially strong companies—felt to a much lesser extent the effects of the diminution in prices, as their costs of production are considerably lower than those of their less-favoured competitors, and they were, and still are, able to search for and obtain orders which the mere finishing mills are unable even to take into consideration as commercial transactions. The production of pig-iron amounted to 19,291,000 tons in 1913, or 1,395,000 tons in excess of the previous year, but a number of furnaces were blown out or slowed down in the final quarter in consequence of the reduced demand. Many furnaces have to be kept in blast in order that the furnace gases may be utilised for power or heating purposes in connection with the steel works, and this partly affords an explanation for some of the additional tonnage of pig made last year. On its part, the Steel Syndicate had a turnover of 6,331,000 tons in 1913, or only 110,000 tons less than in the preceding year.

The promotion of the export trade, to which special attention is devoted in periods of receding prosperity, was continued and forced last year, and the trade returns for the 11 months ended with November show total exports of 5,918,000 tons, as compared with 5,454,000 tons in the equivalent term in 1912, being an advance of 464,000 tons. Owing, however, to the difference in classification, it is necessary to make a deduction of at least 150,000 from each of the two totals, but this necessity does not alter the fact that the export trade showed a large expansion, whilst as a whole the iron and steel trades, apart from prices, had a fairly prosperous year.

The volume of activity enjoyed by the shipbuilding trades was also satisfactory last year. Owing, however, to excessive competition among domestic builders the prices of new construction, both for the merchant marine and the navy, were unfavourable in 1912, as well as in 1913, and the financial results of various shipyards in 1912-13 were unfavourable, the lack of experience in the building of specially large steamers being a contributory factor. No scarcity of orders was experienced, and the merchant vessels under construction on October 1st represented 535,000 gross tons, as contrasted with 467,000 tons a year previously, whilst the orders on hand or in prospect will provide work for the yards for the next two years. The machine construction trade, which was well and profitably employed at the opening of last year, gradually followed the course of the iron and steel trades. As the old orders were completed, new contracts became fewer, and came to hand more slowly.

The chemical and the electrical industries were the only two trades which experienced no material effects from the general retrogressive movement in the economic situation. In taking the electrical industry into consideration, it has to be remembered that the manufacturing departments are preponderatingly concentrated in the hands of three or four large companies, one alone of which is believed to provide occupation for as many workers as are engaged in the whole of the other branches combined, outside of the three or four firms in question. Yet these outside firms—the special electrotechnical works, as they are termed by their representative association—are responsible for approximately 70,000 workers throughout the country, and are therefore of considerable importance in many branches of the industry. As to the course of business in general in 1913, it cannot be denied that it was very satisfactory. It is true that a slight slackening occurred in the heavy branches—at least the Siemens-Schuckert Co. reported a weakening for a portion of the financial year 1912-13—but the telegraphic and telephonic apparatus branches were rather severely hit by the decreased volume of business. Apart from these circumstances, the manufacturing industries were well and profitably employed during the year, although sale prices, as the chairman of the Schuckert Electricity Co. declared on January 8th, have not yet reached the level which would afford adequate profits in proportion to the turnover.

The A.E.G., which had a considerably increased business in 1912-13, completed in the three months ended with October, 1913, orders of the value of £1,150,000 in excess of the corresponding period in 1912, and two months later the company announced that the orders then on hand were greater by the value of £1,500,000 than on the same date in 1912. But more recent information was given by Dr. Spiecker, chairman of the Siemens & Halske Co., when addressing the shareholders on January 6th, 1914. The chairman, in referring to the Siemens-Schuckert Works, in which the Siemens & Halske Co. is one of the two proprietors, recalled the statement made in the former's annual report to the effect that a slackening had occurred, but that a change for the better had recently taken place. This improvement, the chairman of the Siemens & Halske Co. was able to announce, has continued down to the present time, and unless unforeseen circumstances arise, it will be possible to reckon also on satisfactory results for the current and ensuring years. As to the separate undertaking of the Siemens & Halske Co. itself, Dr. Spiecker admitted that notwithstanding an increased turnover in 1912-13, the net profits had not materially advanced, but this was due to the pressure of competition. The degree of activity, which next occupied attention, was illustrated by the statement that since the conclusion of the financial year the number of workers employed was greater than at the close of the financial year 1912-13, and the orders had undergone a corresponding increase. The questions of improving the methods of manufacturing, and of further substituting labour-saving machinery for manual labour, are constantly engaging the attention of the three companies mentioned, and in this connection the A.E.G. was able to intimate for 1912-13 that notwithstanding the greatly augmented volume of business, the actual number of workers had been reduced. These factors appear to command consideration in every trade in Germany where the financial situation of the works concerned will permit of expenditure being incurred for these purposes, and they have a certain bearing upon the successful cultivation of the export trade, which is being specially developed by the huge electrical firms.

The future seems to be regarded by the large electrical interests with confidence, and the lesser important firms have, therefore, no reason for apprehensions on their part, in view of the contest which they are successful in conducting with the great works. The extension of electricity supply or overland generating stations is proceeding, new tramways are being built and existing lines prolonged; the conversion of the Berlin City and Circle Railways has yet to be put in hand, and the underground line from Gesundbrunnen to Neukolln and the North-South Berlin lines have also to be constructed; whilst other railway schemes are projected or in progress in the country. The year 1913 concluded favourably, and, with cheaper money now available, the prospects for the present year are deemed to be very hopeful for the home market, and foreign markets may be expected to receive further attention in the near future, particularly if, contrary to expectation, the electrical industry should be drawn within the cycle of declining trade prosperity.

The Senghenydd Verdict.

The inquest upon the 439 victims of the Senghenydd explosion ended on Wednesday, the 14th inst., after a prolonged hearing lasting over eight days. The Home Office inquiry, on the other hand, had to be adjourned indefinitely, as it was found impossible to carry out the two inquiries simultaneously. We mentioned last week how difficult and awkward it would be if the two inquiries went on together; in fact there seems to have been quite a little clash of arms between the Coroner and the Home Office on the question of precedence, in which the former got the best of it.

As regards the verdict of the jury, they found as follows:—That death was due to accidental causes; that the colliery was properly ventilated and properly inspected on the morning of the explosion; that there were a sufficient number of examiners; that the explosion was due to gas, and was fed by coal dust; that there was a systematic cleaning of the floors of the roads, but, they thought, more attention should be given to the roof and sides. They suggested the placing of sprinklers much nearer to the working places than at present, and urged the Home Office to endeavour to find means of dealing with the dust problem. There was insufficient evidence to state clearly the place where the explosion originated, but there was a preponderance of evidence to enable them to fix the lamp station as the probable starting point. They were unable to say whether the gas was ignited by a spark from the electric wire, but the evidence pointed to the naked light at the lamp station as the cause of ignition; there was no neglect on the part of any persons contributing to the deaths of the victims. They also made the following recommendations:—That the lamp station should be placed in the archway near the shaft; that the water tanks should be fitted with a sprayer instead of the men having to use shovels and buckets; and expressed the opinion that there was an insufficient number of inspectors of mines to enable a thorough inspection of the colliery to be made as often as it should be done.

With the verdict most people who have followed the evidence will, we think, with ourselves, be in complete agreement, and as regards the origin of the explosion, namely, at the lamp station, and the cause of the ignition, a naked light, the verdict confirms our agreement with Mr. Shaw's evidence in our issue of last week. As regards the recommendations, however, we very much question either their usefulness or desirability, on the following grounds:—(1) There ought not to be any lamp station where lamps can be opened below ground; (2) It is very questionable whether water spraying has any effect in lessening the danger of coal dust: and (3) If there had been an inspector permanently attached to the Senghenydd Colliery, the explosion would not have been prevented. There were one or two minor breaches of the Coal Mines Regulation Act, but it was admitted that these had absolutely no influence whatever upon the initiation or effect of the explosion. It is the managers' duty to carry out the rules and regulations of the Act, under penalty, and it is absurd—nay, a calumny—to suggest that they are not doing their utmost to render their pits safe and to prevent accidents—not on account of the Act, but because accidents are costly, and we have no hesitation in saying that no amount of inspection or volumes of rules and regulations will improve matters in this respect.

In conclusion, we may just refer to the suggestion that the explosion might have been caused by sparks from the electric signalling wires. We are glad to note that the jury discounted the suggestion, in accordance with the expression of opinion we put forward last week. Evidence was given that Mr. Sparks carried out a series of experiments at New Tredegar rescue station, which proved that with a pressure of 13½ volts, which was 50 per cent. more than the normal pressure used, it was found impossible to ignite fire-damp. On the other hand, an explosive mixture of town gas and air was ignited instantaneously. As, however, this question will be more minutely dealt with during the Home Office inquiry, we will leave the matter where it is until after the issue of the Commissioner's report.

Electrical Exports and Imports during 1913.

Elsewhere in this issue we publish our usual annual summary, in graphic form, of statistics which have appeared month by month in this journal, relating to British electrical export and import business. The curves deal with the most important centres of British trade and with the business of foreign competitors in this country, and indicate with sufficient accuracy the tendency of business during the year just ended and preceding years.

It will be seen that while in the matter of value all previous records of electrical business were exceeded, the curves show unmistakable signs of slackening trade in several directions, accompanied by a revival of activity on the part of the importing interests, whose business in this country has shown no particular expansion during the last few years.

Probably due to the widely-extended character of our overseas trade, the only noticeable effect on our exports as a whole is in the nature of a decreased rate of increase in business, which, it may be—though trade conditions in general do not support the view—is an effect of temporary depression only. We need scarcely add our hope that the latter view may be justified by future events.

The Copper Position.

The last returns of the American Copper Producers' Association were woefully bad, showing as they did an increase in the stocks at the refineries of about 20,000 tons, owing to the wretchedly small home trade deliveries, but the figures are believed on this side of the Atlantic to be much too bad to be correct, consequently their effect was less than might have been expected. Partly under the influence of these figures, copper fell to about £62 10s. for near deliveries, but from this point there was a steady and sustained recovery. For one thing, the mid-January European statistics infused some heart into the market, for they showed that the position here was not nearly so indifferent as that in the United States, there being actually a decrease of about 1,000 tons in the stocks in England and France, while there was a decided drop in the quantities afloat from Chile and Australia, and the stocks in unspecified European ports had also fallen. This revived the flagging hopes of "bulls," and there was a little repurchasing done by the "bears," while consumers also came forward with more freedom. For the time being the corner was safely turned, and the market opened this week with a strong tendency on reports that there was some sort of agreement proposed whereby the output of the leading United States producers would be restricted. It is far too soon to say whether the proposals to this effect will mature, but there is a strong opinion in influential quarters that something will be done to adjust matters, and that the leading spirits will prove to be the Amalgamated Copper Co., the American Smelting and Refining Co., and the Phelps Dodge group. These are quite sufficiently powerful interests to sway the course of the market if once they agree to put a restrictive policy into operation, and it may quite well be that something of the kind, though informal, may be brought into being. The attitude of the chief American producers has lately assumed more confidence, and this may indicate that there are good prospects of the limitation of output being put into effective operation, while the prices asked have improved to the measure of the advance in the price of standard copper. The position of copper is really not so bad even apart from the setting up of a restrictive policy, for the European trade continues to absorb large quantities, while it is the opinion of well-informed concerns that in America things are nearing the turning point. There have been so many outside influences which of late have conspired to instil distrust, that all things considered it is a wonder that copper has not suffered more than has proved to be the case. There is a fair amount of electrical work about still, and this leads to hopes that with easier monetary conditions as recently witnessed, there may be a releasing of schemes which dear money would cause to be held in suspense. Some of the German wire firms, especially the larger fry, are hard up for orders, but this is because the Convention regulating the trade is diverting orders for wire to those works which do nothing but drawing, leaving works with mixed plants to concentrate their energies on other material. The immediate prospect at the time of writing is for rather higher prices, seeing that the tone of the market has materially improved on the chances of a restriction of production.

The fact that the labour position at the mines of the Rio Tinto Co., in Spain, has become more threatening again, after it had been thought that things were in a fair way to being settled amicably, constitutes another bull point, and the trend of events in North America has become decidedly more reassuring, for a considerable business has been done by producers at advancing prices. The next American returns are, it is believed, bound to make a better showing than the last, and with easier financial conditions all round, the situation is brighter.

Overhead Mains.

The happy concurrence of Mr. Welbourn's paper on high-pressure overhead transmission lines, and Mr. Trotter's on overhead wire construction for medium and low pressures, has rendered the subject of overhead mains the leading feature of our pages in this issue. The electrical supply industry is fortunate in having placed at its disdisposal the mass of practical information contained in these two papers, each of which is the work of an engineer of very wide experience and authority. Reading with these the excellent paper written by Mr. W. B. Woodhouse in 1910, and that by Mr. Trotter, which was unfortunately entombed in the *Proceedings* of the Institution of Civil Engineers, the constructional engineer will find abundance of inspiration for erecting overhead mains on sound lines, and for devising improved methods. Several articles on actual examples of village lighting with overhead wires have also been published in our pages.

The great importance of the subject is acknowledged by all electrical engineers; contrary to what might be expected, it is increasing in importance, for the bulk of the work that can be accomplished on a commercial basis with underground cables in this country has been done, and practice has become largely standardised. No doubt there is much scope for improvement in underground work, and the adoption of underground cables for pressures exceeding 20,000 volts is already a question of expediency rather than practicability; but progress in this connection is likely to follow well-defined and normal lines. In overhead work, however, owing to the conditions peculiar to this country, which have retarded the development of aerial conductors, not only are we far behind other countries in the extent of our overhead distribution, but also the details of construction must be developed on quite different lines.

Public opinion in Great Britain professes an exaggerated regard for the preservation of human life, and insists upon the most elaborate precautions with this end in view. Hence the inconsistency which, while tolerating the presence of 500-volt copper rods supported usually by solder over our most populous thoroughfares without protest, because experience has shown how little risk is entailed by their use, nevertheless demands the provision of innumerable safeguards around a pair of light, securely-fixed wires carrying a maximum pressure of 250 volts. In the course of time, as experience grows, no doubt the attitude of the public towards electrical mains will grow more reasonable. No such difficulties are met with in our Dominions abroad, where overhead distribution, except in the largest towns, is the rule, and where no trouble is experienced from broken wires. The very safeguards themselves have been known to bring about the disaster they were intended to prevent.

In the meantime, the question is how to meet the requirements with the minimum expense, and in this respect both papers are extremely helpful. It was gratifying, too, to hear the central station engineers who took part in the discussion on his paper, expressing their deep appreciation of the earnest desire that Mr. Trotter had always displayed to co-operate with them to the utmost towards this end—even to the extent of himself inventing the best and simplest device yet employed for preventing the risk of shock from a fallen wire.

The paper by Mr. Welbourn has been discussed at five meetings of the I.E.E. at different centres, and the information obtained will undoubtedly prove of great value to the industry. There is one point to which we wish to draw special attention—the case put forward by the author for the amendment of the law relating to wayleaves. In a thickly-settled country such as this, the obtaining of wayleaves is often the most difficult problem to be solved in erecting an overhead line, and we cordially agree with the many engineers who maintain that one of the most urgent needs of the time is legislation to facilitate this process, to abolish the veto of local authorities, and to compel private owners to grant wayleaves on reasonable terms. The Institution of Electrical Engineers is the one body which can act effectively in this matter, and we trust that the Council will fully appreciate the urgency of the demand for such action.

Wireless Telegraphy on Board Ship.—The International Conference on Safety of Life at Sea, which has been sitting in London, concluded its work on Tuesday. A Convention has been drawn up embodying the conclusions arrived at, and, if ratified during the current year, it will come into force on July 1st, 1915.

The Convention provides for the institution of an ice patrol service in the North Atlantic, under the control of the United States Government, which will keep vessels informed as to the position of ice, by wireless telegraphy.

All merchant vessels, whether steamers or sailing vessels, engaged upon international voyages, and whether they carry passengers or not, if they have on board 50 or more persons, must be provided with wireless telegraph apparatus, and a continuous watch is to be maintained by all such vessels, unless automatic apparatus is devised to render the presence of an attendant unnecessary. The wireless plant must have a range of at least 100 miles, and an emergency apparatus must be provided, unless the main installation is situated in the position of maximum safety. An elaborate classification of vessels is provided for, the foregoing merely representing the general trend of the regulations.

ELECTRICAL CASES IN 1913.

[By our Legal Contributor.]

To judge from the number of queries addressed to the editors of the Electrical Review, it would seem that legal questions are frequently arising in relation to the supply of electricity. Nor are they always easy to solve. The provisions of the various electric lighting acts are seldom considered in the courts; and the majority of serious disputes relating to the supply of electricity and electrical machinery, being of a highly technical nature, are decided by courts of arbitration or by the official referees, whose decisions and rulings are not published to the world. With regard to the most recent electric lighting act—that of 1909—we do not know of any case in which its provisions have been considered by any court.

Nevertheless the digest of cases decided by the courts in the year 1913 does contain certain cases which should be kept in mind. It is proposed to state their effect as concisely as possible.

One case which came before the Court of Appeal (Battersea Borough Council v. County of London Supply Co. (29 T.L.R. 561)) raised the question as to what is meant by the phrase "make a connection." It appears that Sec. 4, Sub-sec. 2, of the London Electric Supply Act, 1908, provides that "an authorised undertaker of a specified company may also by means of electric mains make a connection between any two or more areas which that authorised undertaker or specified company is authorised to supply, or between any such area and a generating station of that authorised undertaker or specified company."

It was held that the words "make a connection" did not mean that there could be only one connection, but that they meant nothing more nor less than "connect."

The Master of the Rolls, in giving judgment, said that he thought that Parliament intended to give the company greater rights and to put them in a position to supply their large district with electricity.

The harnessing of Niagara for the generation of electrical power has given rise to a considerable amount of negotiation and has involved numerous agreements between the Canadian Government and private companies. One such agreement was considered in the case of the Attorney General for Ontario v. Canadian Niagara Power Co. (1912 A.C. 852). It there appeared that by agreement in 1899, supplemental to an agreement in 1892, the respondent company agreed to pay a specified fixed rental for a strip of land lying by the water's edge in a public park, together with the use of a portion of the flow of the river as it passes, which had been placed at their disposal for the purpose of constructing works and generating electricity; and also additional rentals varying in amount by reference to the electrical horse power generated and used and sold or disposed of by the company, "such additional rentals as shall be payable for and from such generation and sale or other disposition" to be paid half-yearly.

It was held that the basis of calculation, according to the true construction of the clause relating to additional rentals, was the highest amount or quantity of electrical horse power generated and used and sold or disposed of at any one time, and so remained until a higher point was reached.

While dealing with Colonial decisions, mention may also be made of the case of Toronto Niagara Power Co. v. North Toronto Corporation (1912) A.C. 834, wherein it was held that the powers given to the appellants by their Act of Incorporation passed in 1902 enable them to enter upon the streets of the town of North Toronto for the purpose of erecting poles to carry power lines for the conveyance of electricity, without first obtaining the leave and licence of the municipality, and are not restricted by the provisions of the Railway Acts of 1888, 1899 and 1906.

Certain principles were laid down in the case of National Telephone Co. v. Postmaster-General 29 T.L.R. 190, which may be of considerable value in future years when the compulsory purchase of tramway undertakings begins to take place.

In the case in question, which in point of length, complexity, and cost, probably beat all previous records of litigation, it will be remembered that the Postmaster-General was under statutory agreement to purchase the undertaking of the National Telephone Co. at a price to be fixed by the Railway and Canal Commissioners. By the agreement by which the Postmaster-General acquired, as from December 31st, 1911, the undertaking of the National Telephone Co., it was, *inter alia*, provided that "the value on December 31st, 1911, of all plant, land, buildings, stores, and furniture purchased by the Postmaster-General . . . shall be the then value (exclusive of any allowance for past or future profits of the undertaking or any compensation for compulsory sale or other consideration whatever) of such plant, building, land, stores, and furniture, having regard to its suitability for the purposes of the Postmaster-General's telephonic service, and in determining the value of any plant no advantage arising from the construction of such plant, by leave of the Postmaster-General, upon any railway or canal over which the Postmaster-General possesses exclusive rights of way for telegraphic lines shall be taken into account."

It was held that the value of the plant taken over by the Postmaster-General was to be arrived at by taking the cost of construction, less depreciation, and that every expense which was necessary to construct the plant was an element to be considered, including in such expense (*inter alia*) the reasonable costs of obtaining subscribers' agreements which were in force at the date of the transfer, and also (Sir James Woodhouse dissenting) the cost of raising capital necessary to construct the plant.

It was also held that the method of depreciation applicable was to take the value as reduced in the ratio which the age bore to the life of the plant, and that the mode of computing the life of the plant was to take its physical life as reduced somewhat in respect of defects and obsolescences of certain classes of the plant.

AMERICAN v. ENGLISH METHODS AS VIEWED BY A COLONIAL.

By "J. R."

I was much interested in Mr. Seabrook's article in the Electrical Review of November 14th, in which he maintained that American business methods should be copied for England. I should not trouble readers of this journal in this connection after this interval had it not been on the tip of my pen for some time to write you on the same subject, but in a different strain.

Mr. Seabrook's text amounts practically to "The blessed uses of advertisement," holding up the ways of the American as the shining example to us all. Now, I will give place to no man, not even Mr. Seabrook, in unbounded faith in the future in store for our art, but I feel very strongly that pretty pictures are not going to play much part in hastening progress, and that the engineer has still a lot more to do than the advertiser or the salesman, and I feel a little indignant that Mr. Seabrook should put the services of the drummer above those of the investigator, the scientist, and the engineer. One would think, to hear this young man in a hurry talking, that the electrical art in England had been the most stagnant of all instead of, on the whole, sensationally progressive, Chicago notwithstanding.

Now as an antidote to the recently acquired passion among certain engineers for copying the methods of the soap-maker and the patent medicine vendor, I would like to state a case on the other side, to wit:—

1. That the electricity industry at the present time is largely under public management and should therefore be conducted on model lines. Its methods should be an example in every respect to those carrying on private enterprise, and its advertising matter, for instance, should be scrupulously truthful in spirit and in letter.

2. That the present cost of advertising is such a grievous burden on manufacturers that the selling prices of many of the necessaries of life are unduly high on that account, involving serious economic waste, and one contributing factor to the increasing cost of living.

3. That a truthful presentation of the merits of an article is not the first consideration of most advertisers. That a striking effect is the object usually aimed at—sometimes artistic, often bizarre, and that there is something unfitting in the sight of public undertakers vieing with their competitors in such a field.

4. That from the writer's personal knowledge the statements of some American electrical manufacturers will not bear close investigation.

5. That in the matter of electric stoves, for instance, English makers are already ahead of Americans, and in five years will be unapproachable, whereas in the matter of the presentation by advertisement of the same one would think it was America first, the rest nowhere.

6. That at the same time electric heating and cooking has a long way to go.

7. That those who advertise that electricity has reached the stage where it competes in efficiency, reliability and cheapness with gas for the poor or middle-class householder are guilty of a terminological inexactitude, and are doing at the same time a great deal of harm and no good to what they have at heart.

8. That the best thing that could happen to electric heating and cooking would be the withdrawal for five years of all advertising matter thereon, except in journals circulating among electrical engineers, for the reason—

9. That one satisfied consumer is worth a thousand pictures of her, and one dissatisfied consumer will counterbalance ten thousand, and—

10. That the average electric supply authority is not in earnest in offering electric heating to all its customers unless it can run its distributors red hot, Mr. Chamen being an exception, pointing out to the "Point Fives" that none of them can stand ten stoves installed per street.

I present the above with deference to publicity enthusiasts, and, in conclusion, would respectfully reply to Mr. Seabrook as to whether American (advertising) methods are suitable to English conditions:—

1. That the Englishman can generally be trusted to work out his own salvation.

2. That from my knowledge of the two competitors in this neutral field, the American's advertisement is more "telling" (I do not say what kind of telling), but the Englishman's is the one I would sooner believe.

3. That if advertisement makes the same progress during the next ten years, the public will begin to take some trouble to find out the firms who refrain from it.

4. That you can fool everybody some of the time, that you can fool somebody all the time, but you can't fool everybody all the time.

5. That our gas competitors have been working a good many years and are now entitled to talk some, and that electrical engineers have got to do a lot more working yet before they may talk as much.

6. That finally, in case Mr. Seabrook would gather that I am a stick-in-the-mud, I will say that we are selling current here for ⅝d. less 10 per cent., and our electric heating business is going on quite nicely, but that we haven't got gas to compete with, thank Heaven.

ELECTRICAL ENGINEERING IN JAPAN.

An interesting article on the development of the electrical engineering industry in Japan appears in a recent issue of the "Japan Weekly Mail," from which we take the following extracts. The latest figures available are those for the year 1911, at which time the capital stock of all companies in Japan interested in electrical enterprises, both in operation and projected, was over £46,200,000. Of the companies actually in operation at the end of 1911, the capital invested was as shown below:—

	Lighting companies.	Electric railway companies.	Electric light and railway companies.	Total.
	£	£	£	£
Total capital ...	13,930,900	1,936,000	15,846,400	31,713,300
Capital paid up ...	9,684,100	1,159.400	13,502,100	24,345,600
Loans on equipment	1,692,800	522,600	1,538,200	3,753,600
Reserve funds ...	624,800	33,800	230,500	889,100

The great development of the electrical engineering industry has taken place since the Russo-Japanese War, for in 1906 the capital invested was only £11,518,000, while in 1903 it was but £2,800,000. Between the last named year and 1911, the output of electric power in Japan advanced from 44,000 to 344,000 kilowatts, and the mileage of the electric cables and wires in use from 5,981 to 33,584; during the same period the mileage of Japanese electric railways advanced from 93 to 704, and the number of electric lamps in use from 457,000, of an average of 10 c.p., to no less than 3,122,000.

The increasing demand for electrical machinery and apparatus of every description has given an impetus to the establishment of works for their manufacture in Japan, in connection with which the Government established a law fixing a standard of quality to be observed in the equipment and the production of electrical engineering work, but despite this law and the fact that many of the factories are well equipped, there are some to which such a remark does not apply, while in a large number of cases the available plant does not permit of operations on a large scale. Hence it is that there is a large importation of electrical machinery and apparatus into Japan, such imports amounting in 1912 to over £500,000.

The principal electrical engineering works in Japan are the following:—

Kobe.—The Mitsubishi Dockyard and Engine Works.
Tokio.—The Shibaura-Seisakujo, the Meidensha, the Keiryoki Seizo Kwaisha, and the Jü Shokai.
Kyoto.—Okumura Denki Kojo.
Osaka.—Osaka Denki, Kaisha-Kawakita, Denki Kigyo Kwaisha.
Ibaraki Prefecture.—Hidate Kojo.

The Shibaura Seisakujo specialises in the manufacture of electric motors in co-operation with the American General Electric Co., and is regarded as the premier factory in Japan. The Keiryoki Seizo Kwaisha, of Tokio, is specialising in the production of electricity meters.

Notwithstanding the development of the home industry, it is estimated that over 80 per cent. of the electric motors in use in Japan are of foreign make, and despite the efforts of the home manufacturers to drive foreign machinery out of the Japanese market, this is not likely to occur as regards electric plant for many years to come, especially in view of the statement that "all machinery pretending to any degree of accuracy must still be procured abroad."

One feature of the electrical development in Japan is the large number of companies that have sprung into existence to put down plants to utilise water power. At present all the plant for such installations has to be imported, but in view of the fact that a warship has recently been completed at the Mitsubishi Dockyard, at Nagasaki, entirely from Japanese material, the time is approaching when home manufacturers will be able to supply at least a portion of the material for hydro-electric stations.

BRITISH PRACTICE IN THE CONSTRUCTION OF HIGH-TENSION OVERHEAD TRANSMISSION LINES.

By B. WELBOURN, M.I.E.E.

(*Continued from page* 116.)

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *January*, 1914.)

ON spans up to 50 yds. tramway practice may very safely be followed in using solid wires from 11½ S.W.G. up to 0000 S.W.G. For longer spans and larger sections the conductors should certainly be stranded because of the additional strength obtainable, and 7, 19, or 37-strand conductors will be suitable. When specifying the breaking strain of the copper, it is very useful to employ a formula of the form suggested by Mr. A. P. Trotter :—

$$T = 30 - 20\,D,$$

where T = breaking strain of each wire in tons per sq. in.,
D = diameter of wire in inches.

In other respects the copper should comply with the latest British Engineering Standards Specification, dated March, 1910. The "limit of proportionality" on the wire may be taken at 75 per cent., and the minimum size of solid copper conductor now allowed by the Board of Trade on a high-tension line is No. 11½ S.W.G.

With aluminium it is essential to use stranded conductors, and there should never be less than seven wires in the strand. The breaking strain of the wires employed in the strand can be obtained from a formula similar to the above, viz. :—

$$T = 16{\cdot}5 - 24\,D.$$

In order to obtain suitable wire it is suggested that the specification should call for wire having a "limit of proportionality" of 70 per cent. approximately, and conforming after stranding with the tests set out in the following table :—

SUGGESTED TESTS FOR HARD-DRAWN ALUMINIUM CONDUCTORS.

Standard wire gauge.	Diameter of wire. Inches.	Breaking strain. Tons per sq. in.	Extension on a 5-in. length. Per cent.	Wrapping te
4	0 232	11·00	3·00	Three times round its own diameter on and three times off.
6	0·192	12·00	3·00	
8	0·160	13·00	3·00	
10	0·128	13·50	3·00	
12	0·104	14·00	2·50	
14	0·080	14·50	2·50	
16	0·064	14·75	2·50	

The object of the "wrap test" is to ensure that no brittle wire is used, and it should be noted that compliance with the Board of Trade Regulations is only obtainable by ignoring wires larger than No. 6 S.W.G.

It is usual to make all joints at insulators and not under strain. The best way known to the author for jointing copper on lines which have to carry heavy loads is by means of the copper braids described by Mr. C. Vernier before this Institution.* During calm weather there is no difficulty in making excellent butt-welded joints with blow-lamps on aluminium conductors up to 0·25 sq. in. section.

Placing one insulator on a ridge-iron above the zinc pole roof and two insulators on a horizontal arm below is not to be recommended. A better arrangement is that obtained by using three galvanised wrought-iron brackets, two on one side and one on the other side of the pole or all on one side of the pole if there is any possibility of a second circuit being required later. In all real heavy work steel channel and not wood cross arms are now generally used, and there is a growing practice to abandon the equilateral triangular arrangement of the wires on three-phase duplicate circuits, and to erect the wires of each circuit either vertically or horizontally. The latter is the better arrangement, as trouble has been experienced with the vertical arrangement through snow loading down an upper wire until it fouled a lower wire. When duplicate circuits are needed it is an excellent plan to place one circuit on a single-pole, and the second on another single pole at least one pole length away from it if way-leaves can be arranged.

The spacing on any length of span should not be less than—3 ft. for 20,000 volts ; 2 ft. 6 in. for 11,000 volts ; 2 ft. for 6,000 volts ; 2-ft. for 3,000 volts.

In order to prevent two conductors in a horizontal plane from swinging together, they should, theoretically, be suspended so that their distance apart is more than twice the maximum deflection, but in practice it is safe to assume that the wires will not swing "dead out of phase," and on 80-yard spans to make the spacing equal to the sag of the conductors at 60° F.

Galvanised channel arm of 3½ in. × 2 in. × ½-in standard section is one which is found most useful. The channel arms, being earthed, have the disadvantage on lines which are operated with an earthed neutral and automatic protective apparatus, that big birds, chiefly crows, stand on the arms and peck at the live wires, involving a shut-down of the line. The difficulty has been overcome on several lines by providing porcelain bushes round the insulator pins from the channel arms upwards into the insulator and by clipping pieces of bitumenised fibre conduit on to the arm so as to insulate the bird.

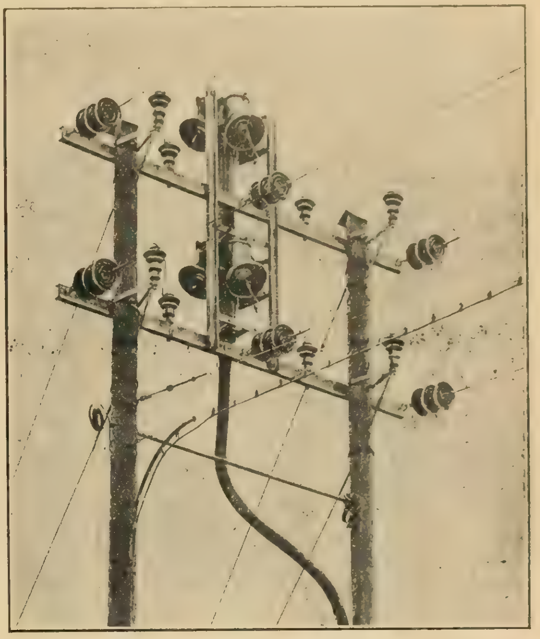

FIG. 2.—TERMINAL POLE.

Tying-in conductors is one of the most important features in the construction of any line.

In the author's opinion the flexible binder demands the services of skilful wiremen, and is the best both for copper and aluminium if it is made correctly. Fig. 4 shows the copper binder which has stood the test of several years' work on the Newcastle-upon-Tyne Electric Supply Co.'s lines, and has never been known to fail. Fig. 5 shows the successful aluminium binder used on the War Office lines at Aldershot and developed on suggestions made by Mr. S. B. Donkin for line conductors up to 0·10 sq. in. For larger conductors the binder shown in fig. 4 is quite suitable. In both these designs one essential feature is the "pigeon" or chafer of wire to prevent abrasion of the line wire and of the glaze on the porcelain. Another feature is that flexibility is obtained without the possibility of longitudinal movement of the conductor.

The only semi-rigid binder known to the author is that designed and patented by Mr. G. K. Paton, chief engineer of the North Wales Power and Traction Co., and used successfully by him both on 72½ miles of single circuit employing solid copper conductors varying from No. 4 to 00 S.W.G., and on 8 miles of single circuit composed of stranded aluminium (fig. 6). The binders have also been used exensively by the Ebbw Vale Steel Co. and the Lambton and Hetton Colliery Co. The Paton binder was designed to overcome troubles on lines which run over mountains and are subject to very severe weather in winter. Under these conditions it was found that the soft copper flexible binders originally installed stretched and left the line wire loose at the insulator. Vibration in the line wire then caused chafing both of the wire and of the insulator groove, in which the glaze was broken away. The Paton binder is made of solid copper wire, No. 4 to No. 6 s.w.g., according to the size of the line wires of copper. With aluminium lines the aluminium binder varies from No. 2 to No. 6 s.w.g. The binder is formed on a special jig to clip round the neck of the insulator, a standard jig being made for each size of insulator. The binder is hooked on the line wire and then bound under tension at the other end with about 15 turns of No. 14 s.w.g. soft binding wire. A leather or pig-skin chafer is fixed between the line wire and the neck of the insulator, and after five years' use it has been found that the chafer remains as good as new and does absolutely stop the chafing effects on the wire and the insulator. The whole binder remains tight and is yet flexible owing to the cushioning effect of the chafer. The cost is about the same as that of a well-made flexible copper binder, and about one-fourth the cost of some mechanical clips. No special skill is required for fixing it.

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* ELEC. REV., March 24th, 1911.

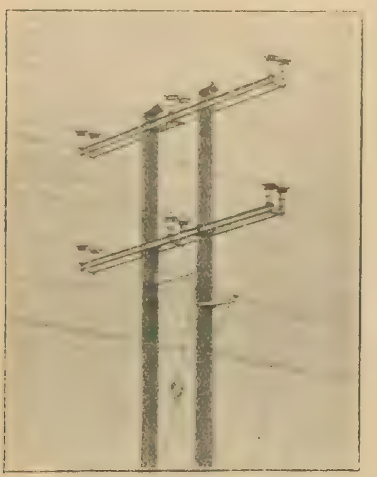


Fig. 3.—Corner Pole.

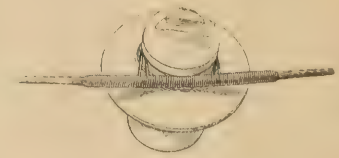


Fig. 4.—Flexible Copper Binder.

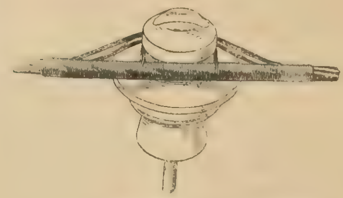


Fig. 5.—Flexible Aluminium Binder.

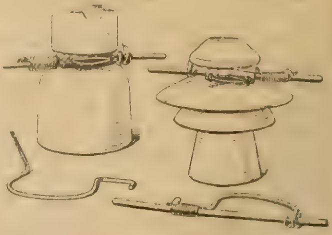


Fig. 6.—Paton Semi-rigid Binder.

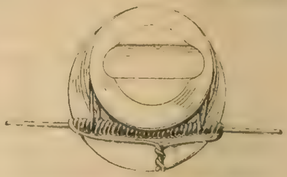
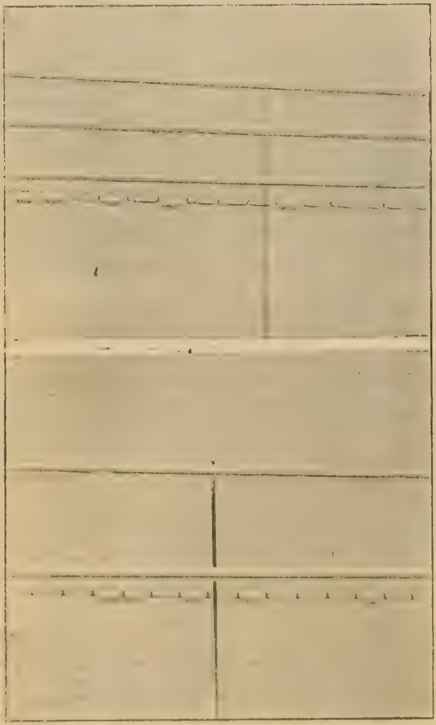


Fig. 7.—Flexible Telephone Binder.


Figs. 8 and 9.—Snow-laden Wires.

When rigid clamps are very carefully fitted by experienced wiremen, they appear to give satisfaction, but to get good results, each clamp should be fitted to the insulator on which it is to be used, because of the variations in dimensions of all insulators.

Rigid clamps are wrong in principle, because they reflect back vibrations in the line wire, and ultimately the line wires must crystallise and break at these clamps, even if the clamps do not fail first.

In making a telephone-line binder (fig. 7), a cushion of, say, 24 turns is first made on the line wire, and the two ends are then taken around the insulator; in order to avoid having a cross at the back, the wire which starts under the line wire is kept at the bottom of the groove and under the line wire at the other side, and similarly the other wire is kept at the top of the groove and over the line wire. Not less than four turns are now made round the line wire on each side, and the ends are brought together and twisted to prevent the binder spreading.

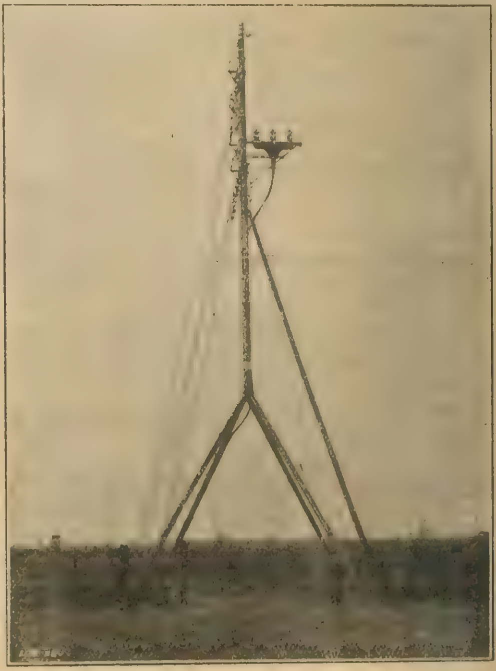


Fig. 10.—Callender-Kay Terminal Pole.

(*To be concluded.*)

Discussion in London.

In opening the discussion on this paper, **Mr. W. B. Woodhouse** said the question of altering the law relating to overhead transmission lines had often been discussed since Mr. Addenbrooke brought the matter before the Institution in 1905. The question of wayleaves was important, and he asked whether the author included the cost of these in his figures of cost of lines. The author avoided discussing tension and the effect of elasticity in modifying loading; he (the speaker) disagreed with the suggested specification for aluminium wires, as elongation could not be measured from a 5-in. specimen. "Earths" were very unreliable, and he had known a 10,000-volt wire fall on to the ground and not trip the switches; the best results were obtained with numerous earth plates coupled together. He agreed with the author that lightning arresters were useless. The minimum spacing of wires depended on the clearance necessary at the points of support, allowance had also to be made for the swinging of wires in long spans, but it was not necessary to give such large spacings as were suggested by the author. As regarded outdoor terminals, experience showed that boxes with insulators on the top broke down in time, but the box shown by the author would be awkward to fill and fit in rough weather; the clearance between conductor and earthed metal also seemed small. The insulators should be renewable with little trouble.

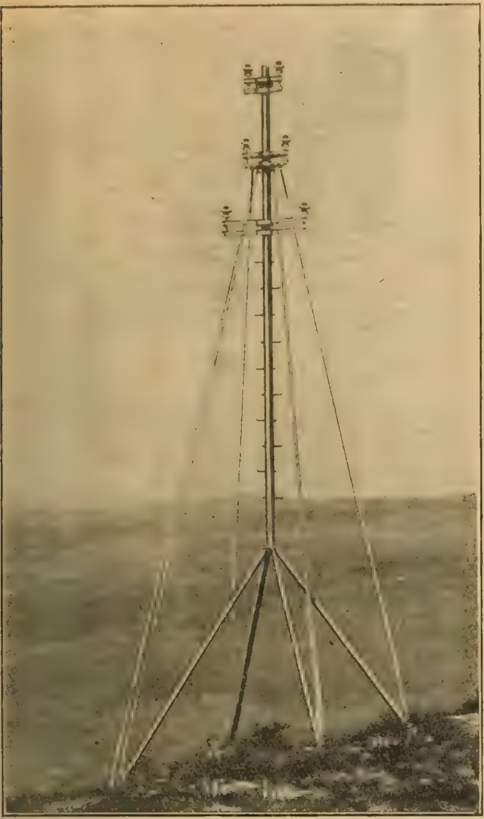


Fig. 11.—Callender-Kay Pole for 1,400 ft. Transmission Span.

Mr. A. P. Trotter pointed out that the B. of T. regulations were based on the best practice of the day, and would be further amended when necessary. It was quite important that insulation should not depend on glaze on an insulator, as the glaze was worn by the binding wire and the porcelain was liable to be ground away. Tests had proved the 18-in. square earth plate to give the best results. As regarded the running of transmissions along main country roads, it was hardly worth while, as the Post Office occupied all the straight roads with telegraphs, &c., and it was better to run straight across fields than follow crooked lanes. Some reference was made to the use of pole transformers, which he was told was a fruitful source of fatal accidents in Japanese cities; he would be very sorry to see little transformers, the size of hat-boxes, on poles supplying farm houses from h.t. pole lines in this country.

Commander Schwann drew attention to the effect of overhead transmission lines on aerial navigation, which would develop greatly in future. Lines across open country were very hard to see, and in such positions were very dangerous to aerial craft. It was proposed to make charts showing the routes of such lines, and he urged if possible that the lines should be rendered distinguishable from above.

Mr. C. W. Kay described and illustrated by means of slides the new Callender-Kay tubular pole, which we illustrate in figs. 10 and 11. This is of very light and simple construction, facilitating transport and erection, and consists of a vertical tubular pole standing on the point of junction of four inclined legs with square thrust plates on the ends embedded in the ground. The vertical top pole is guyed to each of the inclined legs and one of the thrust plates is galvanised and used as an earth plate. The type of construction was developed experimentally, and poles were tested to destruction; all were designed to fail at four times the working load and withstood the tests with success. The author described a 560 ft span using 65-ft. poles in the North of England, and a 1,420-ft. span (the largest in England) using 40-ft. poles, the factor of safety on poles and line being about 7. An 81-ft. high pole for a three-phase line near Sheffield was also illustrated. Erection with the materials on the ground was, he said, a matter of 1-1½ hours; and maintenance and upkeep were much smaller than for a lattice pole.

Mr. Charles Vernier remarked on the extent of overhead transmission lines operating in this country. The capital cost of overhead lines of high voltage was only about a third that of underground cable. The cost of wayleaves was, if anything, over £100 per mile, and one must not forget that a short cut with underground cable would also necessitate payment for wayleaves, if across private property. Wayleaves were a real difficulty, and it would be useful if the Institution could take the matter up; he believed the local veto on h.t. lines originated in connection with the h.t. wires running from the Grosvenor Gallery Station in London. He had no wish to see any reduction in factors of safety in connection with his work; he doubted whether prior to the storm of January last people had any idea of real snow conditions

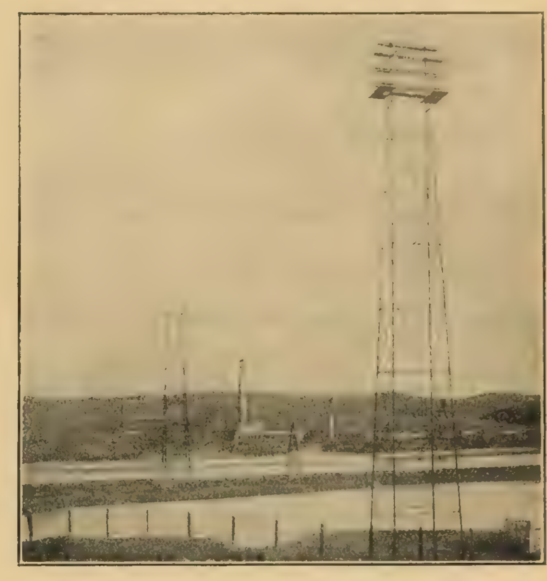


Fig. 12.—Transmission Across Hayle Harbour, Cornwall.

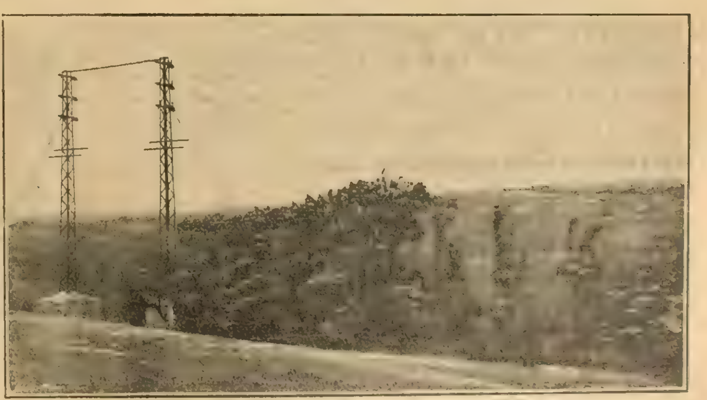


Fig. 13.—A Long Span; Cornwall Power Co.'s Lines.

in this country, but out of 42 overhead lines in use on his system, only three were seriously affected. All the heavier wires stood well, and he rather favoured the use of heavy wires in future work.

[In connection with the above matter, Mr. Vernier has kindly allowed us to reproduce two views of snowed-up wires, shown by Mr. Welbourn: the overall diameter of the snow-laden wires shown was 5 in., the size of the copper wire was ·05 sq. in. 9/32-in. diameter. The uncoated wire at the top of fig. 9 is the middle wire of fig. 8, which sprung up some 5 ft. when the snow was knocked off. The spans were 80 yds. The views illustrate the danger of erecting wires in the same vertical plane.]

Mr. Vernier, continuing, said he had never yet been able to make a case for steel poles, the maintenance cost being so high, and he did not believe in the practice of running duplicate lines on the same pole. He agreed as to the trouble experienced with birds, and had given considerable attention to the matter without much success.

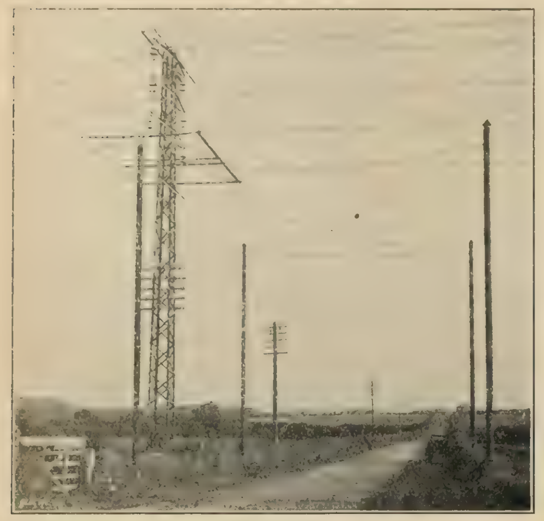


Fig. 14.—Lattice Pole carrying Power and P.O. Wires, Cornwall Power Co.

Mr. A. Jacob regretted that some comparison had not been made with long-distance transmissions abroad. While there were 650,000 yds. of aluminium lines in use in this country, there were many thousand times this amount in use abroad. He referred at some length to the use of aluminium in Scandinavian transmission work, incidentally mentioning the winter effect on the Rjukan transmission lines, described in our issue of January 2nd, page 22. Various views were shown, one being of a 1,970-ft. aluminium span, and another of comparative curves based on the French, German and American regulations for overhead lines.

Mr. J. S. Highfield said it was important that there should be no movement between wire and insulator for reasons already stated; it was also better to use two small earth plates than one large one, and where several earth plates were used these should be spaced out.

Mr. J. C. Wigham showed a number of views of the overhead transmissions of the Cornwall Power Co., some of which we are able to reproduce, viz, of the Hayle Harbour span of 900 ft., with 40 ft. sag, fig. 12; of a long span, fig. 13; and of a typical pole erection carrying both power and P.O. wires, with guard wires over the road, fig. 14. He said there was about 40 miles of overhead lines in use and no underground cable; at terminal poles adjacent to sub-stations the overhead lines were coupled to the latter by vertical wires dropping straight to insulator terminals in the galvanised roofs.

Mr. Welbourn briefly replied, and the discussion closed.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

B.T.H. Electric Hoists.

The British Thomson-Houston Co, Ltd., of Rugby, are introducing a new form of electric hoist to meet conditions where it would be difficult or inefficient to install travelling cranes of the usual type, and especially for places where small loads are frequently handled.

Fig. 1 shows a Type S_1 hoist with motor-driven trolley, but it is also supplied with a plain trolley, for hand travelling, and is designed for loads up to ½ ton and 1 ton with different types of controller.

The apparatus consists of a cylindrical iron casting containing the motor, controller and hoisting drum; this is bolted through suspension lugs to a four-wheeled trolley running on a rolled steel joist. The gears are located outside the frame, but are covered in. The hoisting drum, of cast-iron, is grooved to receive the full diameter of the $\frac{5}{16}$-in. diameter flexible rope; an automatic limit device acting on the controller prevents overwinding.

Either 50-cycle A C or D C motors of 1½ H P are fitted, for pressures between 110 and 550 volts, with drum type controllers—the "single speed" type for work not requiring accurate setting of the load, "rheostatic" type where accurate setting is required, and "foundry" type for slow speeds with two-rope hoists.

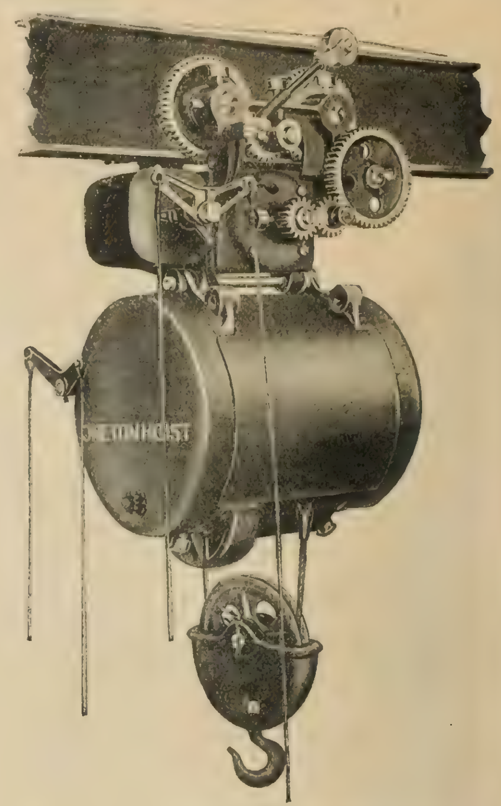


Fig. 1.—B.T.H. Hoist with Motor-Driven Trolley.

The armature shaft carries a service brake which is automatically applied by stopping the motor; a load brake of the screw and disk type is also fitted for use when lowering.

The "Morehen" Stage Plug and Socket.

A plug and socket which have been specially designed by a competent stage engineer to meet the stringent conditions of theatrical work have recently been introduced by the General Electric Co, Ltd, of 67, Queen Victoria Street, London, E C. This, known as the "Morehen" plug, is an adaptation of the G.E.C. dock plugs, modified to suit the special requirements of theatres and music halls. The socket is fixed under the stage level, and affords every facility for taking temporary leads to portable stage

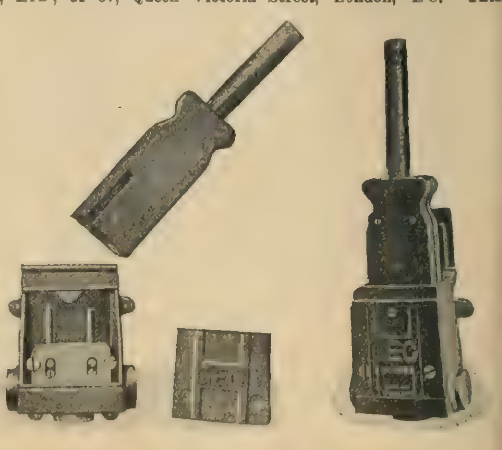


Fig. 2.—View of Interior of Socket with front and Plug removed.

Fig. 3.—G.E.C. Stage Plug and Socket.

properties. The plug portion is of hard wood and is practically unbreakable. Having no projecting pins, the live end may be dropped on a metal floor without danger of shorting, while the counter-sunk contacts preclude all danger of shock. As will be observed from the illustrations, when the plug is removed, the protecting lid automatically closes up the plug entrance, and is designed so that there is little liability for water or dust to enter the interior. Nevertheless, under extreme circumstances, it is impossible even to keep water out, and in order that any water that enters may immediately be discharged, the socket is designed with tapering sides and with an inclined bottom, the water immediately running out of two holes which are provided. The plug is so designed that it is impossible to reverse the polarity, and it can therefore be used on arc-lamp circuits. The plug can be supplied for either arc or incandescent lamps, each type being non-interchangeable, *i.e.*, an incandescent plug cannot be inserted in an arc lamp socket or *vice versâ*. These plugs have already been supplied to a number of theatres and music halls, in which they have met with every success.

Low-Temperature Indicator.

The Foster Instrument Co., of Letchworth, have made an application of the Hoskins alloys to the measurement of relatively low temperatures such as are met with in electrical machinery. In this apparatus, illustrated in fig. 4, advantage is taken of the relatively high E.M.F. of the Hoskins thermo-couple to give an open scale on a simple and robust portable indicator. In this case the thermo-couple comprises a central wire insulated from an outer tube, the two being joined together at the tip, forming the "hot junction." The thermo-couple is about three-sixteenths of an inch in diameter except at the tip, which is flattened to about $\frac{3}{16}$ in. × $\frac{1}{16}$ in. This flattened tip is therefore convenient for insertion in very narrow spaces, and the whole thermo-couple being semi-flexible, it is easy to apply it to a wide variety of cases. The flexible cable giving connection to the portable indicator is of the "compensating" type, transferring the "cold junction" to the interior of the indicator itself. A mercury thermometer inside the case may be read through the scale opening, and the zero of the instrument correspondingly set before taking a series of readings. By this method cold-junction correction is avoided.

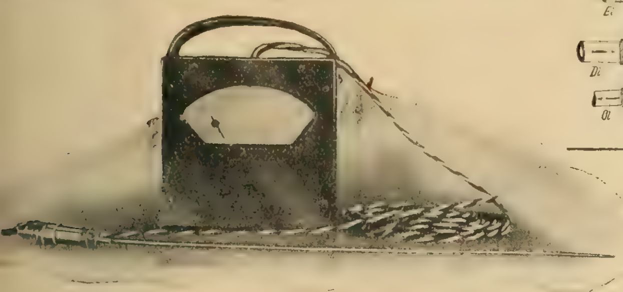


Fig. 4.—Hoskins Alloy Pyrometer for Low Temperatures.

Universal Conduit Box.

Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., have sent us particulars of an improved universal conduit box which they have introduced. The box, which is illustrated in fig. 5, is primarily intended for screwed conduit installation, and can be used as a bend, or a T box, for mounting such accessories as ceiling roses, switches, wall plugs, &c., thus lending itself to a wide range of applications; it can be had undrilled or tapped for conduit as desired, and is issued at reduced prices (supplementary list T5).

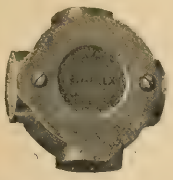


Fig. 5.—New Pattern Universal Conduit Box, with Cast-iron Cover.

Automatic Temperature Control.

The Steam Fittings Co., Ltd., of West Drayton, Middlesex, have introduced an electric automatic control system in connection with steam or hot water heating systems, radiators, calorifiers, &c., of which the arrangement, as applied to an ordinary L.P. steam radiator, is shown in fig. 6.

The arrangement consists of a contact thermometer and a solenoid operating a valve, and designed to use 100-250 volts direct current. Where only alternating current is available, direct current can be obtained from an electrolytic rectifier, except for the standard ¾-in. valve size, which can be supplied for 110 volts, 50 periods, suitable for L.P. heating. The contact thermometer is placed in any desired position in the room and is connected through terminal box E to solenoid M, with a rise in temperature the solenoid is energised and the polar extensions P attract disk K, closing a double-beat valve V, and thus shutting off the steam supply; a drop in temperature has the reverse effect.

The company guarantees the device to keep the room temperature constant within 2° F. of its setting. D represents a steam injector tube, while C is the condensed water discharge.

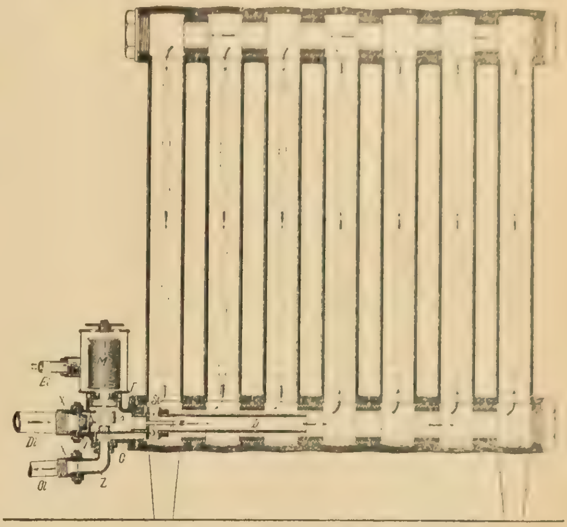


Fig. 6.—Automatically Controlled Radiator.

Fig. 7 shows a steam boiler G, for which class of apparatus an internal contact thermometer is provided, screwed in at A, and electrically connected to the solenoid-operated valve B, in the supply pipe C.

Temperature regulation can be effected by turning a screw on A; a reference thermometer E can be supplied if desired. Temperature differences of ½° above or below the setting cause the contact-maker to operate the solenoid and valve.

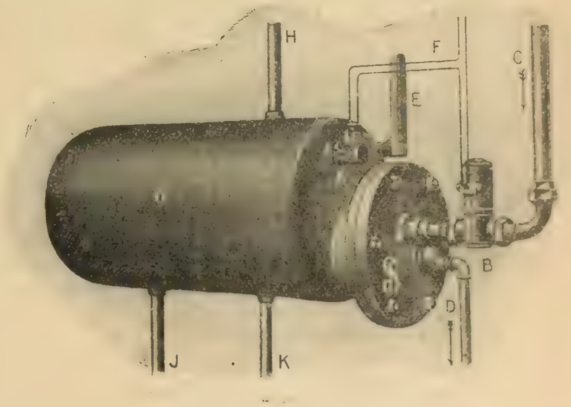


Fig. 7.—Boiler fitted with Automatic Control.

The power consumption of the solenoid is about 5 watts when energised. The arrangement obviates personal attention and secures the most efficient use of the heating medium.

Variable-Frequency Alternator.

The Crypto Electrical Co., of 149, Bermondsey Street, S.E., have recently introduced a patented A.C. generator giving practically any frequency over a range of 1 : 4, as from 40 to 160, with a speed variation of only 1 : 2, the generator having a pole-changing device controlled by a single throw-over switch. The machine is of use for testing A.C. motors and meters, &c.

New Half-Watt Lamp Fitting.

Messrs. Nathan & Allen, of Queen Anne's Chambers, Westminster, who represent the Wardle Engineering Co., send us particulars of a new fitting which will be on the market within the next week or two. It is 3 ft. long, and is intended primarily for street-lighting purposes, for use with any of the half-watt lamps.

The reflectors are designed to give the maximum candle-power at an angle of 20° from the horizontal. The lamp filament is above the level of the bottom of the upper reflector, and the horizontal rays are reflected at the desired angle, the upper and lower rays being reflected at a similar angle from the conical opal reflector underneath the lamp.

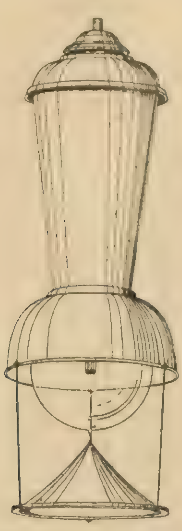


Fig. 8.—Street Fitting for Half-Watt Lamp.

The lamp is adjustable for focusing, and the fitting can be supplied with an automatic cut-out and substitutional resistance for series working.

Credenda Cooking Apparatus.

Particulars of the new patterns of electric heating and cooking apparatus of the Credenda Conduits Co., Ltd., Chester Street, Aston, Birmingham, have just been issued, and in figs. 9 and 10 we illustrate their grill and cooker. The special feature of the grill is that the heating elements are of the Credenda new bar type, mechanically supported by a channel section of metal insulated with mica, over which the nichrome heating ribbon is wound.

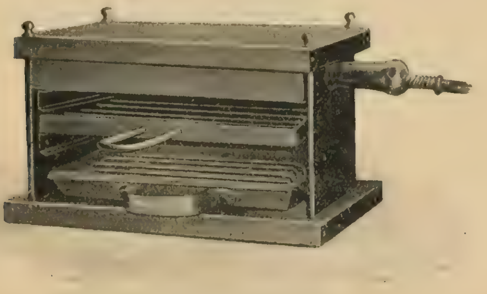


Fig. 9.—Credenda Electric Grill.

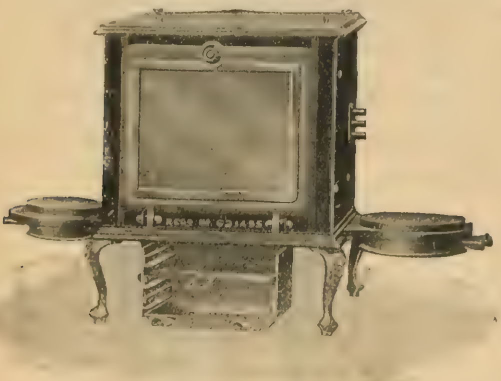


Fig. 10.—Credenda Electric Cooker.

The elements are accessible on removing the top plate, and the lining can be removed for the purpose of cleaning it.

The electric cooker (S 200) is noteworthy in that the whole of the framework can be taken to pieces, and spare parts are standardised; the elements are arranged on heat-plates at either side of the oven, long lengths of heating wire of heavy gauge being wound on six strips, and the whole unit heater can be taken out complete, the strip elements being permanently connected to pin connectors mounted on the heat-plates. With this arrangement, internal wiring is dispensed with, thus avoiding leaks and short-circuits. Outside the oven there are two hot-plates, which can be provided with connector control or switch control, with four heats, as desired. The whole is arranged to stand on a cooking board or table. The cookers are also being manufactured complete with tall cast-iron stands, bringing the hot-plate and oven to a convenient height for cooking, so that one need not stoop. A grill is provided under the oven, and the whole can be controlled by switches. The finish of the plates is art green enamel or polished nickel.

Folding Box for Lamps.

The Britannia Folding Box Co., Ltd., of Dace Road, Old Ford, E., have sent us a sample of their ingenious cardboard box for packing incandescent lamps; the lamp is held in position at both ends without touching the sides of the box, and can be inspected and tested without taking it out of the box. When empty the box folds as flat as an envelope.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Continuity of Supply.

I think shift men in general will be more than ordinarily interested in your leading article in last week's Review on the "Continuity of Supply." It should bring home to chief engineers the fact that even down-trodden shift men may contemplate striking as a means of righting their wrongs. The general run of shift men would, I am sure, be some of the last persons in the world to adopt such a course without a just and sufficient cause, but I ask the question: What is the remedy against such concerns as the Newcastle Electric Supply Co. (sub-stations), Yorkshire Electric Power Co., Bury, Tynemouth and Wakefield Corporations, to mention a few, who have for years past paid their shift men so poorly? We all admit that where a concern is not paying its way the chief is somewhat handicapped and cannot always pay the salaries he would like to, but what excuse have the chiefs of the concerns I have mentioned, which all make decent profits, for paying their men about 10s. per week less than is paid in similar stations for the same class of work?

Shift Engineer.

January 14*th*, 1914.

Small Electric Light and Power Undertakings.

Referring to Mr. Sowter's letter in your issue of January 2nd, the cost of running these works, which entirely depend upon suction gas plant, and where the total annual sale for the year ending 1912 did not exceed 181,417 units, with a maximum load of 190 kw. on a load factor of only 10·87 per cent., was as follows:—Fuel, ·37d.; oil, waste, water, &c., ·04d.; wages and salaries, ·32d.; repairs, buildings, plant, tools and accumulators, ·27d.; total works costs, 1·00d.

It is interesting to note that this figure is much lower than those of many of the undertakings using Diesel or gas engines, though their outputs are considerably better.

There is one point in which this station possesses an advantage over a great many other gas-driven stations, and that is that the gas plants are fitted with exhausters. The additional cost is, in my opinion, justified in sizes over 150 h.p., not only on account of the fact that you relieve the attendant of a large amount of manual labour, but because the gas can be obtained with certainty and celerity. This is a special point, because in connection with gas-driven stations it is often said that the serious risk of an occasional failure to get gas unfits them for electric supply. With a hand-starting fan you are liable, when conditions are bad, to be troubled with an occasional delay, and the possibility of this necessitates the attempt being made in good time every day, whereas, if fitted with exhausters, gas can be relied upon in full quantity in a quarter of an hour. It is not that the time taken is anything remarkable, although it is pretty good with a large size gas plant, but the regularity is of great importance.

It is a serious matter for those stations which are wholly dependent upon one source for a supply of fuel, and it is not surprising to note the rapid developments that suction gas is making for small undertakings.

As time goes on it is quite reasonable to conclude that gas will be produced satisfactorily from even less expensive fuel, when existing engines will only require the improved plant to bring them up to date in the matter of fuel cost.

With regard to the method of starting small gas engines referred to in Mr. Girling's article, this system has been in use here several years, and is very satisfactory.

The capital cost of a 150-KW. suction gas engine plant complete with cooling tower, compressed air starter and reservoirs, piping, &c., erected on purchaser's foundations is approximately £13·7 per KW.

It is somewhat regrettable that only a small proportion of the gas-driven stations publish their records, as such data would be of great assistance to engineers responsible for the small undertakings.

F. Swarbrick, A.M.I.E.E., A.M.I.Mech.E.,
Engineer and Manager.

Electricity Works, Minehead.
January 13th, 1914.

Co-operative Control of Electric Supply Undertakings.

It seems to be admitted on all hands that the existing position of electric supply in this country is most unsatisfactory, and it is apparent that the reorganisation of this important industry on the best lines in the public interest is a problem requiring the most careful consideration. No doubt this is the reason why none of your correspondents who are opposed to municipal or State control have so far ventured to formulate any scheme of reorganisation.

Whether dual company and municipal control, or entire State control, be the ultimate remedy, it can be shown that the new scheme referred to in your leading article on December 19th last, to form a holding company to acquire control of the existing companies in the London area, is a form of control open to serious objections equal to, if not greater than, those pertaining to any municipally-controlled electric undertaking.

Control of electrical undertakings, as at present existing, by a holding company puts such a company in an arbitrary position, rendering the safeguards of the Electric Lighting Acts worse than useless. There is nothing to prevent a holding company forcing on its subordinate company, the Parliamentary undertaking, either plant for the operation of the business or a supply of electricity in bulk at any price it thinks fit, 50 or 100 per cent. above or below market price. The holding company may take a profit direct or bear a loss direct that properly belongs to the subordinate company, the Parliamentary undertaking. Or the holding company may bring in an outside company to co-operate with it in taking exorbitant profits out of the Parliamentary undertaking, to the detriment of a cheap supply to the manufacturing community. Thus the statutory accounts of a Parliamentary undertaking, devised for the protection of the public, may be made to show either a profit or a loss not genuine at will of the holding company. A holding company may therefore be taking unlimited profits out of a Parliamentary undertaking, the benefit of which, or a portion of it, ought to be employed in a reduction of price to the consumer, to enable him to hold his own against foreign competition. The irregularities that may be practised by a holding company are without limit.

Unless some means can be devised whereby existing company control can be properly and adequately safeguarded so that the cheapest possible supply may be assured, many who are not the Socialists feared by Mr. Seabrook will have no alternative but to support a scheme for the nationalisation of electric power supply, as suggested in Mr. R. A. Chattock's able article in your journal of December 19th last, on similar lines to Government control of the postal service. Mr. Seabrook's objections to municipal or State control set forth in your issue of December 26th last do not help much. If he or some other expert would show how an effective dual or co-operative control could be arrived at so that the cheapest and most reliable supply of power were secured to the national industries to enable them to compete in the markets of the world, a public service would be performed.

That something definite should be done to render impossible the abuses at present practised under the Electric Lighting Acts is imperative. I incline to think that investigation by a Parliamentary Committee into the whole subject of electric power supply is desirable at the present juncture. If in the meantime the projected scheme for a holding company to acquire control of the various power companies in the London area is proceeded with, the Bill will require careful watching in the public interest. Control by a holding company appears to be the worst of all possible types.

Andrew Gemmell.

Ovingham-on-Tyne, *January 12th*, 1914.

The New Half-Watt Lamp.

It is to be presumed that, at the outset, users will find it difficult to decide which particular make of the above lamp to adopt.

Although I have not so far examined the rival claims very closely, I have discovered that the "Osram" lamp has at least one distinguishing feature, for it is claimed to consume "only one-half watt of electrical *energy* per candle-power."

One word has been italicised by me to make the claim clearer.

W. Perren Maycock.

West Norwood, S.E., *January 16th*, 1914.

Kindly warn your readers to be careful in the erection of "Half-watt" lamps. The installation of one was delayed in a certain Northern town through the fact that a careless erector dropped the lamp from a height of 17 ft.

The wind caught it before it reached the pavement, and it was carried out of sight. It was later found by a policeman, who took charge of it and locked it up, under the "Foreign Balloon on English Soil" Act, the "Dog" Act, or the "Explosives" Act—I am not sure which.

It was bailed out the next day and erected satisfactorily, having suffered no harm except from under-feeding whilst in the cells.

By the way, talking of the "Explosives" Act, has a householder any right to keep such a dangerous explosive as "gas" without a proper licence?

Watteau.

[We are assured on unimpeachable authority that the above report is a true statement of fact. The rumour that Rugby football will, in future, be played with half-watt lamps, however, has not been confirmed.—Eds. Elec. Rev.]

The Position of Electrical Railway Staffs.

I was very much interested in the letters by "Omen," "Idoneus Homo," and "Interested," which appeared in your issue of the 16th inst.

The miserable wages paid to educated men who at present fill some of the positions in electrical stations, will effectually stop others from spending time and money in fitting themselves for such positions, and will eventually result in the employment of men whose knowledge of the work is on a par with that of the assistants who form the subject of one of the letters appearing in your last issue.

The employment of these unskilled assistants will not seem to the employer to warrant a higher rate of wages; quite the contrary.

In electrical stations, more than in any others, a mere handful of men control plant which, directly or indirectly, affects to a considerable degree the daily life of the majority of the people in our cities; and further, no stations are more easily rendered inoperative for long periods. In view of these facts, the policy of those responsible for the present rate of remuneration seems, to say the least of it, short-sighted.

Will these underpaid men, who have been driven to form a Union in order to try and keep their wages at a bare subsistence level, stop to think of the result of their actions on the community in general, should a demand from this Union be met by a refusal—or will the thought of the treatment they received when they offered their services as individual units, blind them to everything except a sense of their wrongs? Judging from the recent strikes here, and the still more recent national strikes in two of the Colonies, there seems no doubt as to the answer.

Personally, I am against strikes; the bitterness they engender far outweighs any advantages that may accrue from them, and they appear to me to be leading to a state of things not far short of civil war. But the present state of affairs in the electrical world is intolerable, and although I agree to a certain extent with your correspondent "Interested," when he says that the chief engineer is, in most cases, to blame, I do not think this gentleman could effect a great improvement unless backed up by united action on the part of the men under him. As long as business is conducted on the present lines, so long will there be shareholders having shares in an undertaking about the inner workings of which they are completely ignorant.

These shareholders will be the first to let directors hear of their displeasure should dividends fall, and an engineer who approached such directors with requests for higher wages for his staff would—in the absence of clamour sufficiently loud to reach the ears of shareholders—be advised to wait until a more favourable moment. It would be an exceptional man who would add to his worries by making himself unpopular with his directors. As long as this state of affairs obtains, any improvement in their conditions must be effected by the men themselves.

Yet Another.

With reference to "Interested's" letter in your last issue, I must endorse his statement that the chief engineers are responsible for the "sweated" conditions under which central station men are working. They do not seem to realise that they are lowering the prestige of their own profession, and incidentally their own position, by their "labour-sweating" tactics. Before very long, if this matter is not rectified, we shall have our municipal councillors asking why the chief engineer is paid so very much more than his assistants. They will naturally conclude that he is being overpaid, and will inform him, if he is not satisfied with his present remuneration, that there are plenty more men, equally as capable, who would only be too glad to take the job for less money. This is exactly what the chief tells his assistants at the present time when they apply for an increase.

Chiefs! I implore you to see, before it is too late, the rut into which you are inadvertently drifting. Increase the status of your own profession by giving your assistants a fair salary, and at the same time you will better your own position. You cannot complain, if you refuse to do what it is your duty to do, that your assistants form associations, &c., to get that which is only due to them.

The A.E.S.E., I am glad to see, has taken this matter up whole-heartedly, and if the chiefs will only step out of their own light, it will not be necessary to introduce Bills into Parliament for the prevention of strikes in central stations.

In conclusion, I must ask all station men who have this matter at heart, and who have not previously done so, to communicate with Mr. W. J. Ebben, honorary secretary, A.E.S.E., 7, Vermont Road, London, E., for unity means strength.

Vapour.

In reference to "Omen's" letter and complaint in last week's Review under this heading, I would point out that the London County Council have, and have had for some considerable time past, a proper quarter to which all such complaints can be referred, namely, the Conciliation Board, which has granted many concessions to the Council's employes since its inception. Why, then, do not "Omen" and his colleagues make their complaint to that, the only constitutional authority, instead of starting an ink-slinging campaign through an already over-burdened Press? Has it taken him 11 years to decide whether he would be justified in joining some suitable Society to look after his interests? If so, one might presume that when he is satisfied that he is so justified, it will take him another 11 years to decide which is a suitable Society. Again, he asks: "Can the A.E.S.E. do anything to help us?" Why not join and see; surely the numerous articles on the Association's objects which have appeared in the Review answer that question, or does "Omen" wish someone to start an Association, pay his subscription and obtain benefits for him, who admittedly has done nothing to assist himself for 11 years?

Charge Engineer L.C.C. Tramways.

Every railway sub-station charge engineer has received particulars, &c., of the A.E.S.E., and has a knowledge of its existence; a good many have been personally canvassed, and a fair proportion have become members.

Now, if some of the railway sub-station men join the N.U.R. and some the A.E.S.E., and a few remain outside both organisations, the effect on future conditions will be nil; perhaps less than this, the conditions may even get worse, owing to the fact that the whole of the men might not be able to act at a given moment. What I wish to emphasise is that all these men must join one organisation, otherwise there is little hope for the future.

Should the railway electrical engineers join the N.U.R., as a body they will constitute only a minute proportion of the Union, and when it comes to a ballot, they will be hopelessly outnumbered and will be pushed hither and thither by the votes of men whose only interest will be to bring their men out in case of a strike.

Of course we have heard of a special committee to be organised by the N.U.R. to look after the sub-station men; a case of get them at all costs.

The A.E.S.E., as its name implies, was formed for electrical station engineers, it is governed by station engineers (railway subs. are well represented), all the officials are station engineers, and all are at present *employed* in electrical stations, consequently the executive know more of the conditions prevailing and the best means for remedying grievances that exist.

Should the N.U.R. wish the sub-station men to cooperate with them in any way and they were all members of the A.E.S.E., the sub-station men could please themselves and make their own terms or demands, whereas if they were members of the N.U.R. they would have to abide by the vote of the majority of the members, who are not electrical engineers.

Now I put it to the railway sub-station men, your future welfare depends on whether you join an organisation to safeguard your interests, or not; strikes (which we all abhor) are caused more by the men who remain outside their organisations, than by those who join them. Railway Electrical Engineers—Choose! A.E.S.E. or N.U.R. It is your duty to yourselves and fellow-workers to join an organisation without delay.

With regard to the question asked in "Omen's" letter in last week's issue, the answer is: Yes, the A.E.S.E. can help L.C.C. electrical engineers as well as the railway electrical engineers, by organising the whole of the workers in this section of the industry, and as we have constantly before us striking examples of that very sad fact that the arrangements of society are founded on force, and also that it is largely carried on by means of the knowledge that force can be exerted, surely these facts speak for themselves.

W. J. Ebben,
Hon. Secretary, Association of Electrical Station Engineers.

London, E., *January 20th*, 1914.

Concerning a Review.

I note that your reviewer still thinks the book in question is worth the price asked. Those who buy the book can judge as to his recommendation as I did. As a matter of fact, I had intended to buy several copies of the book for distribution to some juniors, but a perusal of the part of most interest to them decided me not to.

In the preface, Mr. Collis says the book deals with the subject in elementary terms and invites criticism, as he again does in his letter in your last issue, and I have pleasure in giving him some details of what I complain of, dealing only with that part of it which treats of the plant in which the juniors I have referred to are interested.

I have dealt with one chapter only of the book, in which there are 34 of the 80 pages and 16 diagrams, some of them full page and some nearly so, and so far as I can see, there is only one satisfactorily clear and accurate diagram, viz., No. 9. Some of the points raised are doubtless not serious, but some of them are, *e.g.*, fig. 2, and I think that there are sufficient errors in the part dealt with to call for the reviewer's comment. Even if they were not serious, there are so many of them that it is surely not unfair to say that most of them should have been corrected before the book was put on sale.

If Mr. Collis considers the diagrams in the light of my remarks, I think he will agree that there are errors not only of omission, but of commission, although one kind is not necessarily worse than the other, and that the book will not—as he hoped in his preference—assist much towards a better understanding of the functions of switchgear.

As one who has had some experience in teaching, I should like to express the opinion that elementary books, above all books, should be accurate, both for the sake of the student and for the sake of the apparatus and plant he has to handle.

R. Rankin.

Ilford, *January 13th*, 1914.

[The list of faults pointed out by our correspondent has been forwarded to the author of the book.—Eds. Elec. Rev.]

Insurance Companies and Consulting Engineers.

The series of letters published in your issue of the 16th inst. are very interesting in their attack upon "Tyke," but only "A.M.I.E.E." has appreciated that genuine insurance companies do not come under the category referred to by "Tyke" in his indictment.

Your correspondent "Facts not Fiction" is very interesting when telling us of his qualifications, but he is hopelessly muddled when he describes as "Fairy Tales" the remarks about earthing and burn outs. I can thoroughly endorse all that "Tyke" has written about the supposed inspectors; I possess the business cards of the individuals in question which contains the names of the insurance companies.

In reply to "Inspector," I would point out that "Tyke" has not had "the misfortune to be enlightened upon some scheme," &c., but wrote the indictment with the primary object of awakening the genuine electrical insurance companies to the fact that companies of the type referred to by "Tyke" are a smudge on fair competition and efficiency, and tend not only to lower the status of the electrical engineer, but of the industry as a whole.

I enclose my card and sign myself

El-les.

British Combines.

A correspondent makes a complaint against the action of an association of electrical manufacturers in postponing for a week beyond the time specified the submission of tenders for certain articles. And in the writer's opinion, as the French say, he "has right" in so doing. For some obscure reason, known only to the association concerned, the prospective buyer is given to understand, in an indirect way, that his Council will be favoured with the required tenders so soon as the combined sellers see fit.

While it must be admitted that this is an extreme instance—and one of which a reasonable explanation will, no doubt, be promptly supplied—and not a general occurrence among our "associations," yet one is drawn to inquire into the ways of these "rings" generally, as to their *raison d'être*, their policies and influence upon business, more especially in the electrical world. Therefore the writer proposes to run briefly over a few points relating to this matter, not with any desire to "give away" any one or other of the associations, but rather to ascertain, by balancing the pros and cons, how far "associations" or "rings" tend to benefit or stultify the welfare of the electrical interests of the country. One can often hear and read of, if not directly experiencing the results oneself, the enormous trusts which have grown up in the United States, some of which deal in commodities of vast importance to all, *e.g.*, oil or food-stuffs. Strange to say, the average citizen here never mentions the kindred organisations on our side of the water. Granted that they are not so powerful in the property and capital at their command, or in the extent of their spheres of influence, still they are numerous, and affect many things as remote in character as common table-salt and tungsten lamps. The electrical trade has its share too. Some of them are well known. Others there are of which comparatively few, even in business, are aware. The policy of all, however, is that of "combines" all the world over; *i.e.*, to obviate price-cutting, and to maintain prices at a satisfactory level. In some cases, members of the "ring" are handicapped month by month according to their aggregate sales for the preceding month, in order that each firm has a chance of sharing orders. It is, of course, essential that orders should be distributed, or the Association would not survive for long, and, whatever may be the method, either the one mentioned or some other, the sharing of orders is the rule.

It is important to notice that, generally speaking, the agreed "ring" prices only operate for home orders or contracts. When a colonial or foreign quotation, with certain exceptions, is involved, each member goes in on his own independent basis, without any interference from the "ring." The reason of this is not far to seek. The competition for "foreign" orders is far more acute than for the home business. This statement may be disputed, but the fact remains that such is the *modus operandi*, and the price to a home buyer is usually in consequence higher, for identical material, than to a buyer in, say, Australia. This is one of the direct results brought about by the existence of the "ring" or "combine," and to term it "protection" is only dubbing it with its rightful name.

The "protection" then being established, the question arises as to whom it benefits. The people concerned are the manufacturer and the employé. If the latter benefits, then he receives higher wages in a "combine" trade than he would in the absence of the "combine." There is ample room for doubt, however, that any class of electrical worker is to-day overburdened with his remuneration, while it is certain that in some branches of unskilled, or semi-skilled labour, newly-formed Unions are forcing wages upwards, showing that these workers have previously been underpaid.

The manufacturer, then, reaps the benefit from the higher prices produced by the "combine," and the reason of its existence is "dividends."

In addition to possessing this protection for the standard Association goods, certain other articles are manufactured, where conditions allow of this being done, in a lower quality. These go partly to supply the cheaper class of job at home, and more extensively the requirements of foreign markets, where the demand for such quality (or price) is considerable.

Probably the same machinery makes both grades of material, and so if the margin is less on the lower grade, this at least may serve at times to keep machinery and workers going, where they would be idle. The making and selling of lower grade goods, useful as they may be as a side line, is, on the other hand, partly a concession to the fact that there are competitors outside the combine. Some of these latter make only one quality of goods, and signs are not lacking that such firms convince the market of the value of this single quality.

Surely if protection of trade, whether for manufacturer or workman, is desirable or necessary to us as a nation, or to the electrical industries specially, it ought to be put upon a proper basis, controlled and subjected to due and lawful restrictions, and labelled "protection" for all to recognise it. In present circumstances, all politics aside, we are nominally a Free Trade country, suffering under the anomaly of more or less open protection in certain industries. It would be more logical to make trusts illegal, and to institute State protection by tariff than to leave things as they are to-day, and grumble at combines. The effects of the combines in electrical goods are identical with those in other goods.

If prices are held up the users suffer, while the demand may be to some extent restricted also. Therefore the whole electrical industry which employs motors, lamps, cables, &c., in its work, is handicapped. Then the natural rivals of electricity in the world's work receive a gratuitous benefit, which, although applied indirectly, is as certain in its operation as a direct bounty could well be. To point out that others allow combines is no argument in favour of them. There may be sound arguments advanced by the members of this or that association, but essentially, so far as electricity is concerned, there is only one issue. That is, that the influence of combines upon the future of electricity is a retarding one rather than a sustaining and helpful one. The writer has no animosity in this matter whatever, but public questions should stand broad daylight, and this is one of them.

Contracts.

January 12*th*, 1914.

Poor Law Assessments.

This Council's electricity undertaking has recently been re-assessed, and to get an idea as to whether the new figure is a fair one or not, I circularised some 20 similar undertakings, and from the replies of 10 who were good enough to respond, there is a very, very wide difference in the figures.

As this is a question of interest to many central stations, I should be glad if you could tell me whether the assessment is made upon capital expenditure, gross profit, net profit, or just the Union's fancy. The rating law seems so mixed as to require a "legal" mind to understand it, and, even then, it is doubtful if a clear interpretation could be given.

If any of your readers in England and Wales who have charge of undertakings (either company or municipal), with a capital expenditure up to £30,000, care to send me their capital expenditure on buildings, plant, mains, the gross rateable value and the net rateable value, I shall be pleased to tabulate the replies, and let them have a copy for private use.

C. J. Wood,
Resident Engineer.

Sale U.D.C. Electricity Works,
January 19*th*, 1914.

The Present Discontent.

Several writers in last week's Review had something to say regarding the conditions and wages in power and substation work. While agreeing on several points, I should like to ask whether those writers have considered the other side of the question, and asked themselves whether the general body of men cause their chiefs to look upon them with any interest.

The present writer has met men who on shift have filled in their time practising the banjo, bagpipes and fiddle, in poetry writing and literary work, in repairing bits of motor-cycles with their employers' materials, and in general scrap-iron and marine-store work.

I say that the presence of this sort of man amongst station engineers is detrimental to the interests of those men who are interested in their vocation, and wish to succeed at it; and I should like to state that I firmly believe all men of the uninterested variety, as denoted above, will be enthusiastic supporters of an association which hopes to bring them better pay and shorter hours.

That there are many points which need remedying in power station work is quite true, and it is to be sincerely hoped our chiefs will try to give us better conditions generally. Unfortunately, ours is so comparatively new an occupation that there are no precedents to go by.

One writer misses the point when he makes mention of the 20s.-25s. paid by power companies. I may state here that a man agreeing to stay at least a year at 20s. or 25s., as the case may be, has his wages raised if he gets promotion, and within my knowledge men have succeeded in getting up to 35s. and 37s. 6d. well within their 12 months.

Any man with a little business acumen would request to be shown a copy of any agreement he would have to sign, before throwing up one job to take up another, and if he has not the sense to do so—well, it will be one of those practical little lessons in life which will be of great value to him afterwards. All this of course provided he is at all dissatisfied with the terms of his agreement, which need not necessarily be the case.

But so long as the influx of youths into the occupation is so great, so long as young men with money from home are content to accept low wages, so long as we have "fed-up-with-sea" marine engineers and naval "tiffys," content to work for a time for 25s. to 30s., so long will the pay, prospects, and general conditions of the shift men and sub-men in this industry be poor.

That we are on the mend, however, is the sincere thought of

An Ayrshire Man.

"Rodolite" Heating Elements.

With reference to the letter from your correspondents the Standard Electrical Heating Co., it would have been more to the point had they sent us the sample heating element for inspection, as we should then have been able to indicate wherein it differs from the Bastian "Rodolite" glower.

Anyone interested can turn to the reference in the *Journal* of the Iron and Steel Institute for June, 1908, and judge for himself whether the appliance therein vaguely described in any way resembles our product, and for ourselves, we do not intend to impose upon the hospitality of your columns for the purpose of arguing this particular point.

Probably your correspondents do not appreciate that there is a difference between silica and fused silica or quartz glass, and for further education we would refer them to Paterson and Co., who years ago, in letters addressed to you (also from Newcastle-on-Tyne), professed considerable knowledge of the subject.

C. Orme Bastian.

London, W., *January* 19*th*, 1914.

[This correspondence must now cease.—Eds. Elec. Rev.]

BUSINESS NOTES.

Bankruptcy Proceedings.—J. G. M. Hilton, electrical engineer, 103, Exchange Buildings, Birmingham.—An application was made at the Court House, Corporation Street, Birmingham, last week, for the discharge from bankruptcy of the above-named debtor. It was stated that the liabilities amounted to £975, but the proofs lodged only totalled £422. No assets had been disclosed. Prior to 1899 the debtor had been managing director of an electrical engineering company, in which he invested £4,000. That company went into voluntary liquidation, and being liable for calls upon shares held by him, the debtor filed his petition in the High Court, with liabilities of over £2,000, and no assets. In 1902 he obtained his discharge, subject to a suspension for two years. After holding several appointments, he commenced an agency in 1905, and his remuneration proving insufficient to meet his creditors, he incurred further liabilities. In 1910 the firm by whom he had been employed discontinued to pay him commission, paying him a salary of £275 per annum, which sum he was still in receipt of. In addition, there was an income of £180 derived from property which the debtor settled on his wife on their marriage, and until recently he had received it, so that he had an income of £450 a year. Mr. Harold Kimpton represented the debtor, and said that the liabilities were incurred through the debtor having had recourse to moneylenders. His client, he said, was willing to submit to a payment of £150, £100 to be paid forthwith, and the balance at £4 a month. The discharge was thereupon granted upon those terms. Last day for receiving proofs for dividend, February 4th. Trustee, Mr. A. S. Cully, 191, Corporation Street, Birmingham.

Arc Welding Sets.—The Parsons Motor Co., Ltd., of Southampton, is supplying two of its paraffin-engined arc welding sets for the North-East Coast and one for the North-West Coast. Several repeat orders have been received lately both for self-contained welding sets and for sets to be fitted on lorries or on barges, &c.

Book Notices.—"*Journal* of the American Society of Mechanical Engineers." Vol. XXXVI. No. 1. January, 1914. New York: The Society. Price 35 cents.

"*Journal* of the Institution of Electrical Engineers." Vol. LII, No. 226. London: E. & F. N. Spon, Ltd. Price 3s. 6d. The issue for January, 15th, contains the paper on "British Practice in the Construction of High-Tension Overhead Transmisson Lines," by B. Welbourn.

"The Inventor's Advertiser and Manufacturer's Handbook to Patents, Designs and Trade Marks." By Reginald Haddan. Ninth Edition. 1913. London: Harrison & Sons. Price 5s. net.

"Slide Rule Notes." By Col. H. C. Dunlop and C. S. Jackson. 1913. London: Longmans, Green & Co. Price 2s. 6d. net.

"Debentures." By H. W. Jordan. London: Jordan & Sons, Ltd. Price 6d. net.

"Practical Electrician's Pocket Book for 1914." London: S. Rentell & Co. Price 1s. net.

"Efficiency in Technical Education a Factor in the Development of Professional Ideas." By Dr. W. F. M. Goss. (Presidential Address to the American Society of Mechanical Engineers.) New York: The Author.

"*Journal* of the Western Society of Engineers." Vol. XVIII, No. 2. November, 1913. Chicago: The Society. Price 50 cents.

"School of Mines Quarterly." Vol. XXXV, No. 1. November, 1913. New York: Columbia University. Price 50 cents.

"The Physical Review." Vol. II, No. 6. December, 1913. Lancaster, Pa.: The American Physical Society.

"L'Année Electrique." By Dr. F. de Courmelles. 1914. Paris: Ch. Beranger. Price 3 fr. 50.

Trade Announcements.—The Mansfield Engineering Co., of Pelham Street, Mansfield, have registered their business as a limited company under the title "The Mansfield Engineering Co., Ltd.," to take effect as from June 30th last. The conversion has been made purely for family reasons, and it will not affect the management of the business, which will be carried on as heretofore.

Messrs. W. T. Glover & Co., Ltd., Trafford Park, Manchester, announce that their Newcastle address henceforward will be:—20, Westgate Road; telegraphic address, "Cables, Newcastle-on-Tyne"; telephone No. "878 City." Stocks of rubber-insulated wires, cables and flexibles are kept at this address.

Mr. J. Jackson, electrical engineer and contractor, announces that he has severed his connection with the late firm of Jackman and Marchant, of Folkestone, and is conducting business on his own account at 12, Connaught Road.

It is announced that the business of the late Mr. Jas. Gray, electrical and general engineer, Hatfield, Herts., will be continued under the style of James Gray & Sons, by his two sons, Messrs. Jas. Wm. and Walter Cecil Gray, who for some time were associated with their father in the business.

The new telephone No. of The Leitner Electrical Co., Ltd., is "6477 Victoria."

The Brompton and Kensington Accessories Co., Ltd., announce that their telephone No. is now "Western 1531" (three lines).

The telephone No. of W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, E.C., is now "4560 London Wall" (seven lines).

In our last week's notice respecting Mr. J. Pendreich, for Daley Road read Dalry Road.

Catalogues and Lists.—Messrs. Credenda Conduits, Ltd., Chester Street, Aston, Birmingham.—Fifty-two-page illustrated catalogue of Credenda electric heating and cooking apparatus. Opening notes on cooking by electricity are followed by an illustrated description of the firm's patent disk element. The later pages contain tabulated data and prices as well as excellent pictures of kettles in many shapes, porringers, warming and cooking plates, grills, various utensils, electric ovens and cookers, and so on. Some heating notes preface descriptive and other illustrated particulars and prices of electric radiators and convectors of various designs.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Sixteen-page pamphlet illustrating the applications of aluminium to plant and accessories for chemical processes. Tables are given of the weight of aluminium sheet, safe pressures for, and sizes and weights of, aluminium tubes.

Messrs. Alfred Herbert, Ltd., Coventry.—Monthly review and stock list for January. Thirty-two-page illustrated catalogue of combination turret lathes and tools.

Messrs. W. Geipel & Co., St. Thomas Street, London, S.E.—Priced leaflet of rubber-covered wires and cables, carbons, motor starters and insulating tapes.

Messrs. Schaffer & Budenberg, Ltd., Whitworth Street, London Road, Manchester.—Three sections of their Catalogue. No. 1, of 20 pages, fully illustrated, gives particulars and diagrams of self-recording pressure gauges; No. 2, of eight pages, relates to g.m. pressure gauge taps, iron siphons, &c.; and No. 20 is a 40-page publication dealing similarly with reciprocating and rotary engine counters. All of the lists contain prices.

Messrs. Krupka & Jacoby, Ltd, Chapter Street, Westminster, S.W.—Priced leaflet of half-watt lamps.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Four new publications, No. O.S. 1,771 gives particulars and prices of Osram lamps for automobile, motor cycle and carriage lighting; No. O.S. 1,724 is a well got-up 16-page pamphlet dealing with motor-car lighting by Osram drawn-wire lamps, and gives full tabulated details of such lamps; No. O.S. 1,766 covers the drawn-wire "Striplite" lamps for shop and show-case lighting; No. M 1,762 describes G.E.C. time switches fitted with auto-setting gear which automatically adjusts the time of lighting and extinguishing the lamps according to the season of the year.

The Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, London, W.C.—Section "M" of their illustrated abridged price list of small motors, A.C. and D.C., from $\frac{1}{16}$ to 25 H.P., electric drills, polishing machines, sewing machine motors, starters, &c. Copies can be obtained on application.

The Crypto Electrical Co., 155-159, Bermondsey Street, London, S.E.—Four-page descriptive and illustrated list with prices, of their new type of variable frequency alternators and motor alternators.

Mr. Robt. W. Paul, of New Southgate, London, N.—Catalogue Section S, dealing with apparatus for the elementary electrical laboratory, and covering resistance standards, boxes and bridges of all kinds, rheostats of various types, unipivot galvanometers and millivoltmeters, insulation meters, magnetometers, reflecting galvanometers, electrostatic instruments, vibration galvanometers, &c. Besides the bare description of the apparatus illustrated—many of which are of novelty and interest—the catalogue contains a great deal of useful information regarding the experiments for which they are employed, and will be welcomed in every elementary electrical laboratory. Since writing the above we have received Sections A to H of Mr. Paul's new general catalogue of electrical instruments. In view of the importance of the issue, and the interesting features embodied in its arrangement, we will deal with it at some length in our next issue.

The Coventry Ordnance Works, Ltd., Ordnance Works, Coventry.—New issue of their small tool catalogue (84 pp.), including particulars and prices, with illustrations of twist drills, chucking drills, milling cutters, reamers, taps, &c. Four sectional catalogues are also issued dealing with these different classes of tools separately. All classes of drills, wire jobbers' long set, and taper shanks, are arranged in order under the decimal equivalent of the diameter. It is clearly indicated which are in stock and which are not.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—New "Wotan" battery lamp list (No. W.B.L. 2), containing particulars of numerous types of "Wotan" battery lamps now obtainable. Arrangements have been made by the Committee of the Society of Motor Manufacturers and Traders to standardise lamps for automobile lighting, and the types of lamps listed are in accordance with the recommendations of the Committee as to the correct construction of lamps for automobile lighting. Flashlight, flame, festoon and tubular lamps are also listed in variety, whilst there is a number of lamps suitable for sign lighting, illumination schemes, &c. The "Wotan" automobile headlight lamp has a helical filament arranged so as to bring it in the correct focus of parabolic reflectors, which are used in motor-car headlight fittings. For the convenience of the trade a separate folder has been issued suitable for over-printing with name and address of the retailer, and quantities will be supplied to *bona fide* trade customers.

Calendars and Diaries.—From Messrs. Mavor and Coulson, Ltd., of Glasgow, we have received a wall calendar with monthly date slips.

From Messrs. W. F. Dennis & Co., we have received a neat and useful morocco wallet, a stamp and card case, and a revised edition of their useful tables and data for wire users. The tables in small compass cover a remarkably wide field, giving all the data regarding wire gauges, the properties of steel, copper, bronze and aluminium wires, and copper bar, reduction tables of weights and measures, and other handy figures that are likely to be required for ordinary purposes, and a good many that are not easily run to earth when wanted.

The Weston Electrical Instrument Co. have sent us a handy blotter, fitted with calendar, memo. block and squared paper.

The Union Electric Co., Ltd., of Southwark, have prepared a large wall calendar with monthly slips for 1914. Union motors for industrial service are prominently in evidence, and photographic views of these and other Union electrical manufactures at work appear on the date slips.

Liquidations and Dissolutions.—Prested Miners' Gas-Indicating Electric Lamp Co., Ltd., 101a, Elthorne Road, Upper Holloway, N.—Under a compulsory winding-up order the report of Mr. E. C. Bliss, Official Receiver and Liquidator, has been issued to the creditors and shareholders. The accounts filed under the liquidation showed liabilities £2,348, against assets valued at £1,780, and a total deficiency of £18,896 with regard to contributories. According to the Official Receiver's report, the failure of the company is attributed by the directors to the miners' lamp being too expensive to be made commercially profitable. Latterly the bulk of the business of the company consisted of the manufacture of a coil and battery ignition for motor-cars, but when this system was superseded by magneto-ignition the company had not sufficient capital to put a magneto on the market. The company was registered on January 17th, 1903, and was formed to acquire four patents for a miner's electric lamp, which, it was claimed by the inventor (H. G. Prested), was capable of detecting and indicating the presence of gas in coal mines. The promoters of the company, H. G. Prested, John Moule, W. S. Hogg and C. A. Huni, registered for the purpose a syndicate, called the Prested Gas Indicator Syndicate, Ltd., with a nominal capital of £2,500, of which £1,500 was allotted to Prested, as fully paid, as consideration for the sale of the patents. By an agreement, dated

January 1st, 1903 (adopted by the company on February 5th, 1903), between the syndicate and Prested, and M. E. Ames as trustee for the company, this company acquired from the syndicate the patents, with the plant, machinery, stock, and all other property of the syndicate (except cash and unpaid capital). The consideration was £7,500, payable in fully-paid shares, 5,000 to the syndicate or its nominees, and 2,500 to Prested, who was to be managing director for five years at £500 a year. The syndicate undertook to pay its own liabilities, and the cost of obtaining patents in certain countries, or in the alternative to pay £100, and be relieved of those liabilities by this company. On May 16th, 1904, the company entered into an agreement with Prested for the acquisition of a secret process (not patented), in connection with a battery for the patent lamp. Under this agreement Prested was to receive £200, after payment of a 7½ per cent. dividend, and in the event of a 10 per cent. dividend being paid, a further £50. But no dividends have been paid, and the £200 was never paid. The original capital of the company was £12,500 in ordinary shares of £1 each. In May, 1904, the capital was increased to £15,000, by the creation of an additional 2,500 ordinary shares of £1 each; in March, 1905, it was increased to £20,000, by the creation of a further 5,000 ordinary shares, and in April, 1906, it was further increased to £25,000, by the creation of 5,000 preference shares of £1 each. The company has issued altogether four prospectuses. The total issued capital is £18,725, being 16,500 ordinary and 2,225 preference shares, whereof 7,500 ordinary shares were issued as fully paid. The result of the company's trading is shown in the following summary of the profit and loss accounts:—

	Loss.	Profit.
17 months ending July 31st, 1904..	£961	
Year ending July 31st, 1905	504	
17 months ending December 31st, 1906.. ..	390	
Year ending December 31st, 1907		£50
" " December 31st, 1908		201
" " December 31st, 1909	2,650	

No accounts have been prepared since those dated December 31st, 1909.

Leipsig Fair.—The A.E.G. Electrical Co. of South Africa, Ltd., of Caxton House, Westminster, S.W., inform us that their principals, the A.E.G., of Berlin, will exhibit at the Leipsig Fair from March 2nd to 9th this year. They will be exhibiting on a large scale, including exhibitions of all the latest kinds of electrical heating apparatus, artistic lighting, &c. Letters of introduction to the exhibit at the Fair will be given by the above London office.

LIGHTING and POWER NOTES.

Aberdeen.—The Electricity Committee has recommended the T.C. to reduce the price of current to the Suburban Tramways Co. from 1¾d. to 1⅜d. per unit, for a period of five years from June 23rd next.

Argentina.—Messrs. Colson, Brookhouse & Pyne have informed the Rosario Municipality that they are not prepared to take up the concession granted them for electricity works in that city under the conditions which have been established by the City Council. It will be remembered that the City Council eliminated all but two tenderers on a first perusal, and then called on these two to improve their conditions, which was done, but one of the two withdrew its offer some time before a vote was taken, and now the last firm that was interested has done the same.—*Review of the River Plate.*

Aylesbury.—The U.D.C. has applied to the B. of T. for consent to construct an electricity generating station adjoining the Canal Basin.

Bathgate.—E.L. Scheme.—The T.C. has granted permission to the Scottish Midland E.S. Co. to introduce a supply of electricity into the burgh, for which purpose a sub-station will be erected in connection with the company's 6,000-volt system.

Bexley.—Street Lighting.—A report of the Electricity and Tramways Committee with regard to the proposed scheme for street lighting by means of 100, 80 and 40-c.p. lamps, states that the scheme is likely to affect a considerable improvement in the lighting of the district. The scheme was adopted with the addition that the surveyor should be empowered to arrange for such variations of the scheme as he considered desirable.

Bolton.—The borough electrical engineer has been authorised to obtain tenders for an ash-handling plant at Back-o'-the'-Bank station.

Bradford-on-Avon.—Prov. Order.—The R.D.C. has decided to consent to the application of Messrs. Seymour, Williams and Co., for a prov. order for E.L. in its area.

Brazil.—Messrs. Escher, Wyss & Co. have recently completed a 20,000-h.p. vertical-shaft turbine for the Rio de Janeiro Tramway, Light and Power Co.'s plant at Pirahy.

Cleckheaton.—The D.C. has decided to invite tenders for an economiser and to request the L.G.B. to grant a loan to cover the cost. The Council has also decided to retain Messrs. Kennedy & Jenkin, of Westminster, to report upon the electricity undertaking.

Carlisle.—Gas *v.* Electricity.—At a recent meeting of the City Council, the Gas Committee brought forward a recommendation that whenever the gas or electricity departments are requested to quote for lighting or power, to either gas or electric consumers, the two engineers, and if necessary the Committees, shall confer before quoting, with a view to preventing unnecessary competition. Naturally the Electricity Committee objected strongly to this proposal, while the chairman of the Gas Committee was in favour of it, and it was in the end passed by 20 votes to 16.

Chiswick.—The E.L. Scheme.—A lively public meeting was recently held to consider the proposals of the Councils in regard to obtaining powers to purchase the local E.L. Co.'s undertaking. Only eight supporters were found for the proposal, while there was an overwhelming vote against it. The question of taking poll is being considered.

Continental Notes.—Denmark.—A representative of the Copenhagen journal, *Politeken*, recently interviewed the director of the North Zeeland Electricity and Tramway Co. in regard to the transmission of electrical energy from Sweden to Denmark. He stated that it would in any case be considerably cheaper to buy energy from Sweden than to produce it in Denmark; negotiations with the Trollhattan Power Co. fell through, and his company had now entered into a contract with the South-Swedish Power Co. for the purchase of 4,000 h.p. The Swedish Co. is at present supplying all the larger towns along the coast of South Sweden, including Malmo, Helsingborg, Landskrona and Trelleborg, and is in a position to supply the additional 4,000 h.p. The transmission will require two cables across the Sound, the first of which will be laid in the course of the summer between the towns of Helsingborg and Elsinore. No particular difficulties are anticipated with these cables, especially as there are at present three telegraph cables in about the same place, which have given no trouble during the past 10 years. The cables will work at 25,000 volts pressure, and will be landed at Marienlyst, to the north of Elsinore, at which place a large transformer station will be erected, and the energy will be transmitted to a second station at Lyngby and then distributed from both stations. The present electrical stations will be kept as reserve stations. There will be practically no reduction in price for small consumers, but the larger ones will benefit considerably. It must, however, be remembered that the Government is proposing a duty on crude oil for Diesel engines, which will affect the price of energy to some extent, and it will be an advantage if an increase of the present price can be avoided. The first part of the project will be completed towards the autumn. It may be remembered in connection with this scheme that the South-Swedish Power Co. recently made provision for a 7,000-h.p. reserve plant, by the construction of a new power station at the Hoganas collieries, where inferior Swedish coal will be employed as fuel.

Norway.—According to the *Jeknisk Ugeblad*, the consumption of electricity in Bergen during last year showed an enormous increase; for lighting purposes it has risen by 53 per cent., and for power purposes by 96 per cent. As regards the consumers, the number of these has risen by no less than 5,800, and the total amount of energy transmitted from the municipal power station at Samnanger amounted to 11 million kw.-hours.

Conway.—Proposed E.L. Scheme.—The Council is considering the question of adopting a system of E.L. Application has been made to the North Wales E.P. Co. for terms for supplying electricity in bulk, which will be discussed at the next meeting.

Cork.—Street Lighting, &c.—The R.D.C. has resolved to ask the B. of T. for an extension of six months for lighting powers for the Monkstown division, in view of the fact that Mr. O. S. Piper is installing E.L. plant at Passage, and will be in a position to contract for the public lighting of the district.

Crewe.—The T.C. has decided to lay a cable to supply electricity to the new sewage disposal works for power and lighting, at a cost of £400.

Cromer.—E.L. Transfer.—The T.C. has agreed with Messrs. Edmundson's Electricity Corporation for the electric light transfer to take effect on March 25th.

Cumberland.—The B. of T. announces in the *London Gazette*, that it has made an order under Sec. 101 of the Cumberland Electricity and Power Gas Act of 1906, for the cesser of all the powers of the Cumberland Electricity and Power Gas Co. as to the whole of the area of supply under the Act.

Deal.—The T.C. has resolved to oppose the Deal and Walmer Gas and Electricity Bill, and has appointed delegates to attend a conference of local authorities interested to consider the Bill.

Ealing.—Auditor's Report.—In his report to the B.C., the auditor states that the electricity supply fund for the past year showed a net profit of £1,970, as compared with £1,317 for the previous year. The credit balance stood at £6,934, and the mortgage debt outstanding amounted to £133,031.

Edinburgh.—Extension of Supply, &c.—The T.C. has approved the draft prov. order to extend its area of electricity supply to include the parishes of Cramond, Corstorphine, Colinton, Liberton and Newton.

In order to cope with the demand for electricity, it will be necessary for the Corporation to proceed this year with the erection of a new generating station, which, together with the plant and mains, is estimated to cost £100,000.

Epsom.—E.L. Scheme for Rural District.—A report to the R.D.C. on the proposed application by Mr. G. Allom for a prov. order to supply electricity at Banstead, Walton-on-the-Hill, and Kingswood, states that the compulsory works proposed are inadequate; that no provision is made for mains for Banstead and Burgh Heath, and that a charge of 8d. per unit is excessive. The Council has also received a letter from Mr. P. Amy, of Tadworth, intimating that he intends to apply for a similar order for Banstead, Woodmansterne, Walton-on-the-Hill, Kingswood and Chipstead, and to lay mains in Banstead, Tadworth and Burgh Heath, and is willing to charge for cottage property, including wiring and current, 3s. per month for four 25-c.p. lamps. The charge generally to the public would be 4d. to 6d. per unit. The Council has agreed to the principle of the scheme, and is prepared to consent to a licence being granted on terms to be arranged.

Fife.—The Fife Coal Co. has introduced an electric lighting scheme at its colliery at Kinglassie. The roads to the pits have been brilliantly lighted, the current being supplied from the colliery plant.

Fivemiletown (Co. Tyrone).—E.L. Scheme.—It has been decided to raise £12,000 for an electric lighting scheme in the town.

Flint.—Proposed E.L. Scheme.—The T.C. has decided to consider the question of an electricity scheme. The matter has been referred to the Highways Committee in the first instance.

Forres.—E.L. Scheme Dropped.—The T.C. has decided to take no further action with reference to the proposed E.L. scheme.

Galashiels.—At a meeting of the T.C. a petition by the Galashiels and District E.S. Co. for a warrant to erect a generating station at Netherdale was remitted to the Works Committee.

Glasgow.—At the last meeting of the Electricity Committee, the question of the Electricity Department hiring out cooking utensils, heating apparatus and other appliances, was remitted to a special sub-Committee to consider and report. The convener and the sub-convener are to confer with traders and others as to the desirability of opening a permanent showroom in the centre of the city for the exhibition of electrical appliances.

Gravesend.—Loans for New Plant, &c.—The T.C. has decided to extend the mains to the works of a local chemical company. By the casting vote of the Mayor, it was decided to apply to the L.G.B. for a loan of £13,600 for electricity purposes, including the installation of a 1,000-kw. steam turbine, with condenser, pumps, &c., coupled to a 6,000-volt, three-phase alternator, together with rotary converters, transformers, and switchgear, and h.t. mains between the works and the Rosherville sub-station.

Great Yarmouth.—Street Lighting.—The electrical engineer has informed the T.C. that as soon as practicable the work of substituting electricity for gas for public lighting at Gorleston will be put in hand.

Grimsby.—Plant Extensions.—The Public Lighting Committee has decided to expend £9,550 on additions to the electricity works.

It has been decided to give an extra discount of 5 per cent. off current supplied to Corporation departments; this represents about £52 per annum. The electricity revenue last year amounted to £19,317, including for lighting, &c., £10,271; power, £3,192; Admiralty, £1,191; public lighting, £1,667; and tramways, £2,996.

Halstead.—Proposed E.L. Scheme.—The U.D.C. has sealed an agreement with Messrs. C. C. Pudney & Co., of Bury St. Edmunds, in respect of the formation of an electric light company for the town.

Hastings.—New Loans; Street Lighting, &c.—The Corporation has decided to apply to the L.G.B. for a further loan of £5,000 for mains extensions. It was pointed out that every extension undertaken had yielded a satisfactory profit. The Council has sanctioned the laying of a cable in All Saints' Street in order to convert 58 gas lamps to electricity. The Corporation claims to save 30s. a year on each lamp, the gas company's contract being £3 5s. 8d. per lamp.

Hendon.—The question of adopting slot gas meters in the married quarters of the new fire station has been deferred by the U.D.C. pending a report as to the advisability of adopting electric lighting.

Hinckley.—Prov. Order.—The U.D.C. has consented to the proposed application for a prov. order for E.L. of the Midland E.L. and P. Co., the order to include Hinckley, Barwell and Earl Shilton.

Ilford.—New Sub-Station.—A L.G.B. inquiry is shortly to be held into the application of the U.D.C., for sanction to borrow £4,040 for the erection of a sub-station at Goodmayes.

Inverurie.—Proposed E.L. Scheme.—The T.C. has decided to ascertain whether the G.N. of Scotland Railway Co. would consider supplying the burgh with electricity.

Kirby Lonsdale.—Proposed E.L.—The U.D.C. has appointed two members and the clerk to go into a draft agreement with Mr. C. H. Best, of Bradford, for an E.L. installation for the town.

Leigh.—Plant Extension.—Details of the proposed extensions to the electricity works were given at a meeting of the T.C. last week, as follows:—1,500-kw. steam turbine and air filter, £4,750; 1,000-kw. rotary and switchgear, £2,260; cable connections, £200; foundations, £250; steam and exhaust pipes, £300; boiler, brickwork, stoker, superheater, air heater and ducts, fan engines for air auxiliaries, £2,800; condenser, £950—total, £11,910. The extensions are urgent; the output sold during the last nine months has been some 29 per cent. ahead of that sold during the nine months of the previous year.

Leyland.—Prov. Order.—The U.D.C. will hold a meeting on the 26th inst. to consider the proposal of the Leyland Gas Co. to promote a Bill authorising it, amongst other things, to supply electricity.

Llansamlet.—Street Lighting.—The P.C. has decided to extend the public E.L. in the parish.

Loftus.—E.L. Agreement Sealed.—The U.D.C. has sealed an agreement with Messrs. Pease & Partners for the supply of electricity for lighting purposes in the district.

London.—Fulham.—With a view to an improvement in the lighting of High Street, the Electricity Committee has instructed the engineer to substitute 100-c.p. lamps for the existing 50-c.p. lamps throughout that thoroughfare from Fulham Road to Putney Bridge. The Council is being recommended to join the London Electrical Masters' Association.

Loans for Electricity Undertakings.—The Stepney and Bermondsey Councils are being recommended to approve the resolutions passed at a recent conference of London municipal authorities owning electricity undertakings, strongly protesting against the action of the L.C.C. in first altering the maximum periods for the repayment of loans for electricity undertakings, and later in attempting to alter the periods of existing loans, without consulting the Borough Councils concerned.

Malvern.—Mains Extensions.—The U.D.C. has decided to extend the mains to the West Malvern district, at a cost of £1,450, provided guarantees are forthcoming.

Manchester.—At a citizens' meeting, held last week, in spite of considerable opposition on the part of the Ratepayers' Association, the proposals of the Corporation to purchase land at Davyhulme for a new generating station, and to purchase the undertaking of the Trafford Power and Light Supply, Ltd., for £146,500, were approved.

Margate.—Public Lighting.—The T.C. has accepted the offer of the Isle of Thanet Electric Tramways Co. for lighting the road along the tramway track at Northdown with 15 100-c.p. lamps, fixed on the tramway pole brackets, at £2 15s. each per annum.

Newcastle-on-Tyne.—The E.L. installation at the Cathedral, put in some 18 years ago, is to be modernised at a cost of about £300

New Zealand.—The Whangarei Council has been authorised to borrow £13,000 for an electricity scheme; the current is to be generated at Wairua Falls.—*New Zealand Shipping and Commerce.*

It is stated that the first 6,000 h.p. of plant at Lake Coleridge is expected to be put into operation by May next. The plant is designed for a total capacity of 12,000 h.p., and will supply the Christchurch City Council and some 15 other local bodies, the electrification of the Christchurch-Lyttelton Suburban Railway, and the requirements of the meat freezing works, flour mills, woollen mills and other industries of the Canterbury Plains. The natural features of Lake Coleridge and the adjacent rivers allow of an extension up to 58,000 h.p. The Christchurch City Council will be enabled to retail power at an average of about 3d. per unit for lighting, and 1½d. per unit for power.

A scheme is under consideration for the supply of electricity to all the towns in the North Island, and it is anticipated that such power might also be used for the electrification of the railways and a system of light railways throughout the country districts.—*Board of Trade Journal.*

Penrith.—Public Lighting.—The U.D.C. has referred the question of the better lighting of the town to a Committee for consideration.

Romford.—The U.D.C. has instructed the clerk to ascertain whether the Council's interests will be adversely affected by the new Bill of the County of London E.S. Co. The Bill affects the Romford and District E.L. Order, 1913.

South Stoneham.—E.L. Scheme.—The R.D.C. has granted the application of the Southampton Electricity Committee to supply electricity to the parish of Bitterne.

Swansea.—The Education Committee has instructed the electrical engineer to heat the isolation wards at the Training College with electricity. The Council is being recommended to afford the Nobel Explosives Co. a stand-by supply of electricity not exceeding 50 kw. at any time.

Southampton.—LOAN SANCTION.—Sanction has been received from the L.G.B. to the borrowing of £6,000 for services and £11,350 for mains. The Board has transmitted an order permitting the supply of energy to Chilworth. The Eastleigh and Bishopstoke U.D.C. has informed the T.C. that it cannot entertain the Corporation's proposal to supply electricity in its district. The town clerk has been authorised to obtain a prov. order to supply electricity to Bitterne.

Swinton and Pendlebury.—STREET LIGHTING.—The "Barrow" system of street lighting is to be extended over the whole of the tramway route. The capital cost will be about £1,621, and L.G.B. sanction to a loan is being sought for.

Tasmania.—The St. Leonards Municipal Council has decided to light the town by electricity.—*Tenders.*

Taunton.—A REJECTED SCHEME.—At a meeting of the T.C. on January 14th, a scheme to generate electricity at the French Weir, on the Tore, was defeated by a large majority. The estimated cost was £1,600, and the borough electrical engineer stated that if the same amount was spent on the provision of up-to-date steam plant at the present works, he could cut down the cost of coal by 50 per cent.

Teignmouth.—E.L. SCHEME.—At a meeting of the U.D.C. on Tuesday, last week, a letter was received from the Bovey Tracey E.L. Co. with reference to a supply of electricity. A committee reported that it had had satisfactory interviews with Dr. Purves and Mr. W. Bird, and it hoped to place some definite information before the Council at its next meeting.

Troon.—E.L. SCHEME.—The T.C. is objecting to the prov. order of Kilmarnock Corporation with a view to obtaining the best terms possible in connection with the electric lighting of Troon.

Warminster.—PROV. ORDER.—The U.D.C. has consented to a prov. order for E.L. being granted to Mr. J. H. Edwards, of Bristol.

West Yorkshire.—E.L. PROPOSALS.—The following further decisions have been come to by various District Councils, after consideration of a communication from the Yorkshire Electric Power Co., seeking support for its application for powers to supply electricity for lighting purposes:—The Kirkheaton U.D.C. has decided not to support the application; the Bolton U.D.C., after being informed that the Bill did not provide for a compulsory supply of electricity, and as it was considering the advisability of an E.L. scheme of its own, decided to oppose the Bill, and, if possible, take joint action with other Councils; the Wharfedale R.D.C. has decided to allow the company's letter to lie on the table, the opinion being that the Council was being asked to commit itself before it knew anything definite about the proposals; the Gildersome and Rawdon D.C.'s are supporting the application. The West Riding C.C. has taken the view that a most strenuous opposition is desired, owing to the fact that it was suggested that the company should have authority to make arrangements with private consumers for the supply of energy without obtaining the consent of the local authority; the Otley D.C. generally approves, and both it and Meltham U.D.C. are giving the matter close consideration before coming to a decision; the Penistone U.D.C. has decided to support the company without prejudice to its rights of taking out a prov. order itself; the Wombwell U.D.C. has appointed a Sub-Committee to consider the matter to see how far it affects the interests of the district; the Midgley D.C. has decided to support the West Riding D.C. Association in its opposition to the company's application, and the Cudworth U.D.C. is also opposing. The Morley T.C. has authorised the affixing of its seal to a memorial from the non-county boroughs objecting to the proposals, as, if passed, the Bill would create a monopoly in the districts; the Keighley R.D.C., the Oxenhope U.D.C. and the Haworth U.D.C. have affixed their seals to the Bill on account of the promoters being alleged to have failed to comply with the Standing Orders; the Emley U.D.C. has decided to support the company's application, though a strong point was made by the opponents of the company's application in regard to the monopoly which would be set up when once the company got in; and the Featherstone Council has decided to oppose the Bill, taking the view that the rights of supplying electricity should be reserved for itself.

Windsor.—STREET LIGHTING.—The T.C. has sealed a contract with the Windsor Electrical Installation Co. for public electric lighting.

Worcester.—NEW PLANT STARTED.—On Thursday, last week, a new 2,000-H.P. turbo-alternator was started up by the Mayoress. Mr Robert Clarke, chairman of the Electricity Committee, in welcoming the visitors, pointed out that the demands on the plant, especially for power, had advanced very rapidly, and with a view to securing this valuable load, the Council had agreed to spend £6,000 on the new plant. This was capable of supplying the whole demand of the city, and he mentioned that the air-filtering plant in connection with it, had been supplied by a local firm, Messrs. Heenan & Froude. He concluded with a tribute to the ability of the borough electrical engineer, Mr. Shaw.

Yeovil.—PROV. ORDER.—The T.C. has decided to object to the application of Messrs. Petter, Ltd., for a prov. order for E.L., with a view to securing conditions as to the Council's option of purchasing the undertaking, prices to be charged, &c.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Tramways Sub-Committee has agreed to recommend the Committee to purchase the Militia Barracks for a new depôt and sheds. The scheme will cost more than the Mannofield scheme, viz., £8,600.

Australia.—The Victorian Legislative Assembly has passed four Bills authorising the construction of new electric tramways round Melbourne, viz., the Brunswick and Coburg, the S. Melbourne (Middle Park), the Camberwell, Hawthorn, and Richmond, and the Kew lines. The costs are estimated at £36,000, £60,000, £63,000 and £70,000 respectively for the complete schemes.—*Australian Mining Standard.*

Bingley.—The new tramway route between Nab Wood and Bingley will be formally opened on February 3rd.

Bradford.—RAILLESS TRACTION.—At the last meeting of the City Council tenders amounting to £13,270 were accepted for the supply of railless cars, chassis and equipment; it is hoped to have at least one of the routes in working order before the Yorks. Agricultural Society's Show in Bradford this year.

Continental Notes.—SWEDEN.—The Swedish Railway Authorities have worked out a plan for extensions and improvements of the State Railways over a period of ten years. This plan has now been submitted to the Government for approval, and it will involve a capital expenditure of no less than £16,667,000. Of the above-mentioned amount it is proposed to expend £2,640,000 on the electrification of considerable sections of the main lines, among which may be mentioned the line between Jörna, Malmo and Trelleborg, and the lines between Stockholm and Gothenburg and Malmo and Gothenburg. It is further proposed to electrify the railway between the large iron mines in the North and the port of Lubac in the Bay of Bothnia, which will require a sum of about £417,000. The continuation of this line from Kiruna to the Norwegian frontier is now being electrified.

ITALY.—A project has been approved for the construction of an electric railway, partly underground, in the town and district of Genoa. There will be 14 stations on the proposed line, of which 10 will be underground.

A syndicate of Italian and Belgian capitalists is applying for a concession to construct and work an electric railway between Modena, Lama and Mocogno.

GERMANY.—The Saxon State Railway authorities have decided to commence the electrification of their system. The first section to be converted will be that between Klingenthal and Untersachsenberg, after which the Pirna-Dresden-Meissen line will probably be taken in hand.

On 16th inst. an express train wrecked a tramcar of the Süddeutsche Strassenbahngesellschaft at a level crossing at Essen a.d. Ruhr. The signalman had omitted to lower the barriers, which move vertically instead of, as in Britain, horizontally; neither of the drivers had therefore any warning of the danger. Three persons were killed and a number injured.

The municipalities of Charlottenburg and Wilmersdorf have called upon the Overhead and Underground Railways Co. to submit plans and estimates for the construction of a promised extension 1·6 mile long under the Kurfürstendamm.

FRANCE.—Up to 1900, when the old Campagnie de l'Ouest electrified one of its lines from Paris to Versailles, only the Compagnie d'Orleans followed its example by installing electric traction on its line between the Gare d'Austerlitz and the Gare du Quay d'Orsay. Since then the latter company has electrified two of its lines as far as Juvisy, and is now about to transform in the same manner the two other principal lines. Up to the present, 13 600-volt D.C. locomotives, of 700 KW., and some motor-trains are in use. In order to complete the electrification, five new 1,500-KW. locomotives are being obtained, which will allow of wholly abolishing steam traction and transferring to Juvisy the machinery depôts, workshops, &c., thus setting at liberty a large area of land in Paris. Energy is supplied from the generating station erected at Ivry in 1900 by the Thomson-Houston Co. The State is also about to make a considerable increase in the number of its electric lines by the conversion of all its suburban lines, which will be worked on the 600-volt third-rail system.

Dublin.—The tramway works at Inchicore, which have been closed for four months owing to the labour disturbances, were reopened this week, the workers being reinstated.

Hastings.—PETROL-ELECTRIC TRACTION.—A few days ago Major Pringle, of the B. of T., visited Hastings for a trial of the system which is to supersede the Dolton cars along the front. One of the existing cars had been converted by the substitution of the Stevens petrol-electric motor in place of the skate. Major Pringle intimated that his report would be favourable. The route over which the new system will run is quite level, and the change from motor to overhead wires at West Marina causes only a moment's delay.

Heywood.—The Tramways Committee has decided that the return half of a workman's ticket, costing more than 1½d., shall entitle the holder to return on a tramcar at any hour of the day.

Ilford.—A Tramway Lease.—The Tramways Committee is considering the question of insurance against loss of earning capacity owing to disturbance of the system by fire at the electricity works. With reference to the proposed lease of a tramway from the Barking T.C., the U.D.C. has decided to propose the payment to the Barking Council of £900 per annum for the lease of the section, Barking to supply current at 1½d. per unit and to maintain the track and overhead equipment; Ilford to maintain the overhead equipment, and to retain all fares taken, no other authority to run cars on this section. The foregoing arrangement, if adopted, will be for three years from April 1st next, Ilford reserving the right to terminate same in 1915 or 1916.

Leeds.—Tramway Extensions.—The City Council has approved the tramway extensions and improvements section of the Parliamentary Bill. This portion of the Bill was also approved by a statutory meeting of the ratepayers.

London.—With reference to the report of the Select Committee of the House of Commons on Motor Traffic, the General Purposes Committee has recommended the L.C.C. to concur in the view that in all Metropolitan traffic matters, Parliament should be advised by one authority, combining the traffic duties of the Home Office, B. of T., and L.G.B.; to accept a new B. of T. traffic branch as a suitable authority providing it consists of a small number of competent persons holding office for a considerable period; that county councils within the area of the branch be empowered to submit proposals, and that the branch should inform all parties interested in such proposals that they have been submitted, and, if necessary, hold an inquiry and make by-laws on the subject; that the police should exercise closer control of the traffic; that the police should continue to grant vehicle licences; that traffic points should be provided at a greater number of crossings; that more refuges should be provided; that congestion caused by tramway dead-ends and other obstructions should be removed; and that the Metropolitan Streets Act, 1867, be extended to include the whole Metropolitan area, instead of the six-mile limit.

Bermondsey.—The General Purposes Committee has had under consideration the widenings suggested on behalf of the L.C.C., estimated to cost £6,400, in connection with the electrification of the tramways in Southwark Park Road, &c., together with the widenings suggested by the borough surveyor. Neither of these widenings, the Committee states, will permit of a double line of tramway throughout the route, and it has therefore instructed the surveyor to prepare plans showing the necessary widenings for double track, which he estimates at £29,000, and which will be forwarded to the County Council with a request that immediate steps be taken for the electrification of the tramway in question, and for a double line to be laid throughout the route.

The Highways Committee has recommended that a double-line tramway junction be installed from Essex Road to Canonbury Road, at an estimated cost of £4,000, and that the track be obtained from Hadfield's Steel Foundry Co., at a cost not exceeding £2,200; and that a "lay-by" be installed at the junction of East and West India Dock Roads, at an estimated cost of £1,050.

Luton. — Application is to be made to the B. of T. for an extension of two years for completing authorised tramways.

Nelson.—Railless Traction.—A deputation, representing the Tramways Committee, visited Leeds and Bradford last Thursday to inspect the railless trolley system, in view of the proposal to adopt this form of traction for the Walverden and Southfield Wards of Nelson.

Poole.—The T.C., on January 16th, decided to formally oppose the Bill of the Sandbanks Railless Electric Car Co., which seeks power to provide railless transport through Branksome Park and Canford Cliffs, and thence to Poole Park, a route of seven miles.

Salford.—A report upon the lowering of the fares and the extension of various routes was considered by the General Purposes Committee last week, and was referred back to the Tramways Committee with certain recommendations.

Swansea.—Tramway Extensions.—The Light Railway Commission has, subject to the confirmation of the B. of T., made an order for the construction of further light railways in the borough.

U.S.A.—That it pays central stations to provide facilities for the charging of the batteries of electric vehicles is evident from some figures recently to hand. During the year ending April last the Commonwealth Edison Co., of Chicago, was supplying current for no less than 569 electric delivery vans and lorries, the consumption amounting to 3,780,000 kw.-hours. Current was also supplied to a large number of electric pleasure cars, the revenue from the battery load being over £40,000. In New York the Edison Co. has an annual income of £50,000 from current supplied for the recharging of electric motor-lorries, this increasing at the rate of 30 per cent. a year.

Wrexham.—Year's Traffic.—The number of passengers carried on the electric tramways during the past year was 1,227,328, an increase of 179,000 on the preceding year. The receipts amounted to £6,700.

York.—A meeting of ratepayers has approved the proposed Corporation Bill in so far as it relates to railless traction, motor-omnibuses, the extension of electricity undertaking, and the supply of electricity in bulk.

The Light Railway Commissioners will, on February 25th, hold an inquiry into the application of the T.C. for an order for the extension of the tramways.

TELEGRAPH and TELEPHONE NOTES.

Aeroplanes and Wireless.—It is reported that Mr. Marconi has made considerable progress with a system of transmitting wireless messages from aeroplanes, and has taken several flights with Mr. Gustav Hamel.

Canada.—A total of 272,088 wireless telegraph messages, containing more than four million words, were handled by the Canadian Government during the past year at its coast stations. There are now 40 wireless stations in the Dominion.

Mexico.—The existing 18 Telefunken wireless telegraph stations having operated much better than a French system which is also in use, and having assisted materially in the suppression of the rebellion, the Government have ordered several more Telefunken equipments in addition to the two 10-kw. stations now under construction.

Norway.—The wireless station on the Island of Rundemanden, near Bergen, was recently in communication with Cape Race, Newfoundland; this represents the first wireless communication between Norway and America.

A new telephone central is to be erected at Christiania on modern lines, at a cost of £55,000.

Telegraph Wire Thefts.—In the course of a trial last week, it was stated that the P.O. had installed alarms which rang in the linemen's cottages when telegraph wires were cut. Some £2,000 worth of wire had been stolen from the main trunk lines to the North of England.

United States.—Referring to the recent agreement of the American Telephone and Telegraph Co. (Bell Co.) with the United States Government, by which the former undertakes to sever itself entirely from the Western Union Telegraph Co., and pledges itself not hereafter to acquire control over any competing company, the American *Telephone Engineer* quotes with approval an editorial in a Chicago paper, which points out that the combination now dissolved was not in restraint of trade, but for the benefit of trade, and had resulted in better and cheaper telephone and telegraph service, together with various concessions and conveniences to the public. That the telephone and telegraph services constituted a natural monopoly was recognised by the Postmaster-General of the United States, who had previously recommended that they should be purchased and combined under Government control. The outcome of the new conditions, says our contemporary, will be an impulse to independent telephony such as it has not had since competition began in 1894.

The agreement provides for facilitating intercommunication between the Bell company's system and the systems of all other telephone companies in the United States, a concession which the Government had not hoped to gain. There is still a law-suit in progress between the Government and the Bell Co., with the object of dissolving the connection between that company and the Pacific Telephone and Telegraph Co.

The authorised capital stock of the Bell Co., on December 31st, 1912, was about £100,000,000, and its bonded indebtedness £21,000,000. For the past seven years it has paid 8 per cent. per annum. The Western Union Co. had an authorised capital of £20,000,000, of which the Bell Co. held about 30 per cent.

Wireless Telegraphy.—The Postmaster-General has appointed Lieut.-Col. Fowler, commandant of the Army Signalling School, to be a member of the Committee on Research in Wireless Telegraphy, of which Mr. Hobhouse is chairman.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney (New South Wales).—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

March 2nd. Sydney Harbour Trust. Circular Quay. Three electrically-operated semi-portal travelling cranes for Berths Nos. 1, 2 and 3, Woolloomooloo Bay. Particulars from Engineer-in-Chief of the Trust.

March 25th. N.S.W. Railways and Tramways Department.—Five 1,000-kw. sub-station units to specification No. 124. Particulars at Electrical Engineer's Office, 61, Hunter Street, Sydney.—*Tenders.*

Adelaide.—February 11th. P.M.G. 50 cable terminals. See "Official Notices" January 9th.

Melbourne.—January 24th. Corporation. House cut-out boxes and replacement wedges.—January 21st. 5 tons, 16 cwt. bare hard-drawn copper cable. See "Official Notices" January 9th.

February 17th. P.M.G. Cable boxes. See "Official Notices" January 9th.

April 7th. P.M.G. Accumulator batteries (Tudor) for radio-telegraph stations. See "Official Notices" to-day.

April 7th. For the Postmaster-General. Relays, non-polarised, Stores Schedule 996. See "Official Notices" to-day.

Hobart.—March 2nd. For the Postmaster-General. Telephones, common battery, wall pattern, and table pattern, Schedule T 104. See "Official Notices" January 16th.

Aberdare.—January 31st. Corporation. Four double-deck tramcars. See "Official Notices" January 16th.

Ashton-under-Lyne.—January 29th. Covering three Lancashire boilers and pipes, painting boiler house, &c., for the Electricity Committee. Borough Electrical Engineer, Electricity Works, Wellington Road.

Austria.—BRZESZCZE (Galizia).—February 20th. The State Mines Administration at Brzescze invites tenders for a quantity of pumping machinery, with electric driving, including an A.C. synchronous motor, 550 volts, 50 periods, an ampere-meter, three-pole oil switch in watertight iron case, &c. Deposit 5 per cent. Particulars of the K.k. Bergdirection, in Brzeszcze.

Australia. — MELBOURNE. — February 18th. 1,590 opalescent arc lamp globes for City Council. See "Official Notices" to-day.

April 7th.—Deputy P.M.G. Six accumulator batteries for radio-telegraph stations. Apply, High Commissioner in London for the Commonwealth of Australia, 72, Queen Victoria Street, S.W.

Belfast.—January 28th. Harbour Commissioners. Electric cables. See "Official Notices" January 9th.

Belgium.—The municipal authorities of Fieron (province of Liége) have just invited tenders for the concession for the supply of electrical energy for private and public lighting and power purposes in the town.

Birmingham.—February 11th. Electrical stores for a year, for the Birmingham, Tame and Rea District Drainage Board. Mr. J. D. Watson, engineer, Tyburn, Birmingham.

Bolton.—The Electricity Committee is inviting tenders for the supply and erection of ash-handling plant at the Back-o'-th'-Bank Electricity Works.

Cape Colony.—February 28th. The municipality of Paarl, Cape Province, invites tenders for the installation of generating plant by water power. Plans and specifications from the Town Clerk, Municipal Office, Paarl, or from the consulting engineer, Mr. Thomas Stewart, St. George's Chambers, Cape Town. (two guineas). Tenders to Town Clerk.

Cheltenham.—January 31st. Corporation. Twelve months' supply of electric light fittings, and other stores. Particulars from Mr. J. S. Pickering, Borough Engineer, Municipal Offices.

Croydon.—January 26th. Corporation. Stores for Tramway Department. Tramway Manager.

Dundee.—January 30th. Corporation. (*a*) 5,000-KW. steam turbine and alternator; (*b*) condensing plant; (*c*) 750-KW. rotary converter, with transformer. See "Official Notices" Jan. 2nd.

France.—January 31st. M. Wilhelm, Ingenieur-en-Chef des Ponts et Chausées, at Grenoble, is inviting offers from firms willing to enter into competition for the supply and erection of the turbines required for the hydro-electric station at Pont-du-Loup, in the Hautes Alpes.

Greenock.—February 11th. Harbour Trust. 150-ton electric crane. Specification, &c. (deposit £1), from Engineer's Office, Municipal Buildings.

Halifax.—February 16th. Corporation. Stores and materials for the electricity department. See "Official Notices" to-day.

Hammersmith.—February 4th. Corporation. Stores for the electricity department. See "Official Notices" to-day.

Ipswich.—January 31st. Corporation. Alternator, transformers, switchboard and rotary converters. See "Official Notices" January 2nd.

Keighley.—February 7th. Electrician's work for a year, for the Keighley and Bingley Joint Hospital Board. Mr. J. N. Clarkson, clerk, North Street, Keighley.

Leeds.—February 21st. Corporation. Twelve months' supply of coal and other stores, including a number of electrical items. See "Official Notices" to-day.

Leigh (Lancs.).—January 23rd. Corporation. One 1,500-KW. turbo-alternator (impulse type turbine), 1,000-KW. rotary converter, transformers and switchgear. See "Official Notices" Jan. 9th.

London.—L.C.C.—January 27th. (*a*) 6,300 tons of steel girder tramway track rails and fastenings; (*b*) about 1,500 tons of slot rails and conductor tees for the tramways. Mr. G. W. Humphreys, Chief Engineer, County Hall, Spring Gardens, S.W.

January 27th. 581 tons of special section rolled steel bar for magnetic brake shoes. Chief Officer, L.C.C. Tramways, 62, Finsbury Pavement, E.C.

January 30th. Metropolitan Water Board. Twelve months' supply of electric lamps, wire and accessories, &c. Clerk of the Board, Savoy Court, Strand.

BERMONDSEY.—February 5th. Corporation. Stores for the electricity department. See "Official Notices" to-day.

ISLINGTON.—January 28th. Corporation. Twelve months' supply of electrical and engineers' stores. See "Official Notices" January 2nd.

ST. MARYLEBONE.—February 11th. Corporation. Underground cables, house cables, flexible cords, rubber goods, box compound and insulating materials, &c. See "Official Notices" January 9th.

KENSINGTON.—January 29th. Board of Guardians. Electric lamps and fittings and other stores. Specification &c., from Mr. W. R. Stephens, Guardians' Offices, Marloes Road, Kensington, W.

Manchester.—January 27th. The Corporation Tramways Committee invites tenders for extensions and alterations at the Hyde Road car-shed. J. Gibbons, architect, 4, St. Mary's Parsonage, Manchester.

January 26th. Tenders are invited for the electric lighting of the Chorlton-cum-Hardy library. City architect (one guinea).

Newport. — February 14th. Corporation. Twelve months' supply of stores for Electricity and Tramways Committee. See "Official Notices" to-day.

New Zealand.—March 26th. The Dominion Portland Cement Co., Ltd.—Hydro-electric plant, Wairua Falls.—Section 1: Hydraulic equipment, including turbines (1,500 H.P. each), governors, penstocks, valves, &c. Section 2: Generators (1,000 KW. each), exciters, automatic regulators, &c. Specifications (£2 2s.) from S. Irwin Crockes, consulting engineer, Auckland.—*Tenders.*

Norway.—February 6th. Norwegian State Telegraph Department. 265,000 insulators. Local representation. Particulars from Tekniske Avdeling, Telegrafstyrelsen, Hasselgaarden, Christiania.—*Board of Trade Journal.*

Pontypridd.—February 9th. Corporation. Stores and materials for the electric light and tramway department. See "Official Notices" to-day.

Salford.—Tenders are invited for electric dinner lifts at the Town Hall. Particulars from Mr. J. B. Broadbent, 15, Cooper Street, Manchester.

Sheffield. — February 3rd. Corporation. Contract No. 111. Structural steelwork for carrying coal shoots, coal bunkers and railway sidings over same at Neepsend. See "Official Notices" January 16th.

Spain.—The municipal authorities of Belmez have again invited tenders for the establishment of a central electric lighting station in the town.

Turkey in Asia.—March 14th. Forty years' electric lighting concession for Trebizond municipality. Population 50,000 to 60,000; 12 miles of street lighting. Houses mostly occupied by poorer classes. Water power (Deirmen River) available. An English translation of the conditions may be seen at the Board of Trade Commercial Intelligence Department in London.

West Ham.—February 6th. Corporation. Stores for the electricity department. See "Official Notices" to-day.

CLOSED.

Admiralty.—The Edison & Swan United Electric Light Co., Ltd., Ponder's End, have been appointed contractors to the British Admiralty for ampere gauges from 15 to 500 amperes for the following year.

Ashton-under-Lyne.—The T.C. has accepted the following tenders in connection with the supply of two tramcars:—

United Electric Car Co., Ltd.—Bodies and trucks.
Siemens Bros. Dynamo Works, Ltd.—Equipments.

Australia.—Victoria. P.M.G.'s Department:—

1,768,800 porcelain insulators, pattern B, £19,968.—Commonwealth Art Pottery and Insulator Co., Pty., Ltd.
One common battery multiple switchboard and equipment, to increase the switchboard at Windsor, from 3,360 to 7,080 lines, £16,534.—British G.E. Co., Ltd.

Home Affairs Department:

Federal Territory Power Plant.—Engine and condensing plant, £5,512.—Belliss & Morcom, Ltd.
Steam boiler with chain grate stoker and superheater, £1,478.—Babcock and Wilcox, Ltd.—*Tenders.*

Bedminster.—The Bedminster, Easton, Kingswood and Parkfield Collieries, Ltd., have placed with Messrs. Johnson and Phillips an order for extra-high-tension and low-tension totally enclosed switchgear for surface and underground service.

Belgium.—Six concerns—two each French, German and Belgian—submitted tenders last week to the Société Nationale des Chemins de Fer Vicinaux for the supply of the bronze trolley wire required during the current year. The lowest offer was that of the Société A.E.G. Union, of Brussels, whose prices ranged from 1,785 to 1,800 fr. per metrical ton.

Bentley.—The U.D.C. has accepted the tender of Messrs. W. H. Pease & Co. for installing the E.L. at the offices, at £32 10s.

Bradford.—The Tramways Committee has accepted tenders for the supply of 28 railless trolley cars, and these vehicles will be used for the extended service from Dudley Hill to Bankfoot, and from Laisterdyke along Killinghall Road to Bolton.

The Electro-Mechanical Brake Co., Ltd., of West Bromwich, have received the Corporation order for 30 sets of their "E.M.B." unbreakable jointless grid resistances for railless trolley 'buses.

The Corporation has accepted the tender of the Adnil Electric Co., Ltd., to supply, deliver and erect at the Valley Road Electricity Works, one turbo-generator of 5,000 KW. capacity, running at 1,500 revs. per minute, manufactured by the Bergmann Electrical Works, Berlin, for the sum of £9,370.

The *Leeds Mercury* of Friday last makes the following observations on the matter:—"The Electricity Committee of the Corporation, after paying a hurried visit to Berlin, have decided to recommend the acceptance of a German tender for a large steam turbine plant. All the leading British firms were in competition for the order, some of them at exceptionally low prices, but the decision is understood to be influenced partly by a more speculative guarantee on the part of the German firm, and partly by some prejudice existing against British manufacturers, who have recently associated themselves together in order to obtain fair conditions of contract in municipal work. Possibly there is no firm in Bradford which could produce the plant required, but at all events, certain Yorkshire firms were in the running, and it is understood the differences in the prices were not such as to justify the placing of the contract abroad. As already stated, the question of the guarantee is understood to have been the determining factor. The British makers insist upon a 10 per cent. margin in the matter of fuel consumption and power, whereas many foreign firms take the risk of the rejection of their plant in the event of the specified guarantee not being strictly carried out. Any variation from the British guarantee is, of course, subject to a penalty, but the firms insist upon a 10 per cent. margin being allowed them before rejection. As Bradford is a nursery of labour politics, it is believed that some local protest may be raised against important work going abroad before the question is finally settled by the Council."

Dundee.—The Corporation Sub-Committee, which was appointed with powers, has decided to place a repeat order for a 5,000-KW. turbo-alternator and condensing plant with Messrs. Willans & Robinson, Ltd., and Messrs. Dick, Kerr & Co., Ltd. The other sections for the rotary converters, balancers, &c., of the specification will be dealt with on the result of the tenders.

Glasgow.—The T.C.'s Sub-Committee on Tramways, Works and Stores has recommended acceptance of the following offers:—

Steel conduits and fittings.—Siemens Bros. Dynamo Works, Ltd.
Washed dusters.—James B. Horne.
Electrically controlled clocks for Coplawhill Car Works.—Edward & Sons.
Special track work.—Loraine Steel Co.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

WAR OFFICE.

Electric cells.—J. C. Fuller & Sons, Ltd.
Motors, &c.—Electric Construction Co.
Telephone sets, &c.—International Electric Co., Ltd.; Midland Electric Wire Co., Ltd.; Siemens Bros. & Co., Ltd.; Spagnoletti, Ltd.; Walter's Electrical Manufacturing Co., Ltd.
Supply and erection of cables, Royal Gunpowder Factory, Waltham Abbey.—W. T. Henley's Telegraph Works Co., Ltd.

INDIA OFFICE: STORE DEPARTMENT.

Wireless telegraph apparatus.—Marconi's Wireless Telegraph Co., Ltd.
Cables.—London Electric Wire Co. and Smiths, Ltd.
Electrical plant.—Siemens Bros. Dynamo Works, Ltd.

CROWN AGENTS FOR THE COLONIES.

Electric cranes.—Craven Bros., Ltd.

POST OFFICE.

Telegraphic apparatus.—Tyler & Co., Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; B.I. and Helsby Cables, Ltd.; British L M. Ericsson Manufacturing Co., Ltd.; International Electric Co., Ltd.; London Electric Wire Co. and Smiths, Ltd.; Western Electric Co., Ltd.
Telephonic cable.—W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Siemens Bros. & Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Porus cells.—Siemens Bros. & Co., Ltd.
Fans.—Pitter's, Ltd.
Fuses.—Western Electric Co., Ltd.
Insulators.—Doulton & Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; B.I. & Helsby Cables, Ltd.; F. Smith & Co. (inc. in London Electric Wire Co. and Smiths, Ltd.).
Galvanized iron wire.—Dorman, Long & Co., Ltd.; Rylands Bros., Ltd.; F. Smith & Co. Wire Manufacturers, Ltd.
Conduit work, Eastern and South-Eastern district.—Callender's Cable Co., Ltd.
Installation and jointing of loading coils, London-Birmingham cable.—Western Electric Co., Ltd.
Laying lines of multiple-way ducts, Cardiff-Swansea.—(Section 1) W. H. Worthington, Ltd.; (Section 3) W. Dobson; Manchester-Bolton, W. Pollett & Co.: Manchester-Burnley (Section 1), J. A. Ewart, Ltd.; Manchester, Burnley. Bury (Section 3), W. H. Worthington, Ltd.; Newcastle-North Shields, R. Fisher.
Laying lines of single-tube ducts, multiple-way ducts and pipes, London-Brighton.—(Section 1) J. A. Ewart. Ltd.
Telephone exchange equipment, Wrexham.—Automatic Telephone Manufacturing Co. Ltd.

Great Yarmouth.—The T.C. has accepted the tender of Messrs. E. Foster & Co. for 2,000 tons of Bestwood ½-in. washed slack, for the electricity works; and that of Rose & Co. for 1,000 tons of screened steam coal.

The T.C. has also accepted the tender of Crompton & Co., Ltd., for a high-tension switchboard, at £883.

Grimsby.—The Public Lighting Committee, on Monday, accepted the tender of Messrs. Berry, Skinner & Co., for starting apparatus at £38 for one starter or panel of each size, also that of Messrs. Horace Green & Co. for motors, the price for one motor of each size being £167.

Harrogate.—The T.C. Education Committee has accepted the tender of Messrs. Charles Bell, of Bradford for the installation of the electrical equipment at the new Council Schools in Skipton Road, Harrogate.

Holland.—Messrs. Edward Bennis & Co., Ltd., of Little Hulton, have received an order from their representatives in Holland, for a bucket elevator and a U-link chain conveyor, including distributing shoots, for Leidschendam power station.

London.—FULHAM.—Corporation. The Electricity Committee has received the following tenders for a 2,500 KW. turbo-alternator and condensing plant:—

	Turbine.	Alternator.	Turbo and alt.	Condenser.	Complete set	Time of deliv'ry
	£	£	£	£	£	
Richardsons, Westgarth and Co.	—	—	5,894	2,185	7,925	9 to 10½ months
Jas. Howden	4,250	—	7,810	—	—	8
Vickers, Ltd...	—	1,750	—	—	—	—
A.E.G. Electric Co. ..	—	—	5,550	1,750	7,300	7½
" "	—	—	—	—	7,860	7¼
Butler & Co.	—	2,044	5,834	—	7,624	7½
Rees Roturbo Co.	This firm quotes for air pump only.					
Elec. Equip. and Eng. Co..	—	1,885	—	—	—	9
W. H. Allen & Co.	—	—	—	1,980	—	6
Dick, Kerr & Co.	—	—	5,863	—	—	10½
Cole, Marchent & Morley	—	—	—	2,085	—	4
British Thomson-Houston.	—	—	6,656	—	—	6
" " "	—	—	6,150	—	—	6
Siemens Bros. & Co. ..	—	2,440	—	—	—	7
" " ..	—	2,510	—	—	—	—
General Electric Co. ..	—	2,079	—	—	—	7
Parsons & Co.	3,675	—	5,875	2,202	8,077	9
Willans & Robinson ..	—	—	5,580	1,976	7,890	9
Musgrave & Co.	2,657	2,137	4,794	2,127	6,921	10
British Westinghouse Co..	3,282	2,467	5,765	1,943	7,395	9
" " ..	—	—	6,014	—	7,567	9
Worthington Pump Co. ..	—	—	—	1,785	—	6
Fraser & Chalmers.. ..	3,250	—	—	—	—	6½
British Electrical Co. ..	—	—	7,650	1,625	9,175½	9
Oerlikon Co.	—	—	5,257	1,811½	7,068½	9
Escher, Wyss & Co. ..	—	—	5,704	2,002	7,706	8
Mirrlees, Watson & Co. ..	—	—	—	1,897	—	8
Isaac Storey & Co.	—	—	—	1,870	—	5
Belliss & Morcom	4,215	1,800	6,015	2,425	8,440	10½
Daniel Adamson	—	—	6,283	2,132	8,415	9½

The electrical engineer submitted an exhaustive report and analyses of the tenders, and acting on instructions interviewed the representatives of the British Thomson-Houston Co. and the Worthington Pump Co., with the result that their tenders were reduced to £5,900 and £1,746 respectively. The Committee states that in selecting the most advantageous tender, apart from the actual price, due regard having been paid to the kilowatt capacity, steam consumption, area of condenser, period of delivery and facilities for testing, &c., it recommends that the tenders of the British Thomson-Houston Co. and the Worthington Pump Co. be accepted, particularly as the two turbo-alternators previously supplied by the B.T.H. Co. have proved so satisfactory.

L.C.C.—The Stores and Contracts Committee reports the acceptance of the following tenders during the Christmas recess:—

For Electric Fittings, Schedule 14:—

Atlas Carbon & Battery Co., Ltd.—Items 5 (*a*) to (*d*) and 6 (*a*) to (*c*).
British Central Elec. Co.—Items 14, 16 and 20.
B.I. & Helsby Cables, Ltd.—Items 7 (*a*) to (*c*).
Cooper & Roberts.—Items 1, 4, 17 and 18.
Dorman & Smith.—Items 8 and 9.
Elliott Bros.—Items 22 (*a*) to (*f*), 23 and 24 (*b*).
General Electric Co., Ltd.—Items 3 (*a*) to *h*), 12, 15, 21, 25, 26 and 30.
Siemens Bros. Dynamo Works, Ltd.—Items 2, 19, 27 (*a*) to (*c*), 28 and 31 (*a*) to (*c*).

For Electric Insulating Materials, Schedule 15:—

L. Andrew & Co.—Items 9 and 11.
W. Geipel & Co.—Items 2 and 4.
J. N. Hardy & Son.—Items 12.
I.-R., G.-P. and Telegraph Works Co., Ltd.—Items 5 and 6.
J. G. Ingram & Son.—Items 3 and 10.
Micanite and Insulators, Ltd.—Items 1 and 8.
Siemens Bros. & Co., Ltd.—Items 7.

The Committee recommends the acceptance of the tender of the General Electric Co., Ltd., for the supply of insulated screw-eyes, schedule 14, item 10.

The Highways Committee reports the receipt of the under-mentioned tenders for the provision of control gear and recording apparatus for use in testing motors at the central car repair depôt:—

		£	s.
Edison & Swan United Elec. Light Co., Ltd.	(accepted)	£70	10
I.-R., G.-P. and Telegraph Works Co., Ltd.	.. .. ..	73	15
Nalder Bros. & Thompson, Ltd.	.. ..	77	15
British Westinghouse Elec. & Manfg. Co., Ltd.	.. .. ..	91	10
Johnson & Phillips, Ltd.	.. ..	106	0

The Highways Committee reports the receipt of the following tenders for the provision of steam, exhaust, condenser, feed, &c., piping, water-tanks, &c., at the Greenwich generating station:—

Brightside Foundry and Engineering Co., Ltd. .. .. (recommended)	£5,439
Staveley Coal and Iron Co., Ltd.	5,978
Edward Le Bas & Co.	6,290
Butterley & Co., Ltd.	6,684

The Committee recommends that the Brightside Foundry and Engineering Co., Ltd., be allowed to sub-let to Stewarts & Lloyds, Ltd., the steam and other high-pressure pipes; to Jas. Oakes & Co. the circulating pipes, and to Newton, Chambers & Co. the hotwells.

STEPNEY.—The Borough Council Electricity Supply Committee recommends that the tender of Messrs. J. Smart & Son, Poplar, E., be accepted for the supply of 50 tons of moulded pitch, at £2 7s. 9d. per ton, for the use of the Electricity Department.

Leeds.—The City Council has accepted the tender of Mr. W. J. Turnbull for the erection of a new tramcar depôt at Guiseley for £14,050, and the work is to be completed within six months.

Leigh.—The tender of Messrs. Babcock & Wilcox, Ltd., for a water-tube boiler, £2,800, has been recommended for acceptance by the Electricity Committee.

Luton.—The T.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., at £1,419, for extra-H.T. switchgear.

Manchester.—The Chloride Electrical Storage Co., Ltd., have secured an order from the Corporation for a battery of 264-B.N.W. cells, with a capacity of 2,760 ampere-hours at the 1-hour rate, or 5,520 ampere-hours at the 10-hour rate. The battery will be used in connection with a traction load.

Manchuria.—Messrs. A. W. Penrose & Co., Ltd., have received the contract to supply four large alternating-current electric goods lifts for the Manchurian Railway.

New Zealand.—GISBORNE.—The Electrical Committee has recommended the B.C. to accept the tender of Messrs. Ferranti, for meters, at £522.—*N.Z. Shipping and Commerce.*

Northampton.—The Tramways Committee has accepted the following tenders :—

Stark, Ltd.—Far Cotton extension scheme and doubling of a portion of Kingsthorpe track, £20,352.
Brush Electrical Engineering Co.—Bodies and trucks for seven cars.
Dick, Kerr & Co.—Electrical equipment for seven cars.

Penketh.—Messrs. Johnson & Phillips, Ltd., have received an order from the Penketh Tanning Co., Ltd., for a D.C. generator, balancer, switchboard, overhead and underground cables, &c., for supply of their tanning works at Penketh.

Southampton.—The T.C. has received the following tenders for supplies of tram rails :—

	100 tons of B.S.S. No. 4, at per ton.	20 tons of B.S.S. No. 4 C, at per ton.	Additional price per ton for Sandberg quality.
North-Eastern Steel Co., Ltd. (accepted)	£6 12 6	£6 12 6	5s. 0d.
Walter Scott, Ltd	7 0 0	7 0 0	5 0
Bolckow, Vaughan & Co., Ltd. ..	7 0 0	7 0 0	5 0
Lorain Steel Co., Ltd.	7 3 6	7 18 6	2 6

The following tenders have also been received for the supply of a steam turbo-alternator :—

Name.	Turbine.	Alternator.	Price.
Willans & Robinson, Ltd. ..	Willans	Vickers	£4,190
		Siemens Bros. ..	4,340
		Gen. Electric Co. ..	4,300
		Bruce Peebles ..	4,650
		Brown, Boveri ..	4.600
		Electric Construction Co.	5,355
Brush Electrical Engineering Co., Ltd.	—	—	4,021
C. A. Parsons & Co , Ltd.	Parsons	Parsons	4,297
Dick, Kerr & Co., Ltd.	—	—	4,982
James Howden & Co., Ltd. ..	—	Siemens	4,585
		Brown, Boveri ..	4,695
		Gen. Electric Co. ..	4,518
		Bruce Peebles ..	4 890
Richardsons, Westgarth & Co., Ltd.	—	Brown, Boveri ..	3.900
		Electric Construction Co.	4,650
British Westinghouse Electric and Manufacturing Co., Ltd.	--	—	3.858
Belliss & Morcom, Ltd.	Belliss	Vickers	3,928
		Bruce Peebles ..	4,414
		Siemens Bros. ..	4,069
		Gen. Electric Co. ..	4,067
		Electric Construction Co.	5,041
Fraser & Chalmers, Ltd.	—	Siemens, G.E.C. or Vickers	3,982
Escher, Wyss & Cie.	Zoelly	Siemens Bros. ..	3,893
		Brown, Boveri ..	4,132
British Thomson-Houston Co., Ltd.	—	—	4,084
H. W. Butler & Co. (London), Société Anonyme des Ateliere de Constructions Electriques du Nord et de l'est Jeumont (Nord)	Zoelly	A.C.E.N.E.	4,067

St. Albans.—For installing the electric light at the workhouse and infirmary, the B. of G. received the following tenders :—

C. C. Pudney & Co., Bury St. Edmunds .. (accepted)	£212
Brooks & White, London	221
Mr. P. T. King, Luton	254
Francis Reade & Co., Finchley	284
Pinching & Walton, Cannon Street, E.C.	255
Miskin & Rice, St. Albans	287
Electric Installation, Ltd., London	388
Electric Wiring and Accessories Co., St. Albans	399
Kent & Co., Sunderland	247
Lund Bros. & Co., London	249
Bustin's Electric Works, Barking	553
Giffen Bros., St. Albans	408

Willesden.—The Guardians have accepted the tender of the Electric Contracts Co., at £262, for the installation of intertelephonic communication at the workhouse. Several other tenders were received ranging from £224 to £369.

FORTHCOMING EVENTS.

Physical Society.—Friday, January 23rd. At 5 p.m. At the Imperial College of Science, South Kensington. Ordinary Meeting.

Junior Institution of Engineers.—Friday, January 23rd. At 8 p.m. At 39, Victoria Street. Paper on "Engineering Contracts and Concessions in South America," by Mr. T. Rich.

January 24th. Week-end visit to Birmingham, to meet the Midland Section Members.

Friday, January 30th. At 8 p.m. At 39, Victoria Street. Paper on "Practical Notes on Electric Cranes and other Handling Plants," by Mr. F. E. Chilton.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 23rd. At 6.30 p.m. At Armstrong College. Annual Dinner.

Friday, January 30th. At 7.30. At Bolbec Hall, Newcastle. General meeting.

Manchester Association of Engineers.—Saturday, January 24th. At Grand Hotel, Aytoun Street. Paper on "Power Production," by Mr. E. G. Hiller.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, January 24th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Specifying and Buying Electrical Mining Plant," by Mr. J. P. C. Kivlen.

Electrical Trade Union.—Monday, January 26th. At Memorial Hall. Meeting of members, delegates, &c.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, January 26th. At 7.30 p m. At Armstrong College of Science. And on Friday, January 30th. At 7 p.m. At Hugh Bell School, Middlesbrough. Paper on "Reactance and Reactance Coils in Power Circuits," by Mr. E. P. Hollis.

Institute of Marine Engineers. Monday, January 26th. At 8 p.m. Discussion on paper on "The Working Arrangements for the Combustion of Oil Fuel in Marine Boilers," by Mr. Gander.

Institution of Civil Engineers.—Tuesday, January 27th. At 8 p.m. At Gt. George Street, Westminster. Paper on "Superheating Steam in Locomotives," by Mr. H. Fowler.

Friday, January 30th.—At 8 p.m. Students' meeting.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, January 27th. At 7 30 p.m. At the University Physical Laboratory. Paper on "Electric Train-lighting Systems," by Mr. T. Ferguson.

London Electrical Masters' Association.—Tuesday, January 27th. At 8 p.m. At Caxton Hall, S.W. Meeting.

Institution of Mechanical Engineers.—Wednesday, January 28th. At 7.30 p m. At Philosophical Hall, Park Row, Leeds. And on Friday, January 30th. At 8 p.m. At Engineering Theatre of the University. "Thomas Hawksley" Lecture on "Water as a Mechanical Agent," by Mr. E. B. Ellington.

Institution of Electrical Engineers (Students' Section).—Wednesday, January 28th. At 7 45 p m. At Victoria Embankment. Paper on "Recent Advances in Portable Wireless Telegraph Apparatus, with Demonstrations," by Mr. P. R. Coursey.

Institution of Electrical Engineers (Birmingham Local Section).—Wednesday, January 28th. At 7.30 p m. At the University, Edmund Street. Paper on "Electric Train-lighting Systems," by Mr. T. Ferguson.

Nottingham Society of Engineers.—Wednesday, January 28th. At Welbeck Hotel, Milton Street. Paper on "Microscopical Examination of Metals," by Mr. J. T. Goodwin.

Association of Electrical (Station) Engineers.—Wednesday, January 28th. At 7 p m. At Stone's Restaurant, Ludgate Hill, E.C. First annual smoking concert.

Concrete Institute.—Thursday, January 29th. At 7.30 p.m. At Denison House, 296, Vauxhall Bridge Road, S.W. Discussion.

THE ELECTRICAL ENGINEERS

(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, January 26th.—"A" Company. Technical instruction, 7 to 10 p.m.
Tuesday, January 27th.—"B" Company. Technical instruction, 7 to 10 p.m.
Wednesday, January 28th.—Recruits only. Infantry drill and technical instruction, 7 to 10 p.m.
Thursday, January 29th.—"C" Company. Technical instruction, 7 to 10 p.m.
Friday, January 30th.—"D" Company. Special class on Crossley engine, 7 to 8 p.m. Technical instruction, 7.30 to 9.30 p.m.
Saturday, January 31st.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

The Strike at Holborn.—The strike of electrical and other workmen engaged upon the Pearl Assurance Building, in Holborn, which was ended last week on a supposed undertaking by the main contractor that in future no non-Union electrical workman should be employed on the work, broke out again on Wednesday this week, objection being taken to a non-Union workman and his assistant employed by Messrs. Duncan Watson and Co., the sub-contractors. We understand that no such assurance as is referred to above was given, and that the electrical work is completed, save for a few finishing touches upon which the workman objected to was employed on Wednesday.

British Thomson-Houston Testing Department.—The fourth annual dinner and smoking concert of past and present members of the above will take place in Rugby on February 14th. The chair will be taken by Mr. J. M. Ralph. All past members wishing to attend, and who have not been notified already through the post, are asked to communicate with Mr. H. Silvester, care of B.T.H. Co., Ltd., Rugby, at once, for further particulars.

LEGAL.

Day *v.* Willard and Others.

Ruthenberg Electric Furnace.

In the King's Bench Division, on Thursday, January 15th, and the ensuing Friday, Saturday and Monday, Mr. Justice Pickford, sitting without a jury, heard an action brought by Wm. Thomas Day, of Caxton Cottage, Shepherd's Bush, against Mr. Chas. Danne Willard, of Cromwell House, Surrey Street, Strand, Mr. Fredk Henry Haviland, of Bournemouth, and Mr. Otto Stalmann, of Tavistock Square, Bloomsbury, claiming certain declarations of title to a share of profits derived by the defendants by the sale and exploitation of an invention called the Ruthenberg electric furnace. The defendants denied liability to the plaintiff.

For the plaintiff Mr. Patrick Hastings and Mr. Wallington appeared, and defendants were represented by Mr. Schiller, K.C., and Mr. Whateley.

Mr. Hastings, in opening Mr. Day's case, explained that the plaintiff, in his claim, set forth that in January, 1911, Mr. Marcus Ruthenberg was the owner of a patent process for electric smelting, and the defendant, Otto Stalmann, was the agent of Mr. Ruthenberg, for the purpose of selling or otherwise exploiting the patent. In January, 1911, the defendant Stalmann, on behalf of Mr. Ruthenberg, introduced the patent to the plaintiff for the purpose of plaintiff forming a limited company to work the patent, and in July, 1911, it was verbally agreed between plaintiff and the defendants that they should all become partners and work together for the forming of the proposed company, and that all profits to be derived by the defendants from the formation or from Ruthenberg, or in respect of work incidental to the forming of the company, should be divided equally between the plaintiff and the defendants. By a letter dated August 24th, 1911, Ruthenberg agreed with the plaintiff that in consideration of the services to be rendered by him in connection with the company, he (Ruthenberg) would permit plaintiff to receive, or would allot to him, all the deferred shares of the company, and plaintiff said he held that letter as trustee for himself and the defendants. The plaintiff and defendants formed a company under the name of the North-Eastern Electric Smelting Co., Ltd., about Nov. 29th, 1911. Plaintiff said that defendants received from Mr. Ruthenberg all the deferred shares of the company, and defendants had failed to pay to plaintiff his proportion of the shares. Plaintiff said he had rendered to defendants all the assistance in his power in forming the proposed company, and he had done all that was necessary to enable him to claim the benefit of the verbal agreement, and he said that in October, 1911, his rights under that agreement were wrongfully terminated by Ruthenberg through the defendants, and that the benefits were transferred to the defendants.

The plaintiff further said that if there was any delay in the formation of the company it was caused by the fault of Mr. Ruthenberg, and he said that in breach of the agreement, Mr. Ruthenberg failed to procure a grant from the Newcastle-on-Tyne Electric Supply Co., Ltd., to the proposed new company and a lease of certain premises, and also concealed from the plaintiff material information as to the terms upon which electric current could be supplied. In the alternative, plaintiff said he introduced Mr. Stalmann and the patent to Willard and Haviland for the purpose of the formation of the company upon the implied terms that defendants should pay him a quarter share of the profits to be derived by the defendants for such introduction and for the aid rendered by him in the formation of the company. The defendants had wrongfully refused to give him such remuneration.

Mr. Hastings remarked that his Lordship would see that the plaintiff put his case in various ways, but in substance he claimed that he was entitled to a fourth share of the profits that the defendants had made in exploiting the Ruthenberg patent process, and the claim was based on an agreement made between them all that they would share the profits obtained by the exploitation of the patent which was introduced by Day through the defendant Stalmann to the other two defendants. Mr. Willard and Mr. Haviland were to finance the enterprise of forming the company. Mr. Stalmann was the representative of the patentee, so that Mr. Day stood between the patentee on one side and the financiers on the other. Mr. Day's case was that the defendants went behind his back and got from the patentee similar documents that he held, and which excluded him (plaintiff) from his agreed share in the profits. Mr. Willard was a financier, and was interested in certain mining properties in Wales and Cornwall, and the original idea was to use the furnace in connection with these mines, and it was agreed that plaintiff and the three defendants should equally share the profits. Ultimately the scheme was altered, and there were negotiations with a Mr. Esselmont, who was connected with the Newcastle Electric Supply Co., the idea being to use the furnace there. Matters proceeded, and the company was in due course formed, largely through the efforts of the plaintiff, but plaintiff now said that the defendants eventually combined together to get rid of him. They made various complaints against him, and then went to the patentee and got the document that it was alleged excluded the plaintiff from the benefits that it was agreed he should have.

Mr. Hastings argued that it was clearly established upon the correspondence that the plaintiff and the three defendants were co-adventurers in this matter, and they agreed definitely to share all the profits. Other questions that might arise as to whether the company that was in fact formed, was the one that it was originally intended to form at an earlier date, were really immaterial.

Mr. Day gave evidence in support of his case, and emphatically stated that it was agreed that he and the three defendants should share the profits that resulted from the enterprise. The original idea was that the invention should be used in connection with various mining properties in Wales and Cornwall, but this was not carried out because of the expense that would be involved in the erecting of power stations. When attention was directed to the Newcastle-on-Tyne scheme, Mr. Willard introduced Mr Haviland, whom witness understood was a solicitor and a director of one of Mr. Willard's companies. Witness stated that it was first proposed that the capital of the new company should be £100,000, but this money could not be raised, and the figure was very substantially reduced. Witness denied that he ever undertook to arrange for the capital for the new company, and asserted that this was entirely the province of Mr. Willard.

Cross-examined by Mr. Schiller, K.C., Plaintiff said that the proposed capital of £100.000 was reduced to £75,000, and subsequently to about £35,000. The great expense that would be involved in erecting power stations in Wales and Cornwall was a factor in the abandonment of the West Country scheme.

Mr. Schiller: You are suggesting here that these three gentlemen are trying deliberately to defraud you out of your profits?—Well, that is a nasty way of putting it.

But that is your case?—Yes, I suppose it is.

Plaintiff further stated that he believed Mr. Stalmann was a professional gentleman, an engineer occupying a very high position, and he admitted that of Mr. Stalmann he had written that he was "incapable of telling a lie." Witness also said that Mr. Willard was introduced to him as a person of high repute.

Questioned as to the work of finding capital for the new company, plaintiff strenuously denied that he ever acknowledged that he had undertaken this.

At the close of the plaintiff's cross-examination, Mr. Schiller submitted that there was no case, but

Mr. Justice Pickford said he would not stop the case at that juncture, but would hear the evidence for the defence.

Mr. Schiller then addressed his Lordship, and said that the defendants' case in substance was that the story told by Mr. Day was untrue. Counsel said that Mr. Willard was a gentleman who was largely interested in certain mines which were worked privately, and he and Mr. Haviland had had considerable experience in dealing with business of this kind. The facts of the case were that Mr. Day had been tinkering with this Cornish scheme, because Mr. Ruthenberg, who had parted with all his patents except for Cornwall, had a mine there which he was anxious to develop, his idea being to work the mine and put up his own furnace there, but the scheme came to nothing, because the expense would be too great, involving the building of a power station, and the large sum of £100,000 was wanted. The plaintiff had unsuccessfully tried to get the money, and he got out another scheme, which was hardly more successful than the other. When he came into contact with Mr. Willard, he talked a good deal about the financial interests with which he was connected, and he told Mr. Willard that he could find the money that was needed to exploit the patent, but he wanted somebody who could put his scheme into order and see it through. He had no office, and he wanted this accommodation and the help of experienced gentlemen who could put his rough scheme into proper shape. He said he could get help from his financial friends, and he left his scheme at Mr. Willard's office. Both Mr. Willard and Mr. Haviland assisted him, and the real trouble arose because the plaintiff failed to find the money in the way that he had suggested he could. As time went on, Mr. Ruthenberg got very annoyed because the promises made were not being carried out, and a squabble arose over the fact that Mr. Ruthenberg had omitted to mention certain matters as to the contract with the representative of the company at Newcastle, who were to have a supply of power and let certain premises. This occasioned some delay and considerable trouble, and Mr. Day had admitted that eventually matters came to a time of crisis. The option was expiring, and everybody concerned met at Cromwell House, and on this occasion Mr. Willard asked plaintiff direct how he was getting on with the finance. The position of Messrs. Haviland and Willard was that unless there was an extension of the option by Mr. Ruthenberg, all their labour would have been in vain, as if Mr. Ruthenberg was so minded he could have said to them: "The option is terminated—you have spent your time and money on a good thing which I shall leave in your hands no longer." Mr. Day at that interview admitted that he had done nothing. Mr. Ruthenberg said he would not allow Mr. Day to have anything further to do with the scheme, and would not renew the option to him. Counsel went on to say that in reply to the suggestion that he had not carried out his obligation in the matter of finding capital for the company, Mr. Day put forward two circumstances: (1) That he had been hampered by illness; and (2) that it was the fault of Mr. Ruthenberg, because delay had been occasioned by the fact that he had concealed two important conditions in the contract that should have been given in the prospectus particulars. Mr. Schiller said his Lordship would hear from Mr. Stalmann and the others that at the meeting referred to plaintiff admitted that it was his business to find the money, and that he had failed to do so, and he then put forward the two reasons already referred to. It would be positively denied by Mr. Willard and Mr. Haviland that it was ever suggested there should be a partnership upon the basis of which a claim of this description could be maintained. This electric furnace was a very good invention, largely in use. Mr. Ruthenberg was in the position of having a good asset to sell, and as he did not want his name to appear as vendor, he put it in the hands of Mr. Day to sell, himself getting a certain price, Mr. Stalmann getting something, and Mr. Day his own share. The matter was carried out eventually in the way best suited for the parties concerned, Mr. Day figuring as vendor, having all the shares, and distributing them to those who were entitled to receive them for their services. It was an ordinary simple commercial transaction. Mr. Schiller said that if there was no partnership, as was alleged, there was an end of the case. If there was any complaint in regard to the Newcastle contract and scheme, it could not possibly affect the three defendants; that was entirely a matter between the defendants and Mr. Ruthenberg.

Mr. Schiller first called the defendant Mr. Stalmann, who said he was a mining engineer, and the manager of the North-Eastern Electric Smelting Co., Ltd., and he had been interested in such furnaces for a great number of years. He was acquainted with Mr. Ruthenberg, and early in 1911 he was introduced to plaintiff, who conversed with him generally about the Ruthenberg furnace and the finding of money for the exploitation of the invention. Plaintiff said he had a number of influential friends who could advance money that might be required for a scheme, and at that time the Cornish scheme was considerably debated. The first suggestion was that the capital of the company should be £100,000, and this was subsequently modified to £60,000, and then £35,000, but this scheme eventually fell through. Subsequently the Newcastle scheme came under discussion, and in connection with that it was proposed to form a company, the money to be got together by the plaintiff, but he failed to do this. There was no arrangement made of any kind by which the plaintiff and he should share profits with the two defendants as suggested.

In cross-examination, Mr. Stalmann said he understood Mr. Day only had the responsibility of finding the capital. Mr. Ruthenberg gave as a reason for refusing to renew the option he had granted to the plaintiff, the fact that he had promised to find the capital and had failed to do so.

Further cross-examined, Mr. Stalmann said that other reasons were given by Mr. Ruthenberg for his action, but he (Mr. Ruthenberg) did not appear to trust the plaintiff generally.

The defendant Mr. Haviland, also gave evidence, stating that he was a solicitor not in general practice. When the Newcastle scheme came before his notice he understood that he and Mr. Willard were asked to look thoroughly into its details and provide an office. Witness went into the various agreements and other technical matters, and considerably revised and altered the scheme. Witness gave detailed evidence of the various financial arrangements that were made, and said that eventually Mr. Day acknowledged his failure to collect the capital, and pleaded that he had been hampered by illness and by certain delay that had occurred because of Mr. Ruthenberg's omission to state certain facts concerning the Newcastle contract. Mr. Ruthenberg was angry with the plaintiff, and he ultimately gave the option to Mr. Stalmann.

The defendant Mr. Willard, deposed that he was a director of mining companies, and he met plaintiff in 1911, when Mr. Day came to his office with reference to the Cornish scheme. Witness told him that if it was a question of financing a scheme he could not attend to it, being busily engaged with other matters, but Mr. Day said he was prepared to find the capital; it was a question of having an office and getting somebody who would put the scheme into proper shape. Mr. Willard denied that in connection with the Cornish scheme he was to find capital, and he said that no arrangement was come to with the plaintiff as to the sharing of possible profits. Witness corroborated the previous evidence as to the interview at which Mr. Day said he had been unable to get the capital, and at which Mr. Ruthenberg said he would not renew the option to him.

Mr. Marcus Ruthenberg, the inventor of the Ruthenberg electric furnace, gave evidence that he was a mining engineer and was the inventor of an electrical smelting furnace and process in respect of which he had granted an exclusive licence to an English company, except as applied to the county of Cornwall. In 1910 he was the owner of a mine near Falmouth, and he was anxious to develop the property in relation to his patent electrical furnace. The plaintiff was introduced to him as a person who could control large capital, and for some time the Cornish scheme was under consideration, but it was eventually dropped on account of expense. Subsequently witness suggested the Newcastle project, as there were good premises vacant there that were suitable for the purpose of the patent, and there were considerable negotiations with Mr. Esselmont, of the Newcastle Electric Supply Co., Ltd. He had given an option to the plaintiff, because he did not desire to appear as vendor, and eventually the time of the option expired before Mr. Day had got the capital together, as promised. At the meeting held at Cromwell House, he expressed extreme dissatisfaction with Mr. Day. It was totally untrue to say that the defendants persuaded him to refuse to renew the option to the plaintiff. The fact was that the defendant, Mr. Stalmann, pressed him to renew it to Mr. Day, but he declined to do so.

This completed the evidence in the case, and counsel proceeded to address his Lordship upon the legal aspects of the evidence.

Mr. Justice Pickford eventually reserved judgment.

Tramcar Accident Claims.

At the Wakefield County Court, before his Honour Judge Greenhow, an action was brought by Arthur Clapham Milner, coal agent, of Wakefield, against the Yorks. (West Riding) Electric Tramway Co., in respect of personal injuries sustained in a collision with one of the defendant company's cars. He claimed £100 damages.

According to the evidence submitted by Mr. Felix Palmer, who appeared for the plaintiff, it appeared that on April 5th, 1913, Milner was driving his coal cart along Westgate Common, when, owing to negligent driving by the defendant company's motorman, a tramcar ran into it from the rear, throwing the plaintiff out. He sustained serious injury from the fall.

Mr. Greene contended, on behalf of the company, that there was no negligence, as the driver of the car had been slowly passing a motor-wagon, and whilst doing so was repeatedly ringing his bell. As soon as he got clear of this vehicle the plaintiff's cart turned on to the tramlines, and, though the driver of the tramcar pulled up at once, a projecting sack of coal was caught and the accident was caused. Had the cart kept off the lines no accident would have happened.

His Honour gave judgment for the plaintiff for £60.

In the Nisi Prius Court, Dublin, judgment was given for the defendants, with costs, in an action in which Mrs. Catherine Carton, 9, King's Inns Street, sued the Dublin United Tramways Co. to recover damages in respect of the death of her husband, James Carton, in July last. The jury found that the motorman of the tramcar was not guilty of negligence, but that the deceased had shown want of care in avoiding the tramcar, which was travelling at a slow rate.

Intimation was made in the Court of Session of the settlement of an action for £500 damages for the death of a child, against the Musselburgh and District Electric Light and Traction Co., Ltd., the sum of £60 and expenses having been paid.

NOTES.

Science Masters' Exhibition.—A small but interesting exhibition of scientific apparatus (particularly educational) was held under the auspices of the Association of Public School Science Masters, at the Imperial College of Science and Technology (South Kensington), on January 13th and 14th. Among the exhibits of electrical interest were many which have already been noticed in these columns in connection with the recent Physical Society Exhibition. In addition, however, Messrs. Siemens showed a good range of standard instruments (including their portable sub-standard potentiometer), and a very serviceable instrument stand for lecture table and demonstration work. Any instrument to be used in a vertical position is mounted on a baseboard of standard size, and, as required, the latter is slid into grooves in the vertical member of a wooden stand of inverted-T section.

Messrs. W. G. Pye & Co. exhibited, for the first time, their new multi-range potentiometer, in which is embodied a ratio box, so that the total range of measurement is from 1 micro-volt to 440 volts. The total resistance of the ratio coils is 20,000 ohms, and the arrangement of the whole is such as to prevent heating of the potentiometer coils due to the high voltage applied to the ratio coils. The general arrangement of the instrument is similar to that of the well-known "Granta" potentiometer, but sliding stops have been added on the jockey-bar, so that accidental displacement of the jockey becomes impossible, and readings can be repeated with certainty. Movement of the jockey to obtain balance against the standard cell before and after a reading is obviated by tapping off a portion of the slide wire for this purpose. Balance against the cadmium cell is obtained by turning the circuit switch to "Std. Cell" and depressing a special key. The slide wire is extended to give 0·101 volt drop, thus avoiding repeated changes from one switch connection to the next when working around an exact tenth of a volt (or its multiples). An accuracy of 1 in 5,000 is guaranteed. The same firm exhibited well-made cheap forms of reversing switch, school potentiometers, indicating and reflecting galvanometers, and a very useful type of coarse and fine adjustment wire rheostat.

Messrs. Brown & Son exhibited new types of electric muffle and tube furnaces employing nichrome heating elements, set in alundum cement and packed in eternite and magnesia. The muffles themselves are of pure fused silica. Temperatures up to 1,100° C. are obtainable, the current consumption being 2 amperes at 200 volts for a D-muffle 3½ in. high, 4½ in. wide and 6½ in. deep.

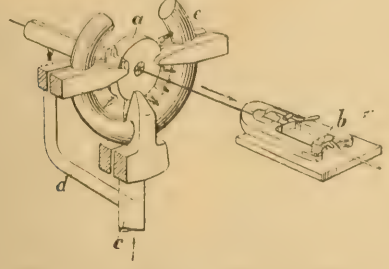
The numerous exhibits by Mr. R. W. Paul included a new electric calorimeter for the determination of Joule's equivalent and resistance temperature coefficients; sub-divided paper condensers with rotating knob key switches, obviating the use of loose plugs; and improved forms of tangent galvanometers, and, as an adjunct or for independent use, magnetometers with very effective air damping. There were also shown a unipivot lecture-room outfit with transparent scale instrument and projector, a useful slide wire and bridge attachment and the McEwen magnetic balance.

Tramcar Controllers.—It is announced in the January issue of the *Journal* of the Tramways and Light Railways Association that as a result of a letter received by the Association from the Board of Trade, a special Committee (consisting of Mr. A. L. C. Fell (chairman), Mr. C. W. G. Little and Mr. A. H. Pott) has been formed to go into this matter,

The Manufacture of Metal-Filament Lamps.—In the *Génie Civil* an abstract is given of a paper by M. Ruff in the *Journal* of the German Society of Engineers, describing the process of manufacture of tungsten filaments.

The metallic tungsten is obtained, as a rule, in the form of a fine powder; not easy to agglomerate, and even when the agglomeration has been effected, the metal thus obtained is not ductile enough to allow of drawing. The metallic powder, therefore, is first heavily compressed in a steel mould, from which a very fragile bar results; the bar is heated carefully in a tubular furnace, the temperature being gradually raised to red heat, and then to a higher degree than that employed in the chemical preparation of the tungsten powder, in a current of hydrogen. The bars are afterwards subjected to "vitrification" at a temperature of 2,850° C. in an electric furnace, on leaving which they are grey in colour, and of a coarse crystalline structure. During this process the metal contracts about 14 per cent.

The bar is then sufficiently strong to be drawn down by hammering or rolling, an operation which is usually effected by means of a special machine which strikes very rapid blows, at a temperature of about 1,300° C. When the diameter of the bar has thus been reduced to about 0·75 mm., the metal is sufficiently ductile to be drawn cold; but preference is given to heated dies, such as that illustrated above. The diamond die *a* is fixed at the centre of a support carrying a heating tube *e*, fed with gas from the pipe *c*, convergent gas jets impinging upon the die-holder. The wire is gripped in a tongs *b*, and before reaching the die passes through a straight tube heater fed with gas from the branch pipe *d*. By progressive drawings the wire is thus reduced to a diameter of 0·025 mm., being passed successively through 100 dies, hot at first and cold in the later stages.



Hot Die for Drawing Tungsten Wire.

The finished wire is said to have a tensile strength of 420—460 kg. per mm.^{2} (266—292 tons per sq. in.). The last process before mounting the wire in a lamp is to reheat it in a current of hydrogen, to remove the thin layer of oxide with which its surface is tarnished.

Annual Dinners and Socials.—The seventh annual dinner of the Doncaster tramways and electricity staff and employés was held at the Guildhall, on Tuesday, January 13th, Mr. E. S. Rayner, general manager, presiding. The Mayor and the Lady Mayoress, as well as a number of Councillors and the borough surveyor, were among the guests. After dinner a most enjoyable programme was gone through, which included songs by Mrs. Rayner, a monologue by Mr. Rayner, duets and solos by members of the staff, and songs rendered by Mr. F. B. Suthery (of the General Electric Co.), all of which were very much appreciated. After the concert a small play was performed by some members of the staff entitled "Area Belle." The remainder of the evening was occupied in dancing.

Fatalities.—A young electrician, named Louis J. O'Rourke, met with his death in the motor garage works of Messrs. Wayte Bros., Lemon Street, Dublin, on Thursday last week. The deceased, who was in the employment of the General Electric Co., Trinity Street, Dublin, had been at work endeavouring to remedy a defect in the electrical apparatus of the lift, when something broke, and O'Rourke received such terrible injuries that he expired almost immediately.

Charles Walker, aged 23, of Kimberley, was killed at Digby Colliery on 16th inst. He was engaged as a coal tipper, and came in contact with a live lighting wire above his head. Death was instantaneous.

Educational Notes.—At the Technical College of Trondhjem, a special laboratory is to be established for carrying out experiments in connection with the utilisation of water power for the production of electrical energy. This laboratory will cost more than £21,000. The necessary electrical energy will be supplied by the town of Trondhjem in the form of three-phase current at 6,300 volts.

At the Akbar Nautical School, Heswall, a complete Marconi installation has been put in, and the scholars are being trained to use both the field and long-distance apparatus.

Accident.—A trimmer named Hills was seriously injured at the Southend Electricity Works last Sunday week owing to his clothing being caught in some pumping machinery.

Institution and Lecture Notes.—Association of Electrical Station Engineers.—A meeting was held at Birmingham on January 13th, at which resolutions were passed in support of the Weekly Rest-Day Bill, and vigorous protest was made by the meeting against the inclusion in Electric Supply Bills of a strike penalty clause. The branch has made excellent progress, having increased its membership by over 50 during the last month. A smoking concert has been arranged for February 3rd.

The Bradford Section recently held a meeting at Huddersfield in accordance with a resolution of the Committee to hold meetings in all the important towns in Yorkshire. The objects of the A.E.S.E. were explained, and an appeal made for new members by Mr. R. D. Spurr. Huddersfield is one of the few places where station engineers enjoy a six-day week of employment. On January 15th a meeting of the London Section was held at Stone's Restaurant, Ludgate Hill, E.C. The Weekly Rest-Day Bill was discussed, and resolutions were passed in support of it. Nominations were received for the election of the London District Committee, which in the past 12 months has been the Organising Committee for the whole of the country, but will now deal with London district business only, an Executive Committee having already been elected to represent the whole of the country. Arrangements have been made to hold monthly meetings as above, on the second Tuesday in every month. A smoking concert has been arranged at the same address, on January 28th.

Society of Engineers.—On Monday, February 2nd, at the Institution of Electrical Engineers, Mr. Arthur Valon, M.Inst.C.E. (President, 1913), will present the premiums awarded for papers published in the *Journal* during 1913. Mr. H. C. H. Shenton, the President for 1914, will then deliver his Presidential Address.

Royal Society of Arts.—Two lectures on "Electrical Vibrations and Wireless Telegraphy" have been given by Mr. R. P. Howgrave-Graham, in the course of which many interesting phenomena and uncommon experiments were demonstrated.

Junior Institution of Engineers.—On Monday Mr. H. H. Thorne read a paper on "Modern Gearing," dealing especially with worm and double helical gearing.

Institution of Electrical Engineers.—The subject of the Kelvin lecture delivered last night by Sir Oliver Lodge, D.Sc., F.R.S., was "The Electrification of the Atmosphere."

Institution of Post Office Electrical Engineers.—On Tuesday Mr. Trotter read his paper on "Overhead Wire Construction for Medium and Low Pressures," printed in full elsewhere in this issue, and an interesting discussion followed, in which many supply station engineers took part. A report of the discussion will appear in a later issue.

British Electrical and Allied Manufacturers' Association.—On Wednesday the annual dinner of the Association took place at the Savoy Hotel. There was a large attendance, and the proceedings were animated and enthusiastic. The President, Lord Ampthill, occupied the chair, and was supported by Lord George Hamilton, Mr. F. E. Smith, Mr. A. Bruce Anderson (chairman of Council), Mr. W. Duddell, and other leaders in the worlds of industry and politics. The principal features of the speeches were the importance of placing British contracts with British works, and the equipment of the electrical laboratories of Hong Kong University by members of the Association. The report will appear in our next issue.

Appointments Vacant.—Works superintendent, for Southampton Corporation Tramways (£150); assistant electrical engineer for Singapore Electric Tramways, Ltd. ($300 per month); assistant representative for the Publicity Department of Sheffield Corporation (£91). Particulars are given in our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Swindon T.C. has appointed Mr. F. Newey, of Rawtenstall (Lancs.), as electrical engineer on the staff of the electricity and tramways department.

Mr. H. W. Everett, electrical engineer to the Clacton-on-Sea U.D.C., has met with an accident. Whilst he was starting an engine there was a back fire, with the result that his left arm was broken.

Mr. F. L. Pedley, test engineer at the Bradford Corporation electricity works, has taken up the position of electrical engineer to Bingley U.D.C. There were 117 applicants.

Mr. J. M'Entee, Belfast, has been appointed assistant electrical engineer to the Urban Council of Dundalk.

The Poplar Borough Council is making the following increases in the salaries of its employés in the electricity department:—F. Tait, assistant manager, £250 to £262 10s.; V. H. Cruickshank, station engineer, £225 to £237 10s.; E. R. Ingram, mains engineer, £225 to £237 10s.; E. E. Farrance, sales manager, £212 10s. to £225; C. A. O'Neal, assistant sales manager, £162 10s. to £175;

A. H Jacks, meter superintendent, £140 to £150 ; F. W. Crompton, draughtsman, £140 to £150 ; H Thistlethwaite, charge engineer, £181 10s. to £185 ; P. C. G. Westlake, do., £162 10s. to £175 ; W. E. Plowman, do., £162 10s. to £175 ; J. Forsyth, do., £150 to £162 10s.

Mr. C. P. Smith, junior charge engineer and switchboard attendant at the Bermondsey electricity works, has resigned his appointment. Mr. W. B. Smith, switchboard attendant, is to be promoted to fill the vacancy at a salary of £98 16s. per annum, rising by two annual increments to £115.

Mr Nichols Moore, the borough electrical engineer of Newport (Mon.) has recommended that station superintendents and senior and junior engineers-in-charge be transferred from the wages sheet to the salaries list. He also recommended considerable increases in salary in nearly every case. The recommendations for transfer were approved, but the recommendations for increases in salary were referred back, together with all other recommendations for increases in salary in the various departments of the Corporation, for further consideration. The Council has also placed on record its appreciation of the services of the chief engineer and staff in connection with the recent extensions, and granted a substantial honorarium to the chief engineer, and deputy engineer, together with a bonus to certain other members of the staff and workmen.

Tramway Officials.—The general staff of the Torquay Tramway Co. has presented a smoker's outfit, in crocodile case, to Mr. H. Holliday, engineer and manager, in appreciation of his kindness and to commemorate the record year of 1913.

Mr. Harry C. McKay, draughtsman of the Aberdeen Corporation Tramways, who has received an appointment under the Preston Corporation Tramways, was presented by the office staff and others with a set of water colours. Mr. Forbes, traffic superintendent, made the presentation, in the absence of Mr Pilcher, manager.

Mr. Thos. G. Marsh, of the staff of the Chatham and District Light Railway Co., who has been appointed chief inspector of the Maidstone and District Motor Services, has been presented by his colleagues with an umbrella and leather pocket case.

The Ilford U.D.C. has appointed Mr. J. C. Richards, of Erith, as chief inspector of tramways. There were 51 applicants for the post.

The Birkenhead T.C. has appointed Mr. Cyril Clarke, who has been acting tramways manager from June to December last, as manager.

The London C.C. on Tuesday appointed Mr. G. W. Knight, as superintendent of the central car repair depôt in the tramway department, at a salary of £300 per annum. Mr. Knight has been temporarily engaged as superintendent since June, 1913.

General.—Mr. G. T. Baxter has taken over the electrical engineering business of Messrs. G. T. Mayfield & Co., of Pier Avenue, Clacton-on-Sea. Mr. Baxter has been with the firm for 27 years, and for the past eight years has managed the local branch.

Mr. E. N. Freer Grant has severed his connection with the firm of Messrs. Grant & Blake, Ltd., Clapham Junction, and has secured an appointment with the Battersea Borough Council in its electricity department.

Mr. Walter H. Tittensor, general manager of the West India Electric Co., Ltd., has recently lost his young son by death under tragic circumstances. The boy, Lindsay, aged 9, attended a costume party at Kingston, Jamaica, and his costume caught fire. He received injuries which caused his death. Mr. Tittensor was formerly Corporation electrical engineer at Dundee.

Mr. F. W. Carter, of the British Thomson-Houston Co.'s railway staff at Rugby, who recently paid a visit to the United States, has been appointed corresponding member on the American I.E.E. Railway Committee, and on the Railway Standardising Sub-Committee ; he is, we believe, the only person outside the United States on either of these bodies.

A 1914 Detroit electric vehicle was presented to Mr. Edison as a Christmas gift by Mr. Henry Ford, president of the Ford Motor Co., of Detroit, Michigan. It is the Model 47 built by the Anderson Electric Car Co., of Detroit, Mich., is mounted on the worm-gear chassis, and contains every luxury and modern improvement.

Mr. John S. Leese is resigning the position of publicity engineer to the British Westinghouse Electrical and Manufacturing Co., Ltd., and at the end of February will join the Osborne-Peacock Co., Ltd., advertisers' agents, Manchester.

Obituary.—Mr. J. A. Pendlington.—The death has occurred, at Newcastle-on-Tyne, of Mr. John Atkinson Pendlington, a well-known engineer. He was born at South Shields in 1861, but spent many of his early years in the United States. When he returned to this country he took service under the Harton Coal Co., Ltd., South Shields, whom he served until 1893, when he was appointed secretary to the Electrical Coal-Cutting Contract Corporation, Ltd., under the chairmanship of Sir Lindsay Wood, Bart. Later he acted as assistant manager to the late Mr. W. T. Goolden, of the firm of Messrs. Easton, Anderson & Goolden, Ltd., engineers of London and Erith. In 1900 he was appointed secretary to the Typewriting Telegraph Corporation, Ltd., of London, and later he founded the Tyneside Supply Co., Newcastle-on-Tyne, which subsequently became the British Electrical and Manufacturing Co., of Newcastle and London.

NEW COMPANIES REGISTERED.

Parmiter, Hope & Sugden, Ltd. (133,406).—This company was registered on January 16th, with a capital of £15,000 in £1 shares (11,500 pref.), to take over the business of electrical engineers carried on by V. Hope and V. H. Sugden, as Parmiter, Hope & Sugden, at Hulme Electrical Works, Ellesmere Street, Hulme, Manchester. The subscribers (with one share each) are :—V. Hope, Glen Cottage, Macclesfield, electrical engineer ; V. H. Sugden, 68, Talbot Road, Old Trafford, Stretford, electrical engineer ; W. N. Sugden, Donnybrook, Wilmslow, Cheshire, secretary. Private company. The number of directors is not to be less than two or more than five ; the first are V. Hope, V. H. Sugden, and W. N. Sugden. V. Hope and V. H. Sugden are managing directors, and may retain office while holding 500 ordinary shares ; qualification of ordinary directors, 400 shares ; remuneration as fixed by the company. Secretary, W. N. Sugden. Registered office, Hulme Electrical Works, Ellesmere Street, Hulme, Manchester.

Bishop's Castle Electric Light and Power Co., Ltd.—Prospectus only of proposed company, filed January 15th. Capital, £2,500 in £1 shares. Proposed directors :—G. W. Summers, Penn Fields, Wolverhampton ; F. H. Hinde, Oaks Crescent, Wolverhampton ; H. Donaldson, Cannock ; F. S. Turner, Woodlands, Dudley ; H. O. H. Wenman, Wolverhampton (will join the board after completion of the works). Secretary, G. Tomlinson. Registered office, 79, Lichfield Street, Wolverhampton.

Electromechan Co., Ltd. (133,418). — This company was registered on January 17th, with a capital of £500, in £1 shares, to take over the business carried on by W. W. Lower and H. F. Eddrup at 25, Red Lion Street, Holborn, E.C., and to carry on the business of electrical and mechanical engineers, &c. The subscribers (with one share each) are :—W. W. Lower, 86, Huntley Street, St. Pancras, N.W., electrical and mechanical engineer ; H. F. Eddrup, 98, Mildmay Road, Romford, Essex, mechanic. Private company. The number of directors is not to be less than two or more than five ; the first are W. W. Lower and H. F. Eddrup ; qualification, 250 shares. Registered office, 25, Red Lion Street, Holborn, E.C.

Irish Towns Electric Light and Power Co., Ltd. (4,087). —This company was registered in Dublin on January 16th, with a capital of £5,000 in £1 shares (2,000 pref.), to carry on the business indicated by the title. The subscribers (with one share each) are :—J. G. Moore, Drumbed, Cregagh, Co. Down, electrical engineer ; M. Curran, 2, Kent Street, Belfast, electrical engineer. Private company. The first directors are M. Curran, J. Moore, J. A. Shannon, S. Finney and W. Garmany. Registered office, 1, Wellington Place, Belfast.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Guildford Electricity Supply Co., Ltd.—Issue on January 8th, 1914, of £5,000 debs., part of a series of which particulars have already been filed.

Walton & Clough, Ltd.—A memorandum of satisfaction in full on November 19th, of mortgages dated November 4th and 14th, 1913, securing £472 each.

R. Herbert & Co., Ltd.—Two debs. dated January 2nd, 1914, to secure £100 each, charged on the company's undertaking and property, present and future, including uncalled and unpaid capital. Holders : R. N. Herbert, 35, St. Martin's Road, Stockwell, S.W., and J. Hall, 78, Devonshire Road, Palmer's Green, N.

CITY NOTES.

Llandudno and Colwyn Bay Electric Railway, Ltd.

The directors' report for the year to November 30th, 1913, states that the profit, after providing for operating and administration expenses and interest on debenture stock, amounts to £7,764, plus £1,258 brought forward, making a total available balance of £9,021. Of this there has been applied in redemption of debenture stock in January, 1913—£1,347, in providing for sinking fund instalment, due January, 1914, £1,403, in writing off balance of discount and expenses of issue of debenture stock, £1,374, leaving £4,895, which the directors recommend should be applied in payment of a dividend at the rate of 4 per cent. per annum (payable, less income-tax, on January 31st, 1914) £3,976, carrying forward £919. The traffic receipts show an increase of £1,511, and the operating and administration expenses a decrease of £185, as compared with the previous year. The sinking fund in connection with the debenture stock has been provided out of the revenue for the year, and the directors consider that this provision is sufficient to meet the depreciation of the system. A settlement has been arrived at with the Colwyn Bay Council with regard to the widenings in connection with the extension to Old Colwyn, and the construction of this extension will be commenced at an early date. The line is now being doubled at the top of Penrhyn Hill, and the doubling from the end of Mostyn Avenue to the North-Western Hotel in Llandudno will shortly be undertaken. The completion of this work will further increase the facilities for dealing efficiently with the heavy traffic during the summer months.

Bank Rate.—The Bank Rate was yesterday reduced from 4½ to 4 per cent.

Continental.—Norway.—At a recent meeting of the Norwegian A/S Elektrometal, at Christiania, it was decided to liquidate. The company was formed a few years ago for the purpose of exploiting the Norwegian patents of the Swedish Elektrometal furnace in Norway, but owing to the failure of these furnaces at the Hardanger Electrical Iron Works, *i.e.*, with coke as fuel, the fate of this type was decided, and, therefore, there is no longer any need for the company's existence. The assets, which chiefly consist in shares in the Hardanger Electrical Iron Works are going to be taken over by the A/S Elektrokemisk Industri, and there will remain about 40 per cent. of the capital for distribution among the shareholders after all liabilities having been paid.

A new company under the name of the Westinghouse Norsk Elektrisk Aktieselskap has been formed and was filed with the Registrar at Christiania on January 2nd. As is indicated by the name it is a branch of the large Westinghouse firms at Manchester and Pittsburg, which previously were represented by another firm in Norway. The business has during recent years increased to such an extent, that the British and American firms have found it necessary to establish an independent Norwegian company as their representative in the country.

Sweden.—It is reported from Stockholm that the Elektrothermiska A./B. has decided on an extension of capital from £155,555 to £266,666, and the public has, in accordance therewith, been invited to subscribe the additional amount. The majority of the shares are owned by the Hydraulic Smelting Corporation, Ltd., in London, or rather the subsidiary company of the same, viz., the Electric Smelting Co., of Scandinavia.

France.—La Société de l'Union Electrique, of Sainte Claude (Jura), reports a net profit of £13,910 for the financial year ending June 30th last. Of this sum, £4,662 is being applied to depreciation, £459 to legal reserve, £8,000 to a 5 per cent. dividend to the shareholders, £746 to a special building fund reserve, leaving a small balance to be carried forward.

The report of the Société Westinghouse, of Paris, for the last financial year shows a net profit of £4,228, which reduces the amount standing to the debit of the profit and loss account to £8,693.

Belgium.—A new company has just been formed in Brussels, with a capital of £4,400, and the title La Société Cinematographie et Electricité.

Germany.—The Bochum-Gelsenkirchen Bahn Gesellschaft is the name of a new company which has just been formed, with a capital of £400,000, to acquire and carry on the electric tramway between Bochum and Gelsenkirchen from the Rhenish-Westphalian Electric Co. Interest in the new concern lies in the fact that 37 per cent. of the shares are being taken up by the municipal authorities of Bochum, a similar number by the Gelsenkirchen authorities, 1 per cent. by the Westphalian Provincial Council, and 25 per cent. by the Rhenish-Westphalian Co.

Russia.—The Russian electrical interests of the Deutsche Bank represented by the Elektrischen Licht und Kraftanlagen A.G. have been extended by the recent formation of the Russische A.G. für Electrische Rayonstationen. Its capital of R. 4,000,000 has been fully subscribed. The administration is domiciled in the offices of the Gesellschaft für Electrische Beleuchtung, whose managing director is the business manager of the new company.—*Elektrotechnische Nachrichten.*

Stock Exchange Notices.—The Committee has ordered the undermentioned to be quoted in the Official List :—

Rangoon Electric Tramway and Supply Co., Ltd.—Scrip, £48 per cent. paid, for £100,000 5 per cent. mortgage debenture stock.

Applications have been made to the Committee to appoint a special settling day in, and to grant a quotation to :—

Castner-Kellner Alkali Co., Ltd.—Further issue of 250,000 shares of £1 each, fully paid, Nos. 500,001 to 750,000.

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 250,000 ordinary shares of £1 each (issued at £2 5s. per share premium), fully and partly (£1 10s.) paid (being 10s. capital and £1 premium), Nos. 1,000,001 to 1,250,000.

To appoint a special settling day in :—

British Electric Transformer Co., Ltd.—Further issue of 16,325 ordinary shares of £1 each, fully paid, Nos. 119,115 to 135,439, and 31,598 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 30,391 to 50,000 and 150,001 to 161,988.

Humphrey Pump Co., Ltd.—3,000 additional ordinary shares of £1 each, fully paid, Nos. 130,001 to 133,000.

And to allow the following to be quoted in the Official List :—

British Electric Transformer Co., Ltd.—61,988 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 50,000 and 150,001 to 161,988.

Compania de Electricidad de la Provencia de Buenos Aires, Ltd.—175,000 7 per cent. cumulative participating preference shares of £1 each, 10s. paid.

Hong Kong Tramway Co., Ltd.—325,000 shares of 5s. each, fully paid, Nos. 1 to 325,000.

Singapore Electric Tramways, Ltd.—400,000 shares of 5s. each, fully paid, Nos. 1 to 400,000.

Companies struck off the Register.—The following companies have been struck off the Register and are accordingly dissolved :—

Anglo-French Turbines.
"Brake Blocks."
British Electro-Metallurgical Products Co.
British Rubber Regenerating Co.
Engineering Digest Publishing Syndicate.
Heat, Light and Power Syndicate.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended November 28th, 1913, amounted to 965,848, compared with 817,119 units in the corresponding four weeks of 1912. For the four weeks ended December 26th, 1913, the units delivered amounted to 952,773, compared with 806,132 in the corresponding four weeks of 1912.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. on the ordinary stock.

Mexican Companies.—A circular in the following terms has been issued by the Mexican Light and Power Co., Ltd., and the Mexico Tramways Co.—"The conditions of affairs in Mexico, as you are aware, have not improved during the last three months. For some years past the dividends on the ordinary stock have been declared and paid quarterly, which the board has felt justified in doing while conditions were normal and the financial arrangements and profits for the whole financial year could be estimated with a degree of certainty. As, however, the board find it impossible to form any opinion as to when normal conditions will be restored, they are bound to conserve the company's resources and await an improvement in the financial conditions and the Mexican rate of exchange before considering the further distribution of profits, and, therefore, the payment of dividends [in the case of the Light and Power Co. the words 'on the ordinary stock' appear here] will be discontinued. The board are pleased to state that, notwithstanding the unsatisfactory conditions, the operation of the company's business in Mexico shows satisfactory results."

Japan.—The Tokio Electric Co., of Tokio, reports a net profit of no less than £43,145 for the last financial year. Of this sum, £1,837 is being placed to reserve, £10,700 distributed in dividends to the shareholders, plus a bonus, which absorbs £7,133 ; the directors and auditors receive £1,700, leaving a balance of £21,775 to be carried forward.

British Columbia Electric Railway Co., Ltd.—The directors have declared a dividend at the rate of 5 per cent. per annum on the preferred ordinary stock for the half-year ended December 31st, together with an additional dividend at the rate of 1 per cent. per annum for the same period.—*Financial Times.*

Reduction of Capital.—The Otis Elevator Co., Ltd., Reduced.—A petition for the confirmation of the reduction of capital from £200,000 to £68,190 has been presented, and will be heard on January 27th.

Harper Electric Piano (1910) Co., Ltd.—A dividend at the rate of 2½ per cent. per annum for the half-year ended December 1st last is announced.

Electric Construction Co., Ltd. — According to a financial daily the directors have declared an interim dividend at the rate of 7 per cent. per annum on the preference shares for the half-year to November 30th.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets have suddenly developed most unlooked-for strength in all the investment departments. There was such a rise in Consols within two or three days as made men rub their eyes and wonder if they saw the figures correctly. The Bank Rate is expected to be reduced to 4 per cent. before the month is out, general anticipation looking for this to come about on Thursday in the present week. Capital long hoarded up is being poured into the markets at a rate so rapid as to create a partial scarcity of the best classes of securities. Put picturesquely, the position is that, whereas two or three weeks ago it was impossible to sell anything, to-day it is equally impossible to buy—assuming in both cases, of course, that buyer and seller wanted to deal at satisfactory figures.

The cheapening of money, the release of capital, and the remarkable collapse of the South African strike are the three principal factors which have brought about so violent a change in Stock Exchange sentiment. What is more comforting to the House itself is the fact that they have also encouraged a decided increase in the volume of business. Even speculation begins to lift up its timid head ; and people who have not been near the Stock Exchange for many a month past are writing to their brokers—sometimes ostensibly on behalf of friends—to know if it is worth while buying anything by way of a flutter. Tuesday's rumour as to the health of the German Emperor was not credited, but it had an arresting influence on business. Wicked men suggested that the Kaiser was suffering from "son-stroke."

From the price lists published overleaf, it will be noticed that the rises far outnumber the falls. The former are well distributed over the six sections into which our quotations are divided ; and although the Electricity Supply department shows a halting tendency, it must be remembered that not a few of the stocks and shares here have enjoyed respectable rises, what time the rest of the markets were steeped in depression and gloom.

Affairs in Mexico, it seems to be generally admitted, are now about as bad as they can be, and the prevailing impression is that any change must be for the better. A comfortable theory this, but one which is likely, of course, to be rudely disturbed, even by a few drunken revolutionaries. It is, however, inappropriate to suggest such a bearish consideration when the markets at last give indications of getting on their legs once more ; and more useful will it be, perhaps, to direct attention to the returns obtainable from bonds of companies connected with the Latin-Canadian group, as a whole. Substantial gains followed upon the circulation of reports that Huerta had responded to United States pressure, and had resigned.

So far as Mexico is concerned, it is tolerably certain that, when affairs settle down, a good deal of extra money will be required to reconstruct the business relations that prevailed previously, and such a consideration suggests the likelihood of prior lien bonds or short-term notes being placed in front of existing securities. Nevertheless, if market conditions keep as strong as they are at present, tempting new issues will certainly find ready homes, and money will be obtainable on terms a great deal less onerous than would have seemed possible, say, a month or so ago.

The Home Railway market is good, with noticeable activity in all the steam stocks. Remains, however, the lurking fear as to how dividends may be expected to materialise in respect of the last half of 1913, seeing that the prophets have no reliable data upon which to work. The principal rises, so far as our lists are concerned, are those secured by the Underground Electric Railways issues, four out of the five showing gains, of which the principal is a rise of 2 in the 6 per cent. income bonds, which carried the price to 94. Metropolitans and Districts are both better. Central London assented stocks have been put up; and within the past few days dozens of Home Railway prior charge securities have advanced ½ to 2 points, in which movement the Undergrounds participated—Districts 6 per cent. Debenture, for example, gaining 3 at 137½. London United Tramways Debenture is 4 points higher. On the other hand, London and Suburban Preference eased off a few pence.

In the Electricity Supply group, City "Lights" have recovered the slight fall which took place at the end of last week, and the company's 5 per cent. Debenture stock improved with the rest of the investment markets. Urban Preference rose to 2¾; Westminster Preference regained the dividend of 2s. 3d. and another $\frac{1}{16}$ as well. The rises secured last week in other stocks and shares have been maintained, and, in Stock Exchange parlance, the market really is better than it looks.

British Columbia Electric issues are rapidly wiping out the falls which overtook them on the appearance of the last and rather disappointing report. The Deferred stock has risen 7, the Preferred is 4 up, and the 5 per cent. Preference recovered 1½ of its dividend. Shawinigan Water, *ex* 3 per cent., is 3½ higher, Canadian General Common rose 2, and other Canadian issues are shaking off the effects of the spasm of suspicion which lately fastened on most things connected with the Dominion. Mexican Light and Power Common and Preference are substantially better, but the Company's Bonds remain depressed. As in the case of the Mexico Tramways Company, the Mexican Light and Power announces that dividends on the Common shares will not be paid, in consequence of the disturbed state of the country; but the declaration was sweetened by an assurance that, in spite of this, the undertakings are making good progress, and have not been upset as much as might have been expected by the disorders. Thanks to this, Mexico Tramways Common shares are actually 4 higher, and the Second Bonds are 2 to the good.

Brazilian investments of all kinds are also making progress towards recovery. Southern Electric of Buenos Ayres Debenture stock followed up its last week's rise of 2 with a further gain of 3 points, and Brazilian Traction shares rose 2 to 86. Outside these, Havana bonds are lower, and Cape Electric Trams went back a little. Brisbane Trams, however, have spurted, and the Ordinary shares are 5s. higher, the 4½ per cent. Debenture stock also improving a point. Calcutta Trams Preference shares and the Debenture stock have improved. Buenos Ayres Port and City Tramways 6 per cent. First Debenture stock fell from 86 to 72, business being marked at 70 early this week.

Most of the active Manufacturing shares are on the up-grade. The feature is the activity of British Westinghouse Preference. These £2 shares have further spurted to 26s. 3d., a gain on the week of $\frac{3}{16}$. The 4 per cent. Debenture stock gained 3, the Prior Lien Debenture at 103½ is 2 up. The reason of the buying is ascribed to knowledge of the excellent business which the company has in hand. There is talk of a possible dividend on the Preference shares in the near future—as to which, however, rumour is unable to speak with any certainty. Brush 4½ per cent. Debenture rose to 41, a gain of 2½ points. On the other hand, the Preference are 0 to ¼. There has been a substantial seller of Edison and Swan 4 per cent. Debenture stock in the market, and although the only quotable change is a fall of 1 in the price, it is possible that a bid at the lower level (54) might attract the stock which has been on offer, but which may, of course, have been taken before these lines appear in print. Henleys have risen 10s., Callenders 5s., and both companies' Debenture stocks have gained a point. British Aluminiums have improved, and a moderate demand sufficed to put up the price of Crompton Debenture to 73, a rise of 4½ since last week. Castner-Kellners are unchanged.

Amongst the speculative shares to attract attention have been Marconis, and here the parent shares are 5s. to the good, while the Preference have risen $\frac{3}{16}$. Americans have jumped to 22s. 6d., and Canadians touched 11s., reverting later to 9s. 9d. The rise is attributed to buying orders from the United States, and that there was, at all events, some demand from the other side is certain enough. The investment stocks and shares in the Telegraph and Telephone group have mostly improved with the rest of the markets. Globe Ordinary and Preference are both 5s. higher. On the other hand, Monte Video Telephones are dull, and West India and Panama Telegraphs, after their sharp spurt, reacted 2½. Indo-European Telegraphs are 10s. lower, and Direct United States Cable shares lost ⅛. The terrible disaster in Japan, while it shook the prices of securities connected with the Government and municipalities, had no particular effect upon the quotations of cable descriptions.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, January 21st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	8d.	..
a „ Sulphuric	per cwt.	5/6	.
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£22 10	..
a Lead, Nitrate	„	£29 10	..
a „ White Sugar	„	£28	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	89/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %)	„	£10 5	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£90	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£116 13 4	..
b „ Sheet, in ton lots	„	£112	...
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅜d.	⅛d. dec.
c „ Tube (brazed)	„	9½d.	⅛d. dec.
c „ „ (solid drawn)	„	8⅝d.	⅛d. dec.
c „ Wire, basis	„	7½d.	⅛d. dec.
c Copper Tubes (brazed)	„	10¼d.	⅛d. dec.
c „ „ (solid drawn)	„	10½d.	⅛d. dec.
g „ Bars (best selected)	per ton	£81	£2 dec.
g „ Sheet	„	£81	£2 dec.
g „ Rod	„	£81	£2 dec.
d „ (Electrolytic) Bars	„	£66 10	£2 dec.
d „ „ Sheets	„	£84 10	£2 dec.
d „ „ Rods	„	£72	£2 dec.
d „ „ H.C. Wire	per lb.	8¾d.	⅛d. dec.
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/-	..
h India-rubber, Para fine	„	8/1	½d. dec.
j Iron Pig (Cleveland warrants)	per ton	50/8½	7½d. inc.
„ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£20 10	£1 10 inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	⅛d. dec.
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£174 to £175	£4 10 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 12 6	..

Quotations supplied by—

- *a* G. Boor & Co.
- *b* The British Aluminium Co., Ltd.
- *c* Thos. Bolton & Sons, Ltd.
- *d* Frederick Smith & Co.
- *e* F. Wiggins & Sons.
- *f* India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
- *g* James & Shakspeare.
- *h* Edward Till & Co.
- *j* Bolling & Lowe.
- *k* Morris Ashby, Ltd.
- *l* Richard Johnson & Nephew, Ltd.
- *m* W. T. Glover & Co., Ltd.
- *n* P. Ormiston & Sons
- *o* Johnson, Matthey & Co., Ltd.
- *r* W. F. Dennis & Co.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—The directors' report for 1913 states (according to the *Financial Times*) that the operations, after providing for all expenses, including repairs, maintenance and debenture interest, resulted in a net income of £27,312, which has been appropriated as follows:—Dividend of 4 per cent. per annum, less income-tax, on the 6 per cent. cumulative preference shares, £8,712; depreciation, renewals, reserve fund in lieu of accident insurance and general reserve fund accounts, £7,090; written off preliminary expenses account, £5,988; carried forward, £5,521. The number of passengers carried during the past year amounted to 10,900,263, and the miles run to 1,787,829, as against 9,787,444 and 1,773,218 respectively for the previous year.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾ xd	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	12 — 14	..	..
Do. Do. Deferred	100	..	..	4½ — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	88 — 91	+1	6 11 10
Do. 7 % Non-Cum. Pr'f.	100	8	..	52 — 55	..	5 9 1
Do. 5 % Perp. Deb.	100	5	5	92 — 95	..	5 5 6
Do. 4½ % 2nd Deb.	100	4½	4½	76 — 79	—1	5 14 0
Central London Railway, Ord.	100	8	8	59 — 64		4 13 9
Do. Gtd. Assented	100	..	4	83 — 85	+1	4 14 3
Do. Pref.	100	4	4	70 — 75		5 6 8
Do. Gtd. Assented	100	..	4	83 — 85	+1	4 14 8
Do. Def.	100	2	..	60 — 65	.	3 1 7
Do. Gtd. Assented	100	..	4	79 — 81	+1	4 18 9
Do. 4 % Deb.	100	4	4	95 — 97 xd	..	4 2 6
City & S London, 5 % Pref., 1891	100	5	5	96 — 98	.	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1908	100	5	5	93 — 95	..	5 5 0
Do. 4 % Deb.	100	4	4	88 — 90	—1	4 9 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 8
Lancashire United, 5 % Deb.	100	5	5	77 — 81	..	6 8 5
London and Suburban, Ord.	1	..	..	¼ — 5/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	9/16 — 11/16	—1/32	7 5 6
Do. Do. 4½ % 1st Deb.	100	4½	4½	72 — 77 xd	..	5 17 0

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	—1	4 7 11
London United Trams, 4 % Deb.	100	4	4	62 — 66	+1	6 1 3
Metropolitan Railway Consol.	100	1⅝	1¼†	45¼ — 46¼	+ ½	3 19 3
Do. Surplus Lands	100	2¼	2¼†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	80 — 82	+2	4 5 4
Do. 3½ % Con. Pref.	100	3½	3½	77 — 79	+1	4 8 9
Metropolitan District Ord.	100	Nil	..	31⅝ — 32½	+ ¾	Nil
Do. 6 % Deb.	100	6	6	136 — 139	+3	4 6 4
Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Do. 4 % Prior Lien	100	4	4	94 — 96	..	4 3 4
Do. 4½ % First Pref.	100	4½	4½	81 — 83	.	5 8 5
Do. 3½ % Gtd.	100	3½	3½	75 — 77	+1	4 11 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	80 — 84 xd	..	5 7 2
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	⅝ — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	3¼ — 3¾	+ ⅛	Nil
Do "A"	1/-	..	..	7/16 — ½	+ 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	113 — 115	+1	5 4 2
Do. 4½ % Bonds	100	4½	4½	98 — 100	..	4 10 0
Do 6 % Income	100	6	6	93½ — 94½	+2	6 7 0
Yorkshire (West Riding), Ord.	5	Nil	..	1/16 — 3/16	+ 1/16	Nil
Do. 6 % Pref.	5	3	4	3½ — 4	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	79 — 84	..	5 7 2

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4¾ — 5	..	5 10 0
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16	..	6 3 11
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	97½ — 99½	.	5 0 6
Auckland Trams, 5 % Deb.	100	5	5	102 — 105	+2	4 15 3
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	92 — 94	..	4 15 9
Do. 5 % 2nd Deb.	100	5	5	95 — 98	..	5 2 0
Brazilian Traction, Light and Power	$100	6	6†	85 — 87	+2	6 17 11
Brisbane Trams Invt., Ord.	5	8	8	7⅝ — 8⅛	+ ¼	4 18 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	.	4 13 0
Do. 4½ % Deb.	100	4½	4½	97 — 100	+1	4 10 0
B. Columbia Elec. Rly., Def.	100	8	8†	106 — 110	+7	7 5 6
Do. Pref. Ord.	100	6	6	103 — 107	+4	5 12 2
Do. 5 % Pref.	100	5	5	99 — 103 xd	+1	4 17 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98 xd	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	91 — 94	..	4 10 5
Calcutta Trams, Ord.	5	7½	5†	6 — 6½	..	5 15 5
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	+ 1/16	4 16 7
Do. 4½ % Deb.	100	4½	4½	96 — 99	+1	4 11 0
Cape Electric Trams	1	5	5	19/32 — 23/32	—1/32	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5¼ — 5¾	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½ — 97½ xd	..	5 2 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
La Plata Elec. Trams, Ord.	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4⅜d.	6	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 8
Do. 6 % Pref.	1	6	6	1⅛ — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
" Elec. Tr. (1904), Deb.	100	5	5	99 — 101	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	67 — 71	+4	..
Do. Gen. Con. 5 % Bonds	.	5	5	73½ — 77½	—1	6 9 0
Do. 6 % Bonds	100	6	6	75 — 79	+2	7 11 11
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5 — 5½	..	9 1 10
Do. 6 % Pref.	5	6	6	4⅛ — 4⅝	..	6 9 9
Do. 5 % 1st Deb.	100	5	5	93½ — 95½	..	5 4 6
Perth (W.A.) Elec. Tr., Ord.	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	[illegible] 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97½ — 99½	+ ½	5 0 6
Do. 5 % Mort. Bonds	100	5	5	89 — 91	..	5 10 0
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	96 — 99	..	5 1 0
Singapore Trams, 5 % Deb.	1 0	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	98 — 100	+3	5 0 0
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 4⅞	..	7 3 7
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	93½ — 96½	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
Bournemouth & Poole, Ord.	10	6	5†	9 — 10	..	4 14 9
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	6 0 0
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord.	5	10	9†	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3½ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 8 0
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	95 — 98	..	4 11 9
City of London, Ord.	10	9	6†	16½ — 17½	..	5 2 10
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	115 — 119	+1	4 4 0
Do. 4½ % Second Deb.	100	4½	4½	97½ — 99½	..	4 10 6
County of London, Ord.	10	6	5†	11¾ — 12¼	..	4 18 0
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	101 — 103	..	4 7 5
Do. 4½ % Second Deb.	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	5/16 — 3/8	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4⅛	..	7 5 5
Do. 6 % Non-Cum. Pref.	5	..	..	1½ — 1⅞	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	80 — 83 xd	+1	5 8 5
Folkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	87 — 89 xd	..	5 1 2

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
Hove	5	8	8†	8¾ — 9¼	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	8†	7⅞ — 8⅛	— ⅛	4 19 8
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	74 — 78 xd	..	5 15 6
London Electric, Ord.	3	2½	..	1⅛ — 1⅜	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4	4†	3⅜ — 3⅞	..	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	..	4 10 10
Do. 3½ % Mort Deb.	Stock	3½	3½	80 — 83	+1	4 6 5
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9	..	5 11 1
Do. 7 % Pref	5	7	7	6¾ — 7¼	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5½	..	2⅞ — 3¼	..	6 15 4
Do. 5 % First Mort. Deb.	100	5	5	97 — 100	..	5 0 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/32 — 1 7/32	..	5 14 9
Do. 4½ % First Deb. Stock	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	5/16 — 9/16	..	
Do. 5 % Cum Pref.	5	3‡	..	2½ — 3	+ ⅛	5 0 0
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Westminster, Ord.	5	10	10†	8½ — 9	+ ¼	5 11 1
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5¼ xd	+ 3/16	4 5 10

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* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 3s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Adelaide, 6 % Pref.	5	6	6†	5⅛ — 5⅜	..	5 11 7
Calcutta, Ord.	5	8½	5†	7⅜ — 7⅞	..	5 8 0
Do 5 % Pref.	5	5	5	4 15/16 — 5 3/16	+ 1/16	4 16 5
Calgary Power, 1st Mort. Bds. ..	100	5	5	88½ — 90½	..	5 9 8
Canadian Gen. El. Com.	$ 00	7	8	104 — 109	+ 2	7 6 10
Do. 7 % Pref.	$100	7	7	119 — 124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 — ⅝	..	7 13 0
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88 — 90	..	6 13 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ — 95½	..	5 4 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	6†	11/32 — 13/32	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	100½ — 102½	..	4 17 6
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	101 — 104	..	4 16 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	64 — 68	+ 2	7 7 1
Mexican Lt. & Power, Common	$100	4	4†	41 — 44	+ 2	..
Do. 7 % Cum. Pref.	$100	7	7	72 — 76	+ 3	9 4 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	73 — 77	..	6 9 10
Do. 5 % 2nd Mort. Bonds ..	100	5	5	58 — 62	..	8 1 4

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	51 — 56	+ 1	8 19 6
Montreal, Lt., H. and Power ..	$100	9	10†	219 — 225	..	4 9 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 — 217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	101 — 106	..	5 18 2
Do. 5 % Deb. Stock	Do.	5	5	93 — 100	..	5 0 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 — 101	..	4 9 4
Shawinigan Water, Capital ..	$100	5½	6†	136 — 141	+ 8½	4 5 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103½ — 105½ xd	..	4 14 9
Do. 4½ % Per. Deb.	Stock	4½	4½	96 — 98	— ½	4 11 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 — 89	..	5 12 4
Victoria Falls Power, Pref. ..	1	6	6	25/32 — 27/32 xd	+ 1/32	7 2 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 8

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	9/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	⅝ — ¾	..	8 0 0
Babcock & Wilcox	1	16	14†	2 13/16 — 3 1/16	..	5 4 6
Do. Pref...	1	6	6	1 5/16 — 1 7/16	..	4 8 6
British Aluminium, Ord. ..	1	..	..	1 1/32 — 1 5/32	+ 1/32	..
Do. 6 % Cum. Pref.	1	6	6	27/32 — 29/32	..	6 12 6
Do. 5 % Prior Liens Debs. ..	100	5	5	93 — 96	+ 1	5 4 0
Do. Deb. Stk.	100	5	5	86 — 89	+ 1½	5 12 4
B.I. & Helsby Cables	5	10	8†	8¾ — 9¼	..	5 8 1
Do. Pref.	5	6	6	5¾ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	99 — 102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref. ..	2	Nil	..	1¼ — 1⅜	+ 3/16	Nil
Do. Deb.	100	4	4	67 — 70	+ 3	5 14 4
Do. 6 % Prior Lien	100	6	6	102 — 105	+ 2	5 14 6
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	8/- — 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	— ⅛	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	.	6 5 0
Do. 4½ % Deb.	100	4½	4½	39 — 43	+ 2½	10 9 4
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	10¾ — 11½	+ ½	6 10 4
Do. Pref...	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. Deb.	100	4½	4½	96 — 99	+ 1	4 11 0
Castner-Kellner	1	20	22½	2 17/32 — 2 21/32	..	..
Do. Deb.	100	4½	4½	104 — 107	..	4 4 1

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb. ✓	100	5	5	71 — 75	+ 4½	6 18 4
Dick, Kerr	1	Nil	..	5/16 — 7/16	..	..
Do. Pref...	1	6	6	23/32 — 27/32	..	7 2 2
Edison & Swan, A, £2 paid ..	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	54 — 58	— 1	6 17 11
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	½ — ⅝	..	7 5 6
Do. Pref...	1	7	7	15/16 — 1 1/16	..	6 11 9
Greenwood & Batley, Pref. ..	10	7	7	6¾ — 7¼	..	9 18 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref. ..	10	6	6	9⅝ — 10⅛	..	5 18 6
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	13½ — 14	+ ⅛	5 7 1
Do. Pref...	5	4½	4½	4⅝ — 4⅞	— ⅛	4 12 4
Do. Deb.	100	4½	4½	100 — 102	+ 1	4 8 3
India-Rubber, G. & T.	10	7½	7½	11 — 12	..	6 5 0
Do. Pref...	10	5	5	9 — 9¾	..	5 2 7
Telegraph Construction	12	20	5†	37 — 39	..	6 8 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref. ..	100	..	..	51 — 56	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	6½ — 6¾	..	6 18 4
Do. 5 % Deb. Red.	Stock	5	5	93 — 96	..	5 4 0
American Telep. & Teleg., Cap.	$100	8	8	125 — 128	+ 1	6 5 0
Do. Collat. Trust	$1000	4	4	88 — 91	+ 1	4 8 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65 xd	..	4 12 4
Do. 6 % Pref.	Do.	6	6	103¾ — 104¾ xd	..	5 14 2
Do. Def.	Do.	30/-	..	23⅛ — 23⅝	+ ⅜	6 7 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	..	4 16 2
Chili Telephone	5	8	..	7¼ — 7½ xd	+ 1/16	5 6 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	78 — 80	+ ½	5 0 0
Cuba Telegraph	10	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	10	10	10	14¾ — 15¼	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	3¼ — 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6¾ — 7¼	..	6 18 0
Direct United States Cable ..	10	4	4†	6½ — 6¾	..	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Eastern Telegraph, Ord. Stock	Stock	7	7	125 — 128 xd	+ 1	5 9 8
Do. 3½ % Pref. Stock	Do.	3½	3½	74½ — 76½ xd	..	4 11 4
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 3 4
Eastern Extension	10	7	7	12 — 12½ xd	+ ⅛	5 12 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust ..	10	6	6†	11 — 11½	+ ½	5 4 4
Do. 6 % Pref.	10	6	6	12 — 12½	+ ½	4 16 0
Great Northern Telegraph ..	10	20	5†	31 — 33	..	6 1 2
Indo-European Telegraph ..	25	13	5†	56½ — 58½	— ½	5 11 2
Mackay Companies Common ..	$100	5	5	77 — 81	..	6 3 5
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	..	5 14 4

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 20th.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph ..	1	20	20	3½ — 3⅝	+ ½	5 10 6
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2⅝ — 3	+ 3/16	5 18 4
Monte Video Telephone, Ord. ..	1	6	6	¾ — ⅞	— ⅛	6 17 2
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99 — 100	+ ¾	4 10 0
Oriental Telep. and Elec. ..	1	10	10†	1⅞ — 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1 1/16 — 1 3/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	86½ — 88½	+ ½	4 10 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	10	10	10†	8¾ — 9¾	..	10 5 2
Submarine Cables Trust	Cert.	6	6	122½ — 125½	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95½ — 97½	+ ½	4 12 4
United River Plate Telephone	5	8	6†	6½ — 6¾	— ⅛	5 18 5
Do. 5 % Cum. Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
West Coast of America	2½	2½	..	1 5/16 — 1 7/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1¼	1¼	2⅜ — 2⅝	+ 1/16	4 15 3
Do. 6 % Cum. 1st Pref. ..	10	6	6	9¾ — 10¼	..	5 17 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	96 — 98	..	5 2 0
Western Telegraph, Ltd. ..	10	7†	7	12⅝ — 13⅛	..	5 6 8
Do. 4 % Debs.	Stock	4	4	91 — 93	+ 1	4 6 0
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 4½ per cent., January 8th, 1914.

A Great Russian Enterprise.—The St. Petersburg Electric Lighting Co. of 1886, in which German capital is largely interested, has now become the largest supply undertaking in Russia, although its scope of activity is not limited to the capital. Formed in 1886 and keeping that year as part of its title, the company has gradually raised its capital to £3,100,000 in ordinary shares and £900,000 in preference shares, and a further issue of £1,000,000 in ordinary shares is now being made, which will increase the total to £5,000,000. The proceeds of the present issue, which has been offered in Germany at the price of 167 per cent. or 110 per cent., including the stamp tax, are to be devoted to the extinction of the bank debt, which amounted to £800,000 at the date of the last annual report, and to the development of existing interests in Sosnowice, Bogorodzk, and the suburbs of St. Petersburg. Having already furnished a supply in certain localities outside St. Petersburg, the company in 1912 obtained a concession for supply in other outside districts, but owing to the difference between the concessions it was deemed essential to form the St. Petersburg Electric Power Transmission Co. to deal with these areas, and to take over the parent company's system for serving them. It is intended to provide a separate power station for the transmission company in the course of time. The station at Bogorodzk, which is to have an initial capacity of 25,000 H.P., is in course of construction and equipment for the supply of that district and also for transmission to Moscow, where the electrical energy will serve as an addition to the output of the St. Petersburg company's station in Moscow. In the case of Sosnowice the parent company has a local supply company which has a capital of £400,000, and which finds a sphere of activity in that industrial district and the adjoining one of Dombrova. The dividend paid by the St. Petersburg company was 8 per cent. on the ordinary capital in 1912, as against 7½ per cent. in 1911.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING DECEMBER, 1913.

The December returns of electrical export and import business, which bring to a conclusion a record year's trade, suffer as regards the exports by comparison with the previous month's huge total, the bulk of which represented telegraphic material. Thus, the December exports were valued at £519,549 as compared with £1,135,400 in November; excluding telegraphic exports, however, the totals were £397,348 and £465,778 respectively, showing a decline in general business for the month, but still a not unsatisfactory total.

The imports for the month amounted to £294 844—the highest total for any month during 1913—which compares with £258,937 in November. the re-exports also reached a high level, £32 347 being some £5,000 in advance of the previous month's total.

Almost without exception the various sections of the exports show decreases, including, of course, the heavy deficit in telegraphic exports, some £20 000 in cables and £10,000 in machinery exports; while as regards the imports, machinery and telegraphic and telephonic imports, among others, show a considerable advance on the previous month.

Of the various purchasing centres Aden, credited with £64 000 worth of telegraphic cable, achieves fleeting notoriety, but amongst our more stable customers with whom satisfactory business resulted, were India, Victoria, Japan, Argentina, &c.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	2,282	816	226	143	3,462	356	3,572	185	293	365	52	1,605	13,357
Germany	2,487	2,549	20	66	456	6	3,014	...	12	578	82	29	9,299
Netherlands, Java and Dutch Indies ...	529	2,496	174	42	39	...	914	...	154	68	...	414	4,830
Belgium	307	431	95	11	327	129	3,585	5	25	54	1,007	105	6,081
France	439	13	5,164	32	83	...	872	346	...	...	106	10	7,365
Portugal	79	82	51	20	8	...	943	48	...	9	814	581	2,635
Spain, Canary Isles and Spanish N. Africa...	61	523	234	8	42	185	3,324	120	77	...	1,133	321	6,028
Switzerland, Italy and Austria-Hungary ...	292	26	327	25	182	10	9,101	...	3	312	38	9	10,325
Greece, Roumania and Turkey	244	140	78	28	18	...	98	27	252	3	5,669	453	7,010
Channel Isles, Gibraltar, Malta and Cyprus...	22	32	125	96	6	13	207	...	...	...	13	10,951	11,465
U.S.A., Philippines and Cuba	805	139	65	346	...	144	2,500	...	206	7	33	405	4,650
Canada and Newfoundland	1,890	1,500	633	723	15	2,696	7,603	...	295	66	...	4,948	20,369
British West Indies and British Guiana ...	125	6	89	98	18	...	15	...	14	11	85	50	511
Mexico and Central America	36	463	...	23	...	...	589	417	10	5	31	95	1,669
Peru and Uruguay	159	14	112	26	...	76	2,511	63	3	...	37	22	3,023
Chile	589	1,113	153	156	14	43	2,243	...	110	9	34	8,305	12,769
Brazil	2,253	1,295	1,267	402	7	14	12,084	2,223	35	19	276	2,541	22,416
Argentina	2,428	2,242	1,027	1,587	435	601	13,195	241	1,139	15	5,182	4,392	32,484
Colombia, Venezuela, Ecuador and Bolivia...	8	107	46	441	12	21	1,441	...	23	2	215	19	2,335
Egypt, Tunis and Morocco	253	1,160	148	147	73	68	769	68	211	14	277	840	4,028
British West Africa	74	46	2	100	9	7	2,103	29	128	27	170	850	3,545
Rhodesia, O.R.C. and Transvaal	1,181	98	325	728	59	7	4,484	3	199	...	3	...	7,087
Cape of Good Hope	1,434	5,433	289	124	3	380	4,819	389	702	51	2,746	1,745	18,115
Natal	1,064	4,103	132	335	107	405	905	...	229	...	...	1,400	8,680
Zanzibar, Brit. E. Africa, Mauritius & Aden	265	88	59	307	...	27	1,837	...	15	7	167	65,647	68,419
Azores, Madeira and Portuguese Africa ...	838	463	111	155	12	3	7,139	...	29	...	360	398	9,508
French African Colonies and Madagascar ...	8	14	2	31	...	...	27	...	...	6	4	49	141
China and Siam	520	1,458	286	128	19	172	916	65	92	10	184	5	3,855
Japan and Korea	1,479	914	670	7	...	390	22,949	3,290	137	35	4,806	6,760	41 437
India	4,429	14,352	1,881	2,780	262	903	25 022	2,487	2,746	228	1,692	2,031	58,813
Ceylon	323	415	6	18	7	47	398	...	590	12	472	261	2,549
Straits Settlements, Fed. Malay States, and Sarawak	799	581	206	39	19	93	1,526	488	31	18	121	412	4,333
Hong Kong	612	291	313	91	...	499	327	...	33	27	...	269	2,462
West Australia	442	630	68	417	431	383	449	40	66	53	4,314	...	7,293
South Australia	558	2,847	252	322	36	558	285	...	509	...	859	2,937	9,163
Victoria	2,935	10,738	1,421	1,066	194	2,720	12 576	618	728	3	8,397	351	41,747
New South Wales	1,986	4,523	625	1,554	179	428	9,841	558	570	93	1,551	2,646	24,554
Queensland	67	1,134	467	126	17	13	2,246	...	138	...	405	...	4,613
Tasmania	18	5	75	...	...	35	...	...	185	...	...	...	318
New Zealand and Fiji Islands	1,511	1,502	313	460	213	497	6,351	240	253	15	8,568	345	20,268
Total, £	35,831	64,782	17,837	13,208	6,764	11,929	172,780	11,950	10,242	2,122	49,903	122,201	519,549

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	172	25	5	...	...	105	16,127	...	1,051	...	9,671		27,156
Germany	5,918	27,237	1,637	18,239	10,856	3,735	50,338	375	8,763	11,227	8,533		146,858
Holland	...	...	...	2,244	381	...	...	...	...	174	...		2,799
Belgium	1,431	4,962	16	417	48	1,387	13,085	28	211	619	4,764		26,968
France	41	176	586	2,679	196	1,389	774	222	1,300	3,843	1,651		12,857
Switzerland	185	728	...	14	8	602	7,980	10	26	113	20		9,686
Italy	259	6,390	...	...	39	...	37	...	...	...	290		7,015
Austria-Hungary	22	930	...	323	...	...	60	...	261	322	38		1,956
United States	7,704	261	2,743	325	265	84	13,694	29,887	174	103	3,193		58,433
Total, £	15,732	40,709	4,987	24,241	11,793	7,302	102,095	30,522	11,786	16,401	28,160		293,728

Additional imports: Spain, electrical goods, £30, machinery, £90, carbons, £446; Canada, electrical goods, £530, machinery, £20.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above ...	13,233	891	...	2,966	515	...	12,307	...	292	1,487	656		32,347

Total Exports: £519,549 · Total Re-Exports: £32,347. Total Imports: £294,844.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

ELECTRICAL EXPORTS AND IMPORTS DURING 1913 AND PREVIOUS YEARS.

For some years past it has been our custom in January to place before our readers a graphic summary of the progress of British electrical export and import business during the year just closed and preceding years. From this year's curves, of which the first series is shown in fig. 1, it will be seen that the exports (heavy curve) are still mounting upwards, but the general business *excluding telegraphic exports*, indicated by the dot and dash curve, while obviously at a higher average level than in 1912, shows a tendency to fall away.

Actually the approximate gross values of the exports and the values of telegraphic material included therein, during the five years with which we deal graphically, were as follows :—

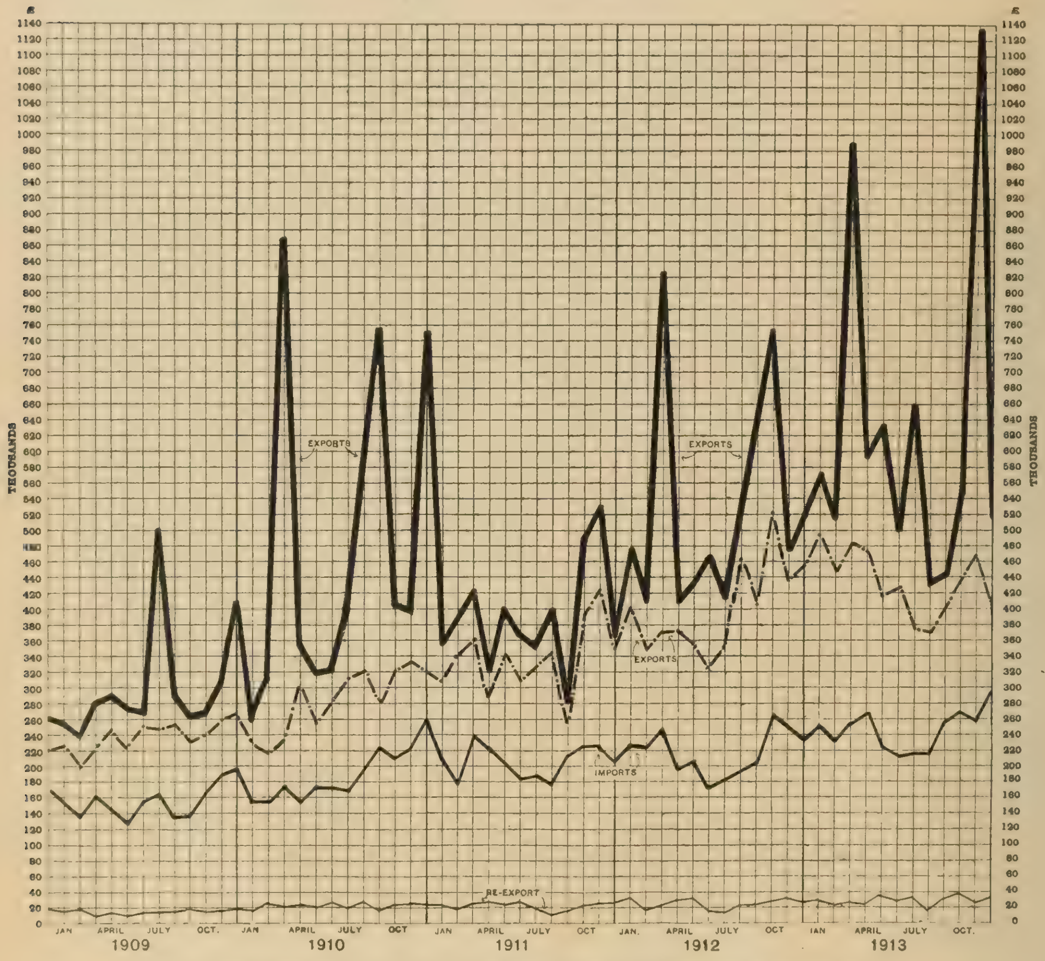
1909,	Gross,	£3,650,000	Teleg.	£805,000
1910	,,	£5,700,000	,,	£2,267,500
1911	,,	£4,600,000	,,	£560,000
1912	,,	£6,300,000	,,	£1,500,000
1913	,,	£7,568,200	,,	£2,388,000

best that can be said of it in 1913 is that it shows no marked downward movement, while actually representing higher values than in 1912.

The curve for cable exports, on the other hand, shows a continuous falling off in business during the year.

The value of electrical machinery exported reached a total of over £2,209,000, being a monthly average of £184,000; cable valued at £968,000—exclusive, of course, of telegraphic and telephonic cable—was exported during the same period, or a monthly average of over £80,000. Together with telegraphic material, machinery and cables are the most important features of our overseas electrical business, and may be compared with advantage with the leading imports into this country, curves for which are shown in fig. 3. These curves show no marked upward or downward tendency during the year in the three sections dealt with, viz., electrical machinery, telegraphic and telephonic material, and lamps and parts, although machinery imports were on a higher level, and the two latter sections at a much lower level than in the preceding year.

Lamp manufacturing has, of course, been largely taken up in this country, and it may be of interest to record that our own exports of lamps and parts were valued at £216,000 for the year, as compared with total imports of the same commodities valued at £313,000.



The lower export curve (dot and dash) is exclusive of telegraphic exports. Value in thousands of £.

Fig. 1.— Chart showing Monthly Electrical Exports and Imports during the past five Years.

The gross values have fluctuated considerably, yet, if we exclude the varying telegraphic exports, the general export business during the five years has steadily improved, as shown by the monthly averages during the period which were :—1909, £236 000 ; 1910, £286,000 ; 1911, £336 500 ; 1912, £400,000 ; and 1913, £432 000. At the same time telegraphic business reached a higher level in 1913 than during previous years.

Turning to the imports curve, it will be seen that the tendency is upwards, particularly in recent months, and this is also true of the re-exports.

The total value of electrical imports for the 12 months of 1913 shown by our published statistics, was £2,946,000, or a monthly average of £245,000, as compared with £217,000 in 1912 ; the electrical re-exports for the year were valued at over £341,000—a monthly average of about £28,000.

Fig. 2 shows separately the curves of electrical machinery and cable exports for five years; our overseas trade in electrical machinery has been steadily progressive for some years, but the

Electrical machinery imports totalled £1,300,000, and telegraphic and telephonic imports £314,000 approximately, during the 12 months.

Purchasing Countries and Importers into the United Kingdom.

Figs. 4, 5 and 6, which show graphically three years' business with some of our principal customers, will be viewed with mixed feelings, indicating, as they do on the whole, an unfavourable tendency during 1913.

Thus in fig 4, the curves of business with Canada, Brazil and Argentina show a decided falling off during 1913, although the year started excellently, and the monthly average was probably as good as that obtaining in 1912.

The curious kink in the Argentinean curve may be noted, when the official returns, rightly or wrongly, showed a month's business amounting to only a few hundreds of pounds. Canada, and indeed other countries, have suffered from a monetary stringency, but Brazil has never been a very stable customer.

The curves given in fig. 5 relate to Australasian and South African exports; in both cases the year started well, but the downward tendency can be seen at the close of the year. On the average, however, business during 1913 compared quite favourably with that during 1912.

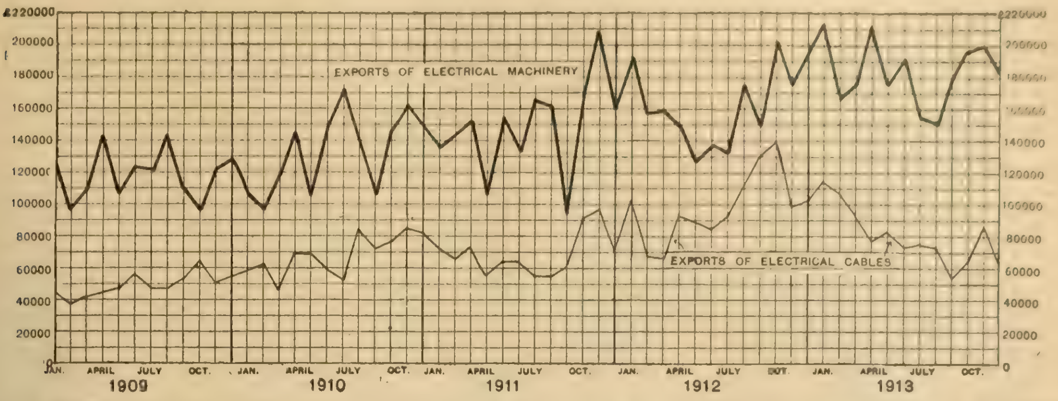


Fig. 2.—Monthly Exports of Electrical Machinery and Electrical Cable—other than Telegraphic or Telephonic Cable—during the past Five Years.

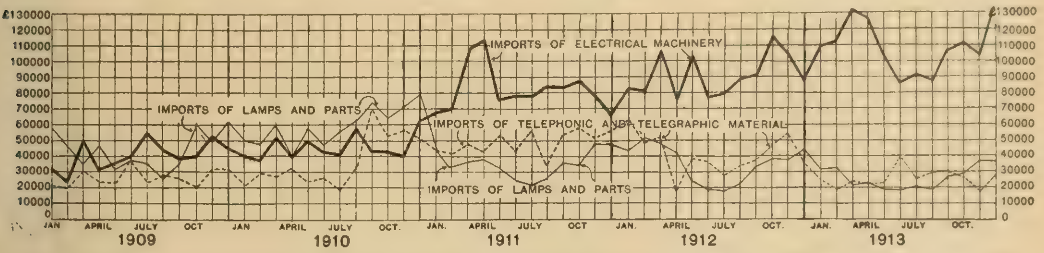


Fig. 3.—Monthly Imports of Electrical Machinery, Telegraphic and Telephonic Material and Cable, and Electric Lamps and Parts, during the past Five Years.

Turning to fig. 6, which deals with our business in the Far East, the curve for Indian trade is a welcome contrast to those previously referred to, as it indicates not only a great increase in exports as compared with 1912, but also a decided upward tendency during 1913, in continuation of that shown in the previous years. On the other hand, our Japanese business fell away during the year to quite small dimensions, as compared with 1912, recovering to some extent towards the end; Chinese trade, which has been somewhat lifeless during recent years, is apparently becoming brisker, the December total being particularly encouraging.

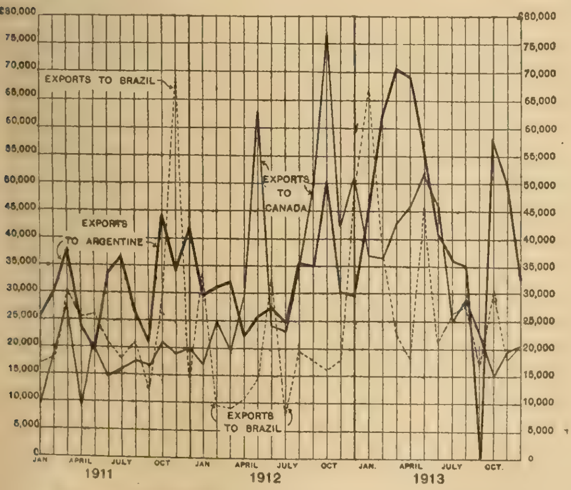
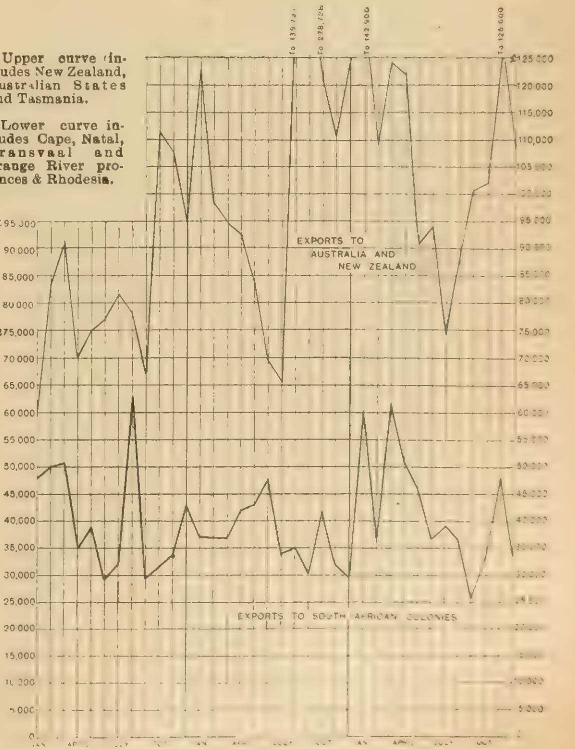


Fig. 4.—Electrical Exports to Canada, Argentina and Brazil, 1911-13.

The gross value of electrical business with the countries mentioned was approximately as follows during the year:—India, £1,769,000; Australia and New Zealand, £1,283,000: Argentina, £558,000; South Africa, £508,000; Canada, £392,000; Brazil, £350,000; Japan, £309,000; and China, £159,000.

Our last set of curves, fig. 7, dealing with the most prominent foreign importers into this country, will be viewed with interest.



Upper curve includes New Zealand, Australian States and Tasmania.

Lower curve includes Cape, Natal, Transvaal and Orange River provinces & Rhodesia.

Fig. 5.—Electrical Exports to Australasia and S. Africa, 1911-13.

Germany, pre-eminent in this direction in the past, it will be seen, shows no tendency to increase her electrical business with us, the trend being generally towards a slight falling off, if anything.

The United States, however, which has for some years maintained a steady electrical business with us, has during 1913 more than doubled its electrical trade with this country, the upward tendency being most marked; to a less extent this may also be said of the Belgian import trade, while French importers are also waking up. It is probable, therefore, that the increased value of the imports for 1913 was due rather to our American and Belgian rivals than to Germany.

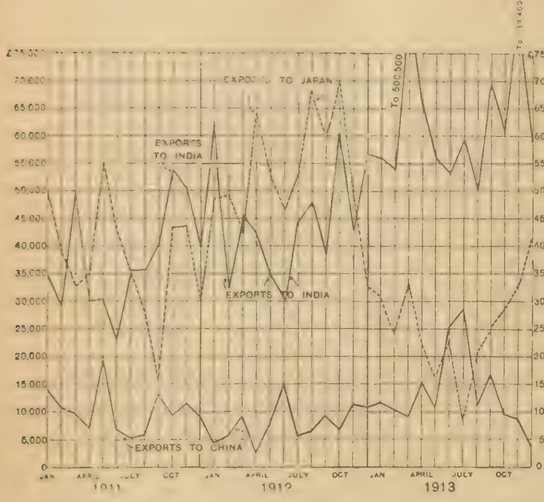


Fig. 6.—Electrical Exports to Japan, India, and China, 1911-13.

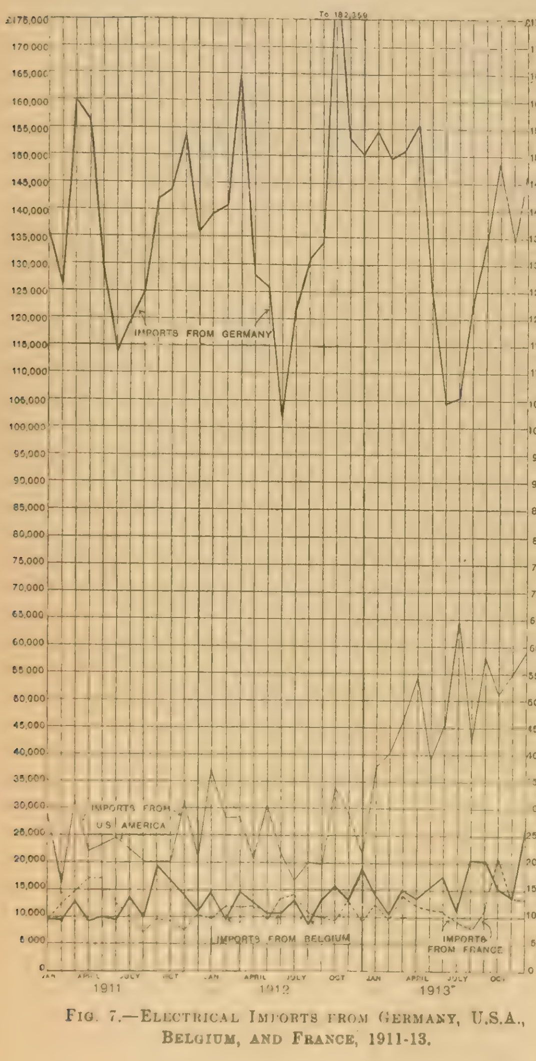


Fig. 7.—Electrical Imports from Germany, U.S.A., Belgium, and France, 1911-13.

General.

Judged by the value of business done, the year 1913 was a record one for the British exporter.

Gratification at this result may, however, be tempered somewhat by the knowledge that very flourishing telegraphic exports have to some extent obscured the fact that the progress in other directions, such as machinery and cable exports, has been on a smaller scale than in previous years.

This slackening off in general business, averaged throughout 1913, was roughly equivalent to a drop of £32 000 a month, as compared with the improvement shown by 1912 over the previous year; and the later curves give some indication of the principal directions in which business has fallen off.

It is, of course, impossible to accurately forecast the trend of events during 1914, and it may be that the recession in business indicated in our curves, is of a temporary nature. As, however, it is accompanied by a revival of activity on the part of certain importing countries, which have until recently been too busily employed in other directions to devote much attention to the British market, it may be assumed that in the electrical as in other branches of trade, the tendency at the moment is towards restricted business and increasing competition in the world's markets.

Electrical Contractors' Association.—The annual dinner of the Newcastle-on-Tyne branch of the Electrical Contractors' Association was held in the Royal Turk's Head Hotel, Newcastle, on the 17th inst. Mr. J. R. Usher presided, and proposed the toast of "The Electric Supply Authorities," to which Mr. L. E. Buckell, of the Newcastle-on-Tyne Electric Supply Co., responded. Mr. Alan G. Robson gave "The Electrical Contractors' Association." Mr. T. H. Webb, the president, in replying, said that among the many advantages of the Electrical Contractors' Association not the least important was the social element, which, together with the monthly branch meetings, brought competing contractors into friendly relationship with one another. It was necessary for the well-being of electrical contractors that they should gather together in such a way to deal with the questions and difficulties arising in their trade through municipal trading in electrical matters, manufacturers' organisations, and Trade Unions. If there were no Electrical Contractors' Association, no brake could be put upon municipal trading in the matter of electrical wiring, &c. A wiring department of a Corporation could never be an advantage to a municipality, and the Committees and Councils who voted for such schemes were principally men not versed in such matters. The Association also carefully watched the interests of the trade in connection with Parliamentary Bills, and had been rewarded by having clauses deleted from Corporation Bills which would, if carried, have promoted rate-aided competition against electrical contractors. Mr. Robert Robson, when proposing the toast of "The Kindred Electrical Trades," mentioned that the Association as individuals had greatly benefited by the agreement which was made with the Cable-Makers' Association. Mr. W. J. Heads replied.

A New Electrical Fertiliser.—It is reported from Iceland that a German firm has now under construction a factory at Haffradir, in the neighbourhood of Reykjavik, for the manufacture of a new fertilising material with potassium as one of its chief components. The raw material consists of a kind of potassium-feldspar, resembling lava, which will be reduced in electrical furnaces together with coal and iron. The products from these furnaces consist of two kinds, viz., a silicious iron, which is easily saleable to steel works, and a potassium slag, which is first subjected to a crushing process, and then brought into the market under the name of Elektro-Kalium, as an artificial manure. It is stated that the same firm already has a similar factory at work in Italy. The process has been invented by a Swedish engineer, Mr. Axel Lindblad, who has a factory of his own in Sweden, viz., the Sansta Electrical Melting Works at the Hägge Station. Elektro-Kalium is quite a new material, and is not to be confused with the material that has been brought into the market in Germany under the name of Feldspar Flour, and consists of crushed feldspar.

Aluminium in 1913.—The report for 1913 of the Berlin firm of N. Levy & Co. refers, in addition to other metals, also to aluminium, which is stated to have been in great demand for the United States motor-car builders in the first half of the year. The large exports resulting therefrom to the United States entirely cleared the European market of stocks, so that the price in the open market advanced by up to 10s. per cwt. above the official quotation of the international syndicate, which was £4 1s. per cwt. The use of aluminium is making visible progress for all branches of industry, and does not remain restricted to the motor-car, electricity, military and domestic utensils. At the end of 1913 inconsiderable stocks were in the hands of merchants in consequence of sales having slackened and of resales on the part of the Americans, which were effected at a price slightly less than that of the syndicate quotation.

Entrance Scholarships.—An examination will be held at Faraday House Engineering College, beginning on Wednesday, April 1st, 1914, for one "Faraday" Scholarship of the value of 50 guineas per annum, tenable for three years, and for one "Maxwell" Scholarship of the value of 50 guineas per annum, tenable for two years. Full particulars can be obtained from the Secretary, Faraday House, Southampton Row, W.C.

OVERHEAD WIRE CONSTRUCTION FOR MEDIUM AND LOW PRESSURES.*

By A. P. TROTTER.

Electric supply by overhead wires may be roughly divided into two branches, transmission of power to sub-stations, and distribution to consumers or for street lighting. In this country the former is almost always three-phase supply at about 6,000 or 10,000 or 20,000 volts. The routes of such transmission lines are across country, and in general sparsely inhabited districts. It is not proposed in this paper to deal with high pressure work.

Distribution to consumers was carried out at first for the most part by continuous current two-wire or three-wire, but recently there has been a good deal of three-phase or three-phase four-wire work. The voltage between phases is generally at medium pressure, about 440, and the voltage to earth or to the fourth wire about 250. The routes of such lines are generally along streets or suburban roads. There are many examples of towns where the whole of the supply except for the street-lighting of tramway routes is by underground mains. The first case of this kind that was officially authorised was at Keighley in 1904.

Two-wire distribution is generally confined to small towns or villages.

In a few cases power is supplied from tramway trolley wires, and the suggestion has been made that the wires should zig-zag, crossing at each span, the earthed negative being below the positive, to give some chance of a shut down in case of breakage of a positive wire.

The three-wire system is generally used for more extensive continuous current work. Seeing how few cases of injury by electric shock are caused by the fall of trolley wires at 500 volts, the risk of accident due to the breaking of a wire carrying continuous current at a pressure not exceeding 250 volts from earth is not serious, but it may be entirely prevented by splitting the neutral into two wires and providing between these two cross wires in each span, so that a positive or negative wire if broken may be effectually earthed.

This method was described in the early Board of Trade Regulations for low pressure overhead wires as follows:—

> Where a supply is given by overhead wires on the three-wire system, the positive and negative conductors shall be placed side by side above the intermediate conductor. The intermediate conductor shall consist of two wires placed side by side at a distance apart greater than that between the positive and negative conductors, and connected in each span by two cross wires placed in such a manner that in the event of either the positive or negative conductor breaking it shall fall on one at least of the cross wires.

The Board of Trade Regulations for medium and low pressure overhead lines are made for continuous current supply at a voltage not greater than 650 from earth, which is intended to include the maximum drop on an overhead tramway feeder, and for alternating current supply at a voltage not exceeding 250 from earth.

It has been assumed for many years that a fatal shock could not be caused by alternating current at 250 volts unless a large surface of metal could be touched, and it may still be held that the risk of a fatal shock at 250 volts alternating is not great. But the wide use of electric lighting and power multiplies the chances, and four fatal accidents and one nearly fatal have resulted from touching broken wires at about 250 volts or less, that is to say, the wires of 400 or 440 volt three-phase circuits. In three of the fatal accidents, the middle point was earthed and in the fourth no intentional earth had been made on the system.

It is therefore necessary that precautions shall be taken to render harmless a broken conductor of an alternating current overhead wire circuit. Minimum-current circuit breakers cannot be relied upon, balanced protective devices would be too expensive, and the only method seems to be the one suggested in a regulation which appears as No. 6 of the latest code of medium and low pressure overhead wire Regulations of the Board of Trade. This regulation combines the two-wire zig-zag mentioned near the beginning of this paper, the regulation already quoted, and covers three-phase four-wire work. It runs as follows:—

> Where one conductor of an overhead line is connected with earth, the other conductor or conductors shall be arranged in such a manner that in the event of breakage of an unearthed conductor it must fall on the earthed conductor or on wires connected thereto.

Hitherto no regulation had been made which was specially applicable to three-phase four-wire work.

So far as I am aware, the earliest example of continuous current three-wire supply on this method was carried out by Mr. Reginald Wilson at Dudley at the end of 1906. Fig. 1 shows the arrangement, and the next figure shows the additional structure required for carrying guard wires.

In the following year the same method was used by Mr. C. J. Wood, at Sale, Cheshire, Fig. 3. In this example a single cross arm is used and the insulators for the neutral wires are of a very simple pattern appropriate for the small voltage from earth.

In 1910 or thereabouts, it was suggested by Mr. Harold Gray of Accrington that the neutral wires should be placed at a level higher than the positive and negative wires, and that they might be used as guard wires. The arrangement has the advantage that the cross wires form a deep pocket which is much more likely to catch a live wire than the arrangements shown in Figs. 1, 2 and 3. The Board of Trade Regulation was amended in 1911 by the omission of the word "above the intermediate conductor."

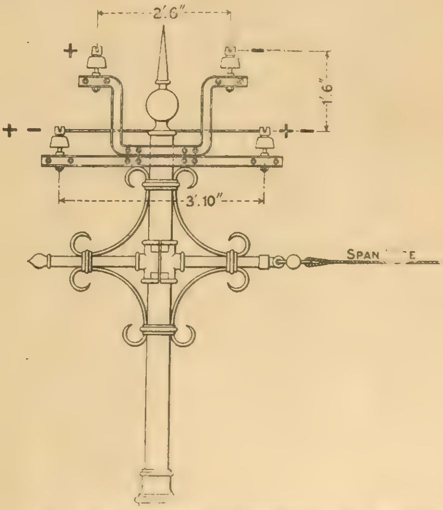


Fig. 1.—Mr. Reginald Wilson's Design at Dudley, 1906. The Cross Wire is Placed at about 5 ft. from the Pole.

The regulations have never called for more than two cross wires. These should be placed as far from the poles as can be conveniently reached from a ladder placed against the pole, say 5 feet. If placed too near to the pole a wire might lie on the ground without touching the cross wire. If placed too far, the wires swaying in the wind are liable to touch the cross wires.

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* Paper read before the Institution of Post Office Electrical Engineers, London, January 20th. The copyright is the property of the Institution.

For tramway spans of 120 feet it is found that 6 or 8 inches is a suitable distance horizontally between two live wires, but Mr. Harold Gray finds that in the case of a live wire and a switch wire, as shown in Fig. 4, a distance of 3½ inches may be used. The method of controlling the street lighting at Accrington from a central point is of interest, and may be mentioned here though it is somewhat beyond the scope of the present paper. The street lighting wires diverge from a central point and these are switched on for the first half mile. The last lamp operates a switch which puts on the next half mile which is supplied from an underground distributor. The last lamp of this half mile switches on the next half mile and so on. The whole system is controlled from one point, but each half mile is supplied from an independent distributor.

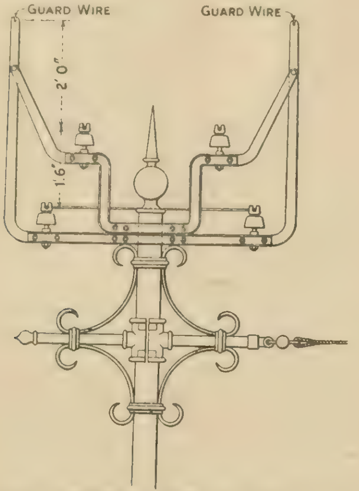

Fig. 2.—The same Design with the Addition of Guard Wires.

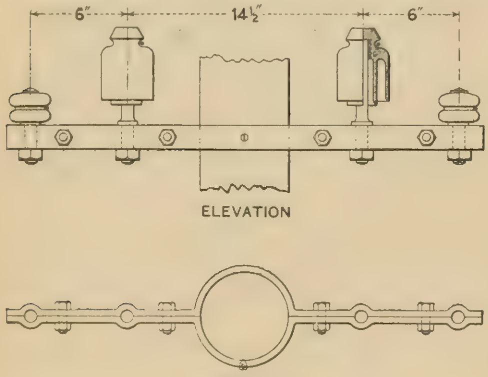

Fig. 3.—Mr. C. J. Wood's Design at Sale, 1907.

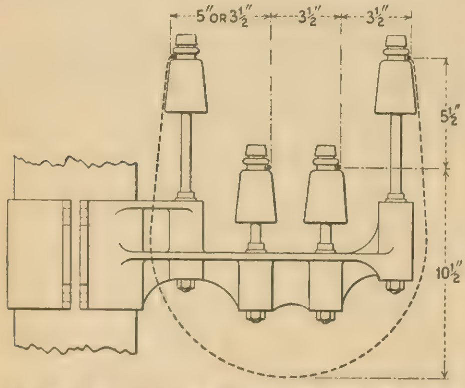

Fig. 4.—Mr Harold Gray's Design at Accrington. Street Lighting. One Live Wire, One Switch Wire, and Two Neutrals.

At Rawtenstall Mr. C. L. E. Stewart has applied this system to street lighting circuits by continuous current at 230 volts to earth on tramway routes. In his first design the outer neutral insulators were mounted on long spindles, and the cranking of the arm to avoid this (Fig. 5) was suggested by Mr. A. J. Stubbs of the Post Office. But at Rawtenstall the tramway poles are sometimes set back in cross streets to avoid obstruction of the pavements of the tramway thoroughfare. Here it is necessary to carry the lighting wires on the span wires. Fig. 6 shows the arrangement he has devised. The span wire is cut, and a double bar, 1¼ in. × ¼ in. is inserted, carrying the neutral insulators. Experience has shown that with the conditions of Rawtenstall these insulators have been sufficient to give satisfactory results with 230 volts to earth, in spite of the absence of any dry shed.

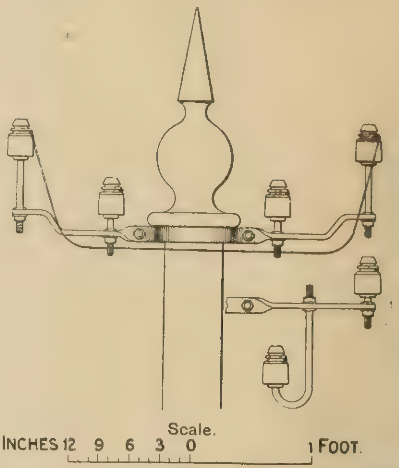

Fig. 5.—Mr. C. L. E. Stewart's Design at Rawtenstall, 1913, for Tramway Poles, with Inset Showing an Alternative Method with a J Spindle.

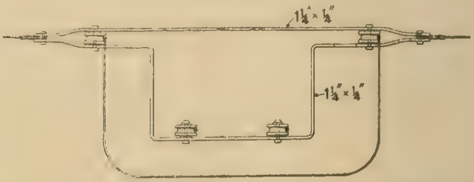

Fig. 6.—Mr. C. L. E. Stewart's Design at Rawtenstall for Span Wires.

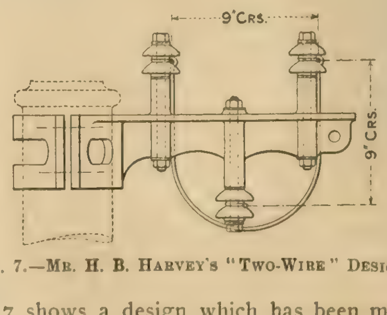

Fig. 7.—Mr. H. B. Harvey's "Two-Wire" Design.

Fig. 7 shows a design which has been made by Mr. H. B. Harvey for a two-wire circuit for street lighting, but which has not yet been carried out. One of the upper wires is a neutral, which is of course earthed at the station, and the other, which is also earthed at the station and at intervals along the route, is an earth wire for earthing the brackets and tramway poles. The type of insulator is of interest, it is a shackle insulator of stock pattern, mounted on a bolt.

Fig. 8 is a design by the same engineer, the two upper wires being neutrals, and the lower ones live wires.

The Post Office requirements for guard wires, as settled with the Board of Trade in 1905 are well known to tramway engineers, and are intended for the protection of telegraph and telephone wires against trolley wires of at least No. O gauge, carrying heavy currents at 500 to 550 volts from earth. But at the end of the document as issued by the Post Office it is provided that "other methods of guarding proposed by Undertakers will be considered, and, if found suitable, will be accepted." The Dudley, Sale, Accrington, Rawtenstall and other examples have been sanctioned in this way.

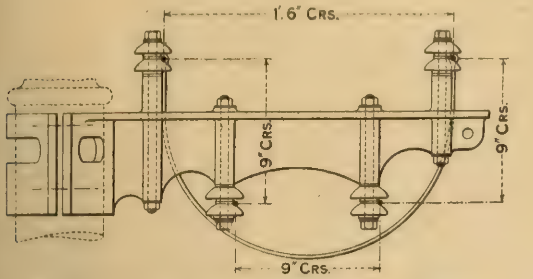

Fig. 8.—Mr. H. B. Harvey's "Three-Wire" Design.

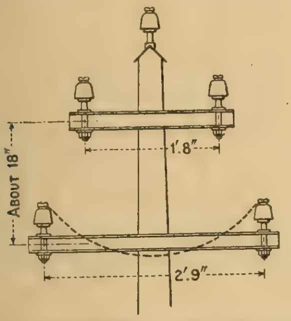

Fig. 9.—A Three-Phase Four-Wire Design.

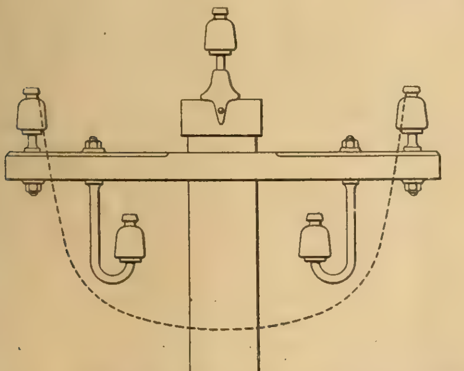

Fig. 10.—A Three-Phase Four-Wire Design with a Single Arm, adopted by Messrs. Strain & Robertson for the Clyde Valley Electrical Power Co.

Fig. 9 shows an obvious mode of construction for three-phase four-wire work, and Fig. 10 is a design which saves the use of a second arm and gives a deep pocket. Guard wires for telegraph and telephone lines are not provided in these and the following cases, public safety against broken wires being the object. In using the arrangement shown in Fig. 10 at an angle pole, care must be taken that the "J" spindle shall pull away from the wires, if it faces the side pull it may twist round This design is being adopted by Mesrs. Strain and Robertson, for the Clyde Valley Electrical Power Co.

The triangular arangement of the phase wires originated with the idea that such a disposition was necessary for the electrical balance of the circuit. This is however of importance, if at all, only on very long lines and for transmission of power at very high voltage.

Some engineers prefer to place the wires in a vertical plane even if a neutral and a switch wire for street lighting make a total of five wires. One reason is to avoid the use of arms, and another is to enable service wires to be led off neatly from the mains. The methods shown in Figs. 9 and 10 cannot be applied.

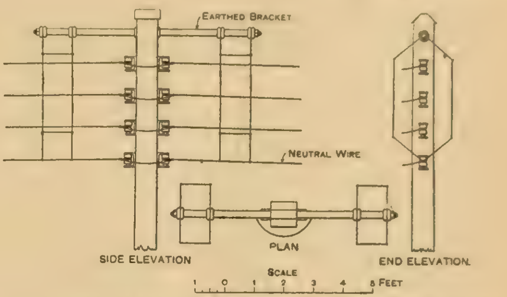

Fig. 11.—Cradle used by the Clyde Valley Electrical Power Co.

A form of cradle (Fig. 11), used by the Clyde Valley Co., has suggested a modification which may be called a triangle guard. It may be applied to wires set in a vertical plane in several ways. These triangles are of the nature of the cross wires, which have been described, rather than guard wires, but they may conveniently be called triangle guards.

Fig. 12 shows a three-phase four-wire line constructed by Mr. E. M. Hollingsworth at St. Helens.

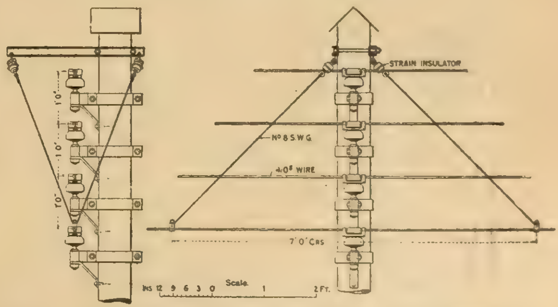

Fig. 12.—Three-Phase Four-Wire Triangle Guarding Constructed by Mr. E. M. Hollingsworth at St. Helens.

The fourth wire is run at the bottom. The triangle wires are insulated from the cross arm for the purpose of carrying out the regulation that a circuit shall be earthed at one point only. As there is no pull on the triangle wires it is rather difficult to make them straight and tidy. In order to tighten the triangle, the fourth wire might be held down as shown in Fig. 13.

A modification of the triangle guard is shown in Fig. 14. A short bracket is used at the top, and a cross arm of equal length is fastened to the fourth wire. The guards become parallel and the clearance is the same for each level. The guards would prevent the cross arms from twisting. This method has not yet been tried.

A three-phase four-wire design by Messrs. Herbert Lewis and Fletcher, employing triangle guards and a split fourth wire acting as guard wires, is shown in Fig. 15. An arm parallel with the line is used to hold out the ends of the triangle wires. This is being used experimentally in South Wales.

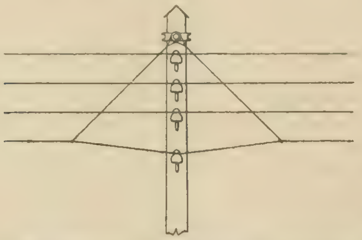

Fig. 13.—Proposal for Tightening Triangle Guards.

The designs which have been shown in the foregoing illustrations indicate that the time has come for some detailed requirements for guard wires; and to distinguish them from tramway guard wires the following conditions may be mentioned. The voltage to earth does not exceed 250. The current used for street lighting circuits does not as a rule exceed 20 amperes. This may be taken as the maximum for the present, and the consideration whether larger currents need be provided for by other regulations may be postponed until occasion arises. The latest code of Board of Trade overhead wire regulations for medium and low pressures fixes the minimum size of wires at No. 11½ S.W.G., or 200 lbs. per mile of copper wire. This is for mechanical purposes and is about the same gauge as the German minimum.

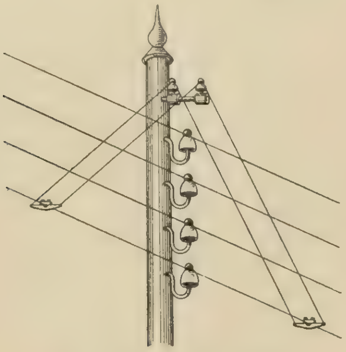

Fig. 14.—Parallel Guards.

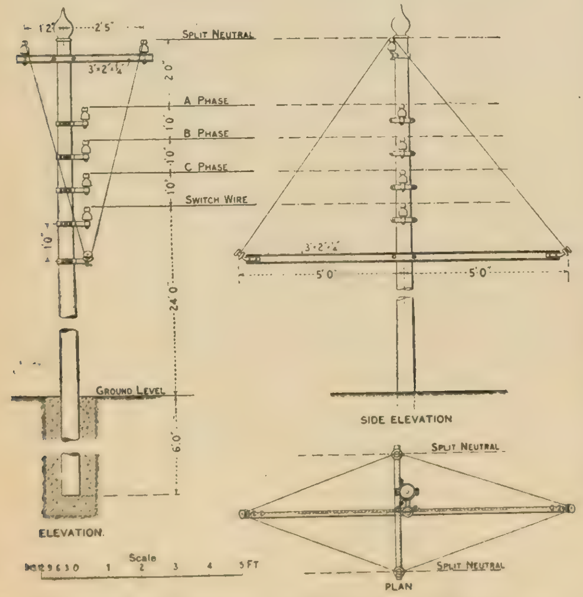

Fig. 15.—Messrs. Herbert Lewis & Fletcher's Three-Phase Four-Wire Design, with Guard Wires.

With these conditions, the new proposals are that an earthed wire forming the neutral or intermediate conductor of a three-wire system, or the fourth wire of a three-phase four-wire system may be used as a guard wire. Without going into details, this has been recognised by the introduction of the words "which is not connected with earth" in the following Regulation (No. 9) of the latest Board of Trade low pressure code.

> Where an overhead line crosses, or is in proximity to, any other wire or metal, precautions shall be taken by the Undertakers against contact between a conductor which is not connected with earth and any other wire or metal by breakage or otherwise.

The first requirement is that there shall be at least two guard wires. This has been a Post Office rule since 1905. But it does not follow that both of the wires need be neutral conductors. In Figs. 7 and 8 one of them is an earth wire, bonding all ironwork together and putting all the earth connexions in parallel. It has been suggested that one of the wires may be used as a switch wire for turning out part of the street lamps at a late hour. So long as the upper wires are not intended to serve as guard wires this is a convenient arrangement. While all the lamps are alight both the guard wires would be neutral wires connected with earth at the works or sub-station, but when part of the lamps are switched off by disconnecting the return wire with "earth" this wire becomes alive.

The reduction of the vertical distance between the guard wires and the neutral wires to 8 inches instead of the 2 feet required in tramway work, and an overlap of 4 inches instead of 8, are valuable concessions which are highly appreciated by those engineers who have heard of them. The designs shown in Figs. 7 and 8 employ these dimensions, and a distance of at least 8 inches is maintained between the live wires.

In triangular guarding and in Fig. 10 the clearance between the guard wires and the lowest phase wire seems to be small, but it must be remembered that the guards are near the poles and the swing of a wire is very small there.

Manufacturers of underground cables have always professed to be unable to provide an insulation adapted for a few volts, as in the case of a negative return feeder of a tramway. But in overhead construction engineers can use insulators reasonably proportioned to their requirements. The neutral wires being earthed at the works or at a sub-station will always be within a few volts of earth, depending on the drop along the route, and on any out of balance currents. The simplest shackle insulators should suffice.

In conclusion I have to thank the various engineers who have given me permission to reproduce their drawings.

10,000 Motors.—On Saturday last, to commemorate the completion of their ten-thousandth electric motor, Messrs. E. Brook, Ltd., of Colne Road, Huddersfield, entertained their employés to a dinner and dance. About 160 guests were present, of whom 100 were employés. The output of the works is now at the rate of 2,000 per annum. The firm has been engaged in motor manufacture for the past 10 years, and to-day it has branches in a number of the more important cities in England, as well as in Canada and New Zealand. Alderman E. A. Beaumont (the auditor) proposed the health of the chief of the firm (Mr. E. Brook), who replied, cordially alluding to the support received from managers, staff and workpeople in the development of the business.

SOME LIMITING FACTORS IN ELECTRIC RAILWAY ENGINEERING.

By E. V. PANNELL.

In almost every country having a railway system of any magnitude the problem of electric trunk-line operation is being seriously considered. The technical possibilities have been thoroughly demonstrated on such schemes as the New York Central and New Haven Railroads in America, the two electrified sections of the Prussian State Railways in Europe, and the Lancashire and Yorkshire Railway in this country. The great disparity between constructional and operating conditions in different countries makes the financial question still a very open one, and it is almost impossible to generalise in this matter. So many variable factors enter into the estimate that it is quite impracticable to attempt to predicate the success of an electric railway worked on any one or other system in this country from the satisfactory operation of a similar line in, say, Germany or the United States. From the engineering point of view, however, it is quite possible to predict and to solve the problems which will arise in practice. It is a far easier matter to predetermine the speed and tractive effort of an electrically-propelled train under given conditions than to make a similar computation for a steam locomotive. This simple fact renders it possible to foretell the limiting sphere of utility of electric traction for any given set of circumstances.

The keynote of any such radical change as the adoption of electric working on a steam railway is *service*. The growth of population and trade demand, year by year, increased service facilities, but it is only where the limits of the present type of propulsion are in sight that the consideration of any other system becomes justified. In other words, there is no logical reason for the installation of electricity on main lines except where the service has become beyond the capacity of steam haulage, either in the matter of speed or tractive effort. Certain special conditions do sometimes dictate the use of electric working, as for instance, the operation of long tunnel sections, but these do not come under the heading of main line operations properly so-called. Admitting as an axiom, therefore, the statement that the use of electricity is to extend the limits of steam working, there are two means by which this can be effected; either by a general increase in the schedule speed or by augmenting the average weight of trains to be hauled. As a matter of fact, the requirements of service are increasing so enormously that it will be necessary to consider the extension of both these factors. It is, however, of particular importance to ascertain the practical and economic aspects of running speeds appreciably in advance of those indicated by present day timetables.

Considering the actual work done by a locomotive or motor-car in hauling a train, the energy is found to be made up of two factors, speed and tractive effort, both of which are limited externally by the permanent way, and internally by the capacity of the driving motors. In cases where it is proposed to substitute electric for steam haulage the internal limits will be extended, but the permanent way will continue to exert the same influence. Economic considerations in most cases preclude complete track renewal, so that electricity must be able to show improved service on the same permanent way as at present laid down for steam traction. This track limitation is a very serious one, and is due mainly to the shocks communicated to the rail joints by the wheels of a heavy locomotive when running at high speed. Added to this is the trouble of "nosing," by which is understood a lateral movement of the locomotive tending to spread the gauge. Lastly, in this connection are the effects of centrifugal force on curves, where the centre of gravity is high (as in modern steam locomotives) the tendency is for the inner wheels to leave the track, and for the whole machine to tilt over outwards. When, however, the mass is centred low down, this centrifugal action is manifested as an exaggerated "nosing," and the gauge may suffer from the enormous pressure exerted by the flanges of the outer wheels. Super-elevation and guard rails are, of course, used to overcome these difficulties, but only to the extent called for by moderately high speeds. Excessive super-elevation cannot be resorted to, as being dangerous for slow trains passing around such curves.

These remarks apply mainly to running around curves, and on straight track the centrifugal action, of course, disappears. Where the permanent way is straight and level, and where, as in this country, it consists of heavy bullhead rails laid in chairs, the limiting factor of the speed is, with steam propulsion, the locomotive. The efficiency of the steam locomotive falls off very rapidly with increasing velocity. Typical characteristics of steam and electric locomotives are shown in fig. 1, and it will be noted that above a certain speed the tractive effort of the steam engine drops down to vanishing point, whilst that of the electric locomotive droops at a much lower rate. This comparison is not a strictly quantitative one, as the two types of locomotive were designed for different classes of service; the forms of curve are, however, quite typical of the two methods of propulsion, assuming the electric motors to be of the series type having highly saturated magnetic circuits. Performance under service conditions shows the effect of this disparity; an extra heavy load or an adverse grade will pull down the speed of the steam-propelled train to a much greater extent than will be the case with the electric train, consequently the latter will keep better time under such unfavourable conditions. In other words, electricity fulfils the requirement of *service* more completely than is done by steam. This is more particularly true in the present instance, where it is desired to extend the speed limits. To secure high running speeds with steam locomotives, large diameter driving wheels have to be employed in order that the piston speed may not exceed judicious limits. This, however, reduces the available tractive effort, and it is found that the maximum weight of train which can be hauled by a steam locomotive falls off very rapidly with increasing velocity.

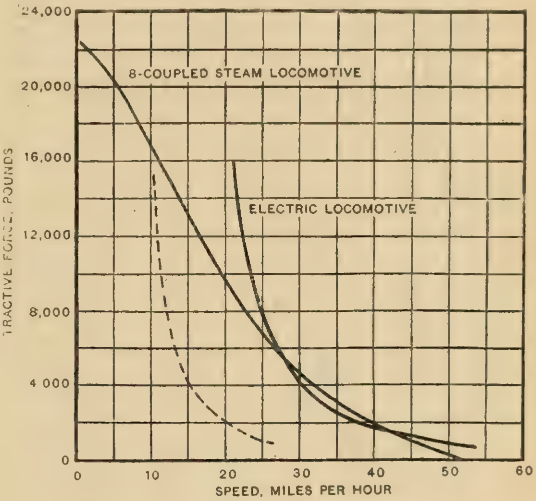

FIG. 1.

Treating of the other factor of locomotive output, *i.e.*, tractive effort, this is effected by several external influences which are quite independent of whether steam or electric operation be employed. The ruling quantity is here the value of the traction coefficient expressed as a fraction of the weight upon the driving wheels. Different values for this quantity have been subscribed by different observers, but it is believed that the curves shown in fig. 2 represent average figures for normal track conditions. It has been asserted that the traction coefficient is lower for single-phase operation than for continuous-current (especially with low frequency), and for steam working still lower; there does not appear, however, to be substantial evidence of this. At any rate, the variation would be less than that occasioned by different weather conditions, and so need not be considered.

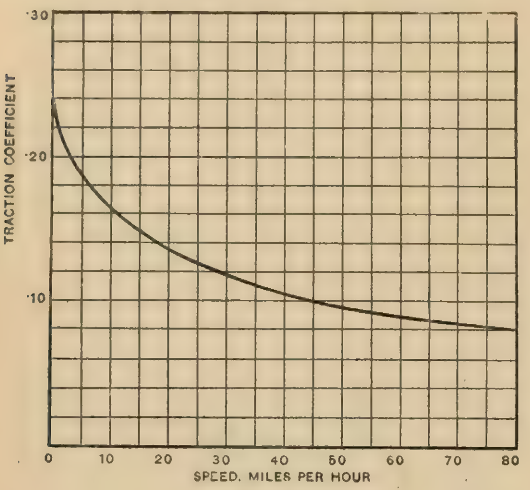

Fig. 2.

The traction coefficient being determined affords a basis for the locomotive design. The weight on the driving wheels being limited by permanent way considerations, it is an easy matter to ascertain the maximum tractive effort of which any locomotive is capable. In several countries the weight per axle is limited by statute, but in Great Britain the practice varies on different systems. Good average practice is represented by the following table:—

Limiting Values of Tractive Effort.

Speed, m.p.h.		20	30	40	50	60	70
Traction coefficient		0·14	0·12	0·10	0 095	0·09	0·085
No. of axles.	Adhesive weight, lb.	Tractive effort, lb.					
1	44,800	6,280	5,370	4,480	4,250	4,030	3,810
2	85,000	11,900	10,200	8,500	8,080	7,650	7,220
3	121,000	17,000	14,500	12,100	11,500	10 900	10,300
4	152,000	21,300	18,200	15,200	14,500	13,700	12 900
5	179,000	25,000	21,400	17,900	17,000	16,100	15,200
6	202,000	28,300	24,200	20,200	19,200	18,200	17,300

The table also sets forth the maximum tractive forces which can be exerted by locomotives of different types. These figures are based upon the curves in fig. 2. This reasoning brings us to an important conclusion, viz., it shows exactly the maximum tractive effort which can be obtained from a locomotive of a given number of driving axles at any speed.

Having discussed the limiting mechanical forces which the locomotive can be designed to yield, it remains to consider the resistance which has to be overcome. Data on tractive resistance have of recent years been largely augmented by the valuable contributions of Aspinall, Davis, Carter, and others. Unfortunately, few experimental values have been obtained at very high speeds, consequently the estimation of tractive forces above 70 miles per hour becomes to some extent a matter of conjecture. The writer has used Aspinall's tests for the calculation of the curves in fig. 3, and it is believed that these figures are more reliable than those from other sources, as they refer solely to British permanent way and rolling stock.

Little use can be made in this country of results obtained in America, owing to the great disparity in the weight and size of coaches, type of permanent way, etc. A standard form of coach has been assumed in the present investigation, having a length of 60 feet and a loaded weight of 35 tons. Allowance has, of course, been made for the effort required to propel the locomotive itself, so that the forces shown in fig. 3 are those obtaining at the driving wheels, and not merely the drawbar-pull. Three sets of curves are incorporated in the diagram; (*a*) the rising lines showing the relation between tractive force and speed for different lengths of train; (*b*) the drooping hyperbolic curves, each of which represents a given horse-power at the wheel-treads; and (*c*) the dotted lines which represent the maximum capacity of the locomotive before slipping takes place. From this diagram can be seen at a glance the maximum number of coaches which can be handled by a locomotive of any given horse-power and number of axles. As already pointed out, these figures refer to average weather conditions, with a bias towards the unfavourable, so that it may safely be assumed that these results will hold for the greater number of days in the year. Under conditions embodying greasy rails, heavy side winds or adverse signal conditions (all of which troubles generally come together), a lower schedule speed and higher power consumption are inevitable. It will be noted from fig. 3 that for all heavy railway work, locomotives of 4, 5, or 6 driving axles must be employed in order to get the necessary tractive effort for the haulage of long trains. This is borne out in present-day practice, as the most recent designs go to show. Presuming that average running speeds of 80 to 90 miles per hour were to be adopted, it would be necessary to use locomotives of 5 and 6 axles to haul trains of 12 to 16 coaches,

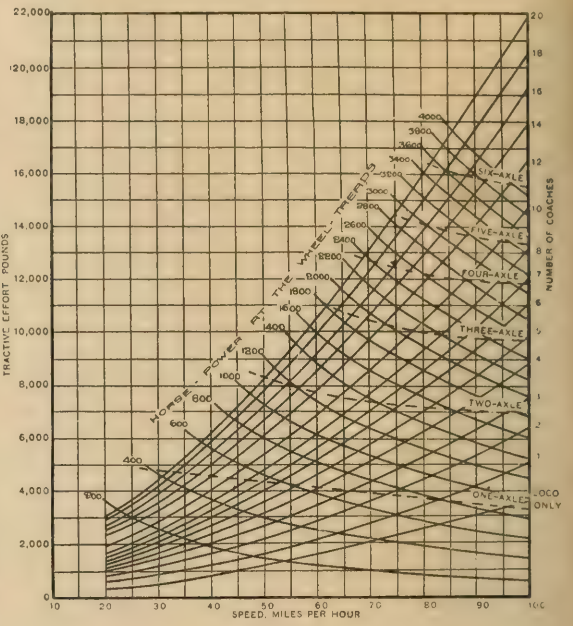

Fig. 3.

whilst the power exerted per train at the wheel-treads would be about 3,400 H.P.. Considering, however, a speed of 60 miles per hour, a smaller locomotive exerting only 1,600 H.P. would suffice. This emphasises the fact that, whatever be the method of traction used, extra high speeds are an expensive luxury, and that the cost of running such trains is out of proportion to the revenue at present obtained therefrom.

Investigation of the matter brings one to the conclusion that if electricity is to be employed to supersede steam to the best advantage, the preferable method will be to give the electric locomotive heavier trains to haul rather than to run it at a very much higher speed. Much could be done by electricity, however, in speeding up the steam trains at present operated on slow schedules.

The foregoing has shown that most of the limiting factors of electric railway operation are limits of locomotive design. The maximum outputs which the weight and friction will permit have already been arrived at, and it remains to consider and compare these with the maximum horse-power which the motors can deliver to the axles. Now, examining a large number of modern locomotive designs, it is found that the weight due to the electrical equipment is always very nearly 50 per cent. of the total locomotive weight. This only fails to hold good in machines of a special type, such as slow-speed or freight locomotives, in which the mechanical parts have to be very heavy to withstand the enormous thrusts and drawbar pulls. On this assumption the table following is based. The adhesive weights are obtained as already described and the *maximum* tractive force under starting conditions is deduced therefrom. Adding to the adhesive weight the necessary tonnage to be placed upon the leading and trailing pony trucks, the total weight is arrived at, half of which is apportioned to the electrical equipment. The horse-power per ton of equipment is a fairly well-defined figure, except that it is often confused by the ambiguity as to the method of rating used. In the present instance, by "output" is understood the horse-power which the motor can maintain continuously with a maximum ultimate temperature rise of 60 deg. C. on the hottest part.

LIMITING OUTPUTS OF ELECTRIC LOCOMOTIVES.

No. of axles	2	3	4	5	6
Adhesive weight, lb. ...	85,000	121,000	152,000	179,000	202.000
Max. tractive effort, lb. ...	17 000	24.200	30,400	35,800	40,400
Do. with sand, lb.	28,000	40 000	50.100	59 000	66,500
Wheel arrangement ...	2-4-2	2-6-2	2-8-2	2-10-2	2-6-6-2
Non-adhesive weight, lb. ...	54,000	54,000	54,000	54,000	54.000
Total weight, lb.	139,000	175,000	206.000	233,000	256,000
Total weight, tons	62	78	92	104	114
Weight of frame, housing, &c., tons	31	39	46	52	57
Do. elec. equipment, tons	31	39	46	52	57
Continuous output (continuous current) H.P.... ...	950	1,200	1,400	1,550	1,700
Do. . (single-phase) H.P.	620	800	920	1,050	1,150
Estimated cost of loco. ...	£5,000	6,200	7,300	8,300	9,100

From the above it will immediately be noted that the maximum output of the motors is far below the dynamical limits of the locomotive, as shown in fig. 3. This affords the chief reason for the adoption of forced draught ventilation on motors of this type. With naturally ventilated motors the locomotive cannot run up to more than about 50 per cent. of its dynamical capacity, and it will be limited by its electrical equipment; to make the most efficient use of a given locomotive—it should be run at the speeds and loads shown in fig. 3 as nearly as possible.

B.E.A M.A.—At the Council meeting of the Association, held at King's House, Kingsway, on the 15th inst., the following firms were elected members of the Association :—Bray, Markham and Reiss, Ltd., W. T. Glover & Co., Ltd., Siemens Bros. & Co., Ltd.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

NEW ZEALAND.—The Customs authorities have decided that the duty on electric hot-air blowers and vibrators shall be 20 per cent. *ad valorem*. The duties quoted are those leviable under the lower tariff applicable to British goods ; the duty on foreign goods of the same kind is 30 per cent. *ad valorem*.

SOUTH AFRICA.—The Trade Commissioner in South Africa has forwarded to the Board of Trade certain further rulings which have been given to the Cape Town Chamber of Commerce with reference to the valuation of goods for import duty purposes, and the declaration on invoices.

The Commissioner of Customs has informed the Chamber that a circular has been issued which lays down special provision in the case of goods which are manufactured solely for sale in the South African market. The certificate, which will be accepted by him, is to the following effect :—

"That goods specified under invoice No.........., dated..............., herein, in the name of Messrs........................., are manufactured solely for the South African market, and there are no similar goods sold for use in the country of manufacture, and we hereby declare the values to be calculated at rates and discounts which would apply if the goods were sold for home consumption in that country."

The Cape Town Chamber raised a further point in regard to duty being levied upon railway carriage to the port of shipment. The law lays down that the "home consumption value" must be the value at the place of purchase, and the Commissioner was asked as to whether it is legal or not to deduct the amount of the railway carriage on goods shipped at European ports for the Union of South Africa.

The Commissioner stated that the value of an article for Customs purposes is its open market value at the place of purchase, and it follows, therefore, that when the price of any article for export at the port is the same as that for home consumption in the country of origin, the invoice value of such goods, without any deduction for railway carriage, is that on which duty is leviable, always provided that the price is not less than that at which the article is sold for home consumption. When a charge over and above the price of an article at the place of purchase is made by bringing it to a port of shipment, such charge is not included in the value for Customs assessment purposes.

If, therefore, an importer wishes to be allowed to deduct any sum included in the price of an article, being included therein to cover f.o.b. charges, he must be able to prove that if the article in question were sold for home consumption at the place of purchase, the price he would have paid would have been less the cost of the f.o.b. charges.

WEST INDIES.—The provisions of the Canada-West Indies Treaty, which, as previously notified in the ELECTRICAL REVIEW, gives a preferential duty on British and Canadian goods imported into certain West Indian islands, have been extended to Grenada. It is understood that the amount of the preference to be granted in Grenada will be one-fifth of the ordinary duty leviable under the tariff.

Wireless Telegraphy on the Quenched-Spark System.—We have received from MESSRS. SIEMENS BROS. AND CO., LTD., a copy of their revised pamphlet, A 550, dealing with their quenched-spark wireless installations for ships. The manufacture of this apparatus was taken up by Messrs. Siemens Bros. and Co. at their works at Woolwich in 1911, and the progress which it has made in England is shown by the fact that there are now over 90 British vessels fitted. Of special importance is the fact that with quenched-spark installations no sound-proof cabin is necessary, any suitably situated cabin being able to accommodate the apparatus. Another important advantage with this system is that twice as much energy is radiated by the quenched spark as by the open spark, and with quenched-spark radiations the electrical oscillations, on conversion to sound waves in the receiving station, give rise to a musical note, which can be heard over natural electric discharges or "atmospherics," even when these are as much as 10 to 15 times as intense as the incoming signals. The latter part of the pamphlet contains brief specifications and illustrations of the principal types of marine wireless telegraph stations, from the smallest type of station, intended for use on launches, up to stations with a guaranteed range of up to 550 miles. This is considerably larger than the stations usually installed upon even the largest mercantile vessels. A large Naval station having a range guarantee from 800 to 2,000 miles has recently been delivered to a foreign Government, which since delivery has placed the order for two more stations of the same type, but with various improvements, which are now being built at Messrs. Siemens Bros. & Co.'s Woolwich works. The pamphlet is well illustrated throughout, and contains photographs of vessels of various types showing the extent to which this system has been adopted on board ship.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

226. "Electric furnaces." I. Rennerfelt. January 5th. (Convention date, January 4th, 1913, Sweden). (Complete).

231. "Suspenders for electric cables and the like." P. Huntington. January 5th.

252. "Relay arrangements for wireless telegraphy and telephony." G. G. von Arco and A. Meissner. January 5th. (Complete).

253. "Dynamo-electric machine." R. H. Lane. January 5th.

284. "Anode of hard lead for electrolytical purposes." E. C. R. Marks. January 5th. (Siemens & Halske Akt. Ges., Germany). (Complete).

285. "Electrodes for metal-vapour rectifiers or the like. Akt. Ges. Brown, Boveri et Cie. January 5th. (Addition to 166/14. Convention date, July 10th, 1913, Germany). (Complete).

299. "Devices for breaking alternating-current commutator motors." Siemens-Schuckertwerke G.m.b.H. January 5th. (Convention date, January 4th, 1913, Germany). (Complete).

310. "Telephone systems." E A. Graham. January 5th. (Complete).

311. "Telephone systems." E. A. Graham and W. J. Rickets. January 5th. (Complete).

313. "Commutator switches." H. Wade. January 5th. (C. Kaisser, Belgium). (Complete).

318. "Water-motor mounted upon or between a floating deck or decks, for the purpose of driving an electrical generator." J. Dent. January 6th.

340. "Switches." G. W. Hart. January 6th. (Complete).

341. "Reversible electric motors." G. W. Warnholz, F. M. Spencer and W. J. Wigmore. January 6th. (Complete).

357. "Sparking plugs." O. Freiberg and O. Petzsche. January 6th. (Convention date, October 8th, 1913, Germany). (Complete).

361. "Recovery of copper from weak copper-sulphate solutions." S. O. Cowper-Coles. January 6th.

362. "Process for the treatment of ores containing iron and copper." S. O. Cowper-Coles. January 6th.

363. "Process for the manufacture of metallic strips and ribbons." S. O. Cowper-Coles. January 6th.

364. "Electro-deposition of alloys." S. O. Cowper-Coles. January 6th.

365. "Process for coating metal plates and the like." S. O. Cowper-Coles. January 6th.

366. "Construction of pipes." S. O. Cowper-Coles. January 6th.

373. "Electric apparatus for heating liquid." J. von Hentzel. January 6th. (Complete).

389. "Fuses for electric circuits." Siemens-Schuckertwerke G.m.b.H. January 6th. (Convention date, May 10th, 1913, Germany). (Complete).

390. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and A. A. Pollach. January 6th.

391. "Electric switching systems." British Thomson-Houston Co., Ltd. and H. C. Hastings. January 6th.

399. "Submarine telegraphy." J. S. Withers. January 6th. (K. C. Cox, Norfolk Island).

402. "Means for and methods of protecting alternating current electric generators." A. M. Taylor. January 6th.

412. "Electric switch." Mickelwright, Ltd., W. W. Peck and W. R. Mickelwright. January 7th.

415. "Gas-controllers and the like." E. H. Horstmann, G. O. H. Horstmann, A. Horstmann, S. A. Horstmann and W. T. Edgar. January 7th.

427. "Distance gas-lighting apparatus, for switching on and off electrically, and means for igniting same." H. T. Brooker and H. Brooker. January 7th.

440. "Call-up switch for wireless telephones." P. A. E. Armstrong. January 7th.

441. "Mercury breaks or interrupters." H. F. Bigge and F. R. Butt. January 7th.

450. "Semi-automatic or automatic graded service telephone systems." H. Baron. January 7th. (G. Heimann, Germany). (Addition to 11,888/13). (Complete).

452. "Transmitter for distant controlling-apparatus for ordnance." R. Girardelli. January 7th. (Convention date, January 16th, 1913, Italy). (Complete).

455. "Mechanical breaks or interrupters." E. E. Greville. January 7th.

459. "Number impulse instrument for automatic or semi-automatic telephone systems." Siemens & Halske Akt. Ges. January 7th. (Convention date, April 17th, 1913, Germany). (Complete).

460. "Sound-transmitters." W. J. Marchant. January 7th. (Complete).

515. "Starting and regulating the speed of dynamo-electric machines." F. Cumont. January 8th. (Addition to 8,108/12). (Complete).

518. "Safety fuse-plug." C. F. Christensen and M. Wettergreen. January 8th.

521. "Shade reflectors for electric and other lighting purposes." J. Morrison and J. Marsden. January 8th.

528. "Process for manufacturing condensation products from phenol, formaldehyde, and the like." Konstantin Tarassoff. January 8th. (Complete).

540. "Electric incandescent lamps." Westinghouse Metallfaden Gluhlampenfabric G.m.b.H. January 8th. (Convention date, January 13th, 1913, Austria). (Complete).

549. "Electrolytic recovery of zinc from solutions of zinc sulphate." E. J. Hunt and W. T. Gidden. January 8th.

557. "Improvements in electrical terminals." Western Electric Co., Ltd. January 8th. (F. T. Woodward, of Belgium).

561. "Method and means for determining and adjusting the speed of rotation of impulse-transmitting device for automatic telephone exchange systems." Western Electric Co., Ltd. January 8th. (F. T. Woodward, Belgium).

570. "Electric induction furnaces." J. Harden. January 8th. (Complete).

590. "Application of the electric properties of metallic sulphides to electrotechnics." G. Mascarini and A. Contardi. January 8th. (Convention date, January 11th, 1913, Italy). (Complete).

597 "Equipment for producing welded seams by means of the electric arc and added welding-materials." F. W. Heuser. January 8th. (Convention date, July 29th, 1913, Germany). (Complete).

599. "Devices for supporting and insulating electric conductors." Neville, Williams & Co. and A. E Woodhouse January 9th

600. "Device adapted to produce, in case of coil defects in the armatures of electric machines, an automatic indication of the said irregularity, or an automatic stopping of the machine, or a decrease of its number of revolutions or of its tension." F. V. Schmidt and W. Rusc. January 9th. (Complete).

624 "Protective devices for dynamo-electric motors G. Ellison and M. R. H. Mueller. January 9th

628. "Method of construction of electric ovens and the like." G H Clarkson, A. J. H. Andrews and D. H. Jackson. January 9th.

630 "Electrical heating-apparatus." A E. Grabonsky. January 9th.

631. "Electrical heating-apparatus. A. E. Grabonsky. January 9th.

643. "High-speed interrupters or vibrators used in connection with electrically operated devices." F. Knabl. January 9th.

683. "Means for collectively actuating and controlling alternating-current motors." J. L. Routin. January 9th. (Addition to 735/13). (Complete).

719. "Sparking-plugs for internal-combustion engines." F. H. Bluemel and Bluemel Bros., Ltd. January 10th.

728. "Method of and apparatus for treating deep-seated parts of the body with Röntgen rays." E. Pohl. (Convention date, March 29th, 1913, Germany). (Complete).

739. "Device for prolonging the period between active intermittent electric impulses." A. B. Webber and Standard Time Co., Ltd. January 10th.

742. "Apparatus for automatically mixing up baths through which electric currents are conducted by means of electrodes." Fried. Krupp Akt. Ges. January 10th. (Convention date, January 17th, 1913, Germany). (Complete).

749. "Supports for electric trolley wires. K. von Kando. January 10th. (Complete).

767. "Telephonic systems." E. A. Graham and E. A. Sanftleben. January 10th. (Complete).

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

21,743. Wireless Telegraph Systems. W. H. Shephard and A. E. McKechnie. September 24th.

26,800. Process for Rendering Non-ductile Metals Ductile. C. Trenzen. November 21st. (August 14th, 1911).

26,899. Regulation of Electric Rotary Converters. P. Whitaker. November 22nd.

29,351 to 29,360. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). November 20th.

29,384. Method of Reproducing Electric Variations. H. de F. Arnold. December 20th. (July 15th, 1912).

29,416. Telegraphic Receiving Apparatus Adapted to Actuate a Perforator, Typewriter, or Analogous Device. A. C. Baronio and K. L. Wood. December 20th.

29,456. Electric Accumulators. B. Heap and Chloride Electrical Storage Co. December 21st.

29,461. Means and Method of Operating Liquid Electric Controllers and Starters. R. F. Baerlocher and Allen West & Co. December 21st.

29,522. Dynamo-electric Machines. Soc. S.T.A.R. (Systeme de Traction Auto-Regulateur). December 23rd. (December 21st, 1911).

29,613. Electric Igniters. F. W. May. December 23rd.

29,620. Electric Ignition Generators. B. Lawrence. December 23rd.

29,719. Impulse-sending Mechanisms. Western Electric Co. (F. T. Woodward, acting for the Western Electric Co.). December 24th.

29,721. Telephone Systems having Automatic Switching Apparatus Connected over Junction Lines with a Manual Exchange. Siemens Bros. & Co. and T. Pettigrew. December 24th.

29,763. Electric Cooking and Heating Appliances. A. H. Railing and C. C. Garrard. December 27th.

29,809. Electric Couplings for Use in the Electrical Installations of Motor Road-vehicles and the like. H. Lucas and W. H. Edwards. December 27th.

29,879. Detachable Electric Immersion Heater. G. H. Ide. December 28th.

1913.

4,355. Electric Ozone Generators. C. W. Denny. February 20th. (Cognate Application, 17,969/13.).

4,638. Electric Time-alarms. W. Rausch. February 24th.

9,463. Earthing Clips for Metallic Covered Electric Cables. F. de B. Hart and Anchor Cable Co. April 22nd.

9,530. Substitution Resistances for Electric Lamps. H. Heins. April 23rd (October 3rd, 1912).

9,685. Amortisseur Windings for Synchronous Dynamo-electric Machines. British Thomson-Houston Co. and F. P. Whitaker. April 24th.

10,018. Substitution Resistances for Electric Lamps. W. Heins. April 29th. (Addition to 9,530/13. November 25th, 1912).

13,654. Electric Switches. E. A. Fagerlund. June 12th. (June 14th, 1912).

13,660. Electric Lighting Indicator. J. C. Hutton. June 12th.

24,126. Geared Alternating Current Electric Motors. Siemens-Schuckertwerke Ges. October 24th. (October 24th, 1912).

24,148. Masts for Wireless Telegraphy and like Purposes. Marconi's Wireless Telegraph Co. and A. Gray. October 24th.

Ashes as Fuel.—The amount of carbon in the ash taken from a boiler is rarely less than 10 to 20 per cent., and is frequently much more, especially in cases of forced firing. A process for saving this has been proposed, wherein the ashes are placed in a liquid having a specific gravity greater than that of the coal, but less than that of the ashes, so that the ashes sink to the bottom and the coal floats, both being continuously removed. In a trial of the apparatus, 800 tons of coked coal were recovered from 2,000 tons of ashpit waste. Of this, some 500 tons were in pieces of from ¼ in. to 2 in. in size, while the rest was available for briquetting. The soot carried over to the tubes and back connection is some 60 per cent. carbon, and the New York Edison Co. is investigating the practicability of briquetting it.—*Power.*

Radium in the U.S.A.—Energetic steps are being taken to secure for the public benefit the great deposits of carnotite in Colorado and Utah, from which radium is being extracted. A National Radium Institute has been established, in conjunction with the Bureau of Mines, to extract the radium and to afford facilities for the free treatment of all cancer patients; none of the radium will be sold. Legislation is contemplated to safeguard any sources of radium that may be discovered in the future.

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AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 16, Palmerston Buildings, Queen Street.
BERLIN: Asher & Co., Unter den Linden; Speyer & Peters, Unter den Linden 43, N.W. 7.
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WAGES AND CONDITIONS OF LONDON ELECTRICAL WORKERS.

THE agitation among the workers in many branches of industry for higher wages and better conditions, now faces the electrical contracting trade in the London district. Two meetings have been held during this week which have shown that the situation may become a serious one, leading to widespread open conflict unless it is handled with the utmost discretion and with a desire on both sides for peace.

We profoundly hope that some way may be found of averting what could only be a calamity.

Let us as briefly as we can state the position. There are said to be 3,000 electrical workers in the London district. Of these, it is understood, 1,800 are now members of the Electrical Trades Union. The officials of that Union base a claim for higher wages upon the increase in the cost of living, and they quote the Board of Trade Labour statistics to show that that increase amounts to 16·8 per cent. since 1900. They ask, for example, that the 9½d. per hour paid to wiremen should be increased to 11d., which they say is only an advance of 8·7 per cent. (we make it 15·8 per cent.), and they also want alterations in conditions as to working hours, overtime and many other matters. Now, if this had been all, the position would have been simpler than it actually is. Such matters afford a basis for negotiations, and, as a matter of fact, both masters and men express themselves agreed that the time has arrived for their consideration. What is it that prevents calm and dispassionate round-table discussion as to what are fair rates of payment? Apparently several months ago there were certain pourparlers between the Electrical Trades Union and the London Electrical Masters' Association, but the latter body declined to negotiate save on certain stipulated conditions. These conditions were strongly objected to by the Union; they refused to discuss matters with their hands tied behind their backs, and desired the questions at issue to be discussed on their merits. The next step was for the L.E.M.A. to issue the notice published in our issue of January 16th calling a meeting at Caxton Hall for Tuesday last, and intimating their desire to improve the status of all electrical workers, whether connected with any organisation or not, with a view to appointing a committee of masters and men to draw up a code of working rules and fix wages and terms of employment. It was this action which enraged the Electrical Trades Union, and they summoned a mass meeting for Monday night last at the Memorial Hall.

We made it our business to attend both of the above gatherings with a view to ascertaining the exact position and forming a fair opinion regarding the dispute. The meeting called by the Union filled the Memorial Hall to its utmost capacity. The throng of 1,500 or so was of one mind; it was too easily carried away at times when the floodgates of Socialistic oratory were opened and abuse was levelled at particular contractors, but there was frequently the saving grace of humour. Laughter was easy, whether occasioned by the imitation of a "cuckoo!" which punctuated speeches at more or less appropriate points, or by the shrill effeminate voice which had a way of crying right above the rest "Hear! hear!," moving to merriment just as some orator or other had been breathing out his threatenings and slaughters, and perhaps was priding himself upon having got home that time, at any rate. Now why was there this humour, this readiness to listen to pretty stories about drowning men with wigs and paper collars, who could not be rescued because they, "like you men, will not hang together"; and about landladies who didn't know how to cook sausages, and said that "when you had cleaned 'em out there wasn't much left of 'em?" The lighter vein of the meeting indicated either that the electrical workers had an unbounded confidence in their cause and felt sure of winning, or else that there were many present who had no life and death interest in the matter.

We must judge things as we find them, and we have dealt with the humour. But there was a deep and serious determination which possessed the whole gathering. It had a conviction that the London Electrical Masters' Association was "out" to "smash the Union"; if that were so, the men were prepared to go any length, it was an infringement of their personal rights and liberties. Men had fought and died for such things as these in the past—they would do so again. Now this, and a great deal of anti-capitalistic froth and Socialistic idealism, may have been merely used to attract members to the E.T.U.—50 were added during the evening—but it may not. There may be some good ground for the men's resentment at the Masters' action when dealing with them in the earlier stages, or there may not. There may have been wisdom in the London Electrical Masters' Association ignoring the Union to such an extent as to omit to send a card to the Union's secretary admitting him to Tuesday's meeting—there may not. We prefer not to decide these points. We are more concerned to prevent a conflict. So far there may have been misunderstandings on both sides, we have nothing to do with that now. We prefer to deal with the position as it stands. The masters at their meeting of workers on Tuesday did not have things as much their own way as they desired. The non-union working element in the Hall was very small, and, generally speaking, was weak. That there is a strong non-unionist case we have shown again and again, and several of the employers indicated strongly their own views, but the non-unionist speakers among the men were not sufficiently representative of the strong case that they might advance for individual liberty. As matters stand both Unionist and non-Unionist are demanding liberty—the Unionist the right to organise, the non-Unionist the right to remain unorganised. But the fly in the ointment is the intolerant spirit of the Unionist toward other men who prefer to remain free. If the members of the Electrical Trades Union mean to conduct their part of the negotiations, which we hope will ensue, in the abominable spirit shown by some of their orators of Monday last, then we cannot feel hopeful of success. We prefer not to print all the ugly things that were said by way of abuse of the non-Unionist, the capitalist and individual electrical employers—we prefer not to embitter the controversy—but we have them in reserve. At the moment we merely treat them as the heated utterances of men who thought that the electrical employers of London were intent on "union-smashing." Several well-known electrical contracting employers on Tuesday night disowned any such intention, and we believe that their fair and frank statements made a good impression on the 50 or more representatives of the Union who were among the delegates. They are compelled, however, so long as there is a large proportion of electrical labour out of the Unions, to pay regard to that element as well, and ensure, as far as may be in their power, that its interests shall be studied. We have repeatedly stated in these pages our views on freedom of labour. We recognise that Trade Unions have a very important non-political place to fill in endeavouring to ameliorate the lot of the worker, also that to try to stop the organisation of workers is both undesirable and futile at this date. Organised employers in the future will have to meet organised labour. The electrical masters declared that they have no desire to fight the Unions, but they are prevented from negotiating with them by their own action in denying the masters the right to give free and Union labour equal rights to work.

The intention of the L.E.M.A. was to pass the following resolution :—

> That a Committee of Workmen's Representatives be appointed consisting of 12 members (not more than one representative from any one firm) to meet the Committee of the London Electrical Masters' Association with a view to agreeing working rules, and terms and conditions of employment.

Eventually, however, that resolution was withdrawn, as Union rules would have debarred any Union man from acting on such a committee, and an amendment moved by a member of the E.T.U. District Committee, who argued with considerable fairness and some ability, and seconded by Mr. Ebben, the secretary of the Association of Electrical Station Engineers, was carried by an overwhelming majority, as follows :—

> That the resolution put forward by the Electrical Masters' Association be referred back to the two organisations, the Electrical Trades Union and the Association of Electrical Station Engineers.

What the next step may be we cannot now say. The exact meaning and drift of the amendment is not clear. How the resolution, which only came before the meeting for the first time on Tuesday, could be referred back to those who had never had it before them, we know not, but we presume it amounts to this, that the two Associations will put their heads together (it was stated on Monday that the A.E.S.E. had thrown in its lot with the Union), and do something toward the appointment of a committee to meet the Masters' Committee. If that be the case, and the masters agree to waive their conditions meanwhile, there is a free way for matters to be considered fully. But if the Union continues to adopt the attitude of open hostility to the non-Union worker and declines to work beside him, or at best continues to make life intolerable to him, then that is a rock on which the ship will split. If Unionists mean it when they say, as they do say, "Let us have peace!" "We do not want war!" then they must not expect to dictate all the terms, and they must certainly moderate their attitude towards the non-Unionist.

Very many interesting points came under discussion at both of the meetings referred to, such as the grading of men, black-listing, inefficient work, apprentices, under-cutting of labour, and under-cutting of contractors' charges to clients, how long a period of training and experience is required in order to make a wireman efficient and so on—but these we cannot deal with now.

We will content ourselves with hoping for a peaceful settlement of the whole of the differences. We note with regret, however, that the E.T.U. Secretary is reported to have stated that the acceptance of the amendment will not affect the position with regard to the building strike at all. "In every case where the Building Trades Federation took action their men would come out automatically."

The Telephone Service.

While the volume of complaint regarding the British telephone service intermittently swells and dies away, it never ceases for long. Granted that the Post Office has had its hands full of work arising out of the transfer, and due very largely to the inexcusable neglect of the Government to make proper arrangements with the National Telephone Co. for the vigorous development of the system during the years immediately preceding the transfer, the fact remains that two years have elapsed since the Post Office took charge of the undertaking, and still the service is not satisfactory. That is the mildest possible way of stating the case, for there is abundant evidence that the development of the system and the quality of the service lag far behind the standards maintained in other countries.

But apart altogether from the technical aspect of the question, the baneful influence of the official attitude towards the public has manifested itself in various ways; the idea that a public service is essentially intended for the benefit and convenience of the public never seems to penetrate the understanding of the bureaucrat, or of his subordinates, who collectively regard the matter as *their* business, and, as was evident in the recent agitation of the postal servants, the profits as *their* profits. Hence there is always a tendency for the officials to assume a hectoring, domineering attitude towards individual members of the community whose views may differ from their own, and to regard themselves as Government officials rather than servants of the public—their true function.

This attitude is well exemplified in the clause in the telephone agreements which, above all, has pressed most hardly on users of the telephone—the clause which compels the subscriber to commend his very soul to the care of the department, and renders it impossible for him to obtain common justice and equity in the Courts. The iniquity of this clause has been frequently the subject of severe and outspoken comments by the judges before whom cases have been brought, and who have found themselves compelled, in direct defiance of the principles of justice, to decide in favour of the Post Office. So long as this condition prevails, the telephone service is not a service, but a tyranny, for no other word adequately describes a state of things in which a citizen is deprived of his legal remedy for wrongful treatment. It is an established principle of the British Constitution that for every wrong there is a right—why should the Post Office be empowered to override this great principle ?

A correspondent of the *Times* recently suggested arbitration as a solution of the difficulty. He pointed out that appeals between the Post Office and friendly societies now come before the Registrar of Friendly Societies, upon whom powers of arbitration were conferred by an Act of 1876. The tribunal thus created, he says, has proved to be one of the cheapest and most expeditious in the country, and he sees no reason why the arbitrator, who now adjudicates in one branch of Post Office work, should not also deal with another.

Whether the same arbitrator do the work, or another be appointed to deal with telephone disputes, is immaterial; the important thing is that the present state of affairs is oppressive and intolerable, and a way ought to be found to remove the legal disability at present imposed by force upon all telephone subscribers.

A new instance of encroachment by the Telephone Department upon the rights of subscribers is brought into the light by another correspondent of our contemporary, who states that the department will not now issue two free copies of the telephone directory to a subscriber who rents an extension as well as a main instrument, unless he is on the "message-rate" tariff. This amounts to charging an extra half-crown a year for the use of an extension. If the rates are to be revised—and we understand that a new tariff is approaching completion—let them be revised systematically and *en bloc;* the policy of pinpricks is a most irritating method of procedure.

Lead.

A very active market has been witnessed for lead within the past few weeks, and the situation, while gaining in strength to a notable degree, has, to a considerable extent, regained some of the interesting features of last year. The bears who sold so heavily in December when prices slumped heavily (the average for the month being only £17 8s. 8d. a ton, against £19 9s. 5d. in November, and £19 14s. 10d. a ton in October) were driven in a half panic to cover, and prices accordingly soared upwards to well over £20 a ton for January shipments, while parcels available for prompt delivery rose to an even higher figure. There was no mistaking the liberties which had been taken with the position, and the Convention, while for a time assuming the *rôle* of mere on-lookers, at last came in and bought a little, which added to the feelings of apprehension. Later on, however, the Convention reversed their tactics, and the price having been forced to an elevated figure, they came forward as sellers on a liberal scale of January shipment, nobody else, in fact, having anything to dispose of. The leading interests met the demand quite liberally at round £20 5s. for this position, and the private transactions in all probability exceeded in volume those put through publicly.

The strong impression is that the price of the metal was raised unduly under the heavy speculative buying witnessed, for there is not any real scarcity of lead even though the quantities coming forward are ample to meet the *bonâ fide* requirements of consumers. The industrial prospects for the near future, although not bad, are not calculated to inspire confidence in very much higher prices. For one thing the building trade here is not at all good, and the labour position generally is, indeed, most disconcerting. On the other hand, there is a considerable bear account.

There has not been so much doing for the export markets, though a few weeks ago the demand for Russia was of a most pronounced character, and the home buying has lately also shown a marked contraction. The advices coming to hand from the Continent are not reassuring, for German conditions are very far from being satisfactory, with a marked slackening of industrial activity in the electrical plants. The immediate position as regards prices will probably, however, be affected very largely by what happens in respect to the present oversold account. The trade as a whole does not yet believe in the stability of prices round £20 a ton, and is inclined to anticipate a falling away based upon the assumed relaxation of consumption, and the fact that, despite the Mexican position, there appears to be sufficient lead to go round, but the oversold account for the early spring months remains of considerable extent, and this will have to be reckoned with sooner or later. The statistical position is sound enough actually, the only thing being that prices are regarded as high.

The total imports for 1913 amounted to 204,136 tons, compared with 205,375 tons in 1912, and 213,704 tons in 1911. The position was thus not materially altered on the year, and it is rather surprising, after all that has been said as to the falling off in the Mexican production, to note that the imports from there were 10,380 tons, compared with 17,757 tons in 1912, and 20,219 tons in 1911. A survey of the British imports for the past 30 years shows that they have risen from 109,016 tons in 1884 to 204,136 tons in 1912. The year of the largest import was 1904, when the total was 246,506 tons, and the average price for the year £11 19s. 8d. a ton. The highest average annual price during recent years was £19 1s. 9d. in 1907, when the imports were practically identical with those of 1913.

A LOCOMOTIVE SLEWING CRANE WITH ACCUMULATOR OPERATION.

[BY OUR BERLIN CORRESPONDENT.]

The locomotive slewing crane recently constructed by Messrs. L. von Roll'sche Eisenwerke, of Berne, Switzerland, had to comply with the following conditions: It had to travel within the factory yards of the Schweizerische Wagonfabrik Schlieren, Ltd., on standard gauge tracks, negotiating curves and switches; its dimensions had not to exceed the standard clear profile and had to be designed for the crane to pass through factory gates 4.30 m. in clear height. Its radius in the rear was limited by platforms to be passed by the crane; the maximum carrying capacity with 6 m. mean radius was fixed at 5 tons, though 6 tons had to be lifted with a smaller radius. Apart from dealing with piece goods, the operation of a grab for coal loading had to be provided for. The crane was also to serve from time to time in shunting and in hauling railway wagons from the near-by railway station to the premises of the above company.

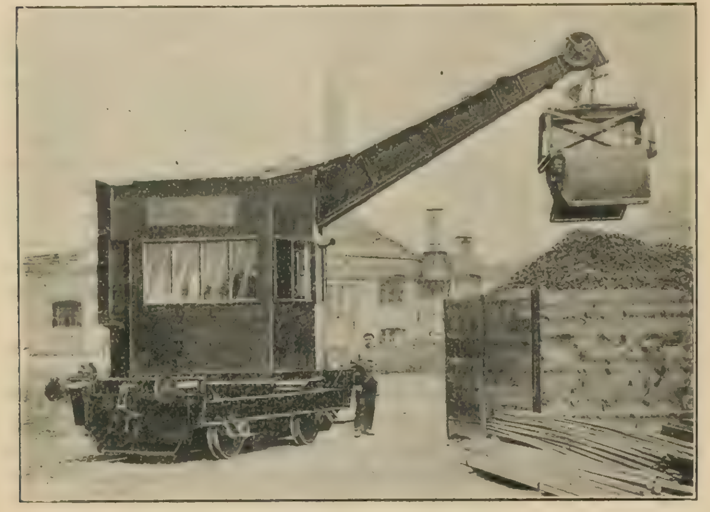

Fig. 1.—Locomotive Battery Crane.

The crane, as illustrated in fig. 1, has been designed as a slewing pillar crane with adjustable radius. The jib, as well as its hammer-shaped supporting framework, is of the plate girder type. This arrangement ensures for the crane operator a free view of the surroundings, while affording a convenient space for arranging the accumulator battery on the top, at the side of the beams. A massive counterweight had to be provided in order to ensure the stability of the crane, any use of the battery as counterweight being out of the question, because of the limited radius at the back of the crane.

On account of the considerable length of track to be travelled through, as well as of the switches and curves, accumulator operation was found preferable to the overhead supplies of electrical energy. The battery was calculated for half the average daily output, its capacity being 185 amp.-hours with a 5 hours' discharge, using 80 cells; the output is about 30 kw.-hours. The battery is charged in two groups, each of 40 cells, at an initial pressure of about 80 to 85 volts, rising to 105 to 110 volts, towards the end of the charging process. During operation the two groups of cells are connected up in series, thus rendering available a discharge pressure of 160 to 170 volts.

All motors are designed with series field windings, the outputs in lifting loads of 5 tons being 17 H.P., in slewing 4.5 H.P., and in travelling 2 by 12.5 = 25 H.P. The lifting speed is 10 m. per minute, the slewing speed 1 metre per second, and the travelling speed 2 metres per second.

The lifting gear is a cable winch with worm drive, spur gear transmission and electromagnetic brake, and is switched out in the position of maximum lift by means of an adjustable segment stop. The slewing gear comprises a horizontal worm drive provided with a sliding clutch, as a safeguard against any overload on the driving gear wheels in the event of jamming of the load or if the jib should stick fast. Two motors, each of 12.5 H.P., have been used in the travelling gear, each of which drives a shaft through a tootned wheel transmission; on account of the differences in travelling resistance of the shafts, in accordance with the position of the jib, a compensation of power effects has, however, been ensured between the two axles by a bevel wheel gear. Control is effected exclusively by means of controllers from the driver's stand on the rotary platform. The lifting and slewing controllers are operated simultaneously by means of combined

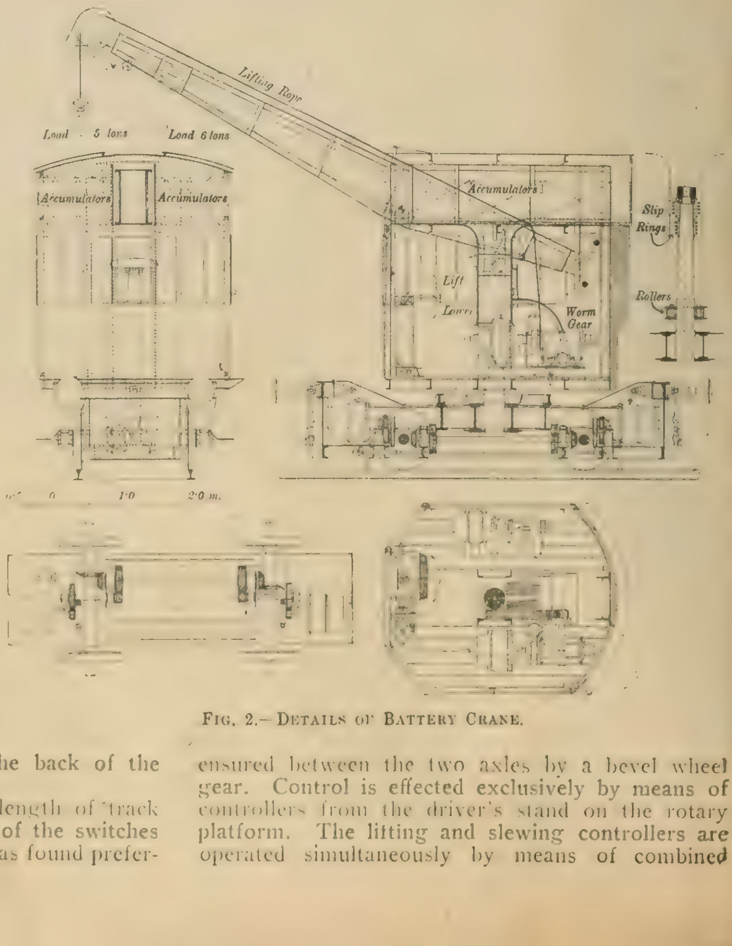

Fig. 2.—Details of Battery Crane.

lever controllers through a single lever. The slewing controller is a simple reversing controller with 5 switching positions, whereas the lifting controller includes lowering brake connections. The travelling controller comprises series-parallel reversing connections, that is to say, the two travelling motors are arranged in series in the first three contact positions and in parallel in the last two positions, the crane travelling in the former case at half and in the latter at full speed.

Self-grabbing operation is performed in the following way: The open grab is lowered down on the material; on striking it, the locking device which has kept the grab open is disengaged automatically, thus allowing the grab to be closed and lifted by means of the lifting winch. In the highest position a fork is, by means of a cable, operated from the driver's stand, slipped below a bolt head of the grab, thus serving as a rest to the grab frame, disengaging the shovels and allowing them to open. In their open position the shovels are locked fast, thus allowing the fork to be withdrawn after a short lift, after which the same operation may be begun over again.

Lifting and lowering of the jib is effected by means of the lifting winch. Lowering can be effected under current, using the controller; the jib or load can also be lowered without the aid of the controller, the electromagnetic brake being lifted by hand and the load being allowed to slide under the control of the brake.

The crane above described has given every satisfaction in connection with its very varied duties.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The London Electrical Trades Dispute.

As an electrical manufacturer, I, in common with, I presume, all (at any rate, London) manufacturers, have received a letter and booklet from the Electrical Trades Union. In the letter they say that as the masters, through their Association, refuse to meet them to discuss wage rates, &c., unconditionally, they have taken the bull by the horns and issued a booklet of their demands. I do not propose to deal with the masters' so-called refusal to meet the men, beyond saying that, as far as I have heard, their only stipulation was that the rights of non-union men should be recognised, and to this the Union would not agree. No doubt this will be dealt with in your paper by some who know more about it, as I am not a member of the above-mentioned Association.

The particular points I should like to raise are with regard to the book of rules issued by the Electrical Trades Union. If the officials had for their sole object the dismissal of all their members, they could hardly have drawn up rules better calculated to accomplish that end, and the following are a few extracts :—

Rule 2.—A 50-hour week.

Rule 5.—Rates of wages : Electric fitter, 11d. per hour ; armature winder, 11d. per hour ; cable joiner, 11d. per hour ; plumber's joiner, 1s. per hour ; joiner's mate, 8½d. per hour ; meter fixers, £2 per week ; coil and magnet winders, 9½d. per hour.

These wages are, as everyone knows, a very considerable advance, and in some cases are obviously absurd. For instance, you will notice that no distinction is made between the rate for winding large and small armatures, whereas of course it would be absolutely impossible to pay 11d. per hour for winding a small armature ; and, in fact, this rate would kill the trade in all machines under about 30 H.P.

Again, the rate demanded for coil and magnet winders is 9½d. per hour ; now, winding coils, at any rate for small sizes, is the simplest possible job, and a boy at 7s. 6d. per week, after being shown for a couple of days, can do it as well as a man. Yet if these rules are allowed to stand, some of the boroughs will stipulate that machines supplied to their orders are to be made by men who are paid Trade Union wages. I should like the views of your readers, as I fail to see how it is to be done.

Now to turn to the still more ridiculous rules. No. 6 reads :—" Inside workers shall be allowed walking time for any distance under one mile, and not less than 1s. per day for over one mile and under three miles from shop. Not less than 1s. 6d. per day outdoor money be paid, and travelling time and third-class ordinary railway fares allowed for any distance over three miles and under 12 miles from shop."

Now I quite fail to see the fairness of demanding 1s. to 1s. 6d., because a man chooses, for reasons of his own, to live at a distance from his work ; or, again, is it fair on the men every time they change employment to have to move their home owing to the masters refusing (perfectly rightly, I think) to pay a man extra because he lives at a distance ?

No. 7.—All members working on any dirty job must receive not less than 1s. per day extra. All members working on any dangerous jobs must receive 2s. 6d. per day in addition to outdoor money.

Finally, I am afraid that if the Electrical Trades Union cannot see how unreasonable many of these rules are they will find that their members, instead of getting assistance from the Union, will find that their membership is a bar to getting a job.

An Employer.

Capping Wood Casing.

In November, 1913, a letter was kindly placed in your paper requesting readers to give us their opinion whether casings would be more satisfactory if the edges were thicker to take a screw, with the centre fillet proportionately less than is usual at present.

We have had numerous replies, and the general opinion appears to be in favour of having the three fillets of equal thickness so that the capping can be screwed on the two edges of the casings, still leaving the fillet in the centre of sufficient size with care to put a screw through, to screw the casing also on to the grounds to which it has to be fixed.

Would any of your readers express further opinions on this point ? We, as manufacturers, wish to make this material to suit general requirements, and intend to alter our standard pattern very shortly with the outside edges and the centre of equal size unless many expressions of opinion are to the contrary.

C. Jennings & Co.

Bristol, *January 23rd*, 1914.

The Present Discontent.

I am glad to see by your " Correspondence " columns that central-station engineers are at last awaking to the fact that it is not *infra dig.* to be a Trade Unionist, and as a central-station man and an official of another Union, I wish the A.E.S.E. every success, and hope all station men will become members.

I should certainly advise " Omen " to join, as if he has the Trade Union spirit he will, just to help his more unfortunate brethren, though he has not much cause for complaint ; if he has to work on Bank Holidays he gets his fortnight in summer, and pay if sick. Also, are not all station men on duty all the eight hours, and seven days per week ? I should like him to try a works power station for a year (if he could stick it so long) ; no holidays ; 24 hours for the longest week-end off ; no sick pay ; time for relief strict—if late lose shift and pay ; not allowed to change shift ; and not on *staff* at all.

I quite sympathise with " Idoneus Homo " in the assistants he is supplied with, but, personally, I would rather have this type than the snob who takes a central-station job for a hobby and works for nothing. No wonder charge engineers get such magnificent remuneration !

The one point where the education of the average station engineer is incomplete is that a driver or stoker or cleaner is every bit as good a " man " in his respective position as the " shift," as " A man's a man for a' that."

If station engineers do not come off the pedestal and join a Union they are likely to get even less than they have at present, and they must not be afraid that if all the station employés are members of the same Union, they will lose caste.

It's an old saying but a true one : " United we stand, divided we fall."

Therefore, join the A.E.S.E. and do your bit to help others and yourself.

Ex-L.C.C.T.

I agree with " An Ayrshire Man " in most of his remarks, but he should have had better taste than to sneer at an Association of which he evidently has very little knowledge, promoted by well-educated electrical station engineers at considerable trouble and a certain amount of abuse, with the object of bettering the conditions under which " An Ayrshire Man " and other engineers are employed. With his aid and that of other engineers, it may be possible to rid our profession of the uninterested variety of which he writes.

There seems to be a great deal of misunderstanding with regard to the necessary qualifications for membership of the A.E.S.E. A considerable number of engineers are under the impression that wiremen, drivers, cleaners, &c., are eligible for membership. This is absurd. Not a single wireman, driver, or cleaner is, or can be, a member of the A.E.S.E. While there may be one or two members who can only by a very great stretch of imagination be termed qualified station engineers, the Committee have, to the best of their ability, scrutinised all applications thoroughly, and refused admission to all whom they considered unqualified.

When it is remembered that over 200 members of the A.E.S.E. are also on the I.E.E. list of Members, Associate Members and Students, it will be readily seen that station engineers have an association to be proud of. I think I am right in stating that the majority of the A.E.S.E. members are either chief assistants or assistant engineers, and it is particularly to these two grades that I appeal for support of this Association, because it is only by the co-operation of all highly qualified engineers that such an Association can be kept at a high standard.

It should be made clear that the A.E.S.E. is a professional association (similar to the B.M.A.) for bringing together station engineers in order that they may debate on educational and social topics concerning stations, consider differences between their members and those above them, with the object of conciliation, and generally consider methods for raising the status of station engineers.

Agitators will receive no encouragement from the A.E.S.E., and they are respectfully asked to give it a wide berth.

An Assistant Engineer and Member of the Executive.

The unjust references contained in the latter portion of your correspondent's letter under the above heading will be resented by all marine engineers engaged in the electrical profession.

The lot of a marine engineer is admittedly no sinecure, but the present-day conditions do not warrant a man leaving a profession where he can command anything from £8 to £18 per month (chiefs excluded) plus board and lodging—a by no means inconsiderable item in a large line—in order to remain ashore for 25s. to 30s. per week, as your correspondent suggests.

If such is the case, then the marine man has a definite object in view, and should his ambitions not be realised, he will not be content to remain very long on the 30s. per week scale, but will readily resume his more lucrative duties.

The marine man is *not* the type of man to lower the status of the engineering profession.

The " fed-up " expression is equally applicable to a great many central and sub-station men—who would probably be only too eager to exchange places with their much-maligned, but none the less useful, seafaring brothers—but who, through either not possessing the necessary qualifications, or being unwilling to face the hard work essential to obtaining those qualifications, prefer to remain as they are, bewailing their lot and casting aspersions upon their more energetic and ambitious colleagues.

The other acquaintances of the " Ayrshire Man " alluded to in the former part of his letter are presumably men who, having discovered their inability to succeed in the electrical profession, utilise their employer's time in endeavouring to cultivate some dormant talent, hoping thereby to secure a more congenial occupation, possibly upon the sands, aided by their beloved banjos, supplemented with straw hats and blackened faces.

W. E. Plowman.

London, *January 26th*, 1914.

Protection or Tyranny ?

When I penned my previous letter to you on this subject, I never imagined for a moment that the B.E.A.M.A. would provide such a striking vindication of my criticism of their attitude, as was the case at their recent annual dinner.

Seeing a long procession of contracts going abroad, such as Aberdeen, Marylebone, Newport, York, Stepney, Sunderland, and others, to be followed by the one from Bradford, was evidently too much for the " high and mighties," so they have recourse to a lawyer-politician from the front-bench, who directs his withering sarcasm against the opinions of our eminent and respected Bradford engineer. Mr. Roles is quite capable of taking care of himself, but I am sure all municipal engineers will join me in protesting against such methods of attack. The front-bencher, however, provides us with an exact simile in his attitude over the " Ulster Question." He objects to an unjust and repressive measure, and the war cry of his comrades is : " We will fight." That is exactly the position of those who are protesting against the B.E.A.M.A. conditions. The fight is only beginning, and our friends the enemy are already resorting to the heaviest artillery at their disposal ; but we are not afraid, and will not be stampeded into a panic, rather shall we gain strength and addition to our ranks.

One word in conclusion : if those who fondly sigh for an alteration in our system of taxation only realised it, they would see that the present methods of the B.E.A.M.A. will prove the strongest weapons in the hands of those opposing any alteration. If the treatment we are now receiving is the best under existing (and so-called) " Free Trade," whatever will it be under " Tariff Reform " ?

Frederick W. Purse,
City Electrical Engineer.

Carlisle, *January 26th*, 1914.

Continuity of Supply.

Referring to the letter in your last week's issue under the heading of " Continuity of Supply," I fail to see the reason for the remarks relating to the Wakefield electricity department. An examination of the advertisement columns of the Electrical Review for the past six months seems to prove that the payment of charge engineers in the Wakefield Corporation electricity works, namely, 35s., rising to 42s., per week is a very fair average for works even much larger than the Wakefield one. In addition to the above, relief is given in the event of sickness and on Sunday work, so that the position of a charge engineer at Wakefield is not, by any means, so hopeless a one as your correspondent endeavours to show. With regard to his further remarks, I think again that his knowledge of facts is decidedly wanting.

H. A. Nevill.

Wakefield Electricity Department,
January 26th, 1914.

[See also our " Notes " columns.—Eds. Elec. Rev.]

The Position of Electrical Railway Staffs.

My earnest advice to "Omen," "Idoneus Homo" and their colleagues is to become members of the A.E.S.E. without delay.

Although I advise this action, I cannot promise them any immediate betterment in their conditions. With such a young Association as the A.E.S.E., which has been formed with the object of improving the status of its members without sacrificing the dignity of their position and profession, any drastic action which a Trade Union (such as the N.U.R.) might take is not possible.

It must be clearly understood that the officials of the A.E.S.E. do not intend to sacrifice the dignity of their profession in any manner whatever, and are confident that by the co-operation of all station engineers a very great improvement can be made in their status without this sacrifice.

To join the N.U.R. would be slow suicide for electrical engineers, as they would be placed on the same plane as the ordinary railwayman, and have to abide by whatever decision the railwaymen as a body (station engineers would be in the small minority) might come to. The immediate result might be better than if he were a member of the A.E S.E., but the lasting result as an A.E.S.E. member would be very much better, both in regard to remuneration and social status.

A Member of the Executive (A.E.S.E.).

The Half-Watt Lamp.

With reference to the paragraph in your editorial notes appearing on page 83 of your issue of the 16th inst., we are afraid we cannot agree with you that the half-watt lamp "will exert immense influence on the future of street lighting," except, perhaps, in some of the unimportant thoroughfares, for its efficiency falls too far short of that of the flame arc lamp, and if "no attention when it is once installed" be paid to the cleaning of the lamp, and/or its enclosing globe, the comparison will be even more marked.

We do not agree with you either, for it is far from the fact, that for all-night burning the renewals, &c., of the half-watt lamp will cost about the same as the trimming, attendance, and depreciation of the flame arc. Again, at even 1d. per unit, the cost for energy, light for light, of an efficient magazine flame arc lamp will *not* be "the same for both," but considerably less per annum, as may be easily calculated.

We welcome the advent of the half-watt lamp for, no doubt, it will be a factor in competition with the best and latest method of high-pressure gas lighting, and it will have its uses, but as a competitor of the magazine flame arc lamp for main thoroughfares, &c., except where really efficient lighting is not the great consideration, the arc lamp manufacturers need have no fear.

In conclusion, we would say we think your article was penned without due consideration of the various factors that make for efficient and economical street lighting,

per pro. **Oliver Arc Lamp, Ltd.**
Wm. D. Pell, *Director*

Woolwich, *January 23rd*, 1914.

[We certainly thought we had held the balance fairly in our brief comparison of the relative merits of the flame arc and the half-watt lamp, and regret that our correspondents feel that we have not done justice to the former. As regards the probable influence of the new lamp on the future of street lighting, we did not advocate its use for main thoroughfares, but remarked that it could "be advantageously employed in streets where the flame arc would be too large a unit"; we may point out, as a practical case, that the lighting of 13 miles of streets in the borough of Holborn was carried out with one-watt tungsten lamp units of the following sizes:—20 of 1,800 c.p. (= 3 × 600 c.p.), at 30 yd.; 212 of 400 c.p., at 15 yd.; 717 of 90 c.p.; 5 of 600 and 4 of 200 c.p. (Elec. Rev., October 25th, 1912).

The largest size of lamp used was 600 c.p. Disregarding the streets lighted with 90-c.p. units as outside the question, over 2 miles of streets were lighted with tungsten lamps of high candle-power, at a cost for energy and renewals which can now be reduced by more than one-third. If flame-arc lamps were not considered suitable for these streets when only the one-watt lamp was available, their chance of adoption there is obviously much less now.

Our comparison on the score of cost was based on the figures given by Mr. M. Solomon in the discussion on his paper on Yellow-Flame Arcs, in May, 1912. Taking 1,000 m.s.c.p., and allowing for the absorption of globes, for 4,000 burning hours per annum, the author gave the following data:—

Flame arc:—			
Carbons and depreciation	£4	10	0
Trimming and attendance	2	0	0
Energy at 1d. per unit	7	0	0
	£13	10	0
New tungsten lamps and depreciation to fittings	£3	16	0
Trimming and attendance	0	10	0
Energy at 1d. per unit	18	0	0
	£22	6	0
Using half-watt lamps, this figure will be reduced by £9...	£13	6	0

Whether the flame arc or the half-watt lamp proves actually the cheaper at 1d. per unit depends upon the cost of renewals—that is, upon the life of the half-watt lamp, and it will be remembered that the actual recorded average life of tungsten lamps in street lighting has been several thousand hours. If this experience is repeated in the case of the half-watt lamp, as it probably will be, the comparison will not be far wrong.—Eds. Elec. Rev.]

The New Half-Watt Lamps.

With reference to Mr. Maycock's letter in to-day's issue, I am afraid that the writer has not very carefully studied the various "half-watt" lists, as in the Ediswan list before me it distinctly states: "It has an exceedingly low consumption of current, *the energy* consumed being only ·5 watt per candle-power."

C. W. Bennett, *Engineer.*

Wood Lane Works, London, W.
January 23rd, 1914.

A Correction.

Your personal reference to myself on page 148 of your issue of the 23rd inst. is incorrect in one detail. I am not on the railway staff of the British Thomson-Houston Co. I do not wish to obtain credit where I have no responsibility.

F. W. Carter.

Rugby, *January 26th*, 1914.

Central Stations by Auction.—The existence of the Akkumulatoren und Elektrizitatswerk vorm W. A. Boese, of Berlin, has now been practically brought to an end, after four years of difficulties, by the disposal by auction of the company's last assets at the instance of the protection association for the debenture-holders. Some time ago the Mark Electricity Works Co. acquired from the company three Pomeranian stations for £17,500, although the transfer carried with it the acceptance of various liabilities of the stations. On the present occasion, however, and in order to satisfy debentures for only £450, the shares held by the Boese company in no fewer than nine stations and controlling the latter, have been sold for the mere song of £2,500 to the Rhenish Siemens-Schuckert Works Co., which, although only requiring two of the stations, has purchased the lot in order to make certain possession of the two at Witzenhausen and Kandel respectively. The new proprietary company has also had to take over the liabilities attaching to the stations. The value of the works does not lie in the stations themselves, but in the concessions incidental to them, and having a currency of about 40 years, with the right of erecting overhead mains over the roads. It is considered that if the debenture-holders had exercised greater patience and had abstained from drastic action as in the past four years, the stations might have been disposed of at a future period on considerably better terms than have been obtained by forcing the sale.

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION.

We have been favoured with the following summary of the report of the Council for the year 1913:—The Council submitted the certified income and expenditure account and balance-sheet for the financial year ending September 30th, 1913 (which were adopted).

The Council were of the opinion that any general statement which might be made as to the progress of the Association at the eighth year since its incorporation, and the second year of working under its new constitution, might be made quite frankly in terms of congratulation. The position of the Association had, during the year just concluded, been established beyond question, the membership had again substantially increased; and keen activity was indicated by the fact that the number of Sectional and Committee meetings held during the year was 185, an increase of 50 over the number held during 1912, all of them being commendably well attended.

The Council recalled that the report for 1912 named the subject of the standardisation of a complete set of general conditions of contract, as between manufacturer and purchaser of heavy plant, as of first-rate importance, and looked forward to early agreement on this subject between the Association and the Institution of Electrical Engineers. The Institution had recently referred the matter back for the advice of counsel, whose opinion had now been received; and, though experience showed that prophecy in this connection was hazardous, it was believed that the Institution would now use little time in coming to a decision.

Scarcely less important than the foregoing was the subject of standardising the conditions of sale which governed those smaller commercial and industrial transactions in which a large majority of members were engaged. The Revising Committee had now produced, and, under the Council's direction, put into circulation, two complete sets of conditions of sale with a legal and business commentary clearly explaining their use and importance.

The excellent system of tendering embodied in the agreements known as Cross-Tendering Agreements had won further adherents during the year, and there were now in operation the following such agreements: (1) Steam-engine builders and dynamo makers; (2) Diesel-engine builders and dynamo makers; (3) Condenser makers, turbine builders, and steam-engine builders; while a fourth, between gas-engine builders and dynamo makers, awaited the consent of certain gas engine firms before going into operation.

Leaving the purely business and legal sides of the internal work of the Association, satisfactory progress was reported on the scientific side of standardisation. The Committee dealing with the revision of standards for electrical machinery had completed and printed a set of Rules entitled "Standardisation Rules for Electrical Machinery," and, pending further action by the Engineering Standards Committee, these had been put into circulation and were being used as a reference handbook in connection with the general standardisation of types and performance of machines as well as between buyer and seller. Further technical recommendations had been prepared upon several important subjects dealing with the performance of standard machines, and other sections were in hand. The Standards Committee's representation at the Zurich and Berlin meetings of the International Electrotechnical Commission had been of great assistance in obtaining full consideration for manufacturing interests, and was now co-operating closely with the Engineering Standards Committee and the Standardisation Committee of the United States of America in connection with the preparation of new international rules. The Engineering Standards Committee had invited the co-operation of the Association in the work of revising Report No. 37, dealing with consumers' electric supply meters, and two members had been appointed to serve. The Committee for the standardisation of accessories had been actively engaged during the year, and had produced and transmitted to the Engineering Standards Committee specifications for two and three-plate ceiling roses, which were receiving the favourable consideration of the panel of that body. A further draft specification for one of the sizes of wall sockets and plugs in most general use would shortly be put forward. The Committee for the standardisation of radiator lampholders and plugs for cooking apparatus had made progress, but a report was not yet available. A Committee of the Switchgear Section had given attention to the subject of electrical symbols as a basis for further standardisation, and produced a set of prints, which had been circularised to members, and had met with general acceptance. The same section had also to its credit the provisional settlement of many differences which previously existed as between manufacturers and purchasers and the Home Office inspectors, which resulted in mistakes and misunderstandings, the cost of rectifying which usually fell upon members. With a view to removing all doubt as to what the present factory regulations really call for, this section had sent two deputations to Mr. G. Scott Ram, H.M. Electrical Inspector of Factories. The result was that a settlement of all difficulties to date had been obtained, and a full report would shortly be circularised.

No fresh legislation proposed or introduced during the last part of the Parliamentary Session had appeared to call for action. The Council had opened negotiations with the Commercial Intelligence Department of the Board of Trade with the object of securing that the method of analysis and summary at present adopted in the annual statement of the tradè of the United Kingdom with foreign countries, issued by the Board should afford segregated figures, for imports and exports, in the many branches of the electrical industry now grouped. Deputations of the Association which met the railway managers at the Railway Clearing House and elsewhere in respect of the classification of electric heating stoves, had been successful in obtaining redress of grievances, and, the sanction of the Board of Trade having been obtained, the new classification would be circulated as soon as the railway managers had notified a date upon which it would go into force. A deputation in respect of the railway classification of switchgear had obtained certain concessions which were considered inadequate, and the matter was being carried further.

An agreement was looked forward to between the Electrical Contractors' Association and the sections of the Association immediately concerned.

The Council expressed the hope that within a reasonable time further progress could be reported in respect of the removal of handicaps to members' trade in Canada, the matter having been referred for expert opinion.

The Council had passed resolutions strongly recommending intertrading between members of the Association, and these had, as far as information was available, been well supported. Detailed arrangements giving effect to these resolutions were under discussion by the various sections.

Standing Rule No. 2, which prohibited members from exhibiting at exhibitions not patronised by the Association had practically controlled all promotions attempted during the year, and the rule apparently met with the unanimous approval of members.

The subject of the Association's patronage of municipal exhibitions had been placed on a definite footing by the creation of a Joint Committee of the Municipal Electrical Association and the Association.

An application had been received during the year for contributions of plant and apparatus towards the equipment of the laboratory of the youngest University in the Empire, that of Hong Kong. Investigation had showed that, by acceding to the application, British manufacturers would be placed in a position of commercial advantage in that portion of the globe. Inquiries made through the Foreign Office showed that the University was properly constituted and had a satisfactory endowment. The opinion of the President, Lord Ampthill, had then been taken on the whole subject and, as a result, it was decided to invite members to make a gift to the University of a completely equipped electrical laboratory, containing every sort of plant and apparatus which the Faculty of Engineering deemed to be necessary. The response of members to the call made upon them had been generous, and this laboratory would, before long, be completely equipped with plant and apparatus of entirely British manufacture. The thanks of the Council were, in particular, due to Mr. A. H. Preece, of Messrs. Preece, Cardew & Snell, consulting engineers to the University, for the great pains to which he had gone in arranging details and for his indispensable assistance in bringing that large undertaking to a satisfactory issue. At the special request of the governing body, and by permission of the President, the electrical laboratory of Hong Kong University was called "The Ampthill Laboratory," and its walls bore a brass inscription setting fourth the source of the gift.

The number of members on the register at the beginning of the year was 125, being an increase of 16 on the number on the register as recorded in the last annual report.

Under Article 17 of the Articles of Association, five members of the Council retired as from the date of the annual general meeting and, being eligible, offered themselves for re-election (and were unanimously re-elected) as follows:—

Ferranti, Ltd. (A. Bruce Anderson).
British Thomson-Houston Co., Ltd. (H. C. Levis).
General Electric Co., Ltd. (M. J. Railing).
Dick, Kerr & Co., Ltd. (W. Rutherford).
Elliott Bros. (W. O. Smith).

Messrs. Price, Waterhouse & Co., the auditors of the Association, retired under Article 53, and, being eligible, offered themselves for re-election (and were unanimously re-elected).

Annual Dinner.

On January 21st the annual dinner of the Association was held at the Savoy Hotel, the Right Hon. Lord Ampthill, G.C.S.I., President, being in the chair. Amongst the guests were Lord George Hamilton, Mr. F. E. Smith, M.P., Sir J. W. Taverner, Mr. W. Duddell, Mr. J. McD. Henderson, M.P., Dr. Glazebrook, Mr. Faithful Begg, Dr. W. C. Unwin, Dr. H. F. Parshall, Mr. Samuel Insull, Mr. J. A. Bryce, M.P., and Sir J. McCall, as well as many eminent engineers, and some 420 covers were laid.

After the loyal toasts, Mr. A. Bruce Anderson, chairman of the Council, proposed "Our Guests," remarking that the dinner was held primarily for the purpose of inviting them. The main object of the Association, he said, was to ensure for its members conditions under which they could attain the maximum efficiency—an object to be desired by everyone, but agreement with other responsible sections of the industry was not likely to be attained if individuals acted upon independent lines. They were all interested in the extended use of electricity, which meant increased output of plant and machinery; their combined interests should outweigh any sectional differences that might exist, and he was certain that in time all would unite for the same ends. If the electrical industry were to undertake a national propaganda after the style of the gas industry, the municipal authorities ought to be amongst the first to put their hands in their pockets; but they were hampered by legislative restrictions, and it was the intention of the manufacturers to assist them to remove those restrictions.

The manufacturers would also be called upon to bear their share in such a national propaganda, but what guarantee had they that the resulting orders would be placed with members of the Association, or even in this country? The Association would do good work in driving home the fact that if a man, by buying abroad, injured those from whom, later on, he would want assistance, he would be embarking upon a suicidal policy, and destroying the market upon which they all subsisted. No one in this land could afford to regard without grave concern conditions which were prejudicial to the welfare of the British manufacturer; what was good for the manufacturer was good for the country, and by doing their best to consolidate the electrical industry, they were doing their best to advance the interests of the Empire.

Responding for the guests, Mr. F. E. Smith said Mr. Anderson had spoken of the importance of keeping work in England and not sending contracts abroad; but those were most elementary fallacies—they had been told so by the highest authorities; if a big order went to Germany, then Germany must necessarily buy something from England. He had read that day that Bradford Corporation was going to buy a German turbine at a cost of £10,000; several British tenders were lower, but the German plant was so much superior to the British that the Corporation had to accept the German tender. They might suppose that it was unfair to them to send the order abroad, because they had to bear a heavier burden of taxation than the manufacturer in any other country, and that the order ought to have gone to those who supported this country and helped to build Dreadnoughts to defend it, rather than to those who were building Dreadnoughts to destroy this country. But although it was true that this contract had been lost to a British firm, they had forgotten that Germany might buy something from other British manufacturers, or some of our raw material which, when developed in Germany, might return to this country. He used to think that that manufacturer had an advantage who had the largest market with security and without restrictions, and could undersell one who supplied a less open market. The German manufacturer had free trade throughout the German Empire, and also in these islands; the English manufacturer had free trade in this country (except Bradford) but not in Germany; thus we had secured a considerable free trade market—for our competitors. If we had started *de novo* at a great European congress, and our representative had come back with the statement that whatever country we sent our commodities to, they should be taxed, but whatever commodities were sent to us should come in free, we should not have had a high opinion of his intelligence. It was most regrettable that this matter had ever become a party question; no one could find a responsible body of business men who would say that the question ought to be waved aside as a party cry. The manufacturers' interests were bound up with those of the workpeople in the prosperity of the country, and if it were suggested that their interests were separated or divergent, an irreparable wrong would be done.

Mr. Duddell, also responding, spoke of the importance of broadening the field of application of electricity, and said that he particularly wished to see its uses extended in connection with agriculture. He was sure that with the aid of electricity great progress could be made on a commercial scale; the experiments already carried out had had satisfactory results. The Institution of Electrical Engineers would do its best to advance the interests of all branches of the industry.

Proposing "The Electrical and Allied Industries," Lord George Hamilton said that the object of the Association was to protect the electrical industry from attack and to promote its welfare. Two instances occurred to him illustrating the need of such an Association. In 1881 a well-intentioned Act of Parliament was passed which had the effect of practically killing electrical enterprise for seven years; the Board of Trade then found out the mistake, but in the meantime our foreign competitors had got ahead of us. The Association, had it existed then, might have prevented the error. Again, Germany and the United States saw their opportunity in China, and initiated the young Chinese engineers into their systems. But a complete set of equipment was being sent out to Hong-Kong University to acquaint the young Chinese with British methods, and would enable us to start on terms more advantageous than would have been possible without this Association. The British manufacturer could compete in quality with anyone, and where price and quality were equal, a contract should go to the Englishman; but if the quality were not right, this was not so—quality must have the preference to price.

In reply, Lord Ampthill said he thought the reason why he was made president was that the Association believed that the welfare of British industry and the national prosperity were bound up together, and politicians must be made to realise the fact. He was proud of the gift to Hong-Kong University, at a cost of £5,000—an act of patriotism to ensure that British practice should be made familiar to the Chinese; the effect would be evident in the future, when China was developed and British industry would have a fair share of the trade. In this connection special thanks were due to Messrs. Anderson and Hirst, and to Mr. Arthur Preece. British manufacturers were holding their own, but that was not enough; it would not be satisfactory until some of them were making their fortunes—for that would mean that the workpeople also were prospering from the great trade boom; that could not be so unless the profits were invested in the industry, but manufacturers were not inclined to back British industry in this way, because in this country alone foreign competition was not checked by the action of the State. The working classes were not getting a fair share of the increased national wealth; we were becoming more and more a nation of financiers, and our profits were invested abroad, so that the demand for employment was not fostered. Cobden's prophecy had not been fulfilled, and England had not become the workshop of the world; it was a matter of common-sense to change our policy as soon as possible, to suit the altered circumstances. Until the State took action they must help themselves—hence the formation of the Association; they had to make themselves heard, otherwise Parliament and the nation would take no notice of them, and much could be done by organised combination. The laws dealing with municipal trading needed bringing up to date. With regard to the *Invincible*, the Admiralty had not succeeded in making electric driving effective, though foreign nations had, and an inquiry into the circumstances was urgently needed, to run the fault to earth. He agreed with their chairman that the welfare of each and every class depended upon the welfare of British industry.

Mr. F. R. Davenport proposed "The Health of the Chairman of the evening," referring to the practical energy of the President and his efforts in connection with the Hong-Kong presentation, and Lord Ampthill briefly responded.

An excellent programme of music and song was performed during the evening.

CURRENT AT 2d. PER UNIT FROM PRIMARY CELLS.*

So early as 1838, Matteuci discovered the existence of a potential difference between two platinum plates immersed in different gases, and a year later Grove invented the gas battery which bears his name. This battery comprises two platinum plates, surfaced with spongy platinum, covered by gas containers, and dipping into dilute sulphuric acid. If one electrode be surrounded by oxygen, the other by hydrogen, and the external circuit be closed, current flows through the latter from oxygen to hydrogen. The E.M.F. of the Grove battery varies with the gases employed, the electrochemical series ranging from chlorine to hydrogen. During working certain characteristic changes appear on the surface of the electrodes, and concerning the nature and significance of these changes—and, indeed, concerning the whole nature of the action proceeding in this cell, which employs a triple contact of solid, liquid and gas—many of the most famous scientists of last century contributed more or less inconclusive data.

Grove himself entertained no high hopes as to the practical utility of his gas cell, and until recently the work of no other investigator indicated that the cell could be made of practical value. It is now reported, however (*loc. cit.*) that Dr. Karl Siegl has succeeded in developing a modified cell of from 100 to 1,000 times the capacity of the Grove cell, which is by far the most economical primary battery yet discovered.

Commencing by investigation of the seat of E.M.F. in the Grove cell, Siegl concludes that all parts of the electrodes are operative during short discharges. During longer discharges, the gases occluded in the electrodes are consumed. The portions of the electrodes surrounded by gas are fed by the latter, but the portions submerged in electrolyte not only cease to be operative, but also become polarised in opposition to the active electrode area, hence the latter should be as large as possible. This desideratum may be realised, while securing a cheap construction, by employing platinised carbon granules (of, say, 3 mm. diameter), contained together with a carbon contactor plate by a porous cell, which also forms the gas chamber, and is saturated with electrolyte. The gas pressure prevents the electrolyte from flooding the porous cell.

As the result of investigations conducted with gas batteries of this type, using chlorine, oxygen, air, carbon-dioxide, acetylene, lighting gas and hydrogen in various combinations, and with hydrochloric acid as electrolyte when using chlorine, but sulphuric acid in other cases, Siegl finds the P.D. available per cell, the gas consumption and the working cost (presumably for gas alone) to be as follows:—

GAS CONSUMPTION AND COSTS PER KW.-HOUR.

Gases used.	P.D. per cell.	Gas consumption. Cb. ft.	Cost per KW.-hr.
Cl — H_2	1·4 v.	10·6 H_2 + 10·6 Cl	5·0d.
O_2 — H_2	0·9 v.	16·2 H_2 + 8·1 O_2	4·1d.
Air — H_2	0·8 v.	18·4 H_2 (+ 9·2 O_2)	2·4d.
Air—lighting gas	0·7 v.	24·7 H_2 (+ 12·4 O_2)	2·0d.
CO_2 — H_2	0·8 v.	not measured	—
Air — C_2H_2	0·3 v.	not measured	—

When using air round one electrode it is, of course, unnecessary to provide a porous cell round the latter; an electrode immersed below in electrolyte penetrates into the open air. To secure adequate upward suction, wadding is placed round the negative electrode cells.

The current taken from Siegl cells should not exceed 3·75 amperes per sq. ft. of active electrode surface on momentary discharge, 0·28 ampere per sq. ft. on longer discharges, or 0·19 ampere per sq. ft. on continuous discharge, otherwise polarisation will occur. The data in the above table assume that the cell is not polarised. Pressure variations from 1 cm. (mercury) to 8 atmos. are said to affect neither the E.M.F. nor the current output of Siegl cells.

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* *Elek. Zeitschrift.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Osram Drawn-wire Battery Lamps.

We have received from the General Electric Co., Ltd., their new list of Osram drawn-wire battery type lamps, covering every possible requirement—from the tiny bulb less than ⅛-in. in diameter for medical work, up to the powerful 50-c.p. for use in automobile headlights; a number of entirely new types have been added. The size of bulbs has been reduced, and new and greatly improved types of filaments have in a number of cases superseded the earlier ones. An entirely new type of Osram headlight lamp is shown in fig. 1, in which special care has been paid to the correct form of filament for use in parabolic reflectors. Side lamps are made with a bow filament (fig. 2), and tail lamps with horizontal spiral filaments and a pipless bulb (fig. 3). Automobile lamps for interior lighting are also listed.

Headlight.

Sidelight. Tail-light. Miner's Lamp.

Figs. 1-4.—New Osram Battery Lamps.

A special miner's lamp, designed to comply with the regulations of the Home Office, is illustrated in fig. 4, and for sign illumination three types are listed. Special lamps for motor-'bus lighting and for medical and scientific work are also available.

The "Extralight" Tariff Apparatus.

It is impossible to fix a tariff for current to give the lowest possible margin of profit equally for all consumers unless the demand of the consumer is known. If current is to be sold as cheaply as possible, it must be on some system by which the demand is measured or fixed. The current limiter in any of its numerous forms will effect the latter; but it is found in practice that the inconvenience to the consumer is too great. He can never exceed his fixed limit, although his occasionally doing so would not raise his effective maximum demand, and would be a great boon to him. The "Extralight" is a current limiter which can be put out of action by the consumer at will, and remains out for some hours; at the end of the predetermined time it automatically resumes its functions. The fixed price paid by the consumer permits him to cut out his limiter a certain fixed number of times yearly; when he has used this permission to the full, the instrument is locked, and must be reset by an official from the station.

The device as shown in the figure is extremely simple in principle. It consists of a magnetic mercury limiter with an extension of the glass tube containing extra mercury. The whole is mounted upon a disk which can be turned by the consumer, whereby the limiter is flooded with mercury and so short-circuited. The mercury is held in position by some of the gas being trapped below a porous plug which divides the tube into two parts; this gas gradually diffuses through the porous plug into the other part of the tube and the mercury sinks again to its former level, putting the limiter into action after the lapse of some hours.

The glass tube with the porous plug is filled with an indifferent gas and hermetically sealed, and there would seem to be nothing which would make the apparatus less reliable than the ordinary mercury limiter, the reliability of which can be ensured by attention to sources of trouble during the manufacture.

It is proposed to employ the apparatus without a meter for small lighting consumers, the cost being very little more than that of the ordinary cheap limiter. For consumers who wish to use their current for all household purposes, it may be combined with a meter on a very low unit tariff; the consumer is thus enabled to economise as he pleases on his maximum demand, instead of being rated according to the size of his house or his installation, while at the same time he can on special occasions exceed his demand, as it is quite fair that he should.

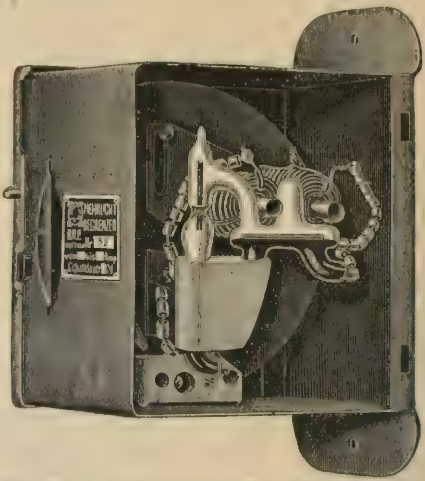


Fig. 5.—The "Extralight" Current Limiter.

The inventor and patentee is Mr. H. Stafford Hatfield, of Herzogin Elisabethstrasse, Brunswick, Germany; the apparatus has been put on the market in Germany by Messrs. Schott & Genossen, of Jena, under the name "Mehrlichtbegrenzer."

Zed Fuses in Railway Work.

Electric light installations in railway stations and yards must of necessity be carried out in a manner which will obviate risk of failure of the light in the public spaces or in the signal lamps. Not only is the wiring and apparatus exposed to all sorts of weather, but there are also the menaces of steam, smoke, and heavy vibration to be guarded against. All materials must undoubtedly be of a substantial and reliable pattern, and they must be erected in a first-class manner.

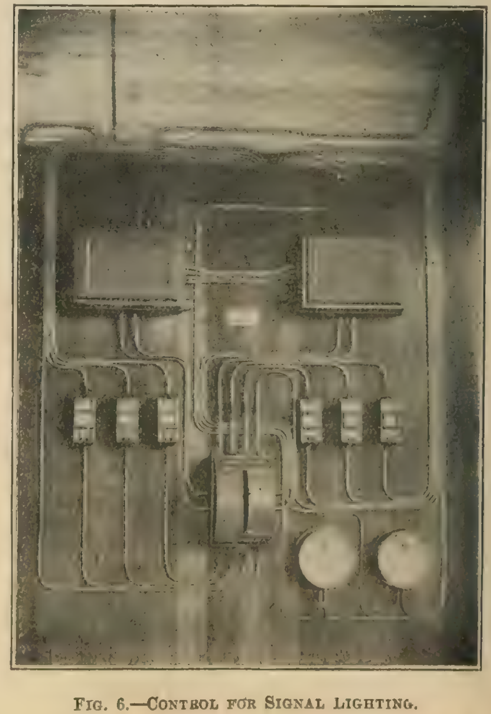


Fig. 6.—Control for Signal Lighting.

In a railway installation in Burmah, recently brought to our notice by Messrs. Siemens Bros. Dynamo Works, Ltd., of Caxton House, S.W., the conditions were doubly severe, due to the tropical climate.

The new station and yard at Rangoon, Burmah, is an important passenger and goods centre, covering a space of 1¼ miles long, and 1,000 ft. wide at its greatest depth. The yard consists of engine, carriage and signal repairing and cleaning sheds. The extent of the installation and the nature of the materials used, can be judged from the following materials used :—Zed fuses, 109 ; bare copper wire, 45,820 yards ; insulated wire, 12,343 yards ; Stannos wire, 11,232 yards ; Wotan lamps, 37,525 c.p.

After operating for over 18 months, and having been subjected to the vagaries of the Eastern climate, everything appears to be as good as when first erected. No faults have been reported.

Fig. 6 shows one of the controls for the signal lighting, consisting of a main four-pole change-over switch with main Zed fuses and an ammeter on each side of the duplicate supply. The ammeters are used as lamp failure detectors, and are regularly watched by the signalman on duty.

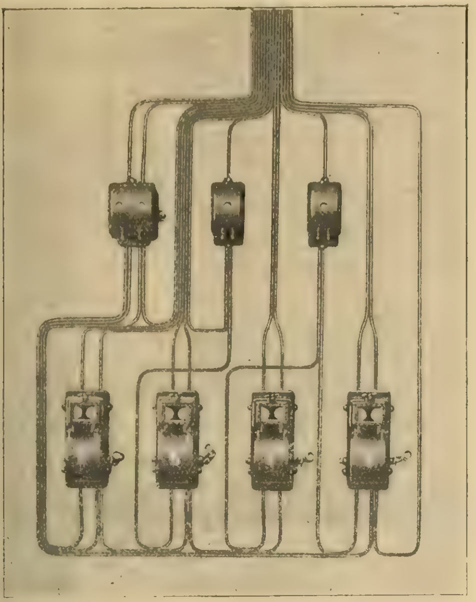


Fig. 7.—Switches and Wiring, Rangoon Railway Installation.

All the Zed fuse boxes, and distribution boxes, are of a heavy cast-iron watertight pattern.

Fig. 7 shows other details of the installation.

The complete satisfaction, which has been given under particularly trying conditions, bears full testimony to the reliability, safety and convenience of Zed fuse fittings, as well as to the suitability of the other classes of material which were selected.

Igranic Rotor Starting Rheostat.

The Igranic Electric Co., Ltd., of 147, Queen Victoria Street, E.C., are introducing a new rotor starting rheostat. In this the switch parts are mounted on an "Igranicised" slate base, and are not crowded at all, but designed with a generous margin as regards spacing of parts.

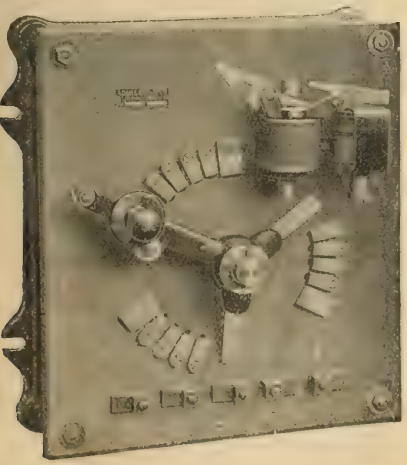


Fig. 8.—Open Type Rotor Starter.

In the small sizes button contacts are used, while all other sizes have contacts of the renewable segmental type easily replaceable from the front. The new and special design of these contacts makes renewal easier and quicker than ever, because, although held very securely in position, it is only necessary to take out one screw in order to remove a contact.

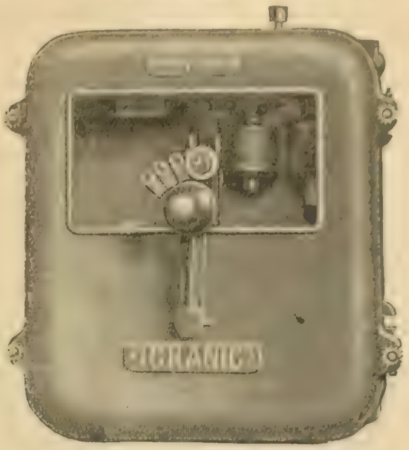


Fig. 9.—Ironclad Switch with Window.

The resistances are arranged to allow approximately full-load current on the first step.

Fig. 8 shows an open-type starter with automatic no-volt and over-load releases, whilst fig. 9 shows the totally-enclosed type with glazed inspection cover.

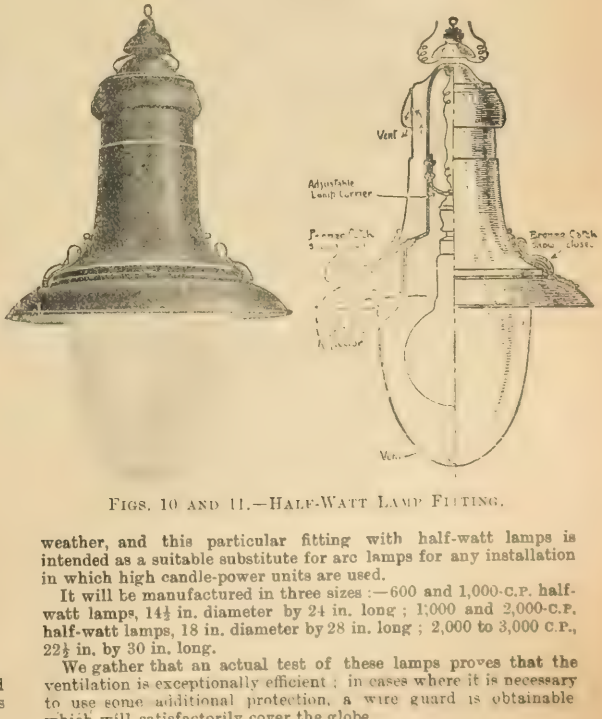
Siemens Half-watt Lamp Fitting.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street N.E., send us particulars of a new lantern specially designed for use with Wotan high candle-power half-watt lamps.

Owing to the amount of heat generated at the neck of the lamp, a special scheme of ventilation is provided so that the lighting units shall be kept as cool as possible, the life of the lamp being thereby increased to a considerable extent. In addition to the special ventilating arrangements, the globe is opalescent, which satisfactorily screens the extraordinary brightness of the filament.

Our views show the construction of the lantern, and it will be observed that the Goliath Edison screw-holder is fastened to a carrier which is mounted in a slide, thus allowing a certain degree of regulation for the position of the lamp in the globe of the lantern.

The lantern itself is provided with an insulated shackle suspension, which renders it suitable for use under all conditions of weather, and this particular fitting with half-watt lamps is intended as a suitable substitute for arc lamps for any installation in which high candle-power units are used.



Figs. 10 and 11.—Half-Watt Lamp Fitting.

It will be manufactured in three sizes :—600 and 1,000-c.p. half-watt lamps, 14½ in. diameter by 24 in. long ; 1,000 and 2,000-c.p. half-watt lamps, 18 in. diameter by 28 in. long ; 2,000 to 3,000 c.p., 22½ in. by 30 in. long.

We gather that an actual test of these lamps proves that the ventilation is exceptionally efficient ; in cases where it is necessary to use some additional protection, a wire guard is obtainable which will satisfactorily cover the globe.

R. W. Paul's Instruments.

Mr. Paul's new catalogue, mentioned in our last issue, brings together for the first time, we believe, a complete account of his many specialities; it is issued in 11 sections, which will eventually be bound in a volume of 550 pages. We have from time to time had occasion to refer to the original and ingenious instruments and devices which he has produced, but there are many others to which we have not referred individually; some of these in the new catalogue are briefly described below.

Fig. 12 shows the "Decade" rotary bridge; the variable resistance coils are mounted in four drums, which rotate between laminated brush connections, so that as the drum is rotated it brings the coils into circuit successively. The resistance is read off as a straight line of figures, and the risk of error is minimised, while the speed of working is increased. Fig. 13 shows one of the drums partly in section, with the brushes at the lower side, and a simple ball-click above to define the contact position. The total contact resistance per dial is only 0·002 ω, and is constant.

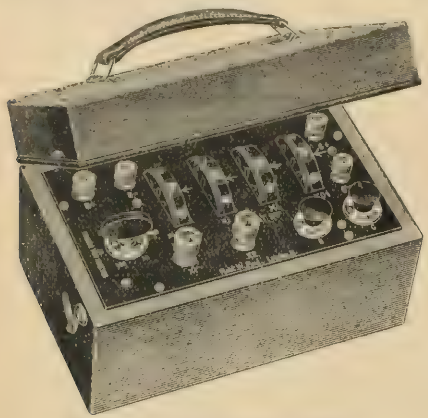


Fig. 12.—Decade Rotary Bridge.

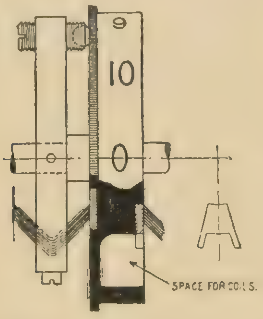


Fig. 13.—Detail of Resistance Drum and Brushes.

A complete section (C) is devoted to the numerous modifications of the "Unipivot" galvanometer, which forms so important a feature of Mr. Paul's inventions. We hardly need remind our readers that the essence of this device is a circular coil pivoted at its exact centre, and, in the case of D.C. instruments, surrounding a sphere of soft iron. The movement is extremely sensitive and robust, and needs no levelling; hence it has been adopted for a great variety of purposes. Fig. 14 shows it in the form of a "Twin unipivot," a combined voltmeter and ammeter of any desired ranges, from millivolts to (with shunts) kiloamperes. A novel application of the Unipivot instrument is to central station or lecture-room purposes, by projecting the image of the scale and pointer upon a screen half a metre or more in length. Fig. 15 shows the screen, which can be suspended from the ceiling or wall at a height of 8 or 10 ft., and is clearly visible over a great distance in broad daylight. In the central station the reading would be amperes, volts or watts, but in the lecture room the device, with accessories, becomes a universal instrument. The great length of scale being obtained by optical means, the indications are as dead-beat as in the smallest instrument, and the projecting apparatus is quite simple.

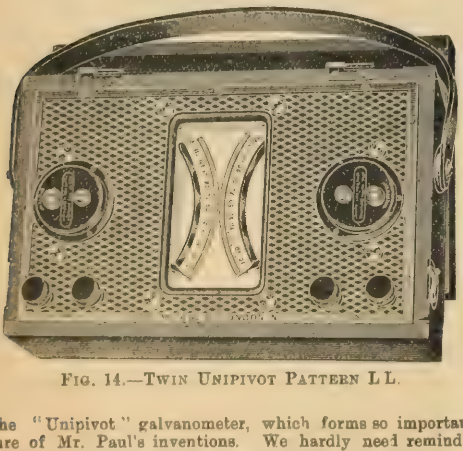


Fig. 14.—Twin Unipivot Pattern L L.

Other patterns of galvanometers are also made, as well as a variety of apparatus for laboratory equipment. Last week we referred to Section S, which covers elementary College apparatus; Section E deals with a higher class of laboratory instruments, such as sensitive reflecting galvanometers, potentiometers, keys, &c. Section F is devoted to alternating-current measuring apparatus, including the Duddell-Mather standard wattmeters, for which the highest attainable degree of accuracy is claimed, even on circuits of very low power factor, for currents up to 1,000 amperes and pressures up to 75,000 volts.

The Irwin astatic dynamometers and wattmeters—also emanating from the Central Technical College—and the Sumpner iron-cored dynamometer, the Ayrton-Mather electrostatic voltmeters, &c., and the Irwin hot-wire oscillograph are other features of this section. Lastly, in Section H, apparatus is listed for measuring inductance, capacity and effective resistance up to frequencies of 2,000 cycles per second, the outcome of present-day research in telephony and radio-telegraphy. We illustrate in fig. 16 a meter which gives a quantitative reading of the amount of cross-talk between two telephonic circuits or apparatus—a matter of increasing importance, owing to the extending adoption of loading coils and superimposed circuits. To the Campbell inductance standards and bridges and vibration galvanometers, the Irwin Optiphone, &c., we can only refer.

Not only are the various instruments fully illustrated and described, but diagrams of connections and instructions for use are provided, and in effect the catalogue forms an educational work of very high merit. We congratulate Mr. Paul and his distinguished collaborators upon a very excellent production. It is interesting to note that the prices are confined to a coloured inset, the first figure of the list number and of the page number are identical, and the initial letter of the code word designates also the section in which the description can be found. The complete catalogue (including the sections relating to ohmmeters and pyrometers, not yet issued) contains over 2,000 entries, and about 800 illustrations and diagrams.

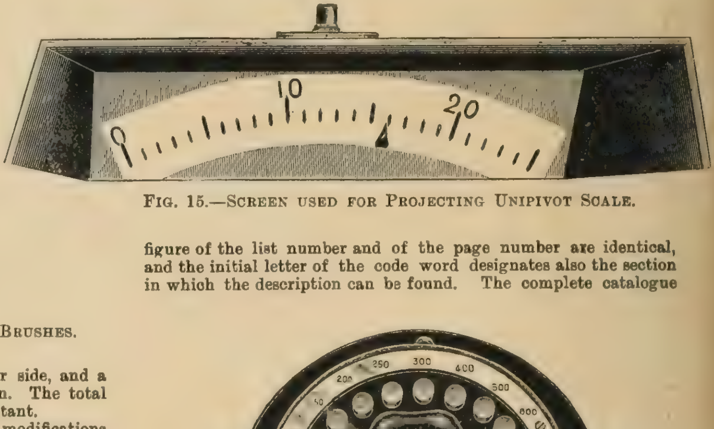


Fig. 15.—Screen used for Projecting Unipivot Scale.

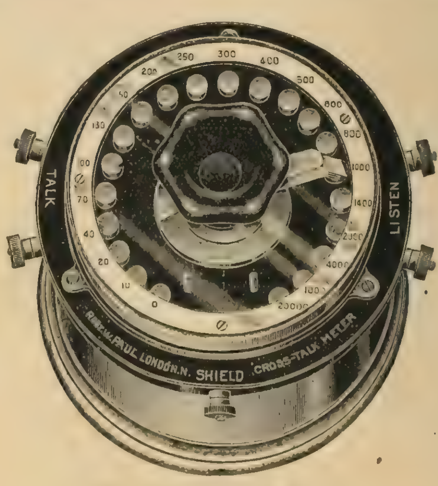


Fig. 16.—Cross-Talk Meter.

Mazda Half-Watt Lamp Fitting.

In their price list on Mazda half-watt lamps, published on January 12th, the B.T.H. Co. illustrated and described six special fittings and a varied selection of Goliath E.S. holders for use with the half-watt lamp.

Since then the B.T.H. Co. have put another semi-indirect half-watt fitting on the market. This fitting—the B.T.H. "Lumino," illustrated in fig. 17—has been designed to comply with the demand for an inexpensive, yet effective, semi-indirect unit, which can be used anywhere, independently of the condition, or even existence, of a ceiling. The top reflector is made of metal, with a white vitreous enamelled reflecting surface, and the under reflector of opalescent glass. The fitting will take a single Mazda half-watt lamp of any size, and is supplied complete with Goliath E.S. holder. As a light distributor and diffuser it is eminently suitable for the interior lighting of shops, factories, &c. The opalescent bottom reflector employed is sufficiently dense to diffuse the light in an agreeable manner, without reducing the efficiency of the unit to any great extent.

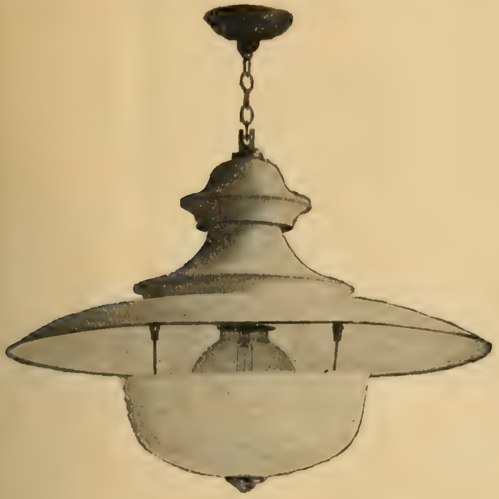


Fig. 17.—Lumino Semi-indirect Fitting.

LEGAL.

Piggott *v.* Nathan.

In the City of London Court last week Piggott Bros. & Co., Ltd., 220, Bishopsgate, claimed £23 16s. 6d. against Mr. Henry Nathan, meat salesman, and his wife, of Stamford Hill, for supplying awnings, rout seats, chairs, carpets, electric light, &c., in connection with the entertainment which they gave to 100 friends upon the marriage of their daughter on July 24th.

Defendants counterclaimed for £20 as damages suffered through the "loss of society of wedding guests" owing to the electric light failing at 11.40 p.m. while the ball and wedding festivities were in progress on their lawn.

Mr. Ross, defendants' solicitor, said that the band was to have stayed until 3 o'clock or 4 o'clock the next morning, and that was impossible as there was no electric light.

Mr. Hart said that the current came from the house supply. Defendants were warned that it might collapse if too much pressure was put on to it. In truth, the company's main fuse blew. There was no negligence on the part of the plaintiffs, nor any breach of contract.

F. Dixon, plaintiffs' electrician, said that the lights burned satisfactorily for several hours He could not help the electric lighting company's fuse blowing.

Judge Atherley-Jones, K.C., found for the plaintiffs on the claim and counterclaim, with costs.

Tramway Accident Claim.

The record has been closed and issues ordered in an action in the Court of Session, against the Dunfermline and District Tramways Co., Cowdenbeath, for £750 damages. The action is a sequel to the death of an octogenarian, who was knocked down by a car.

Osram Lamp Works *v.* Electric Fittings, &c., Co.

In the Chancery Division on Monday, before Mr. Justice Warrington, Mr. J. H. Grey moved for judgment in default of appearance in this action. Counsel said the action was for infringement of two letters patent, certified by his Lordship to be valid.

The order made by his Lordship was an injunction and inquiry as to damages, and delivering up of infringing articles.

Colne and Trawden Light Railway.

The arbitration proceedings concerning the purchase of the above tramways by the Colne Corporation were brought to a conclusion on 19th inst. The hearing occupied 10 days. Mr. A. J. Ram, K.C., intimated that he would give his decision before the end of January.

BUSINESS NOTES.

Consular Notes.—Japan.—The British Consul at Osaka reports that during the last few years a network of electric railways has been built round Osaka. Lines now run west to Kobe, north-east to Kyoto, north-west to Takaradzuka (a pleasure resort), south to Sakai and Wakayama, and south-east to Nagano, while a further line east to Nara is in process of construction. Various other schemes have been brought forward. There are at present about 140 miles of line actually in operation, mainly double line, and about 70 miles under construction or proposed. These systems are for passenger traffic only, and while competing to a considerable extent with the Government railways between the centres served, they form a cheap means of locomotion to and between intermediate points served by the latter.

Finland.—In a recent report, the British Consul at Helsingfors states that negotiations were undertaken in 1912 for the purchase, on behalf of a German syndicate, of the Wallinkoski rapids near Imatra, as well as those of the Enso and Rouhiala. It is considered that the greater portion of the power will be transferred to St. Petersburg, which capital has hitherto been dependent on coal imported from foreign countries (especially the United Kingdom) for the supply of electric power. (Since writing the foregoing, it further appears that the remaining balance of £92,252 has been paid by a St. Petersburg company for the conduit of the electric power, and that the Rouhiala and Wallinkoski rapids now definitely belong to that company.) The total cost of the rapids is said to have been £211,299. A local syndicate has acquired the Kaarannes waterfall, between the lakes Vietonen and Miekojärvi, in the parish of Upper Tornea. From this waterfall much power can be obtained. A large station is to be constructed, from which power will be transmitted to Upper Tornea. A new factory, the Aktiebolaget Finska Flatfabriken, for the manufacture of electric cables and insulated wire, was registered at Helsingfors on December 5th, 1912.

Russia.—In a report recently issued by the American Government, it is stated that the Chief Government Inspector of Factories for the Tiflis Government and Zakatal district has sent out a circular to the owners and managers of industrial enterprises in the district, in which he suggests that in view of the high price of liquid fuel in the Caucasus, they should substitute hydraulic motors for the steam boilers and internal combustion motors now in use, and in that way utilise the power of the numerous rivers and streams in the Caucasus. He calls attention to the enormous advance in the price of liquid fuel, which has been steadily increasing and will continue to increase especially in view of its use now on steamers in place of other fuel. He says oil sold in Tiflis three years ago for only 23 kopecks per pood (6½d. per 36·1122 lb.), whereas it now costs 65 kopecks per pood (16½d. per 36·1122 lb.). This is bound to have a bad effect upon the industrial enterprises in the Caucasus, nearly all of which use liquid fuel extensively. Many of them have survived with difficulty, hoping that the price would sometime be lower again. Unfortunately, these hopes are without foundation, as the world's entire product of naphtha is controlled by large foreign companies, who own most of the Baku naphtha oil fields, and are therefore the absolute masters of the industry in the Caucasus. In order to compete with them the Government has a plan to open its own naphtha works. Forty-five dessiatines (121 acres) of land are assigned for this purpose, and the estimated cost will be 14 million rubles (about £1,500,000). The railroads also have their own naphtha works. The small consumers, however, cannot have their own works. The only solution for them is to avoid as far as possible the use of liquid fuel. In order to utilise the power of the rivers and streams of the Caucasus, the Inspector recommends the construction of hydroelectrical general stations and the transmission of the electrical power there developed to the places of consumption by conduits above and below ground. Among other things, the Inspector says that one large enterprise of this kind that could furnish Tiflis with 25,000 kw., or 33,750 h.p., would be able to supply the electrical power at a charge of 4 to 6 kopecks (1d. to 1½d.) per kilowatt-hour, whereas the price of electrical power now furnished in Tiflis by the private electrical stations is 25 kopecks (about 6d.) per kilowatt-hour.

Firms wishing to communicate with the above-named Inspector should address the Chief Factory Inspector, Udelnaya Ulitza 10, Tiflis, South Russia. Letters and catalogues should be in Russian, German or French.

Hungary.—The American Consul at Buda-Pesth reports that material for electric wiring in Hungary, while differing slightly from that in use in America is essentially the same, except that it is generally a little inferior in quality. Electric wiring material of American manufacture is preferred in Buda-Pesth, but the Austrian and German manufacturers practically control the market. A certain American connector, however, is used very extensively. Nearly all the steel insulating tubes in use in Hungary are of British manufacture. The Austrian and German goods recommend themselves principally on account of their cheapness, and it is generally understood that while similar goods of American origin are more expensive, they are superior in quality. The sockets in use in Hungary are the American Edison base standard. Brick and reinforced concrete are the principal materials used in building houses in Hungarian cities, and they are fire proof to a very high degree. Staircases are constructed exclusively of stone. The height of buildings is limited by law to 25 metres, thus limiting the number of storeys to six. Iron or steel construction is very rare. Electric wiring in buildings must by law be within the walls, and must be properly insulated, and, in addition, be enclosed in iron, steel or brass pipes.

The German and Austrian manufacturers are represented in Buda-Pest by agents, usually by persons formerly connected with the factory or with other selling agencies. These agents, who keep a large stock of all kinds of electrical goods, employ travelling salesmen, who visit periodically the important Hungarian cities and large towns. The agents, on behalf of the manufacturers, contract for advertisements in the best Hungarian trade papers. Electric goods are sold on a credit of four to six months, or against bills of exchange. German manufacturers allow 2 or 3 per cent. discount on the amount of bill when payment is made within 30 days. Payment for electrical supplies is seldom made within three months. The German manufacturers are always willing to allow four months. Other manufacturers must be prepared to offer liberal credit terms and must be represented by agents. Nearly all of the local dealers in electric supplies have contracts with Austrian, German, or English manufacturers that forbid the sale by them of goods of other manufacture.

The Hungarian Electrotechnic Association (Magyar Elektrotechnikai Egyesulet), Buda-Pesth, VII. Erzsebet-krt 48, has published a book containing the name and address of every electric light plant in Hungary, together with detailed statistics. A copy of this book will be sent by the association to any address upon receipt of 12 crowns (10s. 2d.).

The Electric Trade Outlook in Roumania.—The manufacture of electrical goods in Roumania is of small extent only; hence, imports are considerable, the principal contributing countries being Germany and Austria-Hungary. As the trade statistics do not detail lighting materials, it is very difficult to estimate the value of the imports; a rough estimate would, however, place the value at about 1,000,000 fr. About one-half of this amount represents the share of Germany, four-fifths of whose exports consist of electric lighting apparatus, and one-fifth gas and petroleum lamps. France supplies electric and gas lamps to a value of 100,000 fr.; the balance of the imports into Roumania, about 400,000 fr., being supplied by Austria-Hungary, whose share is increased by 350,000 fr. for carbons contributed by Viennese makers. A large number of provincial towns now possess their own generating stations, and the use of the petroleum lamp is steadily declining. Gasworks are only to be met with at Bucharest and Galatz: these two cities, therefore, are the only ones to count upon for a demand for gas fittings, &c. Electric lamps are imported mainly from Germany, thanks to the low prices which German makers ask, and to the fact that the greater number of electric companies are German creations. Metal-filament lamps are mostly used. Some industrial companies and the railways use carbon lamps. The trade in electrical apparatus underwent a crisis last year, owing to the losses sustained by wholesale and retail dealers on glass goods. In view of the present activity in the building trade in Roumania (there are numbers of schemes, for instance, for the construction of hotels, clubs, and public buildings, most of which are under way), there will shortly be an increased demand for lighting material, and this mainly electrical.—*Oesterreschische-Ungarische Konsular-Korrespondenz.*

New Year Festivities.—The festivities which are an annual feature of the social side of Messrs. Siemens Bros.' works at Stafford, were concluded on Saturday, the 17th inst. They commenced with a treat to the children of the employés. The place of assembly was the Siemens Institute, which was brilliantly lit up for the occasion and suitably decorated, on the stage being three ornamental Christmas trees, all of which were illuminated by electric fairy lamps. In addition to a capital entertainment, all the children received a suitable present, each little girl being given a doll and the boys and elder girls a variety of useful and ornamental articles. As the hall is not large enough to accommodate the 1,100 children to be entertained, they were divided into two groups, the party for the older children being on Friday evening, and that for the younger ones on the Saturday afternoon. The employés themselves also had their turn. On Monday night the invitations were for the staff. The rooms seemed more crowded than ever, about 500 guests being present, including most of the heads of the departments and their wives. The large hall was beautifully decorated, and the Christmas trees left from the children's party added to the gaiety of the scene. On the succeeding nights the various shops in turn were invited, and the attendance averaged quite 500 nightly. The carnival, as stated above, concluded on Saturday, 17th inst., when the female employés were the guests. Each evening entertainments were provided for the benefit of non-dancers, the artistes being employés of the company. The arrangements, which were very complete, were made by the general committee, with Mr. F. E. Read as hon. secretary. Everything, we are informed, went off most successfully.

Pictorial Advertising of Half-watt Lamps.—The German makers of Osram half-watt lamps have introduced a novel method of advertising in the daily newspapers by means of pictorial sketches purporting to show the international use of the lamps. In the first place, Turkey is depicted by the German Ambassador who, holding in one hand two German soldiers upon whom the rays of a lamp are being cast, is shown engaged in conversation with a Russian, and the accompanying words are: "Russia makes her mind easy about the German military mission now that the German Ambassador has shown this mission in the right light (Osram lamp)." The words applied to Great Britain, which is outlined with lamps erected on standards all around the coast and with a sailor lying prone in the centre, are as follows: "England has equipped the whole of her coast with Osram half-watt lamps, whose bright lustre causes her to admit that the German danger is a shadowy spectre of the sea." A French soldier fixing lamps on African territory is shown in the third place in order to give force to the statement that "France is making enormous progress in her African colonies and protectorates by the introduction of the Osram lamp everywhere on the Dark Continent." The fourth position is occupied by a Turk and a Greek, at the rear of whom are islands lighted by lamps. The words submit that "Turkey and Greece shake hands reconciled, as their final point of dispute has simply been removed by the Osram lamps having now also conquered the Ægean islands." A salesman disposing of lamps to an Albanian represents the fifth sketch with the words: "Albania orders 100,000 Osram half-watt lamps in order that brightness may at last appear in her dark and obscure conditions." The final sketch indicates China, which is portrayed by a Chinaman who is running with an Osram lamp in one hand, the accompanying words being: "The general enlightenment is also proceeding with gigantic steps in China by the introduction of Osram lamp."

Mill Lighting in Cawnpore.—We have received a letter from the Victoria Mills Co., Ltd., of Cawnpore, from which we gather that the notice that appeared in our issue of September 19th last year under the above heading is incorrect in several of its particulars. On making further inquiries at the source from which we obtained our information, we learn that the statement that the lamps referred to are used throughout this mill was made on the responsibility of a visitor from India who may have mixed up the names of several mills. From the Victoria Mill Co. we learn that only a few of the lamps mentioned have been used in their mill and the vibration tried them considerably. The reference to tests respecting saving of current cannot apply to the Victoria Mill as no such tests have been made. The same applies in respect to the shutting down of a dynamo consequent upon the saving effected, for that has not been done at the mill named. We hope to be able to refer to the matter at a later date as a result of inquiries that are now in the mail.

Book Notices.—*Green's Patent Fuel Economiser* is the title of a volume recently issued by Messrs. E. Green & Son, Ltd., of Wakefield, which, though styled "catalogue P 502" by the publishers, is well worthy of a place amongst the series of specialised descriptive works which modern manufacturers are gradually producing. The remarkable development of the Green economiser is well exemplified in this treatise, which shows how, invented by the late Mr. Edward Green as long ago as 1845, the original design has stood practically unchanged, except in minor details, though numerous inventors have endeavoured to improve upon it. There are few devices widely employed in engineering which can show a similar record. The book, which is handsomely produced and illustrated, deals with the theory and construction of the economiser, its application to all kinds of steam boilers, for heating both water and air, as well as to blast furnaces, coke-ovens, &c., and its use for a variety of special purposes. Tests, working instructions, and numerous plans showing the arrangement of the economiser are given, and sections are devoted to the Green boiler feed pumps and small engines for driving the scrapers.

The Central for December contains an article on the three-phase commutator motor by Dr. S. P. Smith, a summary of the progress of the College in the session 1912-13, with a plan showing the Goldsmiths' Company's extension, an article on Sound by Mr. J. T. Irwin, and other interesting items.

The contents of the *Journal* of the American Society of Mechanical Engineers have been greatly increased in scope. Commencing with the January issue the *Journal* includes the *Transactions*, and is the permanent record of the society, the republication in a separate volume as *Transactions* being discontinued.

The *Old Students' Association Magazine* of Finsbury Technical College, for December, contains a portrait of Mr. E. K. Scott, winner of the O.S.A. Medal for 1912-13, and the conclusion of an account of a visit to the Dover Harbour Works, as well as numerous items of news.

Quin's Metal Handbook and Statistics, 1914. London: L. H. Quin, 3, East India Avenue. 3s. 6d. net.—This is a very useful little book of 150 pages, in which is given a mass of statistical information, from official and private sources, regarding the metal trade of the world. The author has specialised in his subject for 20 years, and has a very intimate knowledge of the markets and market conditions. The daily prices of electrolytic copper and of copper and copper shares, copper stocks and world supplies are all fully tabulated. Other metals detailed are tin, lead, spelter and zinc, aluminium, platinum, tinplates and galvanised sheets, iron and steel. Bringing together so much information of this character in so compact a form makes the book a valuable reference work for electrical and other engineering and industrial offices.

"The Motor-Generator." By James W. Barber. London: Gaues, Ltd. Price 1s. net.

"Spon's Architects' and Builders' Pocket Price Book, 1914." London: E. & F. N. Spon, Ltd. Price 2s. 6d. net.

"Handbook on Electroplating, Polishing, &c." Birmingham: W. Canning & Co. Price 2s. 3d., post free.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Vol. LVII, Part III. January, 1914. Glasgow: The Institution.

"*Proceedings* of the South Wales Institute of Engineers." Vol. XXIX, No. 6. January, 1914. Cardiff: The Institute. Price 2s. 6d.

"*Bulletin* of the Imperial Institute." Vol. XI, No. 4. October-December, 1913. London: John Murray. Price 2s. 6d. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 1. January, 1914. New York: The Institute. Price $1.00.

"*Journal* of the Franklin Institute." Vol. CLXXVII, No. 1. January, 1914. Philadelphia: The Institute. Price 50 cents.

"Electrolysis in Concrete," by E. B. Rosa, B. McCollum and A. S. Peters; "High-frequency Ammeters," by J. H. Dellinger; "Electrolytic Corrosion of Iron in Soils," by B. McCollum and K. H. Logan. Washington: Government Printing Office.

"Annuaire de l'Electricité." 1914. Paris: *La Lumiere Electrique*. Price 1 fr.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 24. December 31st, 1913. Milan: Stucchi, Ceretti & Co. Price L. 1.50.

"Handbook of Wireless Telegraphy." By J. Erskine-Murray. Fifth Edition. London: Crosby Lockwood & Son. Price 10s. 6d. net.

"Motoring." By A. E. Berriman. London: Methuen & Co. Price 10s. 6d. net.

"Memorandum by the Chief Engineer of the Manchester Steam Users' Association, for the Year 1912." Manchester: The Association.

"Annuaire pour l'An 1914." By the Bureau des Longitudes. Paris: Gauthier-Villars. Price 1 fr. 50 c.

"Elektrizität und Volkswohlfahrt." By Prof. A. Raps. Berlin: Verlag von G. Stilke. Price M. 2.50.

Calendars and Diaries.—MESSRS. KING & CO., of Leith, have issued a wall calendar for 1914, with monthly slips. A view of their electrical repair workshop appears above the slips.

From MESSRS. MCLURE & WHITFIELD, Mersey Dynamo Works, Adswood, Stockport, we have received one of their handy pocket diaries with full calendar and daily spaces, also accident insurance form. The opening pages, as usual, contain illustrated information of the firm's generators and motors and petrol sets.

Catalogues and Lists.—MESSRS. ERITH'S ENGINEERING CO., LTD., 70, Gracechurch Street, London, E.C.—Thirty-two-page catalogue (No. 215) describing and illustrating Erith's grateless underfeed stokers, of which over 10,000 are installed. Observations are made on combustion, boiler efficiency, air supply, range of fuels, and charts, diagrams and excellent half-tone views of their stokers applied, are contained in the brochure.

THE EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., Ponder's End.—Eight-page booklet containing illustrations from photographs of the various apartments of a house in which Ediswan "Quartzalite" electric heaters and radiators are used. Prices of the different types of apparatus shown in use are stated.

NATIONAL TIME RECORDER CO., 5, Blackfriars Road, London, S.E.—Twenty-page illustrated booklet, describing their patent fool-proof time recorders, time stamps, and portable control and signal clocks.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Twenty-four-page pamphlet (No. 22A) in the firm's standard form, describing, excellently illustrating, and tabulating details of, their open type and self-contained end hood pedestal type induction motors. Weights and dimensions, as well as ratings and other technical data are given, as are also a list of users, and names and addresses of the firm's foreign and Colonial agents.

CAMBRIDGE SCIENTIFIC INSTRUMENT CO., LTD., Cambridge.—List No. 126 (60 pages) contains very full illustrated descriptive matter, with prices, code-words, &c., relating to the various types of galvanometers which they manufacture, including different types of moving magnet and moving coil galvanometers, and giving particulars of various galvanometer accessories. Special attention may be directed to the Einthoven string galvanometer, which has a large range of usefulness in wireless telegraphy and cardiographic work; and to the Paschen galvanometer, which is very useful for radiometry measurements and is an instrument of extreme sensitivity. Other well-known types are also described.

THE DAVIS ELECTRICAL CO., LTD., 17, Moor Street, London, W.—Circular relating to "Delcoblast," a composition for frosting electric lamp bulbs and other glass; also a blotter giving prices of same. We understand that the solution is being supplied to the Admiralty, H.M. Office of Works and other Government offices, as well as to lamp-makers and Corporations.

WESTINGHOUSE COOPER-HEWITT CO., LTD., King's Cross, London, N.—List No. 64 describes the Rectigraph for the rapid copying of drawings or documents.

MESSRS. CECIL HODGES & CO., LTD., Balfour House, London, E.C.—New catalogue of 14 pages describing fully with illustrations, and giving particulars of weights, dimensions, speeds, prices, &c., of gas, petrol and paraffin engines and dynamos, combined lighting sets, &c.

MESSRS. A. SCHONFIELD & CO. (GLASGOW), 21, Hope Street, Glasgow.—Illustrated price leaflet showing the New Junior "Hestia" electric stove, which they are now manufacturing: also a leaflet relating to their Grundy automatic temperature control apparatus.

BRIMSDOWN LAMP WORKS, LTD., Kingsway House, London, W.C.—A new price list (12 pages) of Wirum lamps is now being distributed to the trade. Prices are clearly shown for lamps of various candle powers and voltages, for interior and exterior lighting, and for traction and train lighting, as well as Wirum battery and motor-car lighting lamps. The Wirum cartons are also illustrated.

BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C.—We have received a copy of the *Mazda House News* for January, which, like previous issues, contains a good deal of chatty and illustrated matter concerning Mazda manufactures for those interested in illumination work.

MESSRS. HENRY POOLEY & SON, LTD., Railway Department, Birmingham. Reprint (8 pages) of an illustrated article on "Weighing Machines on Railways."

PEEL-CONNER TELEPHONE WORKS, LTD., Salford.—Bulletin No. 4, describing the company's small magneto call switchboards. New features have been introduced, making the operation of these boards practically equivalent to that of a central battery switchboard; they are fitted with combined drops and jacks, and a new clearing drop. The operation of inserting a plug into a jack automatically restores the drop shutter: the clearing signals are located in the keyboard, and are restored by operating the combined listening and ringing key. A great saving in time and trouble is thus effected. The parts are easy of access, and special precautions are taken with apparatus for use in the tropics.

MAGNET-SCHULTZ G.M.B.H., Memmingen.—Price list of electromagnets applied to various purposes, such as work-holders, magnetic face-plates, lifting-magnets, separators, &c.

Trade Announcements.—THE LONDON ELECTRIC WAREHOUSE CO. announce that they are now in a position to quote for export requirements in "Metallum" half-watt lamps, which can be supplied in any voltage, and from 600 to 3,000 C.P.

MESSRS. E. P. ALLAM & CO. have removed from 28 to 107 and 109, Gray's Inn Road, W.C., where they have better facilities for carrying on their business of electric light and power contractors. A large stock of motors for hire is held, and a complete workshop for the repair and rewinding of dynamos and motors has been fitted up. Telephone No. as before, "Holborn 1280."

THE WALSALL ELECTRICAL CO., LTD., Walsall, announce that they will be closed from January 30th to February 5th for stocktaking. A small staff will be in attendance to deal with correspondence, &c.

THE ELECTRICAL APPARATUS CO., LTD., have now opened their Birmingham office at Carlton House, High Street, Birmingham. Mr. Way has been appointed manager of this office, and will deal with urgent inquiries from that address. Telegrams, "Elapratus, Birmingham"; telephone No. "Central 7478."

Bankruptcy Proceedings.—CHARLES BLAKE, electrical engineer, 4, Church Street, Bilston.—At the Wolverhampton Bankruptcy Court, on January 21st, bankrupt appeared for his public examination. He attributed his failure to ill-health, shortness of capital and keen competition. Debtor, who had been trading as the Bilston Electrical Co., returned his gross liabilities at £211, of which £206 is expected to rank for dividend, and his deficiency he set down at £86. In reply to questions, the debtor said that in February, 1909, he called a meeting of his creditors together, and paid 6s. 8d. in the £. Later he again got into difficulties, and offered his creditors 12s. 6d. in the £, but this was not accepted, and therefore he filed his petition. The examination was adjourned for debtor to produce an amended deficiency account, and also a trading and cash account.

W. LONGDON & V. G. COBB (trading as Longdon & Cobb), electrical engineers, Nottingham.—Trustee (Mr. E. Wynne Humphreys, 4, Castle Place, Nottingham), released December 22nd, 1913.

W. H. DAVIS (lately trading as the General Incandescent Fittings Co.), dealer in gas and electric light accessories, Saltley, Birmingham.—A first and final dividend of 4s. 4d. in the £ is payable on February 2nd at the Official Receiver's offices, Ruskin Chambers, 191, Corporation Street, Birmingham.

The "Pirelli-General" Cable Co.—A few weeks ago we published a photograph showing the progress that was being made with the erection of the new Pirelli cable works at Southampton, adjoining the Corporation electric light station. Since then the operations have advanced considerably towards completion. It is interesting to announce that the PIRELLI-GENERAL CABLE WORKS, LTD., has now been registered, with a capital of £200,000, for the purpose of manufacturing underground cables, telephone cables, vulcanised rubber wires and cables, &c. The directors of the company are six in number, three representing the Pirelli interests and three the interests of the General Electric Co., Ltd.

Motor-car Lighting and Starting.—MESSRS. DUNCAN WATSON & CO., of 62, Berners Street, London, W., have secured the sole manufacturing and distributing rights in the Bijur electric lighting and engine starting sets, which were recently described in the REVIEW, and which are now being made both in the United States and in Germany.

Electricity Meter Manufacture in Germany.—The completion of the two-millionth electricity meter at the works of the ALLGEMEINE ELEKTRICITATS GESELLSCHAFT, of Berlin, has just been celebrated. The industry was commenced in September, 1897, and within two months 1,000 instruments were turned out. The 100 000 mark was reached in May, 1902; the 1,000,000th in June, 1911, and the 2,000,000th in December, 1913.

Explanation.—MESSRS. CECIL HODGES & CO., of Balfour House, E.C., write to remove any misapprehension that has asisen owing to the illustration of the Feather's Hotel, Ledbury, appearing in their advertisement last week. They wish to make it quite clear that they do not do contracting work, and if their advertisement of electrical equipments should draw inquiries from actual users, the latter would be referred to the nearest electrical contractor in the district.

Liquidations.—Dettifoss Power Co., Ltd.—This company is winding up voluntarily, with Mr. H. A. McMahon, of Winchester House, Old Broad Street, E.C., as liquidator. A meeting of creditors is called for February 5th at Winchester House, E.C. Claims must be sent in by March 25th.

Engineering Instruments, Ltd.—A meeting will be held at Savings Bank Chambers, Darlington, on February 26th, to hear an account of the winding-up from the liquidator, Mr. J. W. Watson

Tramways Third-Party Assurance, Ltd.—This company is winding up voluntarily, with Mr. A B. Johansung, of 90, Cannon Street, E.C., as liquidator.

LIGHTING and POWER NOTES.

Aberdeen.—At a meeting of the T.C., the town clerk submitted two letters from the Suburban Tramway Co. with reference to the proposed agreement with the T.C. as to the supply of electricity. It was pointed out that the company did not desire to contract for five years, but would prefer that the contract run from year to year. The electrical engineer recommended that the existing agreement be extended for a period of five years from June next, all the clauses remaining the same except the charge for electricity, which he recommended for the existing system should be 1⅜d. per unit on the company guaranteeing to take or pay for 140,000 units per annum. The price charged at present is 1¾d. per unit.

Argentina.—The State Electrical Board has ordered the establishment of electric lighting services at Villa Colon, La Paz and Las Piedras.—*Review of the River Plate.*

Asiatic Turkey.—According to the *Daily Telegraph*, a 40 years' concession has been granted to the French banking firm of Perrier, for the construction of a tramway from Jerusalem to Bethlehem, and the lighting of the city with electricity.

Atherton.—The B. of T. has granted permission to the R.D.C. to erect overhead wires for the supply of electricity to the Westhoughton district, and outside its area of supply.

Aylesbury.—E.L. Scheme.—A motion that the proposed E.L. scheme be dropped, in view of a petition against it, signed by 1,850 ratepayers, was defeated at the last meeting of the U.D.C. The petition, which has been forwarded to the L.G.B., objects to the estimated cost, which has risen from the original £17,800 to £21,500.

Bacup.—A new sub-station is being constructed in Market Street by the Corporation, and in order to run part of the Plantation Mill of Messrs. Joshua Hoyle & Sons, a 75-H.P. motor is being installed.

Ballater.—E.L. Scheme.—Mr. Duncan is to proceed with the wiring for the E.L. of the burgh. It is estimated that the installation will be in full working order by the end of July.

Bilston.—Sewage Pumping.—The U.D.C. has been recommended to substitute electric power for oil in connection with the sewage works plant. The conversion is estimated to cost £250

Blackpool.—The proposed introduction of the rateable value system of charging, recently referred to in these columns, is to take effect on April 1st. The flat rate for lighting is also to be reduced from 4½d. to 4d. per unit.

Brampton.—E.L. Scheme Dropped.—At a meeting of the R.D.C. last week, a motion to obtain expert advice as to the feasibility of an electricity supply scheme for the town was defeated. It was proposed to obtain power from the River Gelt.

Brazil.—The first portion of the new hydro-electric station at Sorocaba of the Sao Paulo Electric Co., has just been put in operation. When the whole of the plant has been installed, it will have a capacity of 30,000 KW.

Burnham (Somerset).—The U.D.C. has decided to have the Town Hall and offices lighted by electricity "provided that suitable appliances be used and a reasonable charge made for the installation."

Canada.—By-laws have been passed in the following towns in Ontario to expend the amounts named on the E.L. undertakings—Hamilton, $335,000; Richmond Hill, $4,000; and Stouffville, $7,000.

The following towns have passed by-laws in favour of hydro-electric supplies:—Wallaceburg, Hanover, Fergus, Elora, Strathroy, Tilbury and Chatham.

Plans are complete for the steam auxiliary plant to be erected by the Dominion Power and Transmission Co. at Hamilton. It is expected that two units, with a capacity of 13,400 H.P., will be installed by next fall, and one unit will be added annually until the total capacity is 88,000 H.P. The total cost of the buildings and plant is estimated at $3,500,000.—*Canadian Engineer.*

Chiswick.—The E.L. Scheme.—It has now been decided to take a poll of the ratepayers on the E.L. purchase scheme, which met with an adverse vote at the recent public meeting of electors.

Continental Notes.—Finland.—It is announced that the St. Petersburg Electrical Transmission of Power Co., which is declared to have a share capital of £5,200,000, has approached the Senate of Finland with the object of securing authority to erect hydro-electric works of a capacity of from 300,000 to 400,000 H.P. This scheme aims at the utilisation of the resources of Lake Saima. In the district where the suggested power station is to be erected the Vuoxen River flows from Lake Saima to Lake Ladoga, and in the first part of its course it passes over numerous falls, including the Imatra Falls, which have already formed the subject of an electrical project. At present only 4 per cent. of the enormous forces of the Vuoxen River is used by the timber and paper industries, the remainder going to waste. The ownership of the water-powers is vested to the extent of about one-third in the Finnish State, one-third is the property of industrial and private firms, and one-third is owned by the St. Petersburg Electrical Transmission of Power Co. According to a scheme prepared on behalf of the latter by a Munich firm of engineers, it is proposed to construct a dam across Lake Saima, near Vuoxenniska above Imatra, and to regulate the future discharge of the water which is to be conveyed to the power station by means of a canal of a length of 11 miles, where a useful fall of about 200 ft. is computed to be available. It is intended to install 20 turbines, each of 20,000 H.P., which will be direct coupled to generators. Power is to be transmitted to St. Petersburg, which is about 74 miles distant, and it is calculated that it will be possible to deliver 1,600,000,000 KW.-hours in the Russian capital per annum. A Helsingfors correspondent of a German newspaper states that public opinion in Finland is greatly opposed to this particular scheme, it being contended that if the power station is to be erected the natural owner should be the Finnish State. On the other hand, the Russians are said to have powerful advocates, and the present Senate is declared not to be unfavourably disposed towards them.

France.—An agreement has recently been arrived at between the French and Swiss Governments with reference to the allocation of the rights in the water power of the River Rhone, near the frontier. It has been agreed that the French and Swiss concessionnaires shall jointly build the dam near Pougny-Chanoy, from which each will draw its water to operate the turbines. Negotiations are reported to be in hand with reference to an amalgamation of the interests of the two concerns.

Italy.—A Baden company has applied to the Italian Government for a concession to utilise the waters of the Piave for a hydroelectric installation for an output of 166,000 H.P., at a cost of 70,000,000 lire. The power will be utilised for electric driving on the railways of Upper Italy.—*Revue Pratique de l'Electricité.*

The Technical Investigation Co., which was formed some time ago by the Italian Commercial Bank, the Southern Railway Co., the Southern Electricity Co. and the Franco-Swiss Electrical Co., of Geneva, for the purpose of examining the hydraulic powers of the Sila in Calabria, has now submitted to the Italian Government four schemes which would give a total of 150,000 H.P. As, however, industries have yet to be established in that mountainous district, the promoters only desire to proceed with the utilisation of 50,000 H.P. in the first instance. It is intended to use a portion of the energy for the production of carbide of calcium, and to distribute the remainder for industrial and lighting purposes at distances of up to 170 miles. The capital required for the execution of the scheme is put at £2,000,000, which is said to have been raised by the four promoting companies previously mentioned.

Sweden.—It is reported that a scheme has been agreed upon between the Ljusne Iron Works Co. and the Bergvik Ala Nya Cellulose Works for the establishment of a plant to utilise the water power of Lake Marmen to generate electricity, part of which will be utilised by the companies themselves, and the balance distributed in the district.

Coventry.—The City Council decided on Tuesday to purchase sites for two additional sub-stations.

Croydon.—The B.C. has resolved to oppose the L.B. and S.C. Railway Co.'s Bill, with respect to the provision of electricity, and the South Suburban Gas Co.'s Bill relating to the generation and disposal of electricity.

Deal and District.—E.L. Proposals.—At a meeting last week of representatives of the Town Councils of Deal, Sandwich and Dover, the Walmer U.D.C. and the Eastry R.D.C., a resolution was passed recommending each body to oppose the Deal and Walmer Gas and Electricity Bill, on the ground that the granting of a monopoly for an indefinite period is to be strongly deprecated.

Dublin.—The Alliance and Dublin Gas Bill, which authorises the company to supply electricity within the urban districts of Blackrock, Kingstown and Dalkey, has been forwarded for the first reading.

Dudley. — Annual Accounts. — The Corporation's abstract of accounts has been issued this week, and they show that on the electricity undertaking the expenditure has been £7,958, including £2,538 in respect of interest on mortgage loans paid and accrued, £4,900 repayment of loans, and £519 bank charges. The revenue reached £5,039, and the net loss for the year was £2,918. The deficit for the previous year was £2,662, so that the total net loss up to March 31st last was £5,580,

Glasgow.—Police Lamps.—It is stated that the electric lamps with which the police are provided are too delicate for the knocking about to which they are liable, and that a stronger lamp will probably be introduced.

Greenock.—Loan Sanction.—The Secretary for Scotland has consented to the Corporation borrowing a further sum of £30,000 for extensions to the electricity undertaking.

Harwood.—The E.L. Scheme.—At a meeting of the D.C. last week, the chairman observed that if something was not arranged soon regarding the supply of electricity from Accrington, the D.C. would have to undertake the supply itself.

Hornsey.—New Loan.—The T.C. has approved the borrowing of £3,000 for the purposes of the electricity undertaking.

Huddersfield.—Loan Sanction, &c.—The L.G.B. has sanctioned the borrowing by the T.C. of £30,000; the sanction to borrow £5,000 for motors has been returned for cancellation.

The Electricity Committee has recommended the acceptance of the tender of the British Westinghouse Co. for a condensing plant.

Hull.—Estimates for 1914.—The Corporation electricity department estimates for the ensuing year show an expenditure of £85,718, as compared with £77,526 for 1913. The estimated expenditure for fuel is increased from £16,204 to £20,484, and wages from £6,578 to £7,450. The estimated receipts by meter are £81,751, compared with £73,438 last year, and the balance in hand £3,147 as compared with £2,394.

The electrical engineer stated that by reason of the large recent extensions not having approached their full earning capacity, the capital charges per unit were considerably heavier than might be expected in subsequent years.

Supply to Hessle.—The Committee has under consideration the supplying of electricity to Hessle. There is some opposition to the Corporation paying about £500 in connection with the expense of the prov. order. At a meeting of the Committee on January 22nd, Ald. Brown urged the Corporation to go ahead with laying the mains, or the new houses would be fitted with gas.

The Chairman stated that the electrical engineer had suggested that the supply of electricity to the Pickering Park district should be part of the scheme to supply electricity to Hessle.

India.—The *Indian Textile Journal* states that Messrs. Crompton & Co., Ltd., have applied to take up the triple scheme for Lucknow, Allahabad and Bareilly, in connection with the scheme for the supply of electricity in the United Provinces.

Irish Train Lighting.—The Midland Great Western Railway Co. (Ireland) states that in the course of a few months the third-class carriages on its system are to be electrically lighted.

Kettering.—The U.D.C. has decided to extend the electricity mains to the site of the proposed garden suburb in the Pytchley Road neighbourhood.

New Loans.—The U.D.C. has applied to the L.G.B. for a loan of £2,000 for mains and services.

Kilbowie.—Owing to the failure of the electric power at Singer's sewing machine factory on Thursday, last week, at Kilbowie, several departments were stopped, 5,000 employés being rendered idle.—*Pall Mall Gazette.*

Leicester.—Street Lighting : Electricity *v.* Gas.—The Watch Committee has decided to have King Richard's Road lighted by electricity, and Hinckley Road by gas, for the purpose of an experiment before considering the question of the reorganisation of the whole of the street lighting of the town.

Liverpool.—Annual Report.—In his report for the past year the City electrical engineer states that the reconstruction of the Lister Drive No. 1 station has made satisfactory progress. Three of the water-tube boilers have been in commission since the end of November, and it is expected that the reconstruction of the first section of the boiler house will be completed before the end of March next. The extension of the H.T. mains from Lister Drive power station to the Edge Lane district, and the continuation to Smithdown Road sub-station is practically completed. Provision is also made for additional sub-station plant, which the engineer anticipates may be necessary owing to the increased demand and the rapid development in the use of electricity for power purposes.

London.—Hackney.—The Electricity Committee has recommended the B.C. to oppose the North Metropolitan Electric Power Supply Bill and the London Electric Supply Bill, if protective clauses cannot be secured.

The Committee also recommended the Council to concur in the resolutions of the Conference of London Municipal Authorities owning electricity undertakings. The Conference protested against the action of the L.C.C. in altering the maximum periods for the repayment of loans for electricity undertakings, and attempting to alter the periods of existing loans without consulting the Councils concerned, and resolved that, as the question of loan periods is very unsatisfactory, the L.C.C. be requested to call a conference of the metropolitan Borough Councils authorised to supply electricity to consider the whole subject, more particularly, having regard to the report of the L.C.C. Finance Committee in the case of the Southwark B.C.; and that, in the meantime, the L.C.C. be urged not to recommend any variation in the existing loan periods.

Woolwich.—At the last meeting of the B.C., the Electricity Committee reported that, notwithstanding the low rates quoted, it had not been successful in its negotiations for giving the Erith U.D.C. a bulk supply. The Committee reported that it had also been unsuccessful in inducing the Bexley U.D.C. to take a bulk supply.

The B.C. has decided to ask the Shoreditch Conference to organise a combined opposition of all B.C.'s owning electricity undertakings to the London Electric Supply Bill. In the event of the Conference deciding not to oppose the Bill, the General Purposes Committee proposes, in consultation with the Electricity Committee, to decide whether a petition shall be presented against the Bill from the Woolwich B.C. only.

Marylebone.—The B.C. has decided to deposit a petition against the London Electric Supply Bill. The E.S. Committee states that the Council is not directly affected by the Bill, but it would prolong the period before which the whole of the electrical undertakings in London might come under the management of the L.C.C.

The L.C.C. has also decided to oppose the London Electric Supply Bill.

Lowestoft.—Annual Report.—The E.L. Committee reports that the electricity undertaking showed a credit balance on the past year's working of £171, but after allowing for the expenditure on the showroom account, &c., there was a deficiency of £191. The total receipts were £16,976, compared with £15,992 in the previous year. The working expenses amounted to £9,268, as against £8,502, leaving a gross profit of £7,708; £2,335 was paid into the sinking fund, which now stands at £4,513. During the year 129 new consumers were connected.

Mountain Ash.—The U.D.C. had decided to apply to the B. of T. for consent to use overhead wires for the supply of electricity in the Ynysybwl district at a pressure of 230 volts.

Newfoundland.—According to the *Pall Mall Gazette*, a concession has been granted by the Government for the use of 1,000,000 H.P. of water-power at Grand Falls, Labrador, for the generation of electricity, which will be used to manufacture nitrogen fertilisers from the air.

Peterborough.—The Electricity Committee has decided, before fitting ordinary mechanical stokers to the six boilers, to try two sprinkler and coking types of stoker.

The city engineer has been instructed to report upon the practicability of overhead transmission of electricity.

The T.C. has decided to apply to the L.G.B. for sanction to borrow £2,850 for the electricity works, viz., £1,350 for extension of works, £1,000 for mains and £500 for services.

Scarborough.—E.L. Purchase Scheme.—At a meeting of the Corporation on Monday, last week, a report on the proposed purchase of the E.L. undertaking was considered, and the matter was again deferred

Southend-on-Sea.—New Coaling Plant.—In order to provide facilities for delivering sea-borne coal to the electricity works, the T.C. has authorised the surveyor to construct an electric tramway on the loading pier, at an estimated cost of £500, and is applying to the L.G.B. for sanction to borrow £1,350, the estimated cost of an electric crane and grab and the laying of track and overhead cables on the pier. It has also decided to purchase three electrically-driven coal trucks, at an estimated cost of £1,300.

St. Helen's (I. of W.).—Public Lighting.—The U.D.C. has accepted the offer of the Isle of Wight Electric Light and Power Co., Ltd., for public lighting in the St. John's district for 10 years, at £2 12s. 6d. per lamp per annum, subject to a revision of the price at the end of five years.

Tintwistle. — Public Lighting. — The P.C. has appointed a committee to consider the question of the public lighting of the parish.

Tynemouth. — Annual Report. — The electrical engineer's report shows that the net profit for the past year was £945, as compared with £1,305 for the previous year. The number of units sold from the mains was 1,760,471, and three-phase units 1,361,694, a total of 3,122,165 units, an increase of 246,432. The number of units bought in bulk was 1,985,631. The cost per unit was 1·761d., and the average price charged was 1·78d.

Trimdon (Co. Durham).—The P.C. proposes to install electric light next season

West Yorkshire.—E.L. Proposals.—At a meeting of the Mytholmroyd Council last week, a ratepayers' petition was presented urging it to provide an electricity supply, and a letter was read from the Yorkshire E.P. Co. asking the Council to support its application for powers to supply electricity for lighting purposes.

A communication from the Stainland Council urged it to oppose the application on the ground that it would create a monopoly of supply ; eventually the whole subject was referred to a committee appointed to deal with the matter. The Skipton Council has decided to oppose the Bill and to obtain a renewal of its prov. order ; the East and West Ardsley D.C. has referred the matter to the General Purposes Committee ; and the Selby U.D.C. has decided to hold a special meeting on February 3rd to consider a resolution that it should oppose the Bill. The New Mill D.C. decided not to entertain the company's proposal, but to approach the Huddersfield Corporation to ask what it was prepared to do with regard both to lighting and tramway services.

Walthamstow.—The electrical engineer's report as to proposed extensions to the boiler house plant, has been adjourned by the Lighting Committee for further consideration at its next meeting. The engineer has been instructed to submit plans of the proposed extensions.

West Ham.—Proposed Loans.—Application is to be made to the L G.B. for sanction to borrow £13,500 for transformers, sub-station and switchgear ; £12,750 for mains ; and £4,000 for services.

Willesden.—The U.D.C. is petitioning against the N. Metropolitan E.P.S. Bill.

Winchester.—Rating Appeal.—The City Council has notified the B. of G. of its intention to appeal against the assessment of the electricity works, which is £1,900.

TRAMWAY and RAILWAY NOTES.

Accrington.—New Cars.—A Sub-Committee visited Dewsbury on January 23rd to inspect a new type of car with radial truck and extended wheel base. The Corporation has decided to purchase five additional cars, and the visit was in furtherance of investigations with a view to finding the most suitable type of car.

Ardsley.—The B. of T. has decided to hold an inquiry relative to the application of the Wakefield and District Light Railways Co. for sanction to abandon certain authorised lines not yet constructed. The Council has decided to be represented and to oppose the proposed abandonment.

Brentford.—The Tramways Co. has written the U.D.C. with regard to its complaint as to the tramway track in High Street to the effect that although it was beginning to show wear the track was still in a good state of repair ; the company had under consideration, however, a scheme for relaying the whole of the track.

Burnley. — Tramway Extensions.—The Tramways Committee has recommended the T.C. to construct tramways in Stoneyholme. There will be three sections, with a total length of 5,102 yards. The cost is estimated at £39,530—viz., track and overhead equipment, £26,730 ; 12 cars, £10,800 ; street improvements, £1,000 ; and depôt extension, £1,000. Single-deck tramcars will be used, owing to the bridges on the route.

Continental Notes.—Austria.—A preliminary concession has been granted in respect of a system of electric tramways in the town and district of Cracow.

Italy.—A concession has been granted in respect of a projected electric railway, partly underground, to serve the town and district of Naples. The line will comprise a double track on which a 3-minute service of three-car trains will be run, the maximum speed allowed being 19 miles per hour.

A new electric railway has lately been completed and put in operation between Busca and Bussoleno.

Norway.—Railway Electrification.—This question has been under consideration for several years, and the railway authorities have now worked out a scheme for the electrification of the railway between Wrammen and Kristiania, which has the largest traffic, and will be the first section to be taken in hand. The results have been submitted to the Department for the Interior, and the single-phase system at 15,000 volts and about 15 cycles per second is recommended. It is considered desirable to increase the maximum speed, according to a previous estimate, which was 70 km. per hour, to 80 km., which would reduce the time for the express trains between the two towns by 10 min. The locomotives would be constructed for a maximum speed of 90 km. A new time plan has been worked out in accordance with the altered speed, and the estimate of the consumption of energy is 6,500,000 kw.-hours per year, and the maximum load between 5,300 and 5,600 kw. As it would be difficult to employ steam locomotives as a reserve, the power stations are to be capable of supplying the whole amount of energy at any given time, on the basis of the full maximum load. The railway will serve as an experimental plant, from which experience can be gained before the other sections of the railways are taken in hand.

Russia.—A company has been formed with a capital of £168,600 to construct and work an electric railway between the towns of Kiew and Bedwardanitza.

Negotiations are in hand with reference to the construction of about eight miles of new electric tramways in the city of Odessa.

Sweden.—The electrification of the railway between Küruna and the Norwegian frontier is now approaching completion, and the first trial with an electrically-driven train has been made. The result of the experiment was very satisfactory. From April 1st it is the intention to run electrical passenger trains after sufficient experience has been obtained by the running of mineral trains.

Germany.—The crisis in the Bavarian Cabinet centres almost entirely round the questions, whether the electrification of the State railways shall be delayed, and to what extent the State shall undertake the development of the water powers for traction and industrial purposes. The defeat of the Minister of Communications will hasten the electrification, and probably the power scheme will be run by a company in which the State holds a majority of the shares.

At the end of 1913 there were in Berlin 3,072 horse cabs, 1,962 driven by petrol, and 475 accumulator taxicabs.

Dover.—Tramway Renewals.—After an inspection of the tramways permanent way, the borough surveyor has reported that renewals and repairs estimated to cost £3,477 are required. The general manager of the tramways, reporting on the condition of the cars and general equipment, suggested that the reserve fund should be increased from 1 to 4 per cent. of the annual revenue, with a view to carrying out certain renewals forthwith.

Dudley.—Annual Accounts.—The abstract of the Corporation accounts issued this week shows that on the tramway account there is a balance of £4,552, but in view of the liabilities to be provided for on loan account, no contribution has been made towards the rates.

Huddersfield. — The Corporation proposes to lay a double line of tramways to Marsden, and the U.D.C. is to be informed accordingly.

Glasgow. — The Tramways Committee is considering a suggestion that a tramway should be laid in Polmadie Road to link up the district with other parts of the city.

Leith.—Portobello Extension.—The Tramways Committee is to have another conference with the Edinburgh Town Council regarding the proposed extension of the tramways to Portobello.

Liverpool.—The Corporation Tramways and Electricity Committee has decided to recommend the City Council to place £125,000 towards the reduction of the rates, viz., £100,000 from the tramways and £25,000 from the electricity department. Last year the amount received from the tramways was £66,000 and from the electricity department £30,000. This is a larger surplus than has ever before been placed to the reduction of the rates.

London.—West Ham.—The Tramways Committee is again recommending the Council not to take any action on the suggestion that tramway tickets should be issued in packets at a discount. The tramways manager states that books of tickets, at their face value, have been in force for a number of years, but there has been little or no demand for them, while return tickets have been readily taken up, which, he thinks, will be of more value than discount tickets.

London Ambulance Service.—The L.C.C. has advised the Metropolitan Asylums Board that it will be acting *ultra vires* in giving effect to its scheme for providing an ambulance service. The Ambulance Committee of the M.A.B. states that it does not know on what grounds the Council was advised that the Board would be acting *ultra vires* in carrying out the scheme, and that this would seem to be a question for the Board to settle on the advice of its own legal advisers. The Committee concluded that London must now wait for a further indefinite period for a street accident service, which the Board was prepared to provide by Midsummer next.

Manchester.—All-night Service.—The Tramways Committee has decided to continue the hourly service of tramcars during the night. The chairman stated after the meeting that the loss had been less than was anticipated, and so far as he could see from the returns presented by the general manager, the all-night service had come to stay.

Newcastle-on-Tyne.—A B. of T. inquiry was held by Colonel von Donop on January 21st into the collision between two electric trains, which occurred at the Central Station on the 6th inst. The driver of the colliding train said he drove the train from Tynemouth to Newcastle, and used the Westinghouse brake, which appeared satisfactory, at all the intermediate stations. The destination signal indicated that he was to run into No. 2 platform, and the platform signal indicated that there were other vehicles at that platform. The signal was passed at walking pace, and it was not until within 4 yards of the stationary coaches that he realised he would be unable to avert a collision, which, however, was very slight. He attributed the mishap to the greasy condition of the rails. The guard, a platform foreman and a signalman, corroborated the evidence of the driver. Examiner G. Smith stated that he examined the colliding carriage, and found the brakes in perfect order.

Preston. — Owners and occupiers of property in Adelphi Street and Plunginton Street have petitioned the Corporation protesting against the Adelphi Street tramway extension for which the Corporation is seeking powers. It is submitted that the proposed extension is not required, and that the streets are too narrow.

Rawtenstall.—Halfpenny Fares.—The T.C. has instructed the tramways engineer to obtain information from other towns where halfpenny fares are in operation with a view to adopting the same, if practicable, on certain of its routes.

Rochdale.—A proposal is before the T.C. for the erection of new depôts in connection with the tramways department. The general manager states that 10 or a dozen cars have to remain in the open during the night with the result that they rapidly deteriorate.

South Shields.—The Tramway Committee has recommended the Council to adopt a system of electric motor-'buses to link up the town with the outlying districts.

U.S.A.—It is expected that all local trains between Broad Street Station (Philadelphia) and Paoli and Chestnut Hill will be operated electrically before the end of the year. It is estimated that 3,750 KW., at 25 per cent. load factor, will be required to operate the service, and the Pennsylvania R.R. Co. has contracted with the Philadelphia Electric Co. to supply the power for five years. The complete electrification embraces 32 miles of suburban lines.

It is stated that the extension of the electric lines of the New York-New Haven Railway will be on a three-wire system, with 22,000 volts between adjacent trolley wires, and a common track neutral; this will give the same operating pressure (11,000 volts) as now employed, but it is hoped to largely reduce the rail return current, saving distribution losses and reducing magnetic disturbance to adjacent telegraph systems.

According to a recent estimate, there is now 2,138 electric motor-cars—both pleasure and industrial—in service in the New York district. The New York Edison Co. is supplying current for the charging of 1,300 vehicles, the consumption for 1913 being estimated at 8,000,000 KW.-hours.

Electric 'Buses.—A company has been formed to start a service of electric motor-'buses in New York. The vehicles to be employed are of the single-deck type, with accommodation for 32 passengers, all facing forward. Four motors are employed, one for each road wheel, while the battery is slung below the chassis, and occupies practically all the space between the wheels.

Edison-Ford "Electric."—It is reported from the United States that Mr. T. A. Edison, in conjunction with Mr. Henry Ford, head of the Ford Motor Co., of Detroit, is bringing out an Edison-Ford light electric car. The new vehicle, which is expected to take as prominent a position in the motoring world as has the Ford petrol car, will be able to cover a distance of 50 miles, at a speed of 25 miles per hour, on one charge of the battery, and 75 miles at 15 miles per hour. According to the *Electrical World*, the new Ford electric will be built in a special factory, and will weigh 1,100 lb., including a 405 lb. battery equipment. An experimental car is now in use in Detroit, and the price is to be less than $1,000, and possibly as low as $600.

TELEGRAPH and TELEPHONE NOTES.

India.—The erection of wireless stations in Madras, Secunderabad, Peshawar and Quetta is proceeding rapidly. Lahore, Nagpur, Karachi and Bombay have already been provided with such stations (each with a range of some 600 miles), and the last two are now available for communication with ships at sea. All the leading steamship lines plying to Indian, Burmese and Ceylon ports have fitted their passenger steamers with wireless apparatus. A recent application from the leading shipping firms has resulted in the opening for work by night, as well as by day, of the stations at Karachi, Calcutta, Diamond Harbour, Mergui and Cape Victoria (the southern extremity of Burma). With the opening up of the Madras station (and there is one at Colombo), practically the whole area of the Bay will be within range of some wireless coast station.

Submarine Telegraphy.—At a sitting of the Dominion's Royal Commission last week, Mr. F. C. Crawford, chief of the submarine cable-laying department, and Mr. Rollo Appleyard, chief of the submarine core-manufacturing department of the Silvertown works, gave evidence that during recent years the speed of transmission had increased by 50 per cent. or more, and accuracy had been improved. The cost of a modern Atlantic cable to give a speed of 40 words a minute would be about £500,000. Mr. Appleyard said there was no prospect of a reduction in the cost of construction and working of cables. The advent of wireless telegraphy had in no way diminished the activities of the cable companies—quite the contrary. He had no fear whatever of the competition of wireless with submarine cables; it would be a feeder rather than a competitor. He did not see how wireless could ever become a secret system. The Empire Press Union forwarded to the Commission a communication urging that the laying of a State-owned cable across the Atlantic was an Imperial necessity for the interchange of news through the medium of the Press.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney (New South Wales)—March 18th. For the Postmaster General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

March 2nd. Sydney Harbour Trust. Circular Quay. Three electrically-operated semi-portal travelling cranes for Berths Nos. 1, 2 and 3, Woolloomooloo Bay. Particulars from Engineer-in-Chief of the Trust.

March 25th. N.S.W. Railways and Tramways Department.—Five 1,000-KW. sub-station units to specification No. 121. Particulars at Electrical Engineer's Office, 61, Hunter Street, Sydney.—*Tenders.*

Adelaide.—February 11th. P.M.G. 50 cable terminals. See "Official Notices" January 9th.

Melbourne.—February 17th. P.M.G. Cable boxes. See "Official Notices" January 9th.

February 18th. 1,590 opalescent arc lamp globes for City Council. See "Official Notices" January 23rd.

April 7th. P.M.G. Accumulator batteries (Tudor) for radio-telegraph stations. See "Official Notices" to-day.

April 7th. For the Postmaster-General. Relays, non-polarised, Stores Schedule 996. See "Official Notices" to-day.

Hobart.—March 2nd. For the Postmaster-General. Telephones, common battery, wall pattern, and table pattern, Schedule T 104. See "Official Notices" January 16th.

Aberdare.—January 31st. Corporation. Four double-deck tramcars. See "Official Notices" January 16th.

Ballyconnell (Co. Cavan).—February 14th. Horizontal gas engine and suction plant; 18-KW. dynamo and motor dynamo; storage battery and accessories; switchboard and connections; overhead mains and street lamps, for Ballyconnell Electric Light and Power Co. See "Official Notices" to-day.

Belfast.—February 23rd. Corporation. 12 months' supply of stores for Tramways and Electricity Committee. See "Official Notices" to-day.

Belgium.—February 16th. The authorities of the Fonderie Royale des Canons, in Liége (80, Quai Saint-Leonard), are inviting tenders for the supply of two semi-fixed steam engines for the electric lighting station at the Beverloo Camp.

The municipal authorities of Ghent have this week invited tenders for the supply of the electricity meters required in that town during a period of three years.

Birmingham.—February 11th. Electrical stores for a year, for the Birmingham, Tame and Rea District Drainage Board. Mr. J. D. Watson, engineer, Tyburn, Birmingham.

Blackburn.—February 14th. Corporation. Twelve months' supply of stores for Electricity Department. Specification (deposit 3s. per section) from Mr. P. P. Wheelwright, Corporation Electricity Works. See "Official Notices" to-day.

Bosnia.—The municipal authorities of Gorazda, in Western Bosnia, are about to invite tenders for the electric lighting of the town.

Bradford.—February 19th. Corporation. Cooling towers and induced draught plant. See "Official Notices" to-day.

Bristol.—February 12th. Corporation. 12 months' supply of electrical stores. See "Official Notices" to-day.

Cape Colony.—February 28th. The municipality of Paarl, Cape Province, invites tenders for the installation of generating plant by water power. Plans and specifications from the Town Clerk, Municipal Office, Paarl, or from the consulting engineer, Mr. Thomas Stewart, St. George's Chambers, Cape Town, (two guineas). Tenders to Town Clerk.

Cheltenham.—January 31st. Corporation. Twelve months' supply of electric light fittings, and other stores. Particulars from Mr. J. S. Pickering, Borough Engineer, Municipal Offices.

Chesterfield.—February 9th. Overhauling and renewing telephones at Penmore Hospital, for the Chesterfield Joint Hospital Committee. J. Middleton, Law Clerk, 24, Gluman Gate, Chesterfield.

Colchester.—February 7th. Electrical fittings for lighting, electrical equipment for cars, overhead equipment, car fittings, &c., for the T.C., for a year. Mr. R. C. Bullough, general manager and engineer of the tramways, Magdalen Street.

Croydon.—February 16th. Corporation. 12 months' supply of stores for electricity department. See "Official Notices" to-day.

Dundee.—January 30th. Corporation. (*a*) 5,000-KW. steam turbine and alternator; (*b*) condensing plant; (*c*) 750-KW. rotary converter, with transformer. See "Official Notices" Jan. 2nd.

Germany.—February 4th. The State Canal authorities at Minden, Westphalia, are inviting tenders for the supply and erection of a 20-ton electrically-operated rotating crane.

Greenock.—February 11th. Harbour Trust. 150-ton electric crane. Specification, &c. (deposit £1), from Engineer's Office, Municipal Buildings.

Halifax.—February 16th. Corporation. Stores and materials for the electricity department. See "Official Notices" January 23rd.

Hammersmith.—February 4th. Corporation. Stores for the electricity department. See "Official Notices" January 23rd.

Hornsey.—February 24th. Corporation. Electricity meters, cables, cable stores, &c. See "Official Notices" to-day.

Huddersfield. — Corporation Tramways. Tramwaymen's uniforms. Tramway Manager's Office, Northumberland Street, Huddersfield.

Hyde.—February 4th. Corporation. Electric light installation for the Public Hall, police and other buildings. Specifications from Mr. J. H. Fletcher, architect, 45, Clarendon Place, Hyde.

Ipswich. — January 31st. Corporation. Alternator, transformers, switchboard and rotary converters. See "Official Notices" January 2nd.

Italy.—Savona.—February 10th. Tenders are invited for the supply by foreign firms of a centrifugal fan, with electric motor, and other machine tools (air compressor, boring and polishing machines, &c.), for the locomotive shops at Savona and Rimini. Particulars from the Direzione-Generale, Ferrovie della Stato, at the places named, or at Rome.

Keighley.—February 7th. Electrician's work for a year, for the Keighley and Bingley Joint Hospital Board. Mr. J. N. Clarkson, clerk, North Street, Keighley.

Leeds.—February 21st. Corporation. Twelve months' supply of coal and other stores, including a number of electrical items. See "Official Notices" January 23rd.

Liverpool.—February 12th. Corporation. About 100 standard traction 40 H.P. double-motor equipments. Mr. C. W. Mallins, general manager, Corporation tramways.

London.—L.C.C.—January 30th. Metropolitan Water Board. Twelve months' supply of electric lamps, wire and accessories, &c. Clerk of the Board, Savoy Court, Strand.

February 17th. Installation at County Secondary School, Hilly Fields, Brockley, S.E. (223 points, 312 lights). See "Official Notices" to-day.

Bermondsey.—February 5th. Corporation. Stores for the electricity department. See "Official Notices" January 23rd.

St. Marylebone.—February 11th. Corporation. Underground cables, house cables, flexible cords, rubber goods, box compound and insulating materials, &c. See "Official Notices" January 9th.

Hackney.—Corporation. 12 months' supply of coal for the Electricity Committee. The Engineer, Electricity Works.

Islington.—February 25th. Natural draught cooling tower and pipework for Lighting Committee. See "Official Notices" to-day.

Manchester.—February 17th. Corporation. Twelve months' supply of stores for Tramways Committee. See 'Official Notices" to-day.

Newport.—February 16th. Corporation. 12 months' supply of stores, for electricity and tramways department. See "Official Notices" to-day.

New Zealand.—March 26th. The Dominion Portland Cement Co., Ltd.—Hydro-electric plant, Wairua Falls.—Section 1: Hydraulic equipment, including turbines (1,500 H.P. each), governors, penstocks, valves, &c. Section 2: Generators (1,000 KW. each), exciters, automatic regulators, &c. Specifications (£2 2s.) from S. Irwin Crookes, consulting engineer, Auckland.—*Tenders.*

Portsmouth.—February 17th. Corporation. Twelve months' supply of stores for the Tramways Committee. See "Official Notices" to-day.

Norway.—February 6th. Norwegian State Telegraph Department. 265,000 insulators. Local representation. Particulars from Tekniske Avdeling, Telegrafstyrelsen, Hasselgaarden, Christiania.—*Board of Trade Journal.*

Pontypridd.—February 9th. Corporation. Stores and materials for the electric light and tramway department. See 'Official Notices" January 23rd.

Rhondda.—February 17th. U.D.C. Consumers' electric supply meters for the Gas and Water Committee. See "Official Notices" to-day.

Spain.—February 7th. Tenders are being invited by the municipal authorities of Petin (Province of Orense) for the concession for the electric lighting of the town during a period of 20 years.

Stalybridge.—The engineer to the Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways Board (Mr. R. Blackmore) has been instructed to obtain tenders for the supply of a 1,500-KW. plant.

Sheffield. — February 3rd. Corporation. Contract No 111. Structural steelwork for carrying coal shoots, coal bunkers and railway sidings over same at Neepsend. See "Official Notices" January 16th.

Turkey in Asia.—March 14th. Forty years' electric lighting concession for Trebizond municipality. Population 50,000 to 60,000; 12 miles of street lighting. Houses mostly occupied by poorer classes. Water power (Deiimen River) available. An English translation of the conditions may be seen at the Board of Trade Commercial Intelligence Department in London.

West Ham.—February 6th. Corporation. Stores for the electricity department. See "Official Notices" January 23rd.

CLOSED.

Admiralty.—Messrs. Johnson & Phillips, Ltd., have in course of erection for the Admiralty, switchboard, battery, and booster and cables to its special requirements, in connection with the supply of light and power to the aviation schools and factories at Eastchurch.

Australia.—The following tenders have been accepted by the P.M.G.'s department:—

N.S.W.—

250 telephone meters, £1 4s. 9d. each.—Western Electric Co. (Aus.), Ltd.

4,500 three-steel conductor cords, 10 ft. long, 1s. 11·4d. each.—Lawrence and Hanson Elec. Co., Ltd.

Queensland.—

6,000 dry-cells, 2s. 9d. each.—Brisbane Electrical Co.

Western Australia.—

Conduit steel, couplings, elbows, tees, saddles, clips and ebonite bushes.—W. G. Watson & Co., Ltd.

20 tons h.d. copper wire, 200 lb. per mile, £85 per ton.—Gibbs, Bright and Co.

Victorian Works Department.—

Storage battery at Hospital for Insane, Mont Park, £156.—Sutherland and Ashman.

Nunawading.—Shire Council.

High and low-tension switches and testing sets, £153.—Noyes Bros. (Melb.) Pty., Ltd.

High and low-tension insulators and pins, £153.—Warburton, Frankl (Melb.) Pty., Ltd.

H.T. watt-meter, testing set, meters and fuses, £343.—Australian Metal Co., Ltd.

Transformers, £245.—Union Electric Co. (Aus.), Ltd.

—*Australian Mining Standard.*

Barnes (Surrey). — The U.D.C. has accepted the tender of Messrs. Green & Sons, of Hammersmith, W., for installing the E.L. on the staircase of Castelnau Mansions and Castelnau Gardens.

Belgium.—Five German and one Belgium concern submitted tenders last week to the Belgian Post and Telegraph Authorities in Brussels for the supply and laying of a quantity of telephone cables in the Liége district, the lowest offer being that of Messrs. Felten & Guilleaume, of Mulheim-am-Rhein.

Croydon.—The tender of Messrs. Cory & Sons, Ltd., has been accepted by Croydon T.C., for the supply of 5,000 tons of Murfield washed pea nuts, at 16d. 5d. per ton.

Dover.—The following tenders have been received by the T.C. for tramway rails and fishplates:—

	Rails, per ton.	Fishplates, per ton.
Hadfield's Steel Co., Ltd.	£10 7 6	—
Lorain Steel Co., Ltd.	7 9 0	£9 0 0
Dick, Kerr & Co., Ltd. (50 tons)	7 3 0	9 5 9
" " " (100 tons)	7 0 0	

The offer of Messrs. Dick, Kerr & Co., Ltd., is recommended for 50 tons of rails and the requisite supply of fishplates. The tender of the City Tailoring Co. has also been accepted, at £104, for the supply of uniform clothing to the tramways department.

Harrogate.—The T.C. has accepted the tender of the Chloride Electrical Storage Co. for the repair of the battery at the Royal Baths, and also for the supply of a new storage battery.

Huddersfield.—The Electricity Committee has accepted the tender of the British Westinghouse Electric and Manufacturing Co. for condensing plant.

Leicester.—The T.C. has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for a turbo-alternator, at £11,352; that of the Brush Electrical Engineering Co., Ltd., for 10 canopy-top tramcar bodies, at £3,842; and that of Messrs. Dick, Kerr & Co., Ltd., for the electrical equipment and trucks for the cars, at £3,846.

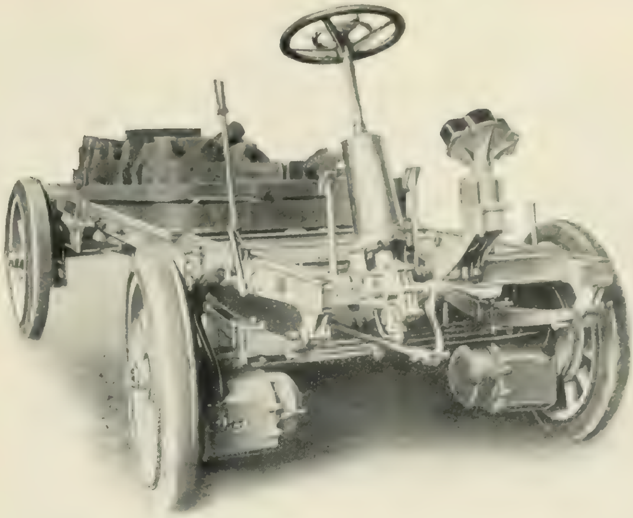
Post Office.—Messrs. Johnson & Phillips have in course of erection, for H.M. Post Office Telegraphs, a complete electrical equipment for the wireless telegraph station, Valencia, Co. Kerry, Ireland, one of the largest coast stations installed by the Post Office.

(*Continued on page* 190.)

THE LLOYD ELECTRIC VEHICLE.

Through the courtesy of Messrs. Mossay & Co., Ltd., of Westminster, we were recently enabled to make a brief trial of the capabilities of a 2½-ton Lloyd electric vehicle, which is representative of a type which has found particular favour on the Continent, being largely used by the German and other Postal authorities, municipalities, hospitals, and for heavy industrial purposes, and passenger vehicles. The constructional features embodied in these vehicles are the result of a good many years' experience, and are of particular interest in view of the attention given to detail.

The method of driving is worth noting. Two high-speed totally-enclosed compound-wound motors are geared to the front wheels, the motors being bolted to the front axle in such a manner that the pivot about which the wheels turn when steering lies vertically over the point of contact between the wheels and the road, and as a consequence shocks between the wheels and the road are not transmitted to the steering wheel, and the steering is surprisingly easy. Moreover, in case of need, the car can be driven by one motor alone without effect on the steering.



2½-ton Chassis, showing Geared Front-Drive Motors, Controller, &c.

Removable end shields are provided at the commutator ends of the motors; the armatures run in ball bearings, and thrust bearings are provided to take the horizontal pressure on the pinion, which is provided with spiral teeth.

The gears are of nickel steel, and run in aluminium dust-proof casings, and strong ball bearings are fitted to all the road wheels.

2½-ton Lloyd Electric Truck.

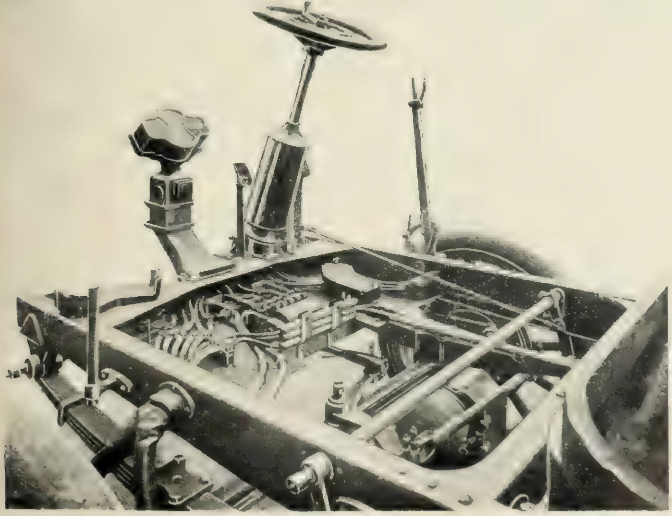
Tudor batteries of 40 cells for light and 80 cells for heavy vehicles, are fitted, being in the ordinary way slung under the chassis by means of hooks; a small winch is provided for hoisting the battery into position from a trolley, which can be run under the chassis. A change of battery can be made in four minutes.

The controller is interesting, the drum being hollow and mounted coaxially with and enclosing the steering pillar, with the controller handle mounted concentrically above the steering wheel.

Normally, the controller is provided with an "off" position, five forward running positions, one reverse and one brake position. It is possible to inspect the drum contacts by slipping off the metal cover, which is slightly conical, and makes a watertight joint when on its seating.

The starting resistances and a small drum controlling them are situated under the driving seat, and the switching is effected by the left pedal; with this drum four resistance steps can be inserted in each position of the main controller by allowing the pedal to rise slowly, and the current may be interrupted on each step of the main controller by pressing the pedal right down.

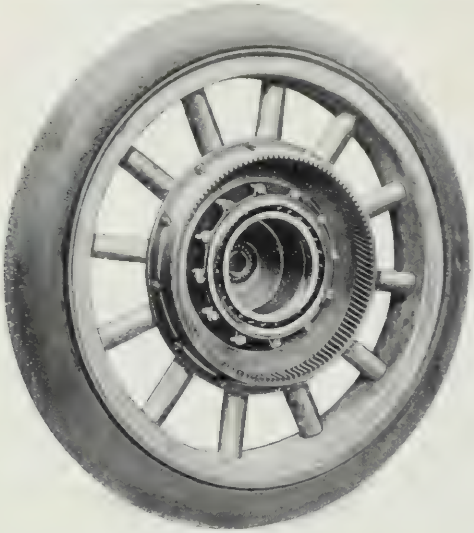
When driving the car, the pedal is used to cut off the current before each motion of the main controller, and subsequently to introduce the four resistance steps, so that no sparking takes place on the main controller, and the insertion of the resistance steps causes the passage



2½-ton Chassis; View of Wiring between Controllers and Motors.
Covers of one disconnecting box and auxiliary controller removed.

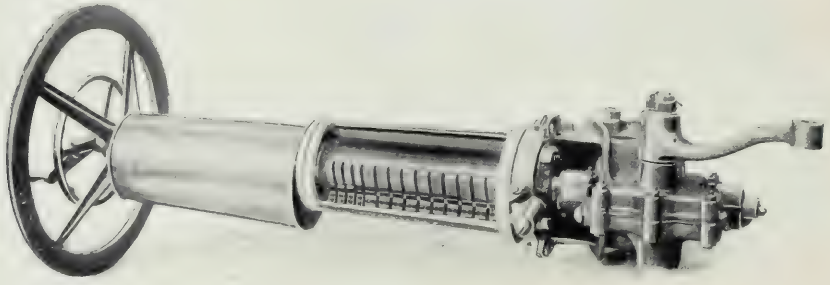
from step to step of the main controller to be extremely gradual and free from current rushes.

Thus controller wear is practically confined to the small resistance controller, and maintenance in this direction is a minor item of expense.



Front Wheel, showing Spur Gearing.

The wiring is simply arranged under the driver's footboard, the controller and motor leads being coupled in distributing boxes, which give every facility for disconnection, and owing to standardisation of nuts, &c., involves the use of a minimum of tools.



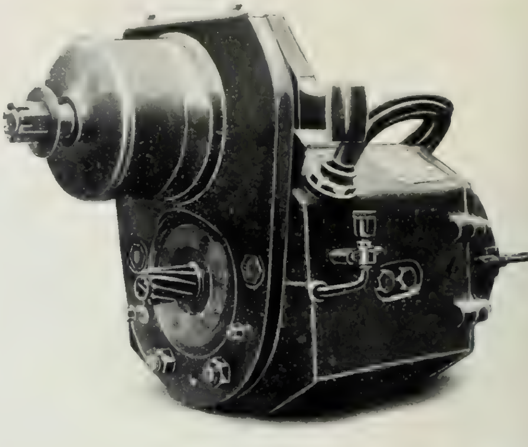
Steering-Control Pillar, showing Controller Cover Removed.

A pedestal in front of the driver carries a combined volt and ammeter, also a contact plug, the removal of which by the driver disconnects the motor circuits; the plug can be used for charging the battery without removing the latter from the vehicle. Electrical braking is provided on the front wheels and two mechanical brakes on the rear wheels.

A feature of the Lloyd vehicle is its front driving, and the high efficiency of the motors employed, which it will be noticed, are geared down (about 10 to 1) on to the wheels.

The electric vehicle uses one of the cheapest forms of power obtainable, and in other ways it lends itself to cheap operating costs, viz., the maintenance of the electric equipment is confined to replacement of controller fingers, ball bearings, brake linings, &c., truing up armatures; and the battery, by arrangement with the makers, can be maintained on a mileage basis.

Tire wear is much reduced, owing to the easier running and starting conditions, and many tire manufacturers are prepared to guarantee 20 per cent. greater mileage than their normal figure for tires on electric vehicles.



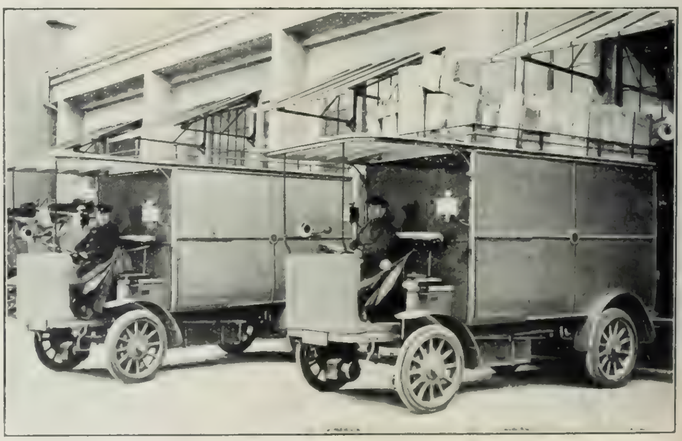
Motor with Pinion and Front-Wheel Hub, Lloyd Electric Vehicle.

Accident risk is low, because such vehicles are particularly easy to handle in traffic, and for obvious reasons fire risk is a negligible quantity.

Experience shows that running costs do not vary to any great extent over a period of years, and that 10 per cent. is a safe rate of depreciation.

A large Continental cab company has been using Lloyd electric vehicles for seven years, and the best testimonial to their efficiency in service is the fact that they have increased in number during that period from 25 to 115; it is further found that such vehicles can be used 350 days a year, which is in great contrast to the usual experience with petrol-driven vehicles.

We may add, in conclusion, that our illustrations show the essential features of the Lloyd vehicles, of which some 700 have been put into service, mainly in Germany, for both goods and passenger transport.



Lloyd Electric Vehicles Supplied to German Post Office.

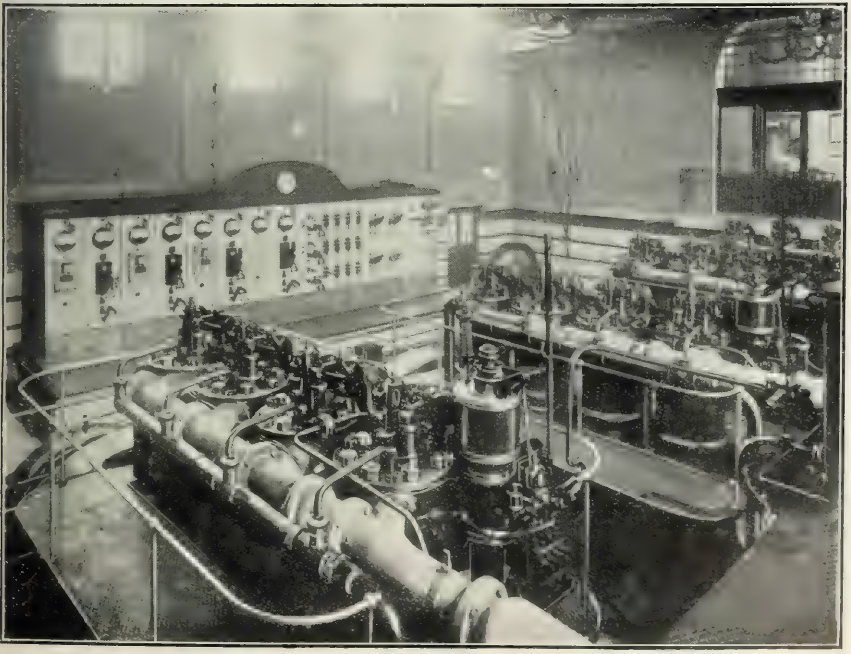
ELECTRIC DRIVING AT THE CLEMENT-TALBOT WORKS.

Amongst the numerous electrically-driven engineering works in this country, the well-known Clement-Talbot motor-car works at Shepherd's Bush, W., is an excellent example of its class. The works were started about 10 years ago, and designed, in the first instance, for electric driving from a works power station, and the arrangements then adopted represent the best practice for a works of this character at the present day.

The power station and offices are situated in a building separate from the works proper, the power station forming one wing adjoining the handsome entrance hall, from which it is visible through large windows, while the office block adjoins the entrance hall on the opposite side. Originally the works power plant consisted of vertical gas engine-driven generators working in conjunction with a Mond gas plant, but some three years ago this equipment was displaced in favour of Diesel engines.

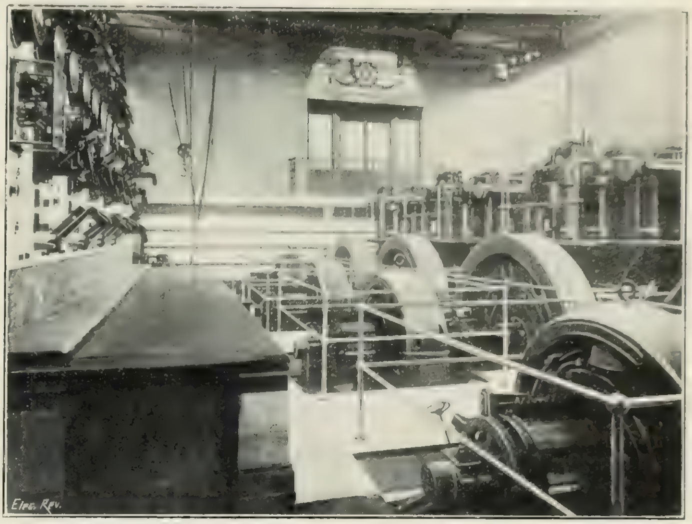
At the present time four 200-B.H.P. four-cylinder Diesel engines, by Messrs. Mirrless, Bickerton & Day, driving 135-KW., 110-volt E.C.C. direct-current generators are installed in the engine room, in conjunction with a switchboard, supplied by the Adnil Electric Co., consisting of 15 marble panels, four pairs for generator control, six feeder panels and one for controlling a small gas engine-driven generator and a battery, either of which are available for office lighting or lighting pilot lamps in the works when the main plant is shut down.

The battery is of the Tudor type, having a capacity of 100 amperes for ten hours, and is operated in conjunction with an Adnil booster giving a boost of from 5 to 55 volts. A special charging board for car ignition cells is provided in the battery room, where any work of this character required in connection with the firm's products is carried out.



General View of the Engine Room, Clement-Talbot Works.

A 25-ton fuel-oil storage tank is provided, from which the oil is pumped to two 200-gallon "ready-use" tanks for the immediate supply of the engines: the same oil is used for firing the heating boiler for the office building and for furnace heating in the works.



Main Switchboard, Diesel Engines and Generators, Clement-Talbot Works.

As day and night work is the rule in these works, the generating plant operates under very advantageous conditions, and the average load factor last year was, roughly, 50 per cent.; the output during the same period was 651,900 units, as compared with 444,800 units the year before, and the generating cost (labour, fuel and lubricating oil, repairs, &c.) amounted to ·442d. per unit, a figure which shows a substantial saving on that of the gas engine plant originally in use.

There are, in all, some 50 motors in use in the works, totalling approximately 610 H.P., as well as 140 semi-enclosed arc lamps and a number of incandescent lamps for lighting purposes, a usual peak load amounting to 3,500 amperes. It may be mentioned here that the motor equipment throughout has been supplied by the Adnil Electric Co., the arrangement of motor drive now in use being practically the same as that originally adopted by the firm's engineer at the suggestion of Mr. R. A. Marples, of the Adnil Co.

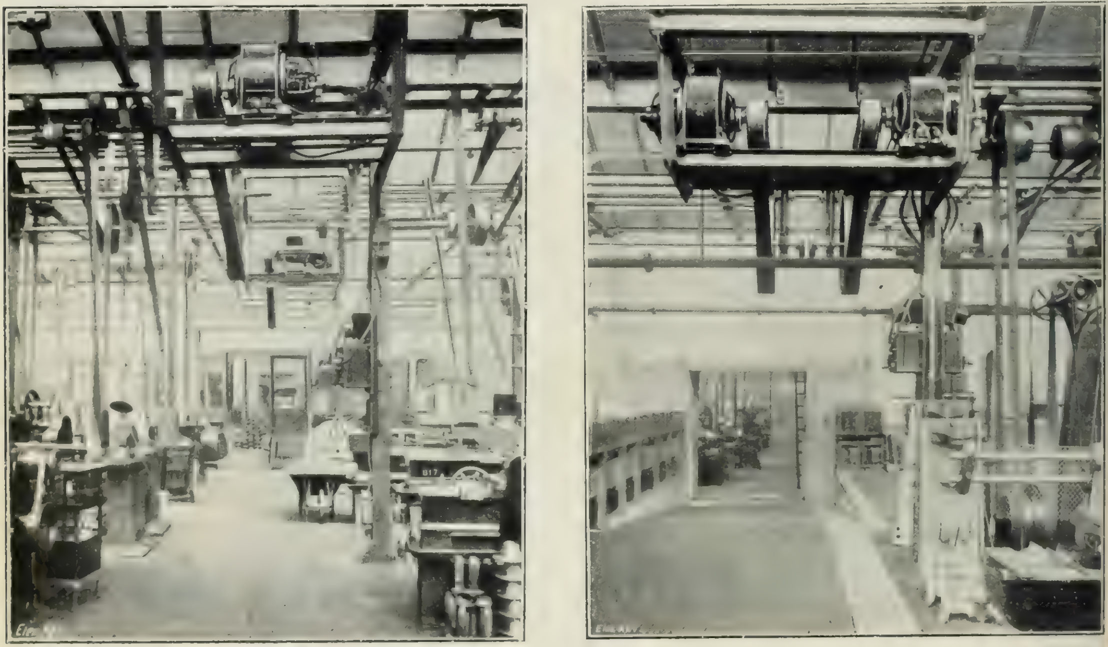
The machine tool equipment of the works consisting of numerous small machines, largely of the automatic type and adapted for repetition work, the group driving arrangement was naturally adopted; the various tools are grouped on to cross shafting, each length of which is centrally driven by a motor, or if dealing with a heavy load, two motors are used, the shafting being split in the centre.

The motors are standard 20 and 40 H.P. machines running at, approximately, 1,000 R.P.M., and driving through belting on to the shafting which runs at from 160 to 235 R.P.M.

The shafting motors are carried in cradles suspended from the roof girders at about shafting level, and are controlled from the floor, through starting and main switches on opposite poles, attached to the nearest stanchion; a shunt ammeter is provided for each motor.

View in Plating Shop.

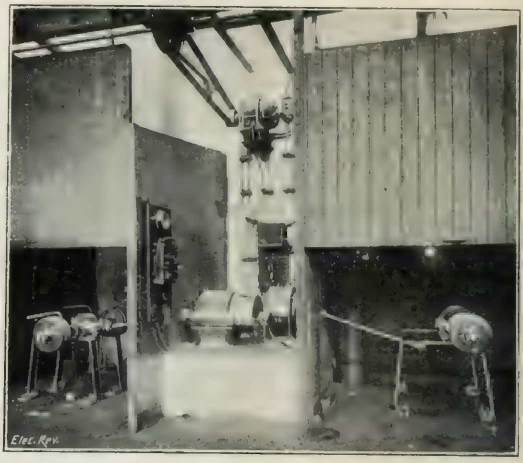
The various feeders from the main switchboard are laid in a special duct running centrally through the works and practically underneath the shafting motors; one main feeder supplies each shop through an ironclad distribution box, which is fitted with switch fuses and from which pairs of cables run through the cable duct to the stanchions carrying motor switches. All the cable is of the paper-insulated lead-covered type. In the smiths' shop a 10-H.P. motor is in use for driving the blower for the hearths, and a similar sized motor operates a swaging tool for drawing red-hot tubes for back axles, &c.



Single Motor Drives. Double Motor Drive.

Electric Driving at Clement-Talbot Motor-Car Works.

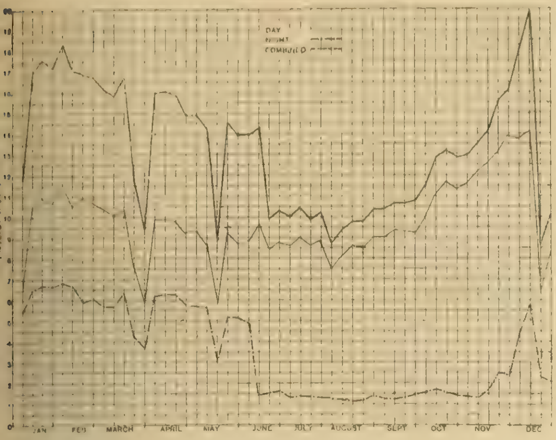
As previously mentioned, an annealing and hardening furnace is in use, fired with similar oil fuel to that required for the Diesel engine plant; this type of furnace is much more flexible, as regards temperature, than the usual gas-fired furnace. This, and the muffle furnaces, are coupled to a recording and indicating pyrometer, so arranged that a record of the temperatures of any three of the 10 pyrometer couples can be obtained, or by means of a selector switch a temperature reading of any particular couple can be obtained on an extra scale.



Differential Testing Cabinets, &c.

For the purpose of engine-testing, a 50-H.P. electric dynamometer by Hilare Huguet is installed as well as Froude water brakes. A special plant is required for the nickel, brass and copper plating of the numerous fittings which embellish the modern car, and this consists of a set of depositing vats, with a small motor-generator set for ordinary use, and two secondary cells for use during the dinner hour or when the works supply is shut down. Indicating instruments with pilot switches for each vat are provided, and the latter are each fitted with a dummy clock face, which can be set to any given time to remind the attendant when the plating process is completed.

Amongst other uses of electricity, one might mention the motor-driven ventilating plant for supplying heated air to many of the shops, also the differential testing plants, consisting of two sound-proof chambers, in which differential gear can be run at high speed, driven through universal joints, by 15 and 10-h.p. motors respectively, placed outside the chambers.



Yearly Load Curve During 1913; Clement-Talbot Works.

The motor-controllers are inside the chambers, and it is possible to judge the tone of the running gear accurately at varying speeds.

A large number of electric hand drills are employed in erecting work, but will, we understand, be replaced by more robust compressed-air drills in the future, and in this connection two Sentinel air-compressors, each flexibly coupled to 60-h.p. Adnil motors, have been installed, compressed air being also employed largely in blowing out crank cases and motor fittings before erection, and in driving various pneumatic tools.

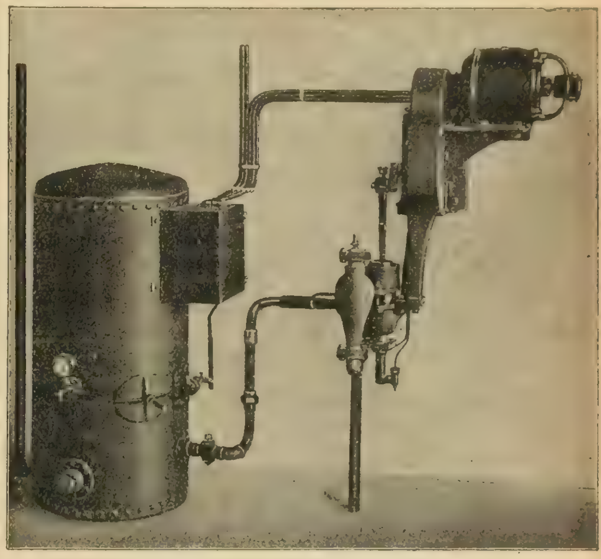
Some idea of the present size of the Clement-Talbot works can be gathered from the fact that between seven and eight hundred mechanics are constantly employed, but very large extensions are being built at the present time, and it is also contemplated to extend the engine room sufficiently to almost treble the present power plant.

In conclusion, we are indebted to Messrs. Clement-Talbot, Ltd., for permission to place on record the no small part played by electricity in the production of the well-known Clement-Talbot car.

THE USE OF ELECTRIC POWER FOR RAISING WATER.

In a good many country houses and similar isolated positions, the supply of water is only available through the agency of a well, and it is frequently a troublesome matter to obtain a pure and abundant supply without a great deal of hard labour. Various means have been used to raise water in such positions, and in some of these electric power has been applied. One of the most ingenious pieces of apparatus of this description is that illustrated herewith, showing what is known at the "hydrobenoid," made by Messrs. Thiem and Towe, of Halle on Saale, Germany. It consists of a small electric motor which drives a combined water and air pump by means of raw hide gearing and a crank and connecting rod motion. By means of this, both water and air are drawn into the pump at the same time, and these are then pumped into a reservoir at a pressure of about three atmospheres. The motor is under the control of an automatic switch which is operated by the pressure of the water in the reservoir, and as soon as this reaches a certain value the motor is switched off automatically. If a certain quantity of water is drawn off from the outlet of the reservoir under pressure, the motor is automatically switched on again as soon as the pressure falls below a certain limit and the water and air pump again starts working.

The quantity of air which escapes from the reservoir with the water or in any other way, is replaced quite automatically by the air pump so that fresh air is always being conveyed, and the pressure remains constant. Hence the whole plant works automatically. The apparatus does not start working when a glass or so of water is withdrawn, but only when a larger quantity is withdrawn, so as to economise the amount of power used in pumping as much as possible. Moreover, the apparatus is so arranged that in the case of the electric power supply being disturbed, the work can be done by hand. The motors are specially arranged as regards insulation to withstand humidity of the atmosphere due to the presence of water, as for example when the apparatus is installed in the well itself. When the well is very deep, the motor with the combined water and air pump can, on account of its very small dimensions, be fixed in the well. An apparatus capable of giving an output of 330 gallons per hour at a height of delivery of 115 feet requires only ½ h.p. to drive it, the reservoir dimensions being 1¾ft. in diameter by 3⅓ft. high, ½in. pipe connections being used. For an hourly output of 1,100 gallons at the same height a 2 h.p. motor is used, the pipe connections are 2in. in diameter, and the reservoir measures 2¾ft. by 5½ft. high. The height of suction must not with a short well laid suction conduit, exceed 23ft. The apparatus is a well arranged and comparatively inexpensive one, which should recommend itself to private houses, factories, and even village and town supplies, where the ordinary methods of operation are not applicable.



Automatic Electric Pumping Plant.

Napier Tercentenary Celebration.—John Napier's classic work on logarithms was published in 1614; it is proposed to celebrate the tercentenary of this great event in the history of mathematics by a Congress, to be held in Edinburgh, on Friday, July 24th, 1914, and following days, under the auspices of the Royal Society of Edinburgh, the President and Council of which issue a general invitation to mathematicians and others interested to communicate with the general secretary, 22, George Street, Edinburgh.

CONTRACTS CLOSED.

(*Continued from page* 184.)

London.—L.C.C.—The Stores and Contracts Committee recommends the acceptance of the following tenders for the supply of stores for 1914 :—For electric carbons, schedule 13, W. Geipel and Co., items 7 and 8 ; H. G. Mayer & Co., item 6 ; for telephone wire, schedule 16, Hooper's Telegraph and India-Rubber Works, Ltd., item 4 (*a* and *b*).

The Committee recommends the acceptance of the offer of Brotherton Tubes and Conduit, Ltd, for the supply of unenamelled steel conduits and fittings.

The Fire Brigade Committee recommends the acceptance of the tenders of the Leyland Motors, Ltd., for the supply of 12 motor fire engines at £865 each, for 11 motor escape vans at £640 each, and for a chassis for a motor instructional tender at £420 (including £20 extras). The Committee also recommends that Leyland Motors, Ltd., be allowed to sublet to the Bosch Magneto Co., Ltd., the supply of the magnetos for the fire engines, escape vans and tender, and to the Rees Roturbo Manufacturing Co., Ltd., the supply of the pumps for the fire engines.

The Fire Brigade Committee reports the receipt of the following tenders for the installation of electric light in the Cherry Garden Street Fire Station :—

Cox, Walkers, Ltd.	(recommended)	£94
Finch & Wheeler, Ltd.		108
Stegmann & Co.		114
Pinching & Walton		115
A. Hawkins & Sons		119

HACKNEY.—The B.C. Electricity Committee recommends that Messrs. Rice & Son, the contractors for the electricity sub-stations, be allowed to sublet the steelwork in the contract to the Aston Construction Co., Ltd.

BATTERSEA.—The B.C. is extending its contract with Callender's Cable and Construction Co., Ltd., for cables, &c., for a further period of 12 months.

WANDSWORTH.—The tender of Messrs. Philpot Bros. has been accepted by the B.C., at £46, for wiring the Rating and Cemeteries Offices in High Street.

New Zealand.—The following tenders have been accepted :—

Five tons binding wire, £455: ¼ mile lead-covered cable, 312 pairs, £326; ¼ mile cable, 624 pairs, £665 ; 100,000 insulator bolts and cups, £2,079 ; 5,000 porous pots, £133.—P. R. Bailie & Co.

100 tons copper wire, 200 lb., £8,700.—Samuel Brown, Ltd.

100 tons galvanised wire, 150 lb. per mile, £1,261 ; 100 tons ditto, 200 lb. per mile, £1,211.—E. W. Mills & Co.

One mile cable, 104 pairs, £520 ; 1 mile cable, 26 pairs, £210 ; 2 miles cable, 78 pairs, £820 ; 1 mile cable, 52 pairs, £303.—Richardson, McCabe and Co.

DUNEDIN.—Corporation. The tender of Messrs. Laurence and Hanson has been accepted for the supply for two years of polyphase Isaria meters.—*N.Z. Shipping and Commerce.*

Norwich.—The T.C. has accepted the tender of Siemens Bros. Dynamo Works, Ltd., for a high-tension switchboard for the new alternator and rotaries, at £676.

Preston.—The following tenders are recommended for acceptance by the Tramways Committee :—

United Electric Car Co., Ltd.—Six car bodies and trucks, £3,324.

Dick, Kerr & Co., Ltd.—Electrical equipment of the new cars, £1,725.

Rawtenstall.—The Corporation on 22nd inst., accepted the tender of Messrs. Babcock & Wilcox, Ltd., for coal-conveying plant.

Southampton.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., at £4,084, for a steam turbo-alternator. The list of tenders appeared in our last issue.

Walthamstow.—The tenders of Hollington Bros., Atkinson & Co., Ltd., and H. Lotery & Co., have been accepted by Walthamstow U.D.C. for an annual supply of uniforms to the tramways department.

Woolwich.—The B.C. has accepted the following tenders for supplies to the electricity works :—

Babcock & Wilcox, Ltd.—Bends, tees, &c., for feed piping for Globe Lane Works, £35.

Mechan & Sons, Ltd.—Exhaust steam piping, £93.

F. A. Daniel, Ltd.—Hand and power screwing machine, £28.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, February 2nd. "A" Company. Technical instruction, 7 to 10 p.m.

Tuesday, February 3rd. "B" Company. Technical instruction, 7 to 10 p.m.

Wednesday, February 4th.—Recruits only. Recruit instruction and technical instruction, 7 to 10 p.m.

Thursday, February 5th. "C" Company. Technical instruction, 7 to 10 p.m.

Friday, February 6th. "D" Company. Technical instruction, 7 to 10 p.m.

Saturday, February 7th.—Headquarters will be opened from 10 a.m. till 12 noon, for regimental business only.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Newcastle Students' Section).—Monday, February 2nd. At 7.30 p.m. At Armstrong College. Paper on "Rectifiers," by Mr. A. E. Riordan.

Institution of Electrical Engineers (Scottish Local Section).—Tuesday, February 3rd. At 8.10 p.m. At Princes Street Station Hotel, Edinburgh. Paper on "British Practice in the Construction of High-Tension Overhead Transmission Lines," by Mr. B. Welbourn.

Royal Society of Arts.—Monday, February 2nd. At 8 p.m. At John Street, Adelphi. Cantor Lecture.

Wednesday, February 4th. At 8 p.m. Ordinary Meeting.

February 4th.—Paper on "Motor Fuels, with Special Reference to Alcohol," by Dr. W. R. Ormandy.

(Colonial Section).—Tuesday, February 3rd. At 4.30 p.m. Paper on "The Montreal, Ottawa and Georgian Bay Canal," by Sir R. W. Perks, Bart.

Institution of Civil Engineers.—Tuesday, February 3rd. At 8 p.m. At Great George Street, S.W. Paper on "The Problem of the Thrust Bearing," by Mr. H. T. Newbigin.

Friday, February 6th. At 8 p.m. Students' meeting.

Rontgen Society.—Tuesday, February 3rd. At 8.15 p.m. At London Hospital, Whitechapel. Demonstration of Wilson Portable Coil Apparatus by Dr. Gilbert Scott ; visit to X-Ray and Electro-Therapeutic Departments.

Institution of Civil Engineers of Ireland.—Wednesday, February 4th. At 8 p.m. At Dublin. Ordinary meeting.

Batti-Wallahs' Society.—Wednesday, February 4th. Informal meeting.

Chemical Society.—Thursday, February 5th. At 8.30 p.m. At Burlington House, Piccadilly, W. Ordinary meeting.

Greenock Electrical Society.—Friday, February 6th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Papers on "Cinematograph Supplies," by Mr. W. B. Smith, and "Faults in House Wiring," by Mr. McGibbon.

NOTES.

A Hard Case.

I HAVE to sing a sorrowful song,
Of the woes of a shift engineer,
For he works very hard, and he works very long,
So his life's not all skittles and beer.

For this he receives a munificent wage ?
It's size is, in fact, microscopic ;
And his chief falls at once in a terrible rage,
If he broaches this horrible topic.

He's always alert, he mustn't sit down,
His nerve must be stiff as a poker ;
That's all very fine, but when pay-day comes round,
He mostly gets less than the stoker.

"Why were the volts down at eight last night ?"
No use saying "Bad coal," or "That rotten condenser,"
"You're not here to talk, but to make things go right"
(I delete the expletives, through fear of the Censor).

All the long night watch his vigil he keeps,
I hope none will ask me the question,
If ever he makes himself snug, and then sleeps ?
'Tis a cruel, and unworthy suggestion.—K.W.

Tungsten Lamp Improvements.—A paper by Messrs. Ward Harrison and Evan J. Edwards, recently read before the American Illuminating Engineering Society, provides an interesting *résumé* of the various improvements which have been made in the tungsten lamp since 1908. The earliest tungsten filament lamps were so fragile that their performance was judged almost entirely on total life figures. The introduction of the Mazda drawn-wire lamp in 1911 gave a filament with a strength 300 per cent. greater than that of the first tungsten lamp. The Mazda filament of to-day is approximately 40 per cent. stronger than in 1911. That this is actually the case has been proved by a series of transverse tests on filaments made in each year since 1907. The present drawn-wire filament can be deflected between 10 and 12 times as much as the pressed filament of 1907 without breaking. Candle-power maintenance has been improved by the introduction of a chemical into the bulb of the modern Mazda lamp. This chemical combines with the black deposit, and renders it light in colour, thus reducing the bulb absorption to a marked degree. At the present time all lamps above 40-watt size are supplied with the chemical. The cost of manufacturing and handling the lamps varies almost directly with bulb size, upon which the cost of reflectors and accessories is also dependent. There has been a general decrease in the size of Mazda bulbs. The actual dimensions of the bulb, cap and filament, and their relative positions, have also been standardised to accord as nearly as possible with the requirements of the illuminating engineer.

Local Government Board's Sanction for Loans.—We have received the following communication, dated January 27th, from Mr. H. Faraday Proctor, hon. secretary of the I.M.E.A. :—

"The Council of the I.M.E.A. at its last meeting had under its consideration a communication from the British Electric and Allied Manufacturers' Association, wherein it was pointed out that cases had occurred where local authorities had requested contractors to accept contracts subject to the sanction of the Local Government Board being obtained to the necessary loan, and had requested the contractors to proceed with the work prior to the receipt of such sanction. The I.M.E.A. has agreed with the B.E.A.M.A. that such procedure imposes an unfair liability upon contractors, unless the local authority in question undertakes to recompense the contractor for any 'work' so carried out at its request in the event of the contract not being entered into ultimately. The Councils of the respective associations have, therefore, agreed that their members should be advised to act in conformity with the foregoing arrangement."

Standard Symbols and Abbreviations.—Our contemporary, the *Elektrotechnische Zeitschrift*, announces that henceforward the nomenclature and notation—units and symbols—now agreed upon internationally will be used in its columns, and the hope is expressed that contributors will do their best to conform with these conventions. Confusion will thus be avoided, and the difficulty of following mathematical expositions will be reduced materially. A little inconvenience may be experienced in changing one's code of symbols, but this inconvenience is one to which practically every technical writer has in the past subjected his readers; the change is now to be made once for all. Certain symbols have already been fixed upon, and others will be determined at future meetings of the International Electrotechnical Commission. The symbols already adopted are reproduced below; they have been selected as offering the best compromise to the more or less conflicting requirements of various languages and applications, and once adopted, they must be retained loyally by all parties if the object of their selection is to be secured.

As the unit of power, it is recommended that the *kilowatt* be used instead of the *horse-power*, but it should be made clear that current consumption or output is not meant when purely mechanical power is concerned (for instance, the power of a water turbine driving a generator should be specified as so many kilowatts on the turbine shaft).

The following abbreviations for metric units are self-explanatory:—

Length: m., km., dm., cm., mm., μ (= 0·001 mm.).
Area: a., ha., m.^{2}, km.^{2}, dcm.^{2}, cm.^{2}, mm.^{2}.
Volume or capacity: l., hl., dl., cl., ml., m.^{3}, dcm.^{3}, cm.^{3}, mm.^{3}.
Mass: t., kg., g., dg., cg., mg.

The A.E.F. (Ausschusse f. Einheiten u. Formelgrossen) recommends the Siemens (S) as the unit of conductivity, and this will be among the suggestions considered by the I.E.C. at San Francisco in 1915.

For obvious reasons, units must be written in full in formulæ, or, at any rate, not so far abbreviated that there is any risk of confusing them with the symbols of the formula itself.

Length	l	Specific heat	c
Mass	m	do. at constant pressure	c_p
Time	t	do. at constant volume	c_v
Radius	r	Coefficient of thermal expansion	α
Diameter	d	Magnetic strength ...	$\mathfrak{J}$
Wave length	λ	Strength of magnetic field	$\mathfrak{H}$
Capacity, volume ...	v	Magnetic induction (density)...	$\mathfrak{B}$
Angle, arc	α, β	Permeability	μ
Angle of lead, phase displacement	ϕ	Susceptibility	χ
Velocity	v	Electromotive force ...	E
Acceln. due to gravity	g	Quantity of electricity...	Q
Angular velocity ...	ω	Self-induction	L
Revolutions in unit time	n	Electrostatic capacity ...	C
Efficiency	η	Electric current... ...	I
Pressure	p	do. resistance ...	R
Modulus of elasticity ...	E		
*Temperature, absolute	T		
do. above freezing	t		
Quantity of heat ...	Q		

* If confusion is liable to arise with the *time* symbol, use θ for absolute temperature and δ for temperature in ° C.

It will be noted that there is no accepted symbol for frequency. We have often pointed out the objections to the use of the symbol ~ in formulæ, &c.; the chief are these: that it is indiscriminately employed for "cycles" and for "cycles per second"; and that while it can be seen, and may perhaps be understood correctly, it cannot be read aloud—a fatal defect. No other quantity in the whole range of practical engineering is ever represented in a formula by a symbol that has no name.

Engineering Labour Dispute.—The daily Press states that a dispute has arisen at Barrow between Vickers, Ltd., and the Amalgamated Society of Engineers. The men have demanded an increase in wages of 6s. per week, and the employers offer 2s., but their concession has been rejected by a majority of the men.

Continuity of Supply.—After our "Correspondence" columns were closed, the following letter came to hand:—"In your last issue under the heading of 'Continuity of Supply,' there appears a letter signed by 'Shift Engineer,' which refers to the Bury undertaking as one of the concerns paying shift engineers about 10s. per week less than is paid at similar stations for the same class of work.

"I am closely acquainted with the wages and salaries of the different grades of men employed in other provincial towns, and have no hesitation in saying that our scale is above, rather than below, the average for undertakings supplying a maximum load of less than 3,000 KW. For the information of your readers, I give herewith the scale which applies to the engineers engaged on shift work:—Shift engineer (power station), 45s., rising to 50s. per week; ditto (sub-station), 37s. 6d., rising to 42s. 6d. per week; juniors, 32s. 6d., rising to 37s. 6d. per week. The juniors act as assistants to the shift engineers at the power station. The average hours per week vary from 51 to 53.

"Your readers have at least the right to expect that correct information should be placed before them, and even assuming that 'Shift Engineer' is one of the downtrodden few, he should make sure of his facts before he places the shift engineers in any other town in the same category as himself.

"S. J. Watson.

"Bury Electricity Works,
"*January 27th*, 1914."

Electrical Rectification and Ageing of Alcoholic Beverages. The improvement and sterilisation of articles of food by the aid of electricity has been the subject of many more or less successful experiments. Recent progress in its practical application to wine manufacture, as described in *L'Electricien*, gives promise of further important developments.

Such spirituous liquors as are commercially manufactured usually contain other organic compounds, particularly aldehydes, which impair the taste, and even render them unfit for consumption. Ordinary distillation not being entirely satisfactory as a method of purification, various attempts have been made to achieve the desired end by chemical or electrical means.

Naudin's method of electrolysis before distillation is based upon the formation of alcohol from the aldehydes by the action of hydrogen. In the perfected form of the process, the juices are passed through a perforated tube into a glass vessel containing a 1 : 1,000 solution of sulphuric acid. The electrodes are of platinum, and two cocks permit samples to be drawn off to judge the effect of the electrolysis. When this has been carried as far as desirable, the mixture passes into a vat containing just enough granulated zinc to neutralise the acid present. Rectification then takes place, the whole process being so economical as to obtain a commercial efficiency 15 per cent. better than that of simple distillation.

The action of ozone has been employed by three inventors:—Eisemann, whose method of oxidisation by means of ozone has never been used commercially; Broyer, who essayed an ageing process by repeatedly bubbling a stream of electrically-produced ozone through the liquid; and Pilsoudsky, whose experiments in Russia have led to a method of purification by a chemical action between the ozone and the liquor, the ozone being generated in the liquor itself. This process not only destroys the organisms of secondary fermentation, but assists the formation of the ethers which give bouquet to the wine, thus greatly improving inferior qualities, both as regards aroma and taste. It may be added that artificial wines deteriorate in this process.

For manufacture on a large scale (10,000 litres a day) the apparatus is generally as shown in fig. 1. The lower electrode E consists of a network of nickel-plated iron tubes provided with small nozzles o and carried on insulators i. From a cylinder R, oxygen flows through the pipes, and passing through the electrically-charged liquid m is partly transformed into ozone. High-tension high-frequency current from a transformer T is applied to the two electrodes, the upper one E^1 being formed by a disk with pointed projections S, which act as sources of dark discharge. The condenser C, connected to an electrode I immersed in the liquid, merely serves to accelerate the process, which occupies a period varying from one hour for white wine to four for Madeira.

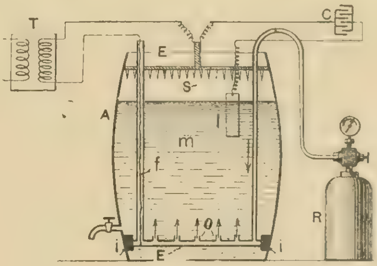


Fig. 1.

A much smaller apparatus is shown in fig. 2 and is designed for dealing with quantities up to 100 litres. The glass vessel A is coated externally with lead foil B, and fitted with a metal band C, which is connected to one terminal of a high-frequency supply, the other terminal being connected to a rod of agglomerated or retort carbom m, which is inserted in the liquid l. The vessel thus becomes a true Leyden jar.

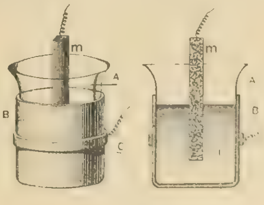


Fig. 2.

In conclusion, it may be added that among other liquids, oils are said to benefit greatly by subjection to this electrical treatment, five minutes sufficing to removing the acidity from rancid oil.

Depositing Nickel on Aluminium.—The electro-deposition of nickel on aluminium, a process hitherto impracticable, can be accomplished by a method described by Messrs. J. Canac and E. Tassilly in a note presented to the French Academy of Sciences; the deposit obtained is firmly adherent, and is unaffected by hammering or bending, or by raising to any temperature short of the melting point of aluminium.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER STUDENTS' SECTION).—This Section is holding a social evening on Thursday, February 12th, at the Technical Schools, Old Trafford. There will be a whist drive from 7.30 to 10 p.m., followed by refreshments and a dance until 1.45 a.m. Will former Students communicate with the hon. secretary, Mr. A. T. Robertson, 240, Ayres Road, Old Trafford, Manchester? The prices of the tickets are:—Ladies, 3s.; gentlemen, 3s. 6d.; double tickets, 6s.

At the meeting of the MANCHESTER LOCAL SECTION on Tuesday last a paper was read by Mr. T. Ferguson, on "Electric Train Lighting Systems." The discussion was closed.

Sir Oliver Lodge's Kelvin Lecture before the I E E., on Thursday last week, dealt with the electrification of the atmosphere in connection with its bearing on the weather (which, he thought, might be amenable to electrical control) and on the growth of crops. A report will appear in a later issue.

POST OFFICE TELEPHONE AND TELEGRAPH SOCIETY OF LONDON.—The January meeting took place at the Institution of Electrical Engineers on Monday last. A paper on the subject of the repair of telegraph and telephone apparatus was read by Mr. G. F. Mansbridge of the Post Office Stores Department.

SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS.—Last month the annual dinner of the Institute took place, and was attended by the Governor-General, Lord Gladstone, and the Minister of Mines. Mr. Bernard Price occupied the chair, in the absence of the President, Mr. J. W. Kirkland.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—The monthly meeting of the West of Scotland Branch was held on Saturday last at Glasgow. Arrangements were made for a social gathering in connection with the branch to be held towards the end of next month. Mr. J. R. Laird, electrical engineer with the Oakbank Oil Co., Mid-Calder, gave a lecture on "Wireless Experiments," illustrated with practical demonstrations.

NOTTINGHAM ENGINEERS AND WORKS MANAGERS' ASSOCIATION.—This evening Mr. W. Dammond will lecture on the subject of signalling on railways, with special reference to his system of cab-signalling. On February 27th there will be a lecture on "Electric Filament Lamps."

Appointments Vacant.—An honorary radiographer is required to attend twice weekly at the City of London Hospital for Diseases of the Chest, Victoria Park; engineering and mechanical draughtsman for Stoke-on-Trent, Electrical Engineer's Department (£104); mechanician, electrical, age 25-40, for Nigerian Government (passage, free single quarters, £250); shift engineer for Warrington Corporation (47s. 6d.); junior switchboard attendant for Salford (26s.); assistant mains superintendent, for Darlington Corporation (30s.). Particulars are given in our advertisement pages.

City and Guilds of London Institute.—The Institute has now returned to Gresham College, Basinghall Street, E.C., which will be in future the address of its head office.

Dinners and Socials.—In view of the approaching marriage of Mr. J. Dawson Paul, director of the firm of Boulton and Paul, Ltd., Norwich, the whole of the employés were entertained on Saturday, January 24th, by the parents of the bridegroom (Mr. and Mrs. J. J. Dawson Paul) to a dinner and smoking concert. The festivities took place in the historic St. Andrew's Hall, Norwich, and during a thoroughly enjoyable evening opportunity was taken to present the bridegroom with a very beautiful silver salver, suitably inscribed. The presentation was made on behalf of the employés by four of the oldest workmen—who have a combined service of over 200 years—and one of their number in a few well-chosen words voiced the feelings of all those connected with the works, also of the staff at the London office, who were simultaneously entertained at the Trocadero.

The electricity and tramways departments of the Bexley Council held their first annual dinner on January 19th, Mr. H. P. Stokes, electrical engineer and manager, presiding. The guests included Councillors E. J. Reid and H. Smith, Mr. N D. Bruce, Dartford Tramways manager, and Mr. A. Davie, accountant. The chairman submitted the toast of "The Subscribers to the Dinner Fund," and Mr. Councillor Reid, in replying, remarked upon the very cordial relations which existed between the employés and the manager. A good programme followed, and included songs by Mr. M. Carroll and Shakespearean recitals by Mr. A. Bryan.

Several members of the staff of the electrical engineering department at the London and North-Western Railway Co.'s works at Crewe are being transferred to the Euston office of the department, and their northern colleagues have entertained them at a farewell dinner. Mr. L. W. Swainson (chief assistant, Crewe), who presided over the dinner, pointed out that the transference had arisen through requirements of the chief accountant in regard to stores and expenditure matters. Complimentary speeches were made, and the departing members were offered best wishes for their future success.

The apparatus department of Messrs. Siemens Bros. & Co., Ltd., at Woolwich, held a dinner at Freemason's Hall, Woolwich, a fortnight ago to-night, when Mr. F. Hird, manager of the department, presided over a company of over 200. A concert followed. The toast of "The Firm" was proposed by Mr. H. Dixon, and responded to by Mr. Hird, who, in the course of his remarks, referred to three employés who had been with the firm from 44 to 45 years without a break.

On Friday, 23rd inst., at the Clarendon Restaurant, Hammersmith, the staff and directors of Messrs. Evershed & Vignoles, Ltd., met for their first staff dinner. The chair was taken by Mr. S. Evershed, who, in responding to the toast of the firm proposed by Mr. F. Martin, gave an interesting account of the formation and history of the company. He mentioned that during the 20 years which it had been established the output had increased at least 10 times, and that the prospects for the future were extremely favourable to further developments. A concert given by members of the staff and arranged by Mr. H. Blundell followed, a very enjoyable evening being spent.

OLD CENTRALIANS.—The 16th annual dinner of the City and Guilds College Old Students' Association, will be held at the Trocadero Restaurant, Piccadilly Circus, W., at 7.30 p.m., Saturday, February 21st, and will be preceded at 6.45 by the annual general meeting. Dr. G. T. Moody, D.Sc., F.C.S., President of the Association, will take the chair. Tickets (price 6s. 6d. each) may be obtained by any old student of the "Central" from G. W. Tripp, 4, Fairfield Road, Charlton, Kent.

The London Trade Disputes.—The latest reports to hand as we go to press do not point to an early termination of the deadlock that has occurred in the London building trade. The men's organisation expresses itself confident of winning, and states that it has the assurance of the sympathetic support from other unions, whose men are working on jobs where hands have been locked out because they declined to sign the penalty undertaking put before them by the employers. The masters, on the other hand, say that the number of men who have signed the clause would "stagger the unions" (*Times*), and that there is no prospect of the building trade being brought to a dead stop as the stoppage has been confined to the large firms that are members of the London Master Builders' Association who have imposed the penalty clause upon their men. The workmen's representatives say that they will not now go back until they get other grievances redressed besides those that have formed the subject of the present discussion. They, however, say that they intend to resist to the utmost the Masters' attempt to destroy Trade Unionism, but they are prepared to give guarantees that any agreements that are entered into shall be carried out. This question of guarantees is of almost supreme importance in connection with any negotiations that may take place between the London Electrical Masters' Association and the Electrical Trades Union. The Union speakers on Tuesday asked what guarantee they had that undertakings given by the Masters would be adhered to, unless there was an organisation to negotiate with. It was strange to hear the question of guarantees raised from that side of the controversy, for it is notorious that agreements made by organisations of workers have been flouted again and again by the workers themselves. Well might one of the employers ask: "What guarantee do you give us?" Whether the L.E.M.A. and the E.T.U. can arrive at a reasonable working arrangement which shall assure a recognition of the sanctity of contracts remains to be seen. That really is the crux of the position.

The *Times* of yesterday states as follows on the electrical dispute:—

"Although the danger of an ultimate conflict between the masters and men in the electrical trade of London has not been entirely removed, it has been postponed indefinitely, with a prospect of a friendly settlement."

According to the *Financial Times*, however, "the Electrical Trades Union took its first definite part in the fight on Wednesday night. Forty-eight electricians were called out from Lyons's new hotel off Piccadilly, and to-day (Thursday) pickets have been placed at all jobs being carried out by the London Master Builders' Association or members of the London Electrical Masters' Association. By night nearly all Union electricians will probably be out."

Copper.—Messrs. Merton's statistical report for the first fortnight of January shows European stocks lower, but prices stil out of accord with the apparent shortness of supply. Englis stocks were 384 tons lower on January 15th than on Decembe 31st, French stocks 608 tons, European supplies 1,652 tons less, an European supplies including Germany and estimates, 1,952 ton less. American supplies to Europe for the fortnight wer low, Spanish about average, Chile shipments under th average, Australian well up. Total deliveries were not u to the average, though, of course, these figures may b materially altered by those for the last fortnight. The stock i American producers' hands at the end of December shows a remark able increase on the figure for November 30th, quite sufficient t explain the moderate price. The increase on the month given i 19,424 tons, bringing the total visible supply up to the respectabl figure of 70,341 tons for the end of December, 1913, a figure whic has not been approached since May last.

Dreams—or Facts?—The *Gas World* of January 24t quoted Sir W. Ramsay as saying that he "could imagine a carp permeated by wires, through which was sent a current of ele tricity," and spoke of him as a dreamer, adding that it was difficu to conceive that a carpet of this character could ever be popula "even with the cats." It may interest our contemporary—a Sir W. Ramsay—to know that the electric carpet is no dream, b a practical reality; it has been on the market since 1912, a there are at least two makers. Foot-warmers, bed-warme surgical heating-pads, &c., are also made in the form of flexi fabrics

The "Point Fives."—A meeting of this Association was held on January 16th at Tricity House, when the Chairman, Mr. A. H. Seabrook, read an address on the "Rateable Value Tariff for Residences." He mentioned his conviction, as a result of investigations, that the rateable value was superior to all other bases of primary charge, with the provision that where gas was not more than 2s. 6d. per 1,000 cb. ft., the secondary rate should not exceed ½d. per unit. The system was easy to understand; it avoided the inspections necessary with a connected-load basis of charge; lamps of improved efficiency did not affect it to the same extent as with the latter system; it was also easy to vary the percentage basis of the primary charge. With gas at 2s. 6d. per 1,000 cb. ft., electricity could well compete at 6d. per unit for residence lighting, but for heating and cooking under the same conditions, not much more than ½d. per unit could be charged.

It was possible to regard the rateable value system in two ways: First, to calculate the primary charge to cover investment costs and standing charges of the complete electric service to the house, the secondary ½d. rate representing running cost, plus profit, of units sold; and second, the primary charge, plus a few units at ½d., could be regarded as the charge for lighting the house, and the secondary regarded as the charge for additional business from other uses than lighting. He did not see that it was unfair to put the standing charges on the lighting, if it gave the consumer the right to use electricity for heating and cooking; if they were debarred from charging a high lighting rate—which the business would stand—they could not offer a low enough rate to get the heating and cooking business, which would benefit the community in general.

The selling price of a commodity was what it would fetch in the open market, and sales and profits depended on the efficiency of selling staffs. It was fair to assume that a man living in a comparatively highly-rated house could afford to pay more for electricity, as he did for water. People often criticised the low secondary charge, which at Marylebone was ½d. per unit, but the running costs due to the increased output were only about ·33d. per unit, and were decreasing.

An interesting discussion followed, in which it was agreed that the rateable value system was not applicable to business premises. Objection was taken to the suggestion that 6d. per unit was a competitive figure with gas, the chairman replying that this was so in his area; he disagreed that 1d. per unit for cooking was a competitive rate, as it would not show a sufficient advantage to induce an every-day use of electric cooking and heating.

On the question of the cooking load being superimposed on the lighting peak, the chairman pointed out that this was the usual fear, and was not justified. At Herstmonceux a 60-KW. plant dealt with a lighting load, on which during the past 12 months there had been superimposed a cooking load connection of about 75 KW., and yet the 60-KW. plant dealt with the whole of the maximum load.

Electrically-Heated Wheel Grips for Motorists.—To avoid the objections to winter motoring caused by numb hands, electrically-heated grips for steering wheels are being manufactured by the Motorist's Warm Grip Co., Marshall, Tex. These heated grips may be laced on to the steering wheel rim and are heated by energy from the battery or low-tension magneto. The consumption of energy is low, being about one-half that required for one pair of electric head-lamps. Flexible cords wound round the spokes of the wheel connect the grips with the battery and switch, which may be fastened to the dashboard.—*Electrical World.*

Iron and Steel Trade.—At the annual meeting of the North of England Iron and Steel Trades Conciliation Board, Newcastle-on-Tyne, on Monday, it was reported that the number of operatives was 3,800, as compared with 4,346, the reduction being due to the stopping of iron works and the Richmond works, and the withdrawal of a body of men at West Hartlepool. Mr. Cox (the men's secretary) said the swinging of the pendulum after the boom was not going to be so serious as it generally had been after other booms.—*Financial Times.*

Fatalities.—Whilst carrying out repairs at the electric generating station of the Burnley Co-operative Society on Friday afternoon, Arthur Uttley, a fitter, received fatal injuries. He was carried round a fly-wheel, and when extricated was found to have sustained a fracture of the left leg, and serious injuries to his head. He died a few minutes later.

At the inquest the evidence showed that he was sent to repair the engine, and he asked H. Entwistle, an assistant engineer, to turn on the steam, as he was ready for a trial. The wheel commenced to move, and the deceased was carried round and injured fatally. Entwistle said he thought the deceased must have forgotten that the steam was turned on. He (Entwistle) said he tried the valve about half an hour before the accident, and found it closed. A verdict of "Accidental death" was returned.

Resonance of the Third Harmonic.—In a note recently communicated to the French Academy of Sciences, Mr. Swyngedauw discusses the resonance of the third harmonic of three-phase alternators, and shows that if the design is such that resonance occurs when the neutral point is earthed, with a network of about 20 km. of cable, then to produce resonance with the same alternator having the neutral point insulated would require hundreds of kilometres of cable. The conclusion is that with the lengths and capacities of cables met with in practice, resonance of the third harmonic is practically impossible when the neutral point is insulated.

Distributing Pole with Self-Contained Transformer.—The Commonwealth Edison Co., Chicago, is preparing to make practical trial of a novel distributing pole with self-contained transformer, which is the invention of Mr. E. O. Schweitzer, chief testing engineer for the company. The feature of the design consists in placing a transformer of somewhat cylindrical form in the lowest section of a tubular steel pole, the high-tension leads to the transformer being brought in through the pole, either from below or from above, while a convenient distributing head is provided for the low-tension conductors.—*Electrical World.*

Coal Mine Explosions. — The Home Office has issued a circular calling the attention of owners of coal mines to the success which has been attained in preventing explosions of coal dust by the addition of at least 50 per cent. of incombustible dust, and urging them to take steps to adopt the system, without waiting until the statutory regulation in which it will be included is issued.

Radium in U.S.A.—An American millionaire, said to be Mr. H. Phipps, has offered a gift of £3,000,000 for the foundation of 20 radium hospitals throughout the United States for the free treatment of cancer and other diseases. Mr. J. M. Flannery, president of the Standard Chemical Co., of Pittsburg, states that there is enough radium in Colorado to supply all the world's cancer victims five times over; radium now costs £48,000 a gramme, but he is prepared to supply to the American Government in the course of five years 200 grammes at £16,000 a gramme.

Inquiry.—Makers of an electrical prober, worked in conjunction with a portable telephone, for determining the existance of metallic deposits in mines, are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—West Ham T.C. is being recommended to grant the following increases to its employés in the tramways and electricity departments:—Tramways department:—H. M. SCOTT, claims superintendent, from £190 to £210 per annum, and subsequently by annual increments of £20 to £250; G. E. GRIFFITHS, correspondence clerk, from £120 to £150 per annum, by annual increments of £15. Electricity department:—J. LAYTON, senior engineer on watch, 65s. to 70s.; A. J. GIFFEN, do., 60s. to 65s.; W. BRIDGER, do., 55s. to 60s.; W. SPITTLE, do., 55s. to 60s.; F. W. MALLETT, assistant engineer on watch, 30s. to 35s.; H. A. CHANDLER, do., 30s. to 35s.; H. LONDON, do., 30s. to 35s.; W. COBB, station foreman, £195 to £208; R. MANDER, draughtsman, 40s. to 55s., and to be designated senior draughtsman; W. F. EDGERTON, assistant sales manager and meter superintendent, £265 to £285; J. TURTLE, assistant wiring and lighting superintendent, £117 and commission to £130 and commission, and to be designated senior lighting and wiring superintendent; S. GOVER, heating and cooking representative, £2 per week and commission, to £156 per year and commission, and to be designated heating and cooking constructional superintendent; J. H. EADES, senior draughtsman, £125 to £140, and to £150 in January, 1915; A. GEORGE, assistant draughtsman, 20s. to 22s. 6d.; W. LEECE, district foreman, £150 to £165; L. W. PERRYMAN, public lighting foreman, £140 to £145. With reference to the salaries of the senior engineers on watch the increases proposed will exceed the limits of the Council's schedule, so that it is intended to raise the maximum to 80s., and the minimum to 60s. The same remarks also apply to the assistant engineers on watch, whose future maximum salaries will be 45s. and the minimum 35s.

The Barnes (Surrey) Council has appointed MR. W. CORNET as junior shift engineer at the electricity works at £150 per annum.

The Aldershot U.D.C. has increased the salary of MR. CHADINGBOWL, second assistant at the electricity works, to £104 per annum.

MR. W. R. ELLIOTT, station superintendent of the East Ham electricity works, is to have his salary increased from £210 to £220 per annum.

MR. T. F. LYNN has been appointed mains superintendent of the Walthamstow electricity undertaking at a salary of £150 per annum. This fills the vacancy caused by the resignation of Mr. Notley. An additional switchboard attendant is to be appointed at a salary of 30s. per week, rising to 35s.

The Oban T.C. Lighting Committee recently recommended that the salary of the electrical engineer should be advanced by £25 per annum.

MR. J. W. TURNER has been appointed deputy electrical engineer to the Huddersfield Council, at £230 per annum, rising by £10 increments up to £260.

MR. B. WESTALL, an engineer at the Darwen electricity works, has been appointed electrical engineer to the Burnley Co-operative Society. There were more than 100 applicants for the post.

MR. H. PARKER, second charge engineer at the Dover electricity works, has resigned his appointment, and, subject to the usual sanction, the junior charge engineer is to be promoted to fill the vacancy, at an increased salary of £94 4s. A new junior is to be appointed at a salary of £78 per annum. It is also proposed to increase the senior charge engineer's salary, from April 1st next, to £125.

The members of the Aberdeen Corporation electricity works, at a smoking concert last Friday night, bade farewell to three of the staff, MR. J. A. V. THOMSON, who goes to Kinlochleven (British Aluminium Co., Ltd.), as engineer; MR. TRAIL, appointed engineer at Lossiemouth; and MR. DAVID S. ALLAN, leaving for Bengal. Mr. Bell, Corporation engineer, on behalf of the staff, presented each with gifts, and expressed the hope that they would be successful in their new spheres. The health of the three guests was drunk with musical honours.

Tramway Officials.—MR. C. W. BENTLEY, A.M.I.C.E., manager of the Musselburgh and District Electric Light and Traction Co., Ltd., having resigned, the position has been filled by the appointment of MR. ROBERT WATSON, late secretary of the company in London. MR. D. L. WINTER, Bo'ness Electric Tramway Co., has been appointed resident engineer.

General. — According to a financial paper, MR. WILLIAM F. HAMILTON, K.C., and MR. GEORGE A. TOUCHE, M.P., have been elected to the board of the Anglo-Argentine Tramways Co., Ltd., to fill the vacancies caused by the deaths of Mr. T. Frame-Thomson and Mr. E. A. Lazarus-Barlow.

MR. JOHN HOLLOWAY, works manager to Messrs. Jas. Howden and Co., of Glasgow, has been appointed to a similar position at the Whiteinch Works of the North British Diesel Oil Engine Works.

ALDERMAN JOSEPH CLIFTON, of Peterboro', chairman of the Electricity Committee, and an ex-Mayor of the borough, celebrated his 80th birthday on Tuesday. He was recently presented with some framed photographs of the buildings, plant and staff, by the employés, at a dinner.

MR. FRED PARLETT has joined Messrs. Isenthal & Co. as sales manager with a view of developing their heating and cooking business. He has lately represented the British Prometheus Co., Ltd., in a similar capacity, and has now severed his connection with them, after 10 years' service.

We regret to announce that owing to continued ill-health MR. BERNARD M. JENKIN, has decided to retire from his partnership in the firm of Kennedy & Jenkin. The partnership will be continued in future by the remaining partners (Sir Alex. B. W. Kennedy. Mr. J. M. Kennedy and Mr. S. B. Donkin) under the name of Kennedy & Donkin.

On Monday night last week at the works of Messrs. E. Brook, Ltd., Huddersfield, a presentation was made to MR. ERNEST BROOK, the head of the firm, to commemorate the making of the 10,000th motor to which we alluded last week. The presentation was subscribed for by the employés, and took the form of a smoking cabinet and spirit flask, suitably engraved. The presentation was made by Mr. Walter Vaughan, the oldest employé, who expressed the employés' pleasure in giving this testimonial as a mark of their appreciation. Mr. Brook suitably responded. The proceedings terminated with a vote of thanks to Mr. Walter Vaughan.

Obituary.—MR. W. CLEARY.—The death occurred on January 20th, at 18, East Avenue, Barnage Lane, Levenshulme, of Mr. Wm. Cleary, who had for 34 years been on the Manchester District staff of the National Telephone Co., and later with the Post Office Engineering Department. He was in his 52nd year.

The well-known Austrian professor and designer, DR. ING. KARL PICHELMAYER, who was for many years at the Technical High School at Vienna, passed away quite suddenly on January 23rd last at the early age of 45 years. He was a very valued member of the Electrotechnical Commission.

We regret to state that MR. W. G. WICKEN, who retired in September last from the position of manager of the composing department of the ELECTRICAL REVIEW, after serving faithfully in that capacity for 30 years, passed away on Monday last.

NEW COMPANIES REGISTERED.

Pirelli-General Cable Works, Ltd. (133 461).—Registered January 20th, by F. Samuelson, Midland Bank Chambers, 71A, Queen Victoria Street, E.C. Capital, £200,000 in £5 shares, Objects: To carry on the business of manufacturers of, and dealers in, india-rubber, gutta-percha and asbestos articles, insulating materials, india-rubber, gutta-percha, insulated and other wires and cables capable for use for telegraphic, telephonic, electric lighting and the conveyance of electricity, electricians, engineers, shipowners, shippers, &c., and to adopt agreements (1) with Pirelli & Co., (2) with Pirelli & Co and the General Electric Co., Ltd., and (3) with Pirelli, Ltd, the General Electric Co., Ltd, and Pirelli & Co. The signatories (with one share each) are: P. Pirelli, 18, Vic Ponte Seven, Milano, Italy, manufacturer; H. Hirst, 67, Queen Victoria Street, E.C., manufacturer. Private company The first directors (to number not less than two or more than 10) are H. Hirst (vice chairman), M. Railing and E. G. Byng, all of 67, Queen Victoria Street, E.C. (appointed by the General Electric Co., Ltd.), and P. Pirelli and A. Pirelli (chairman), of Milan, and H. Bevis, of 144, Queen Victoria Street, E.C. (appointed by Pirelli & Co., of Milan); qualification (except first directors), 200 shares; remuneration (except managing director) as fixed by the company. Registered office, 144, Queen Victoria Street, E.C.

Aeromin Promotion Syndicate, Ltd. (133,471).—This company was registered on January 21st with a capital of £3,333 in £1 shares, to carry on the business of winners, refiners and workers of metals, mechanical, electrical and general engineers, metallurgists, smelters, &c., and to adopt agreements (*a*) with the Aerometal Syndicate, Ltd., and (*b*) with G. W. Sessions. The subscribers are—G. D. Mackay, 100, Victoria Street, Westminster, manufacturer, one share; G. W. Sessions, 15, Copthall Avenue, E.C., international negotiator, one share. Private company. The directors are to number not more than three. G. W. Sessions is the first managing director. Registered by Bristows, Cooke & Carpmael, 1, Copthall Buildings, E.C.

Carleton Electrical Co., Ltd. (133,501).—This company was registered on January 22nd, with a capital of £20,000 in £1 shares (10,000 preference), to take over from G. Inrig, L. Inrig & Gavan Inrig, Ltd., their respective interests in the English and foreign patent rights of certain inventions for improvements in dynamo-electric generators, controlling continuous-current reversible dynamo-electric machines, the generating and control of electricity for lighting trains and other vehicles, apparatus for lighting and starting motor vehicles, internal-combustion turbines, motor-car lamps, &c. The subscribers (with one share each) are:—G. J. Mills, Southern Road, East Finchley, N., gentleman; G. Inrig, 154, Bishopsgate, E.C., consulting engineer. Private company. The number of directors is not to be less than two or more than seven; the first are G. Beeching, G. Inrig, G. J. Mills, A. Braid, W. S. Duffus and G. F. Beeching (all permanent); qualification, £1; remuneration as fixed by the company. Registered office, 569, Garratt Lane, Earlsfield, Surrey.

Weston's, Ltd. (133,469).—This company was registered on January 20th, with a capital of £5,000 in £1 shares (2,000 8 per cent. participating preference) to acquire an exclusive licence or sub-licence for the sale in the United Kingdom of primary batteries, and lamps manufactured under certain patents relating to, or capable of being applied thereto, and to adopt an agreement with A. W. Pask. The subscribers (with one share each) are:—C. A. Hampton, 9, Dayton Grove, Peckham, S.E., clerk; H. H. Cooper, 80, Manor Road, Leyton, accountant. Private company. The number of directors is not to be less than two or more than five; the first are not named; qualification, £100: remuneration, £100 each per annum (chairman £150). Registered office, 104, Wool Exchange, E.C.

British Steam Turbines, Ltd. (133,446).—This company was registered on January 20th, with a capital of £5,000 in £1 shares, to carry on the business of engineers, ship and boat builders, manufacterers of propellers and machinery, &c. The subscribers (with one share each) are:—P. A. Dunderdale, Dashwood House, E.C., engineer; R. F. Collinge, New Broad Street House, E.C., engineer. Private company. The number of directors is not to be less than two or more than five; the first are P. A. Dunderdale and R. F. Collinge; qualification, £100; remuneration, £59 per annum divisible. Registered office, New Broad Street House, E.C.

Superposed Currents, Ltd. (133.520).—This company was registered on January 22nd, with a capital of £5,000 in £1 shares, to carry on the business of electricians, mechanical engineers, machinists, fitters, founders, wire drawers, &c. The subscribers (with one share each) are:—G. R. Neilson, 112, Tulse Hill, S.W., secretary; A. C. Brown, 7, Queen's Square, Finsbury Avenue, E.C., electrical engineer; G. N. G. Tucker, Homeleigh, 109, Lordship Road, Stoke Newington, N., printer; G. C. Jack, Riversdale, 21, Oxford Road, Putney, S.W., accountant. Private company. The number of directors is not to be less than three or more than five: the first are G. R. Neilson (permanent managing director and secretary, subject to holding 100 shares), A. C. Brown, G. N. G. Tucker and G. C. Jack. Registered office, 7, Queen's Square, Finsbury, E.C.

Ernest Wood, Ltd. (133,503).—This company was registered on January 22nd, with a capital of £1,500 in £1 shares, to carry on the business of electrical engineers and contractors, &c., and to adopt an agreement with E. Wood. The subscribers (with one share each) are:—T. Beswick, Station Yard, Knutsford, director; E. Wood, Bank Field, Grove Lane, Hale, director. Private company. The number of directors is not to be less than two or more than five; the first are T. Beswick and E. Wood; qualification, 50 ordinary shares. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Marine Engine Auto Control Co., Ltd. (133,485).—This company was registered on January 21st with a capital of £5,000 in £1 shares, to acquire from A. Esplen the benefit of certain existing inventions in relation to the control of marine engines direct from the telegraph instrument. The subscribers are:—A. Esplen, 3, Redcross Street, Liverpool, consulting engineer, one share; M. Glasgow, 3, Redcross Street, Liverpool, engineer, one share. Private company. The number of directors is not to be less than two or more than five; the first are A. Esplen and M. Glasgow (both permanent). Solicitor: A. S. Lloyd, 61, Lord Street, Liverpool. Registered office, 3, Redcross Street, Liverpool.

Alexandra Electrical and Engineering Works, Ltd. (133,472).—This company was registered on January 21st, with a capital of £500 in £1 shares, to take over the business of the Alexandra Electric Works, of 25, Station Road, Letchworth, to carry on the business of electric, gas and general engineers, gear cutters, automobile and general machinery agents, &c. The subscribers are:—Jack Oppermann, 25, Station Road, Letchworth, Herts., engineer, 100 shares; Mrs. Janet Oppermann, 25, Station Road, Letchworth, Herts., 100 shares. Private company. The directors are to number not more than two or more than five; Jack Oppermann is the first director; qualification, 50 shares. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Porous Accumulator Co., Ltd. (57,526).—Capital, £3,000 in £1 shares: return dated December 27th, 1913: all shares taken up; £1,007 paid, £1,993 considered as paid; mortgages and charges: Nil.

Oliver Arc Lamp, Ltd. (90,880).—Capital, £2,000 in £1 shares, return dated October 23rd, 1913; 1,407 shares taken up; £7 paid, £1,400 considered as paid; mortgages and charges: £15,000.

Railless Electric Traction Co., Ltd. (98,728)—Capital, £5,000 in 4,750 ord. shares of £1 shares, and 5,000 deferred shares of 1s. each; return dated January 5th, 1914; 2,571 ord. and 5,000 deferred shares taken up; £1 per share called up on 2,056 ord.; £1,916 paid, leaving £140 in arrears; £765 considered as paid on 515 ord. and 5,000 deferred; mortgages and charges: Nil.

Dynes Bros., Ltd.—A memorandum of satisfaction in full on January 15th, 1914, of debs., dated May 30th, July 4th, 1910, and August 9th, 1911, securing £3,000, has been filed.

Northern General Transport Co., Ltd.—Trust deed, dated December 30th, 1913, securing £150,000 deb. stock, with power to issue further stock ranking *pari passu* to an amount not exceeding (with certain stock to be held in reserve) the amount of the issued share capital of the company for the time being. Property charged (specifically): Certain shares in the Gateshead and District Tramways Co., the Tynemouth and District Electric Traction Co., Ltd., and the Jarrow and District Electric Traction Co., Ltd., respectively, already acquired by the company, and all other shares in the said companies that may be acquired by the company on or before January 31st, 1914. (As a floating security): The company's undertaking and property, present and future, including uncalled capital. Trustees: The Electrical and Industrial Investment Co., Ltd., Electrical Federation Offices, 1, Kingsway, W.C.

Harraway Bros., Ltd.—Particulars of £2,000 debentures, created January 15th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £300. Property charged: The company's undertaking and property, present and future, including uncalled capital (if any). No trustees.

Electra Rubber and Vulcanite, Syndicate, Ltd.—Issue on January 9th, 1914, of £50 debs., part of a series of which particulars have already been filed.

CITY NOTES.

Chatham and District Light Railways Co., Ltd.

THE directors report that for the half-year ended December 31st, 1913, the revenue was £25,880, and the expenses were £14,115, leaving £11,765, less rent of Rochester Corporation lines, £1,872 ; interest on debentures, £931 ; interest account, £315 ; leaving £8,613, plus £2,766 brought forward, making the balance £11,379. Of this amount £5,500 has been transferred to reserve for depreciation, and the directors recommend that the balance be disposed of as follows : £2,910 to dividend at the rate of 5 per cent. per annum for the half-year on the preference share capital ; £2,120 to dividend at the rate of 4 per cent. per annum for the half-year on the ordinary share capital ; £819 to revenue new account. The traffic receipts show an increase of £1,884, and the expenses an increase of £839, as compared with the receipts and expenses for the corresponding half-year of 1912. During the year £12,900 debentures of the company were purchased and redeemed, and the difference between the purchase price and par value added to reserve for depreciation.

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June, 1912	14·98	4,455,807	£21,570	1·16	544,512	45
Dec., „	14·98	4,850,273	£23,634	1·17	567,202	47
June, 1913	14·98	4,669,161	£22,713	1·17	540,192	47
Dec., „	14·98	5,210,322	£25,519	1·17	567,631	47

Lanarkshire Tramways Co.

THE directors' report for the half-year ended December 31st, 1913, says that the revenue for the period was £48,391, and the expenses were £26,456, leaving £21,935. From this are to be deducted :—Contributions payable to local authorities, £1,433 ; interest on debentures, £911 ; interest account, £580 ; interest account—Lanark County Council Tramways, £272 ; amounts written off, as per revenue account, £1,170 ; leaving £17,567, plus £7,093 brought forward, making the balance £24,661. Out of this amount £11,000 has been placed to reserve for depreciation, and the directors recommend that £11,147 be applied to dividend at the rate of 6½ per cent. per annum for the half-year, £522 to directors (10 per cent. of net profits after payment of 5 per cent. dividend), and £1,991 to revenue new account. The revenue shows an increase of £6,481, and the expenses an increase of £4,266 as compared with the revenue and expenses for the corresponding half-year of 1912. The directors have transferred £11,000 to reserve for depreciation, which, with interest credited to the reserve during the year, makes a total contribution of £13,357. An amount of £1,170 has also been written off as per revenue account. A dividend for the half-year at the rate of 6½ per cent. per annum is recommended, making 6¼ per cent. for the year. The Lanark County Council tramways from New Stevenston to Bellshill, and Holytown to Mossend, were opened for public traffic during the half-year, and have been worked by the company under the agreement with the Lanark County Council. The construction of the line from Bellshill to Mossend has unavoidably been delayed, but the work is now completed and the lines will be in operation in a few days. The directors propose extending the motor-omnibus service, and will acquire additional omnibuses for this purpose.

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June, 1912	23·32	7,062,726	£36,570	1·21d.	893,927	64
Dec., 1912	23·32	8,202,018	£41,367	1·21d.	955,164	64
June, 1913	24·62	8,579,876	£43,884	1·20d.	979,621	66
*Dec., 1913	34·29†	9,471,832	£47,760	1·21d.	1,074,440	78

* Includes motor-omnibus service.

† Tramways, 26·25 miles. Motor-omnibuses, 8·04 miles.

Yorkshire (West Riding) Electric Tramways Co., Ltd.

THE annual meeting was held on Friday last at the offices, 31, Throgmorton Street, E.C., Sir H. S. Leon, Bart., presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 150), said that the year under review had been a good one for the tramways. The weather was fine and trade had been good. Consequently the earnings from the business showed a very satisfactory and substantial increase which enabled the directors to pay an increased dividend upon the preference shares. £6,933 more had been earned over the previous year at an additional cost of £784, giving a net gain on the trading account of £6,149. During the year £20,091 had been expended on capital account. The most important item was the expenditure on the paving of the permanent-way of the Wakefield section. Altogether they had spent £34,376 in that connection, but there would have to be considerable further outlay in the near future upon the track between Nuneaton, Castleford and Pontefract. £3,769 had been expended on fitting the cars with top covers. The total capital expenditure to date was £770,186, and on the other side the amount over-expended was £58,996. That, however, by no means represented all the money that had been spent on capital over and above that subscribed, for the sums put aside for depreciation and reserve had all been utilised for that purpose. Since the tramways had been running no less a sum than £102,404 had been expended out of revenue on capital account. There could be no finality in capital expenditure with an increasing business such as he hoped they were going to have, and in order to popularise their cars it was essential to keep the plant, cars, &c., in such a state of efficiency as would only invite favourable criticism. Additional capital would be needed almost immediately, and when it was decided to make an issue the shareholders would be asked to subscribe. The new capital would be raised in the cheapest possible way ; there would be neither commission nor underwriting, and if the shareholders did not care to subscribe, all the money required would be found by the board and their friends. During the year they had obtained a provisional order for lighting the town of Pontefract, and the company was now engaged in erecting the necessary plant for this undertaking, which would cost very nearly £12,000. From the lighting undertaking an immediate profit was certain as soon as the business was started. The board were not at all satisfied with the traffic between Normanton, Castleford and Pontefract, and they had in view a scheme for doubling the track which would enable them to run a more frequent service. That was a very big undertaking which would not be carried out this year, but they would endeavour to make all arrangements for doing it next year, provided, of course, that in the judgment of the board, the company would receive a certain profit therefrom. The total receipts averaged 9·938d. per car-mile compared with 9·081d. in 1912, an increase of 0·857d. The receipts per car-mile had steadily risen yearly from 7·036d. in 1905 notwithstanding the fact that the mileage run by their cars had increased from year to year. The working expenses were £33,341, an increase of £784. On a car-mileage basis it cost 4·47d. to run each car-mile, whereas in the previous year it cost 4·406d., an increase of 0·070d. per car-mile. That increase was brought about principally by a substantial increase of wages, which was granted to the men during the year, and to additional expenditure on cars. The percentage of expenses to receipts was 45·04, compared with 48·52 in 1912, a decrease of 3·48 per cent. As showing the progress of the company, he might mention that the receipts had risen from £38,051 in 1905 to £74,029 last year. The balance carried forward from the revenue account was £40,688. After paying debenture interest, income-tax, &c., there was a balance of £27,312. That, compared with a balance of £20,106 last year, was an increase of £7,205. They had not yet succeeded in obtaining the sanction of the Board of Trade to the abandonment of three unconstructed routes they had declined to build, nor had they obtained the release of the Parliamentary deposits, but it was hoped that the application now before the Board of Trade, which would be considered next month, would result in the moneys being released and an agreement being come to which would be satisfactory to the Board of Trade, the local authorities and the company, particularly as they had offered to run a motor-'bus service instead of constructing the light railways, and they had already ordered four motor-'buses for that purpose. The year had been a busy and an encouraging one, and the shareholders could contemplate with satisfaction the very substantial progress which had been made. In the early days of the company, when the prospects were anything but bright, the directors were repeatedly pressed to distribute the small surplus in dividends, but those who advocated that policy did not appreciate the fact that the business had to be created, and that only by the most careful management of the company's finances, would it have been possible to weather the few trying years before arriving at the present dividend-paying stage. The board could take credit that they thoroughly grasped the position, and refused to cripple the business to satisfy those who desired dividends before they were properly earned. It was true they had no money in the till at the present moment, but their assets had so much increased in value that they had sufficient credit to be able to command any capital required in reason. It could be reasonably anticipated that unless some catastrophe occurred the present dividend would be continued, and they might even look forward with some confidence to the full 6 per cent. being returned to the shareholders in the near future, perhaps even in the present year.

MR. B. NEWGASS seconded the motion.

The CHAIRMAN, in reply to a shareholder, said that the form in which the additional capital would be issued had not been absolutely settled, but more than likely it would be issued as before—in short term notes repayable at particular dates with semi-annual drawings. With regard to motor-'bus competition the board saw no reason to be alarmed. Of course they would carefully watch any competition in that direction, but it was almost impossible for motor-'buses to be run as cheaply as tramways.

The report was adopted.

Clontarf and Hill of Howth Tramroad Co.—The directors announce a dividend at the rate of 3 per cent. per annum and a bonus of 1s. per share ; £274 is carried forward.

Marconi's Wireless Telegraph Co., Ltd.—According to the *Financial News*, an interim dividend of 10 per cent. is announced, payable January 31st.

Traction and Power Securities Co., Ltd.—The accounts of this company for 1913 show, according to the *Financial Times*, a net revenue, including £11,255 brought forward, of £41,530. After writing off £7,336 in respect of loss on realisation of investments and transferring £10,000 to investment reserve account, the directors recommend a dividend of 4s. 6d. per share, leaving £4,976 to be carried forward. During the period under review there has been returned to shareholders paid-up capital to the amount of £2 per share, and the issued capital now stands at £683,280.

Bahia Tramway, Light and Power Co.—At a meeting, held last Friday, the new contract with the Municipality of Bahia for the acceptance of municipal bonds at 84 in exchange for the existing bonds, was approved by the holders of the 5 per cent. 50-year first mortgage gold debentures.

Japan.—The last Japanese mail brings the financial results for the last half-year of a number of additional electrical undertakings in that country. The Kinugawa Water Power Electric Co. is declaring a dividend of 6 per cent. A net profit of £11,708 is reported by the Hakodate Water Power Co. Of this sum, £1,568 is being placed to reserve, £890 allotted to the directors and auditors, while the shareholders receive £6,625 in the form of a 10 per cent. dividend, the balance being carried forward. The net profit of the Ina Electric Tramway Co. amounts to £4,799. In this case, £302 is being placed to reserve, £100 is being granted to the directors, the shareholders receiving £2,730 in the form of an 8 per cent. dividend, leaving a sum of £1,667 to be carried forward. The report of the Keisei Electric Tramway Co. reveals a net profit of £3,673, out of which £2,400 is being paid to the shareholders as a 5 per cent. dividend, £618 is being placed to reserve, £100 awarded to the directors, leaving £555 to be carried forward. The available net profits of the Keihin Electric Tramway Co. amount to £15,730. Of this sum, £1,460 is being placed to reserve, £730 devoted to bonuses, and £12,112 goes to the shareholders as a 6 per cent. dividend. The amount to be carried forward is £1,428.

Smithfield Markets Electric Supply Co., Ltd.—The directors have declared a dividend at the rate of 2½ per cent. per annum; £780 is to be carried forward. This compares with 2½ per cent. in the previous year.

Westminster Electric Supply Corporation, Ltd.—A dividend at the rate of 10 per cent. per annum is announced for the half-year ended December 31st, making the total for the year 10 per cent., the same as for the previous year.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

Wednesday, February 4th.—Marconi's Wireless Telegraph Co., Ltd.—Further issue of 250,000 ordinary shares of £1 (issued at £2 5s. per share premium) fully and partly (£1 10s., being 10s. capital and £1 premium) paid, Nos. 1,000,001 to 1,250 000.

Wednesday, February 11th.—Humphrey Pump Co., Ltd.—3,000 additional ordinary shares of £1 fully paid, Nos. 130,001 to 133,000.

And ordered the undermentioned to be quoted in the Official List:—

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 250,000 ordinary shares of £1, as above.

Metropolitan Railway Co.—Further issue of £504,216 3½ per cent. "A" debenture stock.

Applications have been made to the Committee to allow the following to be quoted in the Official List:—

Adelaide Electric Supply Co., Ltd.—Further issue of £25,000 5 per cent. debenture stock.

Commercial Cable Co.—£4,446 additional sterling 500-year 4 per cent. debenture stock.

Reduction of Capital.—The Premier Electric Control, Ltd., and Reduced.—A petition for the confirmation of the reduction of capital from £10,000 to £4,125 by reducing the nominal amounts of all the preference shares from £1 to 16s. 6d., and all the ordinary shares from £1 to 1s. 6d., has been presented and will be heard on February 3rd.

Liverpool Overhead Railway Co.—The directors have resolved to recommend the payment of dividends at the rate of 5 per cent. per annum on the preference shares, and 3½ per cent. per annum on the ordinary shares for the half-year ended December 31st, 1913, making with the interim dividend of 2½ per cent. per annum paid in August last, a dividend at the rate of 3 per cent. per annum on the ordinary shares for the year.

Prospectus.—*Melbourne Electric Supply Co., Ltd.*—The list is to close to-day, Friday, in an issue of £150,000 5 per cent. consolidated debenture stock at 97½ per cent. The progress of the company has been fully recorded in our pages recently; the money is required to enable the company to cope with the demand.

Montreal Light, Heat and Power Co.—The directors have declared a dividend of 2½ per cent. (at the rate of 10 per cent. per annum) for the quarter ending January 31st.

St. James' and Pall Mall Electric Light Co., Ltd.—The directors recommend a balance dividend on the 7 per cent. preference shares for the half-year to December 31st of 3s. 6d. per share, and 7s. per share on the ordinary shares, making, with the interim dividend paid thereon, a total distribution of 12 per cent. for the year. This compares with 10 per cent. for the previous year.

Bank Rate.—The Bank Rate was yesterday reduced from 4 to 3 per cent.

STOCKS AND SHARES.

Tuesday Evening.

The altered condition of affairs in the Stock Exchange, to which reference was made here last week, is still further apparent in all the investment markets round the House. The Bank Rate reduction to 4 per cent. is considered merely a stepping-stone to a further decline, and 3 per cent. is predicted as the probable Bank minimum within the next week or so. Money has come to the Stock Exchange in streams. Investment securities have been rising in price hand over fist. The demand outstripped the supply, and in all quarters of these departments substantial advances have been secured. Gains of 3 to 13 points are scattered broadcast over our own price lists this week. For the Electrical markets have shared fully in the all-round strength. It is particularly noticeable how the buyers have run after Debenture and other high-class stocks. In the more speculative groups the recoveries in everything connected with Mexico might be termed sensational or dramatic, had those two adjectives not lost most of their weight in consequence of incessant employment by financial journalists during the past fortnight. The queer part of it is, so far as Mexico is concerned, that the news from that country itself is still extremely vague and nebulous. This did not appear to weigh with the buyers, and the people in the market, who had been obliged to take stock all through the bad times, hoped that they were getting "a bit of their own" back—to drop into colloquialism—by putting up the prices with ever-increasing confidence, as they found that the brokers who came to them were buyers almost to a man.

Labour has again troubled the Home Railway market. The strike in the coal trade and the lock-out in the building trade gave pause to the prospective buyer of Home Railway stocks, who feared lest there might be extension of the troubles. With the atmosphere thus inclined to be somewhat dull, the wiseacres who forecast dividends cautiously modified their estimates, which also had its effect upon prices. On the whole, however, the market maintained a fair amount of firmness, and fixed-interest stocks continue to go ahead gaily, while a good Scottish Railway dividend revived the hopes of the optimists.

While Metropolitan Consolidated is but ¼ up, the Surplus Lands stock rose 2, and the Debenture and Preferences are all a point higher. Districts went back ½, but regained the decline, and rises occurred here as well in the prior charge securities. Underground Electric shares (both £10 and 1s.) further improved, and the 6 per cent. first Debenture gained 2 points. London United Tramways Debenture stock, which stood below 60 two or three weeks ago, has now risen to 66. Central London Assented stocks are harder, and Yorkshire Preference rose to 4 upon the increase in the dividend. Lancashire United Debenture is 2 better.

All the changes in the Electrical Supply section are in favour of holders. Debenture stocks and Preference shares are in strong demand; there is not nearly enough to supply those who want it. Amongst the shares, rises occurred in St. James', Charing Cross, Chelsea, Counties, Westminsters and South Londons. The approach of the half-yearly dividend time serves to direct renewed attention to the market, which is in a hopeful and buoyant condition.

Following upon the rises in Mexican issues last week have come further big gains. Of these, the principal are 13 points in Mexican Light and Power Preference and 10 in the Bonds, 13 in Monterey Debenture, and nearly 10 in both classes of Mexico Tramway Bonds. Buyers have been avid in their appetite, and the whole of the Latin-Canadian group is sensibly better. British Columbia Electric issues further improved upon their previous rises, and the Deferred stock, which was 98 the other day, now stands at 119½, a recovery of 12 on the week. Brazilian Tractions spurted 6 points. Rio Tramway 5 per cent. Mortgage bonds put on 5½. Mexico Tramways Common touched 73, came back again to 70½, and then ran up to 74½, a rise of 5½ on balance.

The improvement spread to others of somewhat similar nature. Anglo-Argentine Tramways descriptions are strong, Bombay Electric Debentures have risen, Canadian General Electric gained 3, and Montreals 2½—the last-named upon the declaration of a quarterly dividend at the rate of 10 per cent. per annum. Shawinigan Water went up 4. Cape Electric Trams regained their small loss of last week, and most things South African have been booming. Para Electric Preference are better, Brazilian issues, like those of Mexico, coming into favour once more. This may be due in some measure to the rise in the price of raw rubber, which has caused a "boomlet" in plantation rubber shares, and revived hopes of their going better still.

There are many rises amongst Telegraph and Telephone stocks. The demand for stock has spread round this market, and jobbers frankly admit that they cannot supply all that is wanted in the way of prior charge securities. Nor does putting up prices appear to have much effect in tempting sellers, most of whom appear to be on the lookout for better prices yet before they realise. So far as appearance is concerned, Mackay Common shares, with a rise of 6, attracted most attention, but the market in this stock is mainly in New York, and, so far as this country is concerned, the improvements in British Telegraph securities are much more interesting. Reference to the price list is the best way to obtain a fitting idea of the strength of the upward movement.

Another strong spurt took Marconis up to $4\frac{1}{16}$ this (Tuesday) evening, dealings being continued late in the street market. The orders came partly from America, partly from Dublin, and partly from more local sources, and the Preference shares, of course, rose with the others. Attention is being paid to the shares of the Marconi Marine Company, which have risen a trifle to 1¾; as a speculative proposition, they are said to be worth considering. Trust Companies' shares have risen with the rest, Globes being conspicuously good.

The Manufacturing group has gone the way of the others. Callenders, Castner-Kellners, Henley's Preference, Aron Ordinary and Preference, British Aluminium and British Insulated all show rises. The Debenture stocks of Cromptons and Brush have improved, and the cry is for more stock. Some idea of the eager way in which it is snapped up when any comes to market may be gathered by the fact that the Melbourne Electric offered its shareholders at the beginning of the week £150,000 5 per cent. Debenture stock, and the whole was taken in an hour or two. The line of Edison & Swan Debenture, which we mentioned last week as being on offer at that time, had no difficulty in finding a home; and many of the quotations in the lists overleaf are really better than they appear, since it is easier to sell stock than it is to buy.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 27th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
ath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ⅞ xd	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
rit. Elec. Trac., 6 % Pref. ..	100	..	..	12 — 14	..	..
Do. Do. Deferred ..	100	..	..	5 — 6½	+ ½	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	+1	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	3	..	52 — 55	..	5 9 1
Do. 5 % Perp. Deb. ..	100	5	5	92 — 95	..	5 5 6
Do. 4½ % 2nd Deb. ..	100	4½	4½	76 — 79	..	5 14 0
entral London Railway, Ord. ..	100	3	3	59 — 64	..	4 13 9
Do. Gtd. Assented	100	..	4	83 — 85	..	4 14 8
Do. Pref.	100	4	4	70 — 75	.	5 6 8
Do. Gtd. Assented	100	..	4	84 — 86	+1	4 13 0
Do. Def.	100	2	..	60 — 65	.	3 1 7
Do. Gtd. Assented	100	..	4	81 — 83	+2	4 16 5
Do. 4 % Deb.	100	4	4	95 — 97 xd	..	4 2 6
ity & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	93 — 95	..	5 5 0
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
astings Trams, 6 % Pref. ..	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
sle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 3
ancashire United, 5 % Deb. ..	100	5	5	80 — 82	+2	6 2 0
ondon and Suburban, Ord. ..	1	..	..	¼ — 5/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	9/16 — 11/16	..	7 5 6
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	72 — 77	..	5 17 0

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 27th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	64 — 68	+2	5 17 8
Metropolitan Railway Consol. ..	100	1⅝	1¼†	46 — 46½	+ ½	3 11 3
Do. Surplus Lands	100	2¾	2¾†	60 — 62	+2	4 8 9
Do. 3½ % Deb.	100	3½	3½	84 — 86	+1	4 1 4
Do. 3½ % Pref.	100	3½	3½	81 — 83	+1	4 4 4
Do. 3½ % Con. Pref.	100	3½	3½	78 — 80	+1	4 7 6
Metropolitan District Ord. ..	100	Nil	..	31¾ — 32¼	..	Nil
Do. 6 % Deb.	100	6	6	136 — 139	..	4 6 4
Do. 4 % Deb.	100	4	4	91 — 93	+1	4 6 0
Do. 4 % Prior Lien	100	4	4	94 — 96	..	4 3 4
Do. 4½ % First Pref.	100	4½	4½	82 — 84	+1	5 7 2
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	⅜ — ½	+ 1/16	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	3⅝ — 3⅞	+ ⅛	Nil
Do. "A"	1/-	..	..	15/32 — 17/32	+ 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	115 — 117	+2	5 2 7
Do. 4½ % Bonds	100	4½	4½	98 — 100	..	4 10 0
Do. 6 % Income	100	6	6	93½ — 94½	..	6 7 0
Yorkshire (West Riding), Ord. ..	5	Nil	..	5/16 — 9/16	..	Nil
Do. 6 % Pref.	5	3	4	3¾ — 4¼	+ ½	4 14 3
Do. 4½ % Deb.	100	4½	4½	79 — 84	..	5 7 2

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Jan. 27th.	Rise + or Fall —	Present Yield p.c.
nglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 13/16 — 5 1/16	+ 1/16	5 8 5
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 9/16	+ ⅛	6 0 7
Do. 4 % Deb.	100	4	4	89½ — 91½	+ ½	4 7 5
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	97 — 99	— ½	5 1 0
uckland Trams, 5 % Deb. ..	100	5	5	102 — 105	..	4 15 3
ombay Elec. S. & Trams, Pref,	10	6	6	11 — 11½	.	5 4 4
Do. 4½ % Deb.	100	4½	4½	93½ — 95½	+1½	4 14 3
Do. 5 % 2nd Deb.	100	5	5	97 — 99	+2	5 1 0
razilian Traction, Light and Power	$100	6	6†	91 — 93	+6	6 9 0
risbane Trams Invt., Ord. ..	5	8	8	7⅝ — 8⅛	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
. Columbia Elec. Rly., Def. ..	100	8	8†	117 — 122	+12	6 11 2
Do. Pref. Ord.	100	6	6	107 — 111	+4	5 8 1
Do. 5 % Pref.	100	5	5	103 — 105	+3	4 15 3
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98 xd	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	93 — 96	+2	4 8 7
alcutta Trams, Ord.	5	7½	5†	6 — 6½	..	5 15 5
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 7
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
ape Electric Trams	1	5	5	⅝ — ¾	— 1/32	6 13 4
ity Buenos Aires Trams (1904)	5	5†	5	6 1/16 — 6¼	+ 3/16	4 0 0
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
olombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	+1	5 7 8
avana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½ — 97½ xd	..	5 2 6
algoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Jan. 27th.	Rise + or Fall —	Present Yield p.c.
La Plata Elec. Trams, Ord. ..	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4⅜d.	6	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1¼ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1 1/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
„ Elec. Tr. (1904), Deb. ..	100	5	5	99 — 101	..	4 19 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	73 — 76	+5½	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	83 — 88	+9½	5 13 8
Do. 6 % Bonds	100	6	6	84 — 87	+8½	6 10 6
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	5 — 5½	..	9 1 10
Do. 6 % Pref.	5	6	6	4⅜ — 4⅝	+ ¼	6 8 1
Do. 5 % 1st Deb.	100	5	5	93½ — 95½	..	5 4 6
Perth (W.A.) Elec. Tr., Ord., ..	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	100 — 102	+2½	4 18 0
Do. 5 % Mort. Bonds	100	5	5	94½ — 96½	+5½	5 3 6
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	98 — 101	+2	4 19 0
Singapore Trams, 5 % Deb. ..	100	5	5	87 — 91	+1	5 10 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	98 — 100	..	5 0 0
Un. Elec. Trams Monte Video ..	5	7	7	4½ — 4¾	— ⅛	7 7 4
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	+ ⅛	5 14 3
Do. 5 % 1st Deb.	100	5	5	94 — 97	+ ½	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Jan. 27th.	Rise + or Fall —	Present Yield p.c.
ournemouth & Poole, Ord. ..	10	6	5†	9 — 10	..	6 0 0
Do. 4½ % Pref.	10	4½	4½	8⅝ — 9⅛	+ ⅛	4 18 8
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
rompton & Kensington, Ord. ..	5	10	9†	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
entral Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
haring Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅝	+ ⅛	4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼	+ ¼	5 6 0
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 8 0
helsea, Ord.	5	5	4†	4¾ — 5¼	+ ⅛	4 15 3
Do. 4½ % Deb.	Stock	4½	4½	95 — 98	..	4 11 9
ity of London, Ord.	10	9	6†	16½ — 17½	..	5 2 10
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 — 120	+1	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	98 — 101	+ ½	4 9 1
ounty of London, Ord.	10	6	5†	11⅞ — 12⅜	+ ⅛	4 17 0
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	+ ⅛	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	101½ — 103½	+ ½	4 7 0
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 9 1
dmundson's, Ord.	£3	..	..	5/16 — 9/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4⅛	..	7 5 5
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅜ — 1⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	81 — 84	+1	5 7 2
olkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	87 — 89 xd	..	5 1 2

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Jan. 27th.	Rise + or Fall —	Present Yield p.c.
Hove	5	8	8†	8¾ — 9¼	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	8†	7⅝ — 8⅛	.	4 19 8
Do 4 % Deb.	Stock	4	4	91 — 93	+1	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78 xd	..	5 15 6
London Electric, Ord.	3	2½	..	1⅛ — 1⅝	..	4 12 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4	4†	3⅜ — 3⅞	..	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 10
Do. 3½ % Mort Deb.	Stock	3½	3½	81 — 84	+1	4 3 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord. ..	5	10	10†	8⅝ — 9⅛	+ ⅛	5 9 7
Do. 7 % Pref	5	7	7	6⅝ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5½	..	3 — 3⅜	+ ⅛	6 10 2
Do. 5 % First Mort. Deb. ..	100	5	5	98 — 101	− 1	4 19 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/32 — 1 7/32	..	5 14 9
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	5/16 — 9/16	..	.
Do. 5 % Cum Pref.	5	3‡	..	2½ — 3	..	5 0 0
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	+1	5 2 3
Westminster, Ord.	5	10	10†	8⅝ — 9⅛	+ ⅛	5 9 7
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5¼ xd	..	4 5 10

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 8s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 27th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Adelaide, 6 % Pref.	5	6	6†	5⅛— 5⅜	..	5 11 7
Calcutta, Ord.	5	8½	5†	7⅜— 7⅞	..	5 8 0
Do. 5 % Pref.	5	5	5	4 15/16— 5 1/16	..	4 16 5
Calgary Power, 1st Mort. Bds. ..	100	5	5	89½— 91½	+1	5 8 8
Canadian Gen. El. Com... ..	$100	7	8	107 —112	+3	7 2 10
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	7/16— ⅝	..	7 13 0
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87½ — 89½	— ½	6 14 1
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94½— 96½	+1	5 3 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32— 3/32	..	Nil
Do. 6 % Pref.	1	6	6†	11/32— 13/32	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	+1½	4 16 2
Madras, Ord.	5	Nil	..	1¼— 1¾	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	101 —104	..	4 18 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	68 — 72	+4	6 19 0
Mexican Lt. & Power, Common	$100	4	4†	47 — 50	+6	..
Do. 7 % Cum. Pref.	$100	7	7	85 — 89	+13	7 17 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	83 — 87	+10	5 15 0
Do. 5 % 2nd Mort. Bonds ..	100	5	5	65 — 68	+7½	7 7 1
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	64 — 69	+13	7 5 0
Montreal, Lt., H. and Power ..	$100	9	10†	222 —227	+ 2½	4 9 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	101 —106	..	5 13 2
Do. 5 % Deb. Stock	Do.	5	5	99 —101	+1	5 0 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital ..	$100	5½	6†	140 —145	+4	4 5 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½—106½	+1	4 14 9
Do. 4½ % Per. Deb.	Stock	4½	4½	96 — 98	..	4 11 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 — 89	..	5 12 4
Victoria Falls Power, Pref. ..	1	6	6	25/32— 27/32 xd	..	7 2 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 8

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 27th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	11/16— 13/16	+ 1/16	8 12 4
Do. 6 % Pref.	1	6	6	11/16— 13/16	+ 1/16	7 7 8
Babcock & Wilcox	1	16	14†	2 29/32— 3 1/32	— 1/32	5 5 6
Do. Pref...	1	6	6	1 5/16— 1 7/16	..	4 8 6
British Aluminium, Ord. ..	1	..	..	1 1/16— 1 3/16	+ 1/32	..
Do. 6 % Cum. Pref.	1	6	6	25/32— 29/32	..	6 12 6
Do. 5 % Prior Liens Debs. ..	100	5	5	94 — 97	+1	5 8 0
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	8¾— 9¼	..	5 8 1
Do. Pref.	5	6	6	5¾— 6¼	..	4 16 0
Do. Deb...	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref. ..	2	Nil	..	1¼— 1⅜	..	Nil
Do. Deb...	100	4	4	67 — 70	..	5 14 4
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref...	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	.	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	78 — 83	+3	6 0 6
Do. 4½ % Deb.	100	4½	4½	39 — 43	..	10 9 4
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	11 — 11¾	+ ¼	6 7 6
Do. Pref...	5	5	5	4⅞— 5⅛	+ 1/16	4 17 9
Do. Deb...	100	4½	4½	97 —100	+1	4 10 0
Castner-Kellner	1	20	22½	2 9/16— 2 11/16	+ 1/32	..
Do. Deb...	100	4½	4½	104 —107	..	4 4 1
Crompton & Co., Deb.	100	5	5	74 — 78	+3	6 8 2
Dick, Kerr	1	Nil	..	5/16— 9/16	..	..
Do. Pref...	1	6	6	23/32— 27/32	..	7 2 9
Edison & Swan, A, £2 paid ..	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	54 — 58	..	6 17 11
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	½— ⅝	..	7 5 6
Do. Pref...	1	7	7	15/16— 1 1/16	..	6 11 9
Greenwood & Batley, Pref. ..	10	7	7	6¾— 7¼	..	9 13 2
Do. Deb...	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref. ..	10	6	6	9⅝— 10⅛	..	5 18 5
Do. Deb...	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	13¾— 14	..	5 7 1
Do. Pref...	5	4½	4½	4¾— 5	+ ⅛	4 10 0
Do. Deb...	100	4½	4½	100 —102	..	4 8 3
India-Rubber, G. & T.	10	7½	7½	11 — 12	..	6 5 0
Do. Pref...	10	5	5	9 — 9¾	..	5 2 7
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb...	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref. ..	100	..	..	51 — 56	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 27th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	6¼— 6¾	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	93 — 96	..	5 4 0
American Telep. & Teleg., Cap.	$100	8	8	127 —130	+2	6 3 0
Do. Collat. Trust	$1000	4	4	90 — 93	+2	4 6 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65 xd	..	4 12 4
Do. 6 % Pref.	Do.	6	6	105½—106½xd	+1½	5 12 8
Do. Def...	Do.	30/-	..	23½— 24	+ ⅜	6 5 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	103 —105	+1	4 15 2
Chili Telephone	5	8	..	7 5/16— 7 9/16	..	5 5 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	+ ½	4 19 0
Cuba Telegraph	10	6	6†	8½— 9½	+ ½	6 9 4
Do. 10 % Pref...	10	10	10	15½— 16	+ ½	6 5 0
Direct Spanish Telegraph, Ord.	5	4	4	8¼— 8¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6¾— 7¼	..	6 18 0
Direct United States Cable ..	10	4	4†	6½— 7	+ ¼	5 14 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	+1	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	128 —131	+3	5 7 2
Do. 3½ % Pref. Stock	Do.	3½	3½	76 — 78	+1½	4 9 9
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	+1	4 2 4
Eastern Extension	10	7	7	12¼— 12¾	+ ½	5 9 10
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust ..	10	6	6†	11½— 11¾	+ ½	5 2 2
Do. 6 % Pref.	10	6	6	12¼— 12¾	+ ¼	4 14 0
Great Northern Telegraph ..	10	20	5†	31½— 33½	+ ½	5 19 5
Indo-European Telegraph ..	25	13	5†	57 — 59	+ ½	5 10 2
Mackay Companies Common ..	$100	5	5	83 — 87	-6	5 15 0
Do. 4 % Cum. Pref.	$100	4	4	67 — 71	-1	5 12 8
Marconi's Wireless Telegraph ..	1	20	20	3⅞— 4	+ ⅜	5 0
Do. 7 % Cum. Partic. Pref. ..	1	17	..	13/16— 7/8	+ 7/16	4 18
Monte Video Telephone, Ord. ..	1	6	6	¾— ⅞	..	6 17
Do. 5 % Pref.	1	5	5	⅝— ¾	..	6 18
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101	+1	4 9
Oriental Telep. and Elec. ..	1	10	10†	1⅞— 2	..	5 0
Do. 6 % Cum. Pref.	1	6	6	1 1/16— 1 3/16	..	5 1
Do. 4 % Red. Deb.	Stock	4	4	86½ - 88½	..	4 10
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 - 100	+2	4 0
Reuter's	10	10	10†	9 — 10	+ ½	10 0
Submarine Cables Trust	Cert.	6	6	122½—125½	..	4 15
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96 — 98	+ ½	4 11
United River Plate Telephone	5	8	6†	6½— 7	+ ¼	5 14
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	+ ⅛	4 11
West Coast of America	2½	2½		1 5/16— 1 7/16	..	4 8
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2
West India and Panama Teleg.	10	1¼	1¼	2 9/16— 2 13/16	+ 3/16	4 8
Do. 6 % Cum. 1st Pref. ..	10	6	6	9¾ - 10¼	.	5 17
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9½	..	6 6
Do. 5 % Debs.	100	5	5	97 — 99	+1	5 1
Western Telegraph, Ltd. ..	10	7†	7	12¾— 13¼	+ ¼	5 5
Do. 4 % Debs.	Stock	4	4	92½— 94½	+1½	4 4
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	95 — 98	+8	2 11

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 4 per cent., January 22nd, 1914.

Walking Races.—The Hackney Walking Club, which was formed as a result of the successful electrical trades London to Brighton walking race, 1911, has decided to hold in the near future the following events, for each of which there is no entrance fee:—February 28th, 20 miles scratch race and yacht handicap over a measured course; Easter, 100 miles time trial walking race finishing at Southend-on-Sea; Whit-Monday, third annual London to Southend walk. Full particulars can be obtained from the Hon. Secretary, Mr. S. C. Haynes, 20, Penda Road, Clapton Park, London, N.E. For the 100 miles walk already seven entries hav been received, these being A. R. Edwards (late of May-Oatwa Fire Appliances, Ltd.), H. Gregory (Crypto Electrical Co.), E. G Hedges (Thames Ditton), C. H. Malivoire (Crypto Electrical Co. winner of the 18 miles race, H. V. Wallington (Harringay), an J. H. Williamson, of Manchester. It is understood that S. (Haynes (Associated Fire Alarms, Ltd.), winner of the London t Southend walk, 1913, will not be a competitor in the 100 mil event.

TECHNICAL ASPECTS OF THE RAILWAY CONTROL SYSTEM.

[BY AN ENGINEERING CORRESPONDENT.]

Public attention has been directed to the subject of railway control by Lt.-Colonel Druitt, of the Board of Trade, whose report concerning a runaway train and subsequent collision in the north of England concludes as follows:—

> "This accident illustrates the advantage of a system of control in case of accident where the line is suddenly obstructed at any point, as the trains can be quickly diverted or broken up instead of having to stand idly behind one another until the line is cleared."

Practically every railway company in this country has adopted, or is contemplating, a special system of control. It would be well therefore to consider in what respects the new method of working differs from that which prevailed a few years ago, and also the technical difficulties involved.

The dictionary meaning of the word "control" is given as "restraint," "authority," "command"; but from a railway standpoint, a modern "control" system should be defined as a scientific means of regulating traffic.

Its object and scope are to ensure that empty trucks are drafted about the line in sufficient numbers to enable goods agents to cope efficiently with local traffic; to see that the more important trains from goods yards, exchange depôts and colliery sidings have preference over the less important ones, and in a special way to direct the movements of all goods and mineral traffic. The control system is also made use of for providing engines and special power, arranging for the relief of goods guards and other functions of a routine character.

Railway Traffic Regulators.—In order to prevent overlapping and to reduce inefficiency to its lowest denominator, a new department, called the "central control," has been brought into existence. Its chief officer and his colleagues are men thoroughly versed in the manipulation of railway traffic. Their knowledge, which is born of a widespread experience, would enable them to judge of the relative importance of two goods trains converging upon a junction, and to decide quickly which should have precedence of the road. That the junction in question may be many miles away from headquarters is a detail of minor importance for, as will be explained later on, both the trains and junction in question would be portrayed in miniature near the "Regulator's" desk. Full power is given the controller to alter the ordinary working arrangements of the trains as occasion demands. Wagons cannot be added or deducted from any train load without authority from the chief controller, nor is an engine driver allowed to perform special shunting operations without permission from the same source.

The control staff or "regulators," as they are sometimes called, should know the haulage capacity of engines, should be able to calculate the speed of trains of different kinds, and must bear in mind the accommodation available at the various loops and refuge sidings dotted about the line.

A control office is unique in respect of its equipment. The walls are decorated with a gigantic diagram, beautifully coloured and highly finished, representing all the sections of line under control administration. It may be mentioned at this stage that a large railway company would probably have four or more control depôts, connected telephonically with, but subordinate to, a chief control office. On the diagram before mentioned are clearly portrayed the whole of the main tracks, sidings, loops and signal boxes within the control area. Small flags of different shape and colour are used to indicate the goods trains of various types. These flags are placed in metal sockets on the diagram so that the precise whereabouts of traffic is visually depicted before the controller's notice. As the trains speed on their way the flags are moved by hand to fresh positions corresponding with those of the actual train movements. This procedure is repeated until the terminal stations are reached or until the trains have passed a prescribed limit.

There are also two other notable features about a control room: It is strictly private and extremely quiet. Attention to the matter of privacy enables the staff to get along with their work unhampered by inquisitive sightseers. The need for quietness, however, involves a question of technical appliances, and at the same time it rules out of consideration any electrical device that is noisy.

The Apparatus that makes a Control system practicable is the telephone.—Like the arms of a gigantic octopus, copper wires extend to the uttermost parts of the railway. An immense number of telephones are bridged across these metallic lines, and brief advices are passing to and fro both day and night. Each operator in the control room sits at a desk furnished with a row of eye-ball indicators, electric lamps or other switchboard apparatus. He is also provided with the usual head and chest gear, which should be of the best quality so that shouting is unnecessary. Fortunately, the manufacturers in this country are able to supply an excellent article and no difficulty need be experienced in choosing a first-class equipment.

The same remarks are true at the outstations, though in rather a different sense. Loud sounding bells and a lusty voice are really needed where engines are blowing off steam and where the marshalling of goods wagons make telephonic sounds a difficult matter. It will be obvious that a combination transmitter and receiver—similar to that used in a control room—would be unsuitable at wayside places. Hence an ordinary telephone, differing only in a few structural details, is found to meet the case.

Several telephone systems are on the market at present. Some are wholly selective in their operation, whilst others are partly selective. Ringing out to line is accomplished either by means of small rotary converters, magneto generators, direct current press buttons, or combination ringing and listening keys. As the advocates of each system claim that their apparatus is specially adapted to control requirements, it would be unfair to boom one particular system to the disadvantage of the remainder.

An opinion may be ventured regarding the voltage of a control telephone circuit. Preference should be given to a low pressure system rather than to a high one, but as "low" and "high" are relative terms, the mistake must not be made of regarding these words as having a Board of Trade signification. For instance, there are telephone control systems working at a pressure of 160 volts, and others at 24 volts, relays being employed in connection with the latter to transmit the low tension current as required. Doubtless both voltages have much to recommend them, but if a telephone wireman had to work among the wires on a wet day he might receive an objectionable shock from a wire at the higher voltage.

Aerial Construction.—What has been already said may perhaps indicate the working conditions on our English railways, whereas the concluding remarks will show the need for exactitude of detail in the work of aerial construction. Failure to build a good telephone line will not merely reveal the work of a novice instead of that of an engineer, it will bring discredit upon the best control system in the world. To those inexperienced in the erection of line wires on railway slopes, the task may appear comparatively easy and so straightforward that mistakes would be exceptional. In the first place it should be remembered that telephone control lines have to be run on telegraph routes, across junctions, round curves, over signal boxes, and along underground paths. The officer in charge has to zealously guard against three things so that when completed the wires may be free from (*a*) metallic faults, (*b*) induction, (*c*) over-hearing.

Development of metallic faults.—To minimise the chance of contact or earth from other wires, a position on the pole should be decided upon where such interference is least likely to occur. That position is at the top. The upper arms should be therefore reserved for control wires, and though such a decision may involve the moving of existing wires to a lower position on the pole, the alteration should be made.

As regards the choice of metal, little need be said: either copper or bronze would be used. The balance is in favour of copper.

It is rather on the erection of control telephone wires that a few pertinent remarks may be offered. Experience has shown that it is one thing to issue instructions and another thing to have them obeyed. Tension vices in suitable numbers may be dealt out to gang foremen: a thermometer may be provided together with a table of sags and stresses to ensure adherence to a specified factor of safety, but unless a strict watch is kept, copper wires are regulated by what is commonly known as "a rule of thumb." And guess work nearly always leads to disastrous results on the occasion of a severe frost. Workmen accustomed to the manipulation of iron wires are apt to display contempt for an instruction which forbids them dragging a copper wire along the ballast or across a rusty stay, but with a courteous firmness on the part of those in authority, the correct method of erection is soon realized and the rules are faithfully observed. If care is exercised in the erection of copper wires, it is amazing what a length of time they last and how few faults develop. Even amidst murky surroundings it is not an uncommon experience for a copper wire to remain in service for a period of 20 years.

Induction.—Only those who have had experience with series and parallel earth circuits can fully realize what an intolerable nuisance induction means. This is true in a marked degree of signalmen's telephone circuits, especially when the latter are adjacent to Wheatstone working postal wires. The special induction referred to manifests itself in the following manner: Commencing with a low humming noise the sound rises to a huge crescendo, making telephonic conversation almost inaudible. After a time the inductive sounds change to a curious staccato movement, then cease abruptly. Ordinary induction may be distinguished from the former in that it belongs to the buzzing or crackling variety.

As far back as 1878 the late Sir Wm. Preece had discovered that the best means of overcoming induction on telephone circuits lay in the use of metallic loops. Then came the order to "cross" wires at every eighth pole. This, however, did not give entire satisfaction. Postal engineers proved later on that elimination of inductive disturbance on metallic loops could only be accomplished by revolving the telephone wires, by equality of insulation, by careful regulation of the wires and of adjacent telegraph circuits.

The object of revolving "control" wires is to ensure that they are brought to the same average distance from all external disturbing influences; that the four spans of one telephone leg, forming a complete twist, are exactly counteracted by the same disturbing influence upon the other leg.

On a railroad, industrial sidings intersect the main line with surprising frequency. The laying of these sidings generally leads to a re-arrangement of the aerial telegraphs and the provision of one or more additional poles. By so doing the symmetry of the twist is destroyed and induction in one form or another is at once apparent.

"When one support is added (thus forming two spans out of one) the shorter of the two should be run straight so that the minimum length may be exposed to external inductive interference.

"When two supports are inserted, forming two additional spans, the wires should be twisted in the usual manner.

"When, however, three extra supports are necessary it would generally be advantageous to make four, by which means the twist will not be interfered with."—(Tech. Inst. xiii, pp. 58.)

Overhearing.—It has been truly said that symmetry of construction forms a very important element in securing immunity from inductive disturbance. It would be worth while differentiating between certain telephonic sounds of a well known character and the transference of articulate speech. The former may be due to actual faults such as earths or high resistance, and the precaution should first be taken of testing the defective route with a view to clearing such faults. On the other hand overhearing, or cross talk (as it is often called), on revolved telephone circuits is caused through lack of equidistance. It is important therefore that all wires on a pole should be bound in on the same side of the insulator. This may seem a trite statement to make, but only those whose daily occupation brings them in touch with aerial telephone lines will fully realize the value of such instruction.

The introduction of 48-inch arms made it possible for two telephone circuits to be erected at the four corners of a perfect square. On many railway systems and throughout the post office, arms are spaced 12 inches apart. This distance was selected, we are told, not because there was any particular virtue in that dimension, but because it had been determined by experience that 12 inches formed a safe and workable separating distance between the insulators upon the arms and between the arms upon the poles. From the standpoint of electrical effects any other square would have been equally suitable, and many illustrations of that statement of fact are evident to-day.

It will thus be seen that the methods by which inductive disturbance is overcome in ordinary telephone practice are much the same in solving the difficult problem of over-hearing on control circuits.

REVIEWS.

Recent Physical Research. By David Owen, B.A., B.Sc. London: *Electrician* Printing and Publishing Co., Ltd. Price 3s. 6d. net.

"Recent Physical Research" is based on a series of bi-monthly articles which appeared in the *Electrician* in 1910 and onwards, and the idea of the book appears to be to provide that long-suffering section of the community known as the "present-day student of Physics" with an opportunity of getting a knowledge of those branches of Physics which are at present a sealed book to him (presumably because his text-book is "several years behind the wave-front of advancing knowledge"). It is, of course, conceivable that there still exists the youth who, with an air of supreme confidence, remarked that he had "done *all* physics in three months—and I read from Ganot, and, of course, Ganot is the *last word!*" To such a one Mr. Owen's book will *not* appeal. But apart from such, the "present-day students of Physics" are a multitude which no man can number, and we have some difficulty in discovering the exact section for which Mr. Owen has written his book.

To the humbler students of physics, and especially to those who are engineers, and who are studying physics from a practical standpoint, positive rays and pressure of radiation and free electrons in metals can be of little interest. To the advanced students or professional physicists these subjects are commonplaces, and, by college lectures and innumerable "monographs," will have become almost as familiar as the historic wave theory of light or the electric thermometer. There is, in fact, very little in this book that has not previously found its way into some book which is easily accessible to the advanced physics student. For example, practically the whole of the two chapters devoted to Pressure of Radiation have already been dealt with in Prof. Poynting's memoir "On the Pressure of Radiation," published over four years ago, and now in a host of public reference libraries.

"The Interaction of Ether and Matter," which is the subject of another paragraph, has been dealt with in great detail by Sir Oliver Lodge in his book on "The Ether of Space," published over two years ago. An even more flagrant case of "recent" research occurs in the chapter on Short Electric Waves and Long Heat Waves—the work of Langley and Rubens, Drude's Equation, and the Ketteler Helmholtz Dispersion formula, are all referred to, and a diagram of the Reststrahlen experiments is actually given in editions of Mr. Edser's book on "Light," published nearly 10 years ago.

Mr. Owen has certainly written and arranged his matter admirably, and has produced a dozen very readable articles, but the point is that this has all been done before, and that every student who *wants* this information has either already got it in his lecture notes or knows where to get it in the reference library. To the student who has lost his lecture notes or forgotten where to find what he wants in the reference library, we would heartily recommend this little book.—P.H.S.K.

Handbook of Technical Instruction for Wireless Telegraphists. By J. C. Hawkhead. London: The Marconi Press Agency, Ltd. Price 3s. 6d.

This is essentially an exposition of the Marconi system of wireless telegraphy as applied to ship and shore communication. No collected account of the appliances special to the Marconi system has hitherto been published in book form. The appearance of the work under review will, therefore, be welcomed, if for this reason alone, by others besides those wireless operators for whom it is primarily intended as a handbook. It treats the matter in an eminently practical way, and there can be no doubt that the volume will henceforth be a familiar object in the wireless cabin of every ship equipped with the Marconi system. The avowed intention is that it shall serve as a book of technical instruction to learners training to acquire the standard of efficiency demanded by Administrations, in accord with international regulations.

The book is divided into three parts, dealing with elementary technical electricity and magnetism, the theory of wireless telegraphy, and practical working information respectively. Of these it may be said generally that the first part is fairly adequate to the purpose in view, even quite good in some respects; the second part suffers from being over-condensed and stereotyped, while the third part forms by far the most useful and the best part of the work.

The illustrations throughout are numerous and generally very good. The exceptions are those in which the author tries to depict the electric and magnetic lines of force, as in figs. 33 and 70. In the latter case especially, the attempt is open to considerable criticism and can only be characterised as feeble. The text, in certain cases, is inclined to be loose in expression, as in the use of the term "resistance" where dielectric strength is intended, and in the statement that the permeability of iron decreases as the magnetic force increases. Perhaps the most serious criticism to be offered is in connection with the opening sentences of Chapter II, Part 2, where the author has "side-slipped" badly in explaining and sketching Lodge's experiment with syntonised Leyden jars. Both the explanation and the sketch are erroneous. A similar criticism applies to the explanation and diagram of currents induced by a moving magnet, as given in Chapter VI, Part 1. The illustration shows a balanced condition in which no deflection of the galvanometer would be produced.

In Part 3 special mention may be made of the very useful and instructive diagrams given, and of the description and methods of application of the testing buzzer. Although some of the information given is distinctly open to controversy, it is, on the whole, sound and reliable. Attention is drawn to an omission on page 234 in regard to a method of tuning the aerial with the aid of a wave-meter while using a very weak coupling of the transmitter, where the author fails to point out that unless the arrester gap is bridged the method is likely to fail.

The book is certainly very good value for the moderate price charged, and will, no doubt, be much improved in future editions.

Elementary Theory of Alternate Current Working. By Capt. G. L. Hall, R.E. London: *Electrician* Printing and Publishing Co., Ltd. Price 3s. 6d. net.

Captain Hall has written a very common-sense book on Alternating Currents. As he says, the standard works on this subject can be read with more profit when a working knowledge of the elementary theory has already been acquired, and he has undoubtedly succeeded both in presenting these elementary principles in as simple a form as possible, and in his endeavour to "rob electrical phenomena of the mystery with which they are so often associated in the mind of the beginner."

A feature of the book is its division into short chapters of from 10 to 20 pages, each dealing with a distinct branch of the subject. There is an introductory chapter on the fundamental properties of alternating currents, followed by chapters on Inductance, Capacity, Resonance, and Power Measurement. The chapter on Resonance is especially interesting, and gives in very concise form the essential facts relating to the combined effects of inductance and capacity in giving rise to resonance in A.C. circuits—a subject that is generally omitted from elementary textbooks, but which is of supreme importance in the design of A.C. machinery.

Single and three-phase generators are then described, and the book concludes with three chapters on the Synchronous, Induction and Commutator Motors. The book is well printed and illustrated, and bound in a serviceable cover.—P.H.S.K.

Natural Sources of Energy. By Prof. A. H. Gibson. London: Cambridge University Press. 1913. Price 1s. net.

The text actuating this little book is the inevitable exhaustion of the so-called fossil fuels. Let this come sooner, or let it come later, it will arrive. At the moment the man in the street regards the end of coal as occurring when his own particular head has ceased to ache. And this vernacular phrase covers the standing opinion of most men.

When Brindley was making his famous mine tunnel at Worsley, and expressing to his Ducal client his hopelessness at the problem, the Duke inquired whether they were getting out a cartload of the rock daily. No, said Brindley. A barrow load? Again, No! The Duke passed his snuffbox and then put the question a third time, but based it on the capacity of the snuffbox, and was assured that much more than that humble measure was coming forth, to which the Duke replied: Then go on, Brindley, you will get through in time. And so with our coal, America's coal, and even the huge deposits of China, waiting until 400 million industrious Chinese enter the crazy race for terrestrial exploitation.

As regards petroleum, the author estimates the present output as only equivalent to 7 per cent. of the coal output, or to 15 per cent. if used in internal-combustion engines. He notes the ease with which oil deposits are exhausted, and does not appear hopeful of much being got from oil. Peat does not afford much hope for the long future. Radium, too, has to be dismissed with scant courtesy, and we are soon brought down to wind and water. The thermodynamic equation is explained, and then we return to fossil fuels and an estimate of how they are used, facts about gas producers, and so on, all of which seems to be begging the original question somewhat, and to pertain to some elementary book on steam power.

At Chapter IV we begin to move outside the beaten track into the realm of solar heat, but the solar motor does not seem likely to help us much. Like the windmill, it appears to demand a large capital expenditure for a small power return, and, like the windmill, it is not of regular habits.

Steam to the weight of 4,800 lb. in eight hours does not seem much to get off an area of 10,000 sq. ft. A plant in sunny Egypt gave 1 H.P. from 100 sq. ft. of heating surface. Our author is rather strong on solar motors, for he says that the 5-mile coastal strip of Australia is good for 120,000,000 H.P., if only 1 per cent. of the strip were utilised. Advance, Australia!

Then there is tidal power. Of this we can only say that it will usually call for very costly head works. If any of our readers have been to l'Isle Bréhât, they may have seen the little tidal mill there with its big impounding dam, and its two pairs of stones, or was it four? The old miller offered it to the writer for a few thousand francs, and chucked in his house, pigs, and hens, only appearing to reserve his own family. But it is not everywhere that coastal formations go to the production of a 15-metre tide, nor is it everywhere that there is so convenient a bay to be dammed by a short dam, as there is at Bréhât. There is a similar mill a few miles away on the mainland, on the Lezardrieux River.

Our author sees the difficulties of tide power—the need of great accumulators, and the need for letting out all the stored water before it is blocked by the next tide.

But we do not see that any number of tidal mills will, even in theory, increase the braking effect of the tides on the earth's rotation. The mill will do work, and it will all end in heat, just the same as it does now. The author evidently has not seen Bréhât, but refers to the bay of Fundy, with its 40-ft. tide. We have always heard this stated as 70 ft., while the Chepstow tide is said to be from 45 to 60 ft. Vegetation remains, for we can always grow potatoes and make alcohol.

This is an excellent little book, very interesting to read, but, with our present limited knowledge, we see little chance for any power except that derived from the sun by way of rain and the earth's differences of level.

The Orinoco has a cresciente of 80 ft. at Ciudad Bolivar, and might be dammed up to that level, and again dammed lower down stream. It flows 7 or 8 miles an hour on a width of a mile or so at the narrows or Angostura, and is over 480 ft. deep, and this great river is said not even to rank with the earth's 12 biggest rivers, though probably for power purposes it does. It is to water power that our posterity will look. Meantime, let us kill the mosquito, the tsetse and other flies, and the tropics, where such rivers flow, will become healthy enough to live in, for it is only because of the flies that the tropical parts of the earth are not the best to live in. Meantime, some of us could stay here and batten on the transmitted energy. Power will be made ultimately by a few engineers abroad, food will be grown out there also, and manufacturing will be done in climates more suitable for work, by the aid of the very long-distance transmission which it remains for electrical engineers to find the way to carry out.

BRITISH PRACTICE IN THE CONSTRUCTION OF HIGH-TENSION OVERHEAD TRANSMISSION LINES.

By B. WELBOURN, M.I.E.E.

Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, *January*, 1914.)

(*Concluded from page* 130.)

The pin type of insulator is most in favour in this country, and is likely to continue so while pressures remain at 20,000 volts; indeed, it is quite reliable up to 66,000 volts. The suspension type of insulator is necessary for really high pressures such as 100,000 volts. All main lines should be designed so that they may ultimately be worked at a higher pressure than that at which they are first operated. The time is approaching when there must be a further raising of working pressures on main alternating-current high-tension circuits, similar to the big change which was made in passing from 11,000 to 20,000 volts on underground cables eight years ago. The only commercially possible alternative would appear to be the Thury high-tension continuous-current system.

There is no difficulty in obtaining excellent pin-type insulators, but unfortunately many of those in use have not been of British manufacture. One British firm of porcelain makers has taken up this question vigorously in the last few years. Late deliveries of insulators by foreign makers are very frequent, and several months sometimes elapse before an order for a few gross of 20,000-volt insulators is completed.

Whether insulators are made in two parts, or not, it is of the utmost importance to insist on the parts being put together in such a way that no air cavity can exist.

Most engineers prefer brown, green, or neutral-tinted insulators as being less conspicuous than white and therefore less likely to attract the attention of stone-throwers, &c. On lines comprising two or more circuits it is sometimes advantageous to use insulators of different colour for each circuit in order to prevent mistakes and danger to linesmen. All insulators should be made of the highest grade porcelain which has been vitrified throughout and is absolutely non-absorbent of moisture and free from flaws, cracks or foreign matter. The colouring of insulators is given by the glaze, which must cover the entire surface, except the area where joints are made, and must be free from crazing, bubbles, cracks, &c. On completion, insulators should be tested both electrically and mechanically.

Suspension-type insulators can be very usefully employed at terminal poles (see fig. 2). Such an arrangement materially reduces the cost of a terminal pole on a heavy line. The practice of using shackle insulators on high-tension lines at terminal and corner poles is to be condemned, because of the weakness of the insulator from the electrical point of view. All telephone-circuit insulators should be of the double-petticoat type when used under power wires.

It is important that all pins should be galvanised, and should be stiff enough to withstand every normal strain. They may be fastened to the insulator by a cement which will not swell on prolonged exposure to damp air, or by packing the free space with hemp or twine soaked in linseed oil, in such a way as to ensure that the insulator cannot work loose.

On all the best work a continuous earth wire, varying in size according to the conditions, is run from end to end of the line either above or below the power wires, and all metalwork on the poles, including a lightning spike, is substantially connected to it. The earth wire itself should be connected to an earth plate at every fifth pole by means of a conductor (of ample section for carrying the possible leakage current), which is protected from mechanical damage above ground by a creosoted wood strip or other means, and below ground from corrosion by being buried in pitch or being painted with a high-class paint, such as P. & B.

The connection to the earth plate must be well made to secure permanent results. One way which the author prefers is to have two bosses cast on the earth plate with 8-in. centres, and to drift into these the terminals of a standard copper tramway bond, to which is bound and soldered the conductor from above. These connections should be liberally painted as before. The earth plate itself should be 18 in. square, and of cast-iron not less than ½ in thick, and should be buried in small coke. Experiments have shown that this is the most efficient size of plate to use. The author wishes to lay special stress on the necessity of great care being taken with the installation of the earthing system and its subsequent maintenance, as human life may be dependent on it for safety. When placed above the power lines, the earth-wire should undoubtedly be of the same metal as the power lines, and not of galvanised steel, which has a shorter life than copper or aluminium, and will, on breaking, foul the power wires and interrupt the supply. No necessity exists in this country for earth-wire protection above the power lines.

Air-core choking coils consisting of not less than 12 turns of line wire are installed in series with each line wire to hold back the high-frequency oscillations until a horn-type air-gap arrester, placed on the line side of the coil, can spark over. In series with the arrester a non-inductive resistance is employed to limit the flow of current to earth to, say, 10 amperes, and for this purpose a carbon-rod resistance may be employed.

The author does not place any faith in horn arresters erected in the open air, especially in industrial districts, as the air-gap varies in length due to corrosion and deposits of coal and other dust. The pressure in the line cannot be relieved by a spark-gap by more than 20 per cent. if the series resistance is designed correctly to prevent surging at the frequency of the supply. Any form of arrester which involves a spark-gap is wrong in principle because of the high-frequency oscillatory disturbances caused by a spark in the circuit. Serious damage to plant may be caused by these disturbances.

Electrolytic aluminium arresters, combined with a horn arrester, have been used on a small scale, but their extensive use is limited by the fact that they need re-charging every day from the line, and this cannot be done, without considerable expense, from locked-up static sub-stations.

Moscicki condensers are coming into favour slowly, possibly because of their high first cost. They have been used by the North Wales Power and Traction Co. for some years with excellent results, and they are always installed as a matter of course on new lines. They have also been adopted recently by Messrs. Kennedy and Jenkin for the War Office lines from Tidworth to Bulford. The neat arrangement of this arrester on the terminal pole at Tidworth is shown in fig. 15. The condenser arrester is automatic in action and able to discharge rapidly high-frequency disturbances in the line, while it only needs occasional inspection for the replacement of any blown fuses. These condensers have not sufficient capacity to afford any improvement in the power factor of a line.

After much trouble with horn arresters, Messrs. Merz and McLellan have discarded arresters on all lines which are connected to the system through step-up and step-down transformers, and instead about 10 per cent. of the end turns on the line side of the transformers are insulated with special materials to a thickness of 300 to 400 per cent. of the insulation on the remaining turns. Atmospheric disturbances on the line are reflected back by the end turns of the transformers, and the oscillations are damped out by the ohmic resistance of the line. Only a very high pressure on the line, *e.g.*, a direct lightning stroke, will break down the insulation, and in practice it is found that the outdoor insulators are punctured and the station apparatus is unaffected. The arrangement adopted is effective and cheap, and is easily worked in with the general design.

Probably some of the good results on all Messrs. Merz and McLellan's lines are due to their practice of connecting up their lines at both ends through paper-insulated cables, which have a very high resistance to breakdown when momentarily subjected to abnormal pressures. These cables have a low capacity and afford a permanent path to earth for high-frequency oscillations, and thus they are similar in action to the Moscicki condensers.

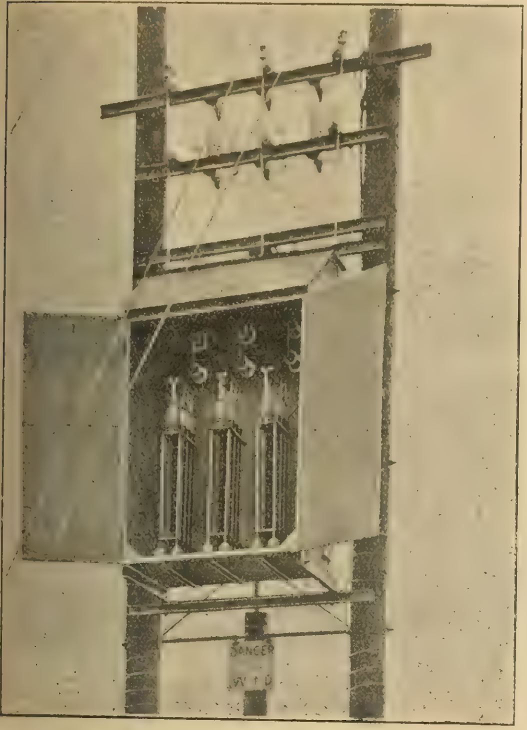


FIG. 15.—TERMINAL POLE, SHOWING MOSCICKI CONDENSER.

Private telephone circuits and circuits for the operation of the well-known Merz-Price protective gear may be combined in one paper-insulated cable protected by a lead sheath. The suspension of the sheathed cable is usually done from the steel-stranded continuous earth-wire when it is run below the power wires.

About 110 miles of lead-sheathed cable on transmission lines have been erected in the Newcastle district under the Elder system uring the past two years, with such uniformly excellent results hat it cannot be made too widely known. Briefly, the system consists of very short chrome-leather hangers which support the able at every foot and which are prevented from having longi-udinal movement by galvanised wire clips sprung on the suspen-on strand. On level routes every tenth hanger is also clamped to he cable by a galvanised flat spring clip, but on steep hills every anger should be clamped. Fig. 16 shows the form of the Elder anger usually employed.

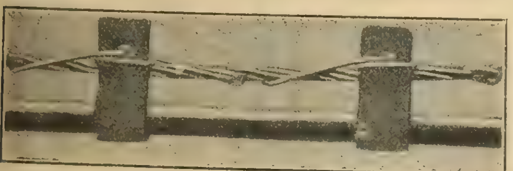


FIG. 16.—THE "ELDER" HANGER.

In suspending lead-covered cables on spans exceeding 50 yards easures should be taken to secure that the cable has no severe bends in the vertical plane, as shown in fig. 2. At horizontal bends the cable must be carefully led round the curve by pull-offs on the suspension strand. At terminal poles provision must also be made to carry the cable round an easy bend from the horizontal to the vertical plane in such a way that no movement can take place which would crystallise the lead sheath. The lead sheath should be definitely bonded at every fifth pole to the supporting earth-wire in order to carry away any charges which may be induced in it by the power wires.

On lines which are not protected with automatic gear which requires a pilot cable for its operation and on which one metallic telephone circuit only is required, it is usual to run two No. 14 S.W.G. phosphor-bronze or hard-drawn copper wires, and of these copper is to be preferred. They may be rotated so as to make one complete revolution at every fifth pole, but the author prefers the simpler plan of not rotating the telephone wires but running them parallel to one another and transposing them at such regular intervals as may be required (fig. 17).

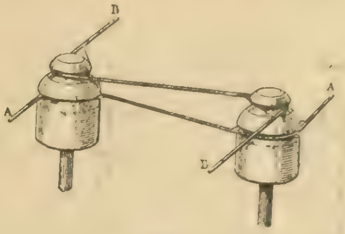


FIG. 17.—SHOWING A METHOD OF TRANSPOSITION OF TELEPHONE WIRES.

When bare telephone wires are used the only instruments which are permissible are those known as high-tension telephones, which are specially insulated in order to make it impossible for the telephone user to get a shock due to the considerable voltage which is induced on these wires under normal working conditions, or to contact between the telephone and power wires. A much favoured high-tension telephone apparatus is that made by Messrs. Siemens Bros. & Co., Ltd. It is connected to the line through a transformer, and the sound is transmitted by insulated hearing tubes so that the user is not brought into contact with any current-carrying part of the apparatus.

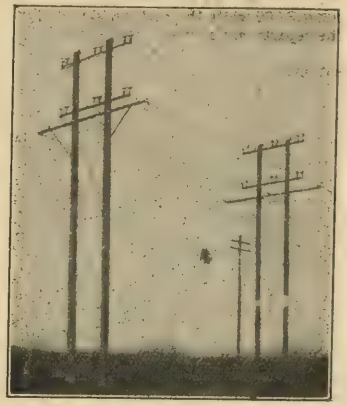


FIG. 18.—ROAD OR RAILWAY GUARDING.

When paper-insulated lead-sheathed cables are used for the telephone circuits, the much cheaper low-tension telephones of any good make may be employed, but it is advisable to protect them by heat coils, fuses, and spark-gaps. It is found that, under fault conditions on the line, the fault current partly travels through the lead sheath and sometimes induces current in the cores of the cables of sufficient magnitude to give severe shocks if the apparatus is not thus protected.

With the education of the public as to the safety of overhead wires, the methods of guarding lines crossing railways and roads are becoming much simplified, resulting in reduced cost of construction and enormous gain in appearance. One important 20,000-volt line which crosses a few roads and several miles of mountain moorland much used by tourists, has been equipped throughout with earthed extension pieces of galvanised wrought iron under each insulator. The metal projects for 12 in. on each side of the insulator and the curved portion is nearly semi-circular with a radius of 8 in.

The suspension guard shown in fig. 18 finds considerable favour for road and railway crossings and is extensively used by the Newcastle Electric Supply Co.

The suspender should be of the same sectional area and material as the line wire. It is anchored to the line wire at the extreme ends and is also attached to it at intermediate points; it seems nearly impossible with this combination for a live wire to fall within reach from the ground. As a further protection, an earthed light cradle may be employed as shown in fig. 18, but it does not seem to be absolutely necessary.

The triangular guard shown in fig. 19 is a new arrangement which is due to Mr. A. P. Trotter, and has been used on the Ham line of the Twickenham and Teddington Electric Supply Co. and by the Fife Power Co. It has the merits of simplicity, low cost, and ease of erection, and is likely to find considerable favour in future work.

In cases where important G.P.O. lines are met with, the department requires that bare wires working at a pressure of 3,000 volts and above shall not cross its wires, except by special arrangement, thus involving serious expense in extra terminal poles and underground high-tension cables. In some cases, the department's requirements have been met by using a joint pole for both sets of wires. A good example of this by the Cornwall Power Co. is shown in fig. 20, in which the earthed metal screen between the wires and the caging round the high-tension wires will be noticed. For pressures below 3,000 volts the high-tension conductors may be erected above the department's wires by observing certain requirements.

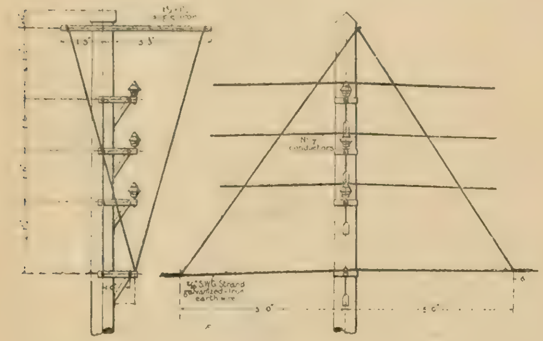


Fig. 19.—Triangular Guard.

With the great attention now given to the details of line construction, and with the equipment of lines with automotic protective apparatus, it is becoming exceedingly doubtful whether any guarding at all is justifiable on such lines. There is reason to believe that the line wires become "dead" within $\frac{1}{80}$ sec. after the occurrence of a fault or short-circuit or the breakage of a wire when the Merz-Hunter split-conductor system is employed. The Merz-Price system will cut out the line within $\frac{1}{20}$ sec. when an earth fault or short-circuit occurs, but it will not deal with the case of the opening of a circuit by a wire breaking until the wire becomes earthed, which may not occur until the wire has reached the ground. Considering these facts, it would seem that the time is approaching when it will be justifiable to ask for the Board of Trade's consent to run high-tension lines along public roads where the conditions are suitable, and so save the enormous amount of trouble that is involved in obtaining numerous private wayleaves.

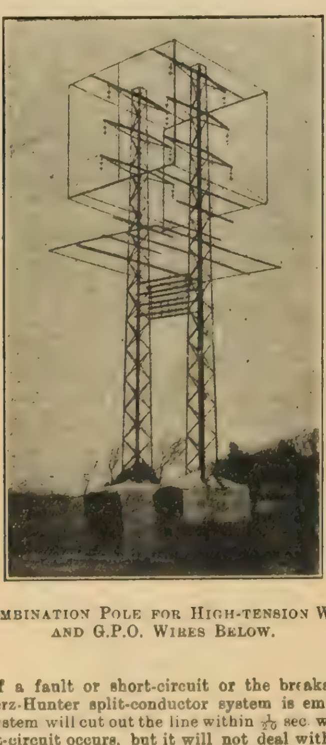


Fig. 20.—Combination Pole for High-tension Wires Above and G.P.O. Wires Below.

Where overhead lines cannot be connected directly to switchgear or transformers by bare conductors, the best practice is to connect up by means of paper-insulated lead-sheathed cables, built, when possible, to the Engineering Standards Committee's specification. These cables are usually armoured with galvanised wire for mechanical protection and to form an additional earthed metallic shield round the cable. The armouring should be protected against corrosion, preferably by compounded tapes. Such cables are also used for bridging across gaps in a line. Experience shows that even at 20,000 volts, three-phase, there is no need to make provision for protection against lightning where the cable and the line meet, and, further, that cables can be "teed" off an overhead line with safety.

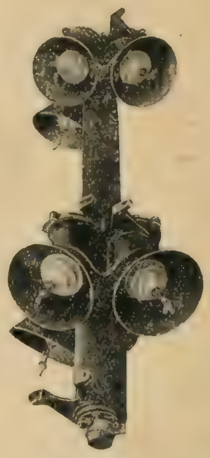


Fig. 21.—Inverted Type of Trifurcating Box Arranged for Split-conductor Working.

A cast-iron box fitted with insulators is employed on a terminal pole for sealing off the connecting cable at its junction with the line wires. Terminal boxes were very fruitful sources of breakdown until the introduction about three years ago of the inverted box, in which the porcelain insulator is considerably protected from wet, snow, dirt, and mechanical damage. The author has never heard of a breakdown occurring at one of these boxes, which are obtainable for all pressures up to 20,000 volts, alternating current. A patented special form of the box for use with Merz-Hunter split conductor 20,000-volt cable is shown in fig. 21, and is also to be seen in actual use in fig. 2 on the terminal pole.

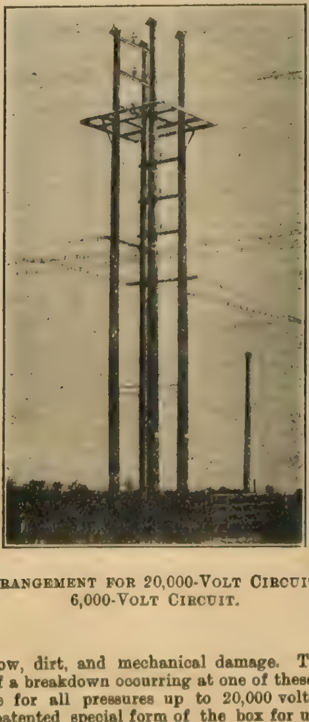


Fig. 22.—Arrangement for 20,000-Volt Circuit Crossing A 6,000-Volt Circuit.

The very greatest care should be taken to ensure that all terminal boxes used out of doors are thoroughly filled with high-grade flexible waterproof compound, which will not soften appreciably under the direct rays of the sun.

Fig. 22 shows the design of a 4-pole structure which is in use for carrying a 20,000-volt line over a 6,000-volt line. The essential feature in it is the earthed metal platform between the two sets of conductors. Such a platform should be strong enough to permit of two men standing on it simultaneously.

Fig. 23 illustrates a neat method of leading-in bare conductors to a station without employing insulated cables. The three horizontal insulators are made in two parts, and these are mounted, as shown, on a vertical slate panel which is built into the wall.

Attention may be called to the fact that the Board of Trade allows a supply to be given from an overhead line through a transformer fixed overhead on a pole, subject to compliance with recently-issued regulations. This concession will probably be of much use when negotiations are on foot for obtaining wayleaves.

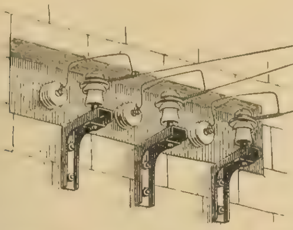


Fig 23.—Method of Leading-in Bare Conductors to Station.

To prevent the climbing of poles, each separate pole should be equipped with about 10 turns of 4-barbed wire about 8 ft. above ground-level, and the wire should be securely stapled to it. In a few cases *chevaux de frise* have been used.

Each pole should have a zinc number-plate (G.P.O. pattern) attached to it by zinc nails, at a height of 5 ft. above the ground.

Danger notices must be fixed on at least one pole in five, and on each pole at a road crossing.

During erection some engineers prefer that wiremen shall use ladders, and not climbing irons, for going up the pole. This is a wise precaution, but it must be used with discretion. Usually it is sufficient to use ladders at terminal and corner poles. In very hilly country the use of ladders may make the cost of erection altogether disproportionate to the benefit derived.

Some engineers stipulate that the tops of poles are to be coated with a mixture of coal tar and creosote before the pole roof is fitted.

Where game guards are required to give warning to flying birds, it is better not to use metal guards, as their swinging has been found to cause cutting of the line wires. It is equally efficient to split and fix on each wire in a span two corks 3 in. long and 1¼ in. diameter. The fixing can be done by binding the two halves of the cork with binding wire.

During erection and during repair work, line wires should always be "earthed." Where this precaution has been neglected, some bad cases of shock to line men have been experienced, due to electrostatic charges on the wires.

On completion of erection of a line, it is advisable to subject it to a pressure-test at twice the working pressure for ½ hour, or else to make it alive at working pressure for, say, two days before commencing the supply of power.

Discussion at Newcastle.

During the reading of his paper, Mr. Welbourn said that his remarks applied to overhead lines at pressures above 3,000 volts, as below this pressure the difference in cost between overhead and underground transmission was so little that cables were in more common use. In view of the importance of the subject, he suggested that it might be worth while for the Institution of Electrical Engineers to appoint a Committee to deal specially with overhead transmission lines. The Admiralty were very much alive to the danger of overhead lines to aviators, and had sent a representative to the London meeting especially to raise the question. With regard to factors of safety, he suggested that the working stresses should be proportional to the elastic limits of the materials used, and not to the ultimate breaking stress.

Mr. V. P. Hunter suggested that the price quoted for the 20,000-volt cable was much too high, and that it could be reduced by modifying the design of such cables, which, in his opinion, were made with too large a factor of safety. Quite a satisfactory job could be made for £1,550. He hoped that a committee on overhead line work would not be appointed, as the result would probably be an increase in the cost of such work. The factors of safety required by the Board of Trade were not by any means too liberal, and he did not think that anyone who had the responsibility of an overhead line would wish to reduce them. With regard to protection against atmospheric disturbances, he agreed that any device involving the use of an air-gap was quite wrong. His experience of lightning arresters in general had not been very satisfactory. He could not see how condensers could possibly be very effective. At one time it was looked upon as an expensive proceeding to have to install a short length of cable in order to pass under Post Office lines, but in view of more recent experience these short lengths of cable were now rather welcome, in view of their property of dissipating surges. As at least three responsible makers were now producing switches which would break circuits in the twenty-fifth part of a second, in the event of an overhead wire breaking, it would have to travel towards the ground at a rate of 300 miles per minute before it could do any damage, as the circuit would be completely broken long before the wire reached the earth.

Mr. J. R. M. Elliott said that he considered the route map shown in fig. 1 rather cumbersome, and that a pocket-book with leaves, say 6 in. × 4 in., each leaf containing particulars of one pole only, would be much more convenient to handle. The factors of safety used by the Post Office appeared to be quite in order, because the average breakage of lines all over the country was only once in ten years. He did not favour the use of steel poles, as it was impossible to inspect the inside of these, and men had been injured owing to breakages of apparently sound steel poles. The Post Office authorities had experimented with aluminium wires some years ago, but they were found to break off frequently at the insulators. Turning to the suggested test for hard-drawn aluminium conductors, he noted that no twisting test was suggested, although this was the only one on which reliance could be placed.

Mr. H. Bridges said that for the suspension of pilot cables short hangers were absolutely necessary, as otherwise the suspension wires and the pilot cable swung at different rates, with the result that the lead sheathing very soon cracked.

Mr. W. A. Gillott said that in the construction of overhead lines, one might supply the best material and design, but it was absolutely essential that the men should be well looked after, and that every attention should be given to details. He had noticed during storms that the proportion of snow and ice on aluminium lines was not so great as on the Post Office telegraph and telephone lines. In erecting poles, the use of spikes should be absolutely prohibited on account of the slight but painful injuries which might happen to men who had to climb the poles after erection.

Mr. C. Vernier said that the statement was often made that in many cases nothing was gained by centralising the plant, as the saving was balanced by the extra cost of transformers and lines, but, assuming the use of 20,000-volt overhead lines, a simple calculation would show that this was not the case. His own practice was never to lay a cable if an overhead line could be used; the maintenance of a well-constructed overhead line was very low indeed. He agreed with the author that it was quite a mistake to give a duplicate supply along the same route. He did not agree with running overhead lines along public roads, because these were very rarely straight, the Post Office lines usually occupied the whole of one side, and a considerable amount of space was required for first-class overhead construction, which meant that one had usually to overhang private ground, and this meant obtaining, and probably paying for, wayleaves. He was strongly adverse to the use of open telephone conductors, as these were a perpetual source of trouble owing to electrostatic phenomena. He thought that the cost of the erection, shown in fig. 20, must be very high indeed, and that it would have been cheaper to carry the power lines by means of cables underground at the crossings. He had abandoned the use of earth wires some three or four years ago, and had had very little trouble since. The four essential conditions to ensure that overhead pilot lines did not give trouble were:—(1) The sheathing must be of suitable material; (2) the hangers must be quite short, in order to prevent ripples; (3) the spacing must be quite short (not more than 18 in.); (4) the spacing must be regular.

Mr. B. Welbourn, in reply, said he agreed that in the Newcastle district, where the "Merz-Price" protective system and other refinements were in use, thinner dielectrics might be used, but this certainly did not apply to every district in the country. The thickness of the dielectric depended to a very large extent upon the radius of the conductor. With regard to open telephone lines, he had measured as much as 230 volts on telephone wires run below a 3,000-volt line. The early troubles which were experienced on the Post-Office aluminium lines were largely due to silica in the composition of the wire. The question of the twist test mentioned by Mr. Elliott was now being very carefully looked into by the makers of aluminium wire. The cost of maintenance of overhead lines, he believed, did not exceed 2 per cent. or 3 per cent. per annum. The privilege of being able to run power lines along public roads might in many cases help suppliers to short-circuit a landowner who was holding out for exorbitant wayleaves.

The Bradford Turbine Contract.—As stated last week, the Bradford Corporation has placed a contract with the Adnil Electric Co., Ltd., for a 5,000-kw. Bergmann turbo-generator set. This plant is to have a continuous output of 5,000 kw. at ·8 p.f. The turbine is of the high-pressure type, and will be supplied with steam at 180 lb. per sq. in. pressure, superheated 100° F., and will exhaust into a condenser with a vacuum of 28 in. with the barometer at 30 in. The alternator is of the three-phase type, wound for 6,000/6,600 v., 50 cycles; whilst the normal load of the turbine is 5,000 kw., the generator is being so designed that it will safely develop 7,500 kw., or 9,375 k.v.a. without dangerous over-heating, and the speed of the combination will be 1,500 r.p.m.

TRADE STATISTICS OF ROUMANIA.

The following statement, showing the imports of electrical and similar goods into Roumania in 1911, is taken from the official trade statistics which have only recently been issued; the figures for 1910 are added for purposes of comparison, and notes of any increases or decreases are given. The predominance of German trade with Roumania in these goods will be immediately noticeable:—

	Kilogs. 1910.	Kilogs. 1911.	Kilogs. Inc. or dec.
Electrical insulators of faience and porcelain even combined with other materials.—			
From Austria ...	63,000	49,000	— 14,000
,, Germany ...	79,000	72,000	— 7,000
,, Italy	1,000	—	— 1,000
,, Other countries	3,000	1,000	— 2,000
Total ...	146,000	122,000	— 24,000
Boilers.—			
From Great Britain...	26,000	22,000	— 4,000
,, Austria ...	86,000	70,000	— 16,000
,, France ...	7,000	7,000	—
,, Germany ...	421,000	316,000	— 105,000
,, Other countries	1,000	3,000	+ 2,000
Total ...	541,000	418,000	— 123,000
Iron wire, galvanised, &c.—			
From Great Britain..	48,000	97,000	+ 49,000
,, Austria ...	103,000	187,000	+ 84,000
,, Belgium ...	9,000	—	— 9,000
,, Germany ...	330,000	530,000	+ 200,000
,, Holland ...	2,000	—	— 2,000
,, Other countries	1,000	9,000	+ 8,000
Total ...	493,000	823,000	+ 330,000
Electric incandescent lamps.—			
From Austria ...	6,000	8,000	+ 2,000
,, Germany ...	16,000	20,000	+ 4,000
,, Other countries	1,000	1,000	—
Total ...	23,000	29,000	+ 6,000
Copper wire.—			
From Great Britain..	66,000	30,000	— 36,000
,, Austria ...	22,000	45,000	+ 23,000
,, Germany ...	83,000	166,000	+ 83,000
,, Other countries	3,000	2,000	— 1,000
Total ...	174,000	243,000	+ 69,000
Steam engines.—			
From Great Britain..	7,000	113,000	+ 106,000
,, Austria ...	69,000	1,813,000	+1,744,000
,, Germany ...	2,398,000	3,949,000	+1,551,000
,, Other countries	50,000	111,000	+ 61,000
Total ...	2,524,000	5,987,000	+3,462,000
Petroleum engines.—			
From Great Britain..	817,000	601,000	— 216,000
,, Austria ...	600,000	259,000	— 341,000
,, Belgium ...	163,000	4,000	— 159,000
,, Germany ...	1,159,000	1,603,000	+ 444,000
,, Switzerland ...	257,000	322,000	+ 65,000
,, Other countries	87,000	234,000	+ 147,000
Total ...	3,083,000	3,023,000	— 60,000
Gas, compressed air, &c., engines.—			
From Great Britain..	62,000	55,000	— 7,000
,, Austria ...	27,000	46,000	+ 19,000
,, Germany ...	165,000	225,000	+ 60,000
,, Switzerland ...	7,000	41,000	+ 34,000
Total ...	261,000	367,000	+ 106,000
Dynamo-electric machines, electric motors, converters, transformers, &c.—			
From Great Britain..	1,000	59,000	+ 58,000
,, Austria ...	20,000	25,000	+ 5,000
,, Belgium ...	9,000	1,000	— 8,000
,, France ...	5,000	60,000	+ 55,000
,, Germany ...	711,000	1,137,000	+ 426,000
,, Other countries	3,000	22,000	+ 19,000
Total ...	749,000	1,304,000	+ 555,000
Accumulators and spare plates.—			
From Austria ...	226,000	134,000	— 92,000
,, France ..	1,000	7,000	+ 6,000
,, Germany ..	22,000	88,000	+ 66,000
,, Other countries	2,000	5,000	+ 3,000
Total	251,000	234,000	— 17,000
Arc lamps.—			
From Austria ...	1,000	2,000	+ 1,000
,, Germany ...	8,000	17,000	+ 9,000
,, Other countries	—	1,000	+ 1,000
Total ...	9,000	20,000	+ 11,000
Electric apparatus for telegraphs and telephones.—			
From Austria	2,000	4,000	+ 2,000
,, Germany ...	8,000	33,000	+ 25,000
,, Other countries	2,000	4,000	+ 2,000
Total ...	12,000	41,000	+ 29,000
Ditto for transmission of power and light.—			
From Austria ...	2,000	2,000	—
,, Germany ...	18,000	16,000	— 2,000
,, Other countries	—	2,000	+ 2,000
Total ...	20,000	20,000	—
Interrupters, &c.—			
From Austria ...	7,000	11,000	+ 4,000
,, Germany ...	72,000	110,000	+ 38,000
,, Other countries	3,000	5,000	+ 2,000
Total ...	82,000	126,000	+ 44,000
Cables for transmission of electricity and insulated wire.—			
From Great Britain..	1,000	6,000	+ 5,000
,, Austria ...	51,000	180,000	+ 129,000
,, Germany ...	692,000	782,000	+ 90,000
,, Belgium ...	18,000	3,000	— 15,000
,, Other countries	4,000	1,000	— 3,000
Total ...	766,000	972,000	+ 206,000
Rails for tramways and railways.—			
From Austria ...	1,373,000	11,011,000	+9 638.000
,, Belgium ...	1,031,000	2,721,000	+1,690,000
,, Germany ...	4,442,000	3,682,000	— 760.000
,, Holland ...	1,258,000	267,000	— 991.000
,, Russia ...	6,216,000	—	—6,216,000
,, Other countries	87,000	119,000	+ 32,000
Total ...	14,407,000	17,800,000	+3,393,000
Locomobiles.—			
From Great Britain..	1,010,000	1,506,000	+ 496,000
,, Austria ...	1,143,000	1,041,000	— 102,000
,, Germany ...	1,096,000	1,480,000	+ 384,000
,, Other countries	19,000	160,000	+ 141,000
Total ...	3,268,000	4,187,000	+ 919,000
Electric apparatus for bells.—			
From Austria ...	2,000	1,000	— 1,000
,, Germany ...	3,000	9,000	+ 6,000
,, Other countries	—	1,000	+ 1,000
Total ...	5,000	11,000	+ 6,000
Electric batteries for medicine and chemistry.—			
From Austria ...	1,000	—	— 1,000
,, Germany ...	2,000	6,000	+ 4,000
,, Other countries	—	2,000	+ 2,000
Total ...	3,000	8,000	+ 5,000
Accessories for dynamo electric machines.—			
From Great Britain..	—	1,000	—
,, Austria ...	—	12,000	—
,, Germany ...	—	62,000	—
,, Other countries	—	3,000	—
Total ...	46,000	78,000	+ 32,000

Callender's Hospital Fund.—We have received a copy of the eleventh annual report and statement of Callender's Hospital and Distress Fund, which was unanimously adopted at the general meeting held on January 24th, at the Belvedere Works. Mr. A. R. Kibblewhite presided. In penny subscriptions the sum of £272 was received, a decrease of £4 as compared with the previous year. Donations, including one of £50 from the firm, amounted to £72. £241 was distributed to hospitals and other institutions, and various sums were expended in providing surgical appliances, spectacles, and financial assistance. It was anticipated that as the medical benefits under the National Health Insurance Act commenced in 1913, there would not be so great a demand on the fund for hospital letters, but actually a larger number have been issued than in any previous year.

OVERHEAD WIRE CONSTRUCTION FOR MEDIUM AND LOW PRESSURES.

HE discussion on the paper by Mr. A. P. Trotter (see Elec. EV., p. 157) was opened by Mr. A. J. Stubbs, who said he was leased to see that the cross wires should be 5 ft. from the pole, so hat they could be reached from a ladder. He asked how one ire could be earthed and the other not earthed when the two ere connected across at every span. The Post Office Regulations or 1905 were intended to afford protection from trolley wires, ut a loophole was left to meet the case of other power wires. he "low" insulation of the earthed wire must not be "no" insuation; it must be sufficiently high to enable the system to be ested. They must not forget the protection of the lead-off to onsumers' premises.

Mr. W. A. Chamen expressed the thanks of supply engineers to r. Trotter for his sympathetic treatment of the various questions hat arose, and said that they were all grateful to him. He (Mr. hamen) had been dealing with low-pressure three-phase distribuion for the last few years. He thought fig. 9 would be a conenient method, but it would not comply with the regulation egarding the angle of 45°. With regard to fig. 10 and others of he same nature, he had never seen this arrangement in practice, nd was doubtful whether it could be made safe. He had experiented with fig. 13, and it seemed to work well where the neutral as at the bottom, but if it were drawn tight it pulled up the wire nd reduced the clearance. Fig. 14 looked the best, but was no ood if the neutral was at the top. Fig. 15 was produced in Mr. hamen's office, and seemed likely to be the safest for five wires. he arrangement of four wires in a rectangle with the fifth wire elow was horrible, especially for services and at cross-roads. The est arrangement was to have the wires in a vertical plane, with the witch wire and the neutral at the bottom. Fig. 15 was quite eat and unobtrusive. The idea of using one guard wire as a witch wire was horrifying to him; it made the circuit alive and angerous. He agreed with Mr. Stubbs regarding the difficulty of ealing with branch circuits; they must have guard wires, which oubled the number of wires and looked unsightly. Would nsulated (covered) wire be accepted at such places?

Mr. Welbourn doubted whether alternating pressures above 50 volts should be allowed on overhead distributors. He preferred the plit neutral to the zig-zag. To his own knowledge, one conductor ad been used as a switch wire, but it was only possible on A.C. ircuits.

Mr. J. Sinnott said that over 40 experiments had been made ith systems of protection covering the reduction from 24 to 8 in., nd they had been found efficient in practice. The arrangement hown in fig. 15 was quite safe.

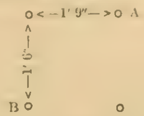
Mr. C. L. E. Stewart (Rawtenstall) said that overhead work ust be done in a really workmanlike way. It would have been mpossible to carry out the street lighting at Rawtenstall, except ith overhead wires. In the case of tramways, parallel guarding as quite a different thing from cross wires. There was a danger f guard wires breaking and slipping back, forming loops which ere very dangerous to persons driving along the roads; the uard wires should be anchored at frequent intervals. He had our guard wires running for 6 miles over trolley wires, and all orts of things happened to them. There was a liability for radle wires to swing in the wind and cause short circuits. A learance of 3½ in. between wires was not enough; the distance hould be such that the wires could not blow together. The reel nsulation shown in fig. 6 had proved quite satisfactory, even nder very adverse conditions. He was grateful to Mr. Trotter or kind assistance, and also to the Post Office engineers.

Mr. Haydn Harrison said that continuity of all the services as important; why should electric light wires be guarded, rather han telegraph wires? Where isolated house transformers were sed, protection was provided on consumers' premises; but in the ase of overhead wires, the protection was placed at the point here the trouble might arise; why should this be so? Surely ll this trouble could be avoided by protecting the telephone and elegraph operators at the places where they worked. The proection of overhead electric light wires was becoming more and ore important. The difficulty of erecting overhead wires had lways held back the development of electric lighting. After all he necessary guards had been put up, the Post Office called upon hem to pay for putting fuses and heat coils on the telephone ires! On the Continent and in America they would see very ittle of guard wires. He had not used the neutral as a switch ire, but had momentarily removed the earth connection from the eutral to switch lamps on. The neutral should be well insulated, s at some time it might be necessary to work with the outer arthed. He asked whether insulated wire would be accepted by he Post Office as sufficiently guarded, so as to avoid the use of nsightly guard wires, and suggested that if No. 14 s.w.g. was oo small for electric light wires, it was too small for telephone ires.

Mr. S. Bartholomew said that fuses and guard wires were necesary because there was danger at two points; fuses would protect he apparatus, but not the public or the lines. The Post Office ccepted the simplest guarding, supplemented by fuses and heat ils. Until last year no lineman of the Post Office had been illed; and where the fatality occurred there were no guard wires. he devices shown would not protect telephone wires under the ne, unless fig. 4 was used, making a stiff cradle with the bights. ith recent progress in telegraphy stray currents had more rious effects than formerly, hence the connection to earth at ore than one point was objected to. Continuously insulated wires were not permanently satisfactory, but were accepted if hung from suspenders. In America it was a common thing to kill members of the public, due to the lack of such precautions as those of the Board of Trade. They had to be chary of making concessions, as vested interests were quickly built up on them.

Mr. Wilkinson said he regarded the publication of the paper as of great importance. He knew the difficulties experienced at Rawtenstall, and appealed to engineers to make overhead work as neat as possible.

Mr. Donkin said that split neutral services were very expensive. He had tried crossing the service wires, but that did not constitute a perfect safeguard. Would Mr. Trotter accept wire catchers fixed on the lower earthed wire? With regard to the spacing shown in fig. 4, he cited a case where two heavy feeders were run over two distributors, thus:



The wires A and B came into contact, and B fell.

Mr. Wigham said that the overhead wiring for lighting a village cost £75, and the guard wires £23; that was too heavy a tax. One way of guarding wires used for low-pressure work was to erect a fouling frame on the pole; this worked well with suspension insulators. It was difficult to make loop connections taut.

In reply to the discussion, Mr. Trotter agreed that the cross wire in figs. 7 and 8 had to be insulated from the earth wire, and that the earth wire should be efficiently insulated. He approved of the vertical arrangement of Mr. Chamen's mains, and agreed that fig. 9 did not comply with the 45°. There was also a risk of short-circuits. If the special insulated wire under trial by the Post Office for telephone wires over electric light wires proved satisfactory, it would be a help. The zig-zag system had been superseded. A vertical clearance of 12 in. was sufficient for fig. 15. The Board of Trade Regulations had always ignored continuously insulated wire, and required wires to be safe as if they were bare; but the Post Office experiments might change this. It had been proved that 230 volts A.C. was a fatal pressure. He did not care for the wire-catcher.

THE WIRELESS SOCIETY OF LONDON.

A meeting was held at the Institution of Electrical Engineers on January 21st to hear the presidential address of Mr. A. A. Campbell-Swinton. The address was largely experimental, and during the evening there was made audible and visible to the audience the reception by telephone and siphon recorder of the diurnal weather report from the Eiffel Tower; messages of congratulation and goodwill from Commandant Ferrié (Eiffel Tower), and the London Telegraph Training College (Earl's Court); and sundry violent and unintelligible messages from the Admiralty.

In commencement, the President congratulated the Society on its first two honorary members, Sir William Crookes and Sir Oliver Lodge. Sir William's memorable article on the possibilities of wireless, published in the *Fortnightly Review* in February, 1892, had proved an extraordinarily accurate prediction, and Sir Oliver Lodge was the first publicly to send signals, ring bells and deflect galvanometers by aid of Hertzian waves.

Only the extreme delicacy of receiving instruments, he said, had made wireless telegraphy possible. The reading of wireless messages by ear, particularly at high speeds, was by no means easy, hence special interest attached to various methods of recording messages. Manometric flames actuated by telephonic vibrations received on the diaphragm of a manometric chamber were extraordinarily sensitive, and it was easy by their aid to record, photographically, messages received by telephone. Alternatively the jumping flame might be used in conjunction with a thermal couple or a paper band treated with sympathetic ink. Signals might be recorded by photographing the spot reflected by a high-frequency moving-coil galvanometer. During the address numerous slides were exhibited to show records of messages made by every method described.

When using small aerials or receiving very weak signals on larger aerials, it was desirable to use some form of relay. The action of the Heurtley thermal relay, and of the Orling jet relay, was described briefly, and a number of most successful demonstrations were made with the Brown "A," "G" and "W" types of relays, the action of which was described in greater detail. In conjunction with these relays was used a Kelvin siphon recorder, the working of which was shown to the audience by means of an epidiascope lent by Messrs. Leitz. This was the first occasion on which was given such a public demonstration of recording wireless messages. To actuate the recorder, all three types of Brown relay were used in cascade, a telephone being connected to the "G" relay and the "W" relay being adjusted actually to break contact. The note of the Eiffel Tower signals being very low, the recorder showed ripples corresponding to each transmitting spark; special damping was required to eliminate such analysis. By chance the simultaneous arrival of signals from the Admiralty and the Eiffel Tower demonstrated beautifully the fact that the telephone discriminated between two messages of different acoustical pitch, whereas the siphon recorder gave a resultant curve incapable of analysis, and therefore unintelligible.

The Morse inker could be used to record wireless messages, but it should be arranged so that the inker circuit was broken when a signal was *received* (the magnets being placed *above* the armature so as to retain ordinary signals, viz., long and short black lines). Otherwise, the breaking of the inker circuit when a signal ceased actuated the relays, and thus caused the inker to work continuously like a trembler bell. Given a sufficiently large aerial or suitable relays, messages could be recorded by a phonograph. Phonograph records were very useful in practising reception at various speeds; this system was actually employed in the Marconi Schools. The action of Poulsen's telegraphone, and the sensitivity and application of the Einthoven galvanometer, were described and illustrated. The Einthoven galvanometer is sensitive to a power expenditure of one-billionth of a watt (1 second is about one-billionth of 3,200 years); the human eye could detect about one-sixth of this amount of power; photographic action had advantage only in respect of the cumulative effect obtainable by prolonged exposure. Lord Rayleigh had shown that the human eye and ear were of the same order of sensitiveness, and the telephone was of the greatest importance as a receiver of wireless messages. The actuation of whistles and organ pipes by wireless signals and relays was demonstrated, and the President stated that he contemplated the public announcement of time signals by this means from his own wireless installation. The checking of chronometers by observing coincidences between wireless and pendulum beats (see ELECTRICAL REVIEW, Vol. LXX, page 564 *et seq.*), was demonstrated; by this means it is possible to check chronometers within $\frac{1}{100}$ second—a point of great importance in navigation and cartography, &c.

In concluding his address, the President indicated briefly the difficulties in the way of realising long-distance wireless telephony, and surmised that trans-Atlantic telephony when realised would be wireless, while, in the not distant future, we might have public halls supplied with speeches, &c., by long-distance wireless telephony. It was difficult to imagine how efficiency could be secured in the wireless transmission of power, but no less than 7,000 H.P. per acre was received in the form of electromagnetic waves from the sun on a clear day, hence there was a substantial basis for hopes of future success.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

815. "Electric Resistances." H. Snowdon. January 12th.

840. "Manufacture of Cartridge-Cases." S. O. Cowper-Coles. January 12th.

841. "Manufacture for Use in Electrolytic Production of Metal Tubes and the Like." S. O. Cowper-Coles. January 12th.

842 "Means for Removing Metallic Cylinders from Mandrels on which they are Electro-Deposited." S. O. Cowper-Coles. January 12th.

843. "Process for the Manufacture of Hollow Iron Articles." S. O. Cowper-Coles. January 12th.

875. "Electric Cells and Batteries." Q. Marino. January 12th.

895. "Machine Telephone Switching Systems." Western Electric Co., Ltd. (F. T. Woodward, Belgium). January 12th. (Divided Application on 5,653/13. March 6th.)

900. "Self-Locking Electric-Lamp Holder." F. Cacha. January 13th.

901. "Construction of Electric Conductor Rails, Safety Guards, and Contact-shoes for Electric Railways, Tramways, and the Like." J. A. F. Aspinall. January 13th.

919. "Polarised Instruments." I. H. Parsons. January 13th.

925. "Electric-Current Controllers and Like Apparatus." G. Ellison. January 13th.

927. "Time-Controlled Electric Switches and Recording-Registers." H. B. McCabe. January 13th. (Complete.)

945. "Time Switches." J. E. H. Beraud. January 13th. (Convention date, January 23rd, 1913, France.) (Complete.)

953. "Switchboards." S. A. Green. January 13th.

963. "Electrically-driven Vehicles" Kalman von Kando. January 13th. (Complete).

967. "Machines for Generating Electrical Energy." H. Wade (C. T. Mason, United States). January 13th.

970. "Switches for Electric Hand Lamps and the Like." G. F. Hitzelberger and New British Ever-Ready Co., Ltd January 13th. (Complete.)

971. "Means for Locking Hand-Ropes for Lifts and the Like, by means of Electric Control" M T. Medway. January 13th.

973. "Telephones." C. B. Wilson. January 13th.

1,008. "Electric Switch." A. C. Greene. January 14th.

1,033. "Device for Supporting and Holding Telephonic Receivers when in Use." S. Scharff & I. Simons (commonly known as Arthur Simons). January 14th.

1,056. "Methods of Making Air-tight Joints Between Metal and Glass." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts-Ges., Germany). January 14th.

1,062. "Process for Manufacturing a Mass of Higher Oxygen Compounds of Nickel for Use in the Positive Electrodes of Alkaline Accumulators." Svenska Ackumulator Aktiebolagetungner. January 14th. (Convention date, January 16th, 1913. Sweden.) (Complete.)

1,119. "Electrical Accumulators." C. de Sedeneff. January 15th. (Divided application on 1,066/13. January 4th.) (Complete.)

1,133. "Insulating-Material." F. Rowley and Sanraine Syndicate, Ltd. January 15th.

1,137. "Plug Contact for Electrical Cooking-Utensils." H. Voigt. January 15th.

1,143. "Supports for Electrical Conductors or Other Purposes." Callender's Cable & Construction Co., Ltd., and C. W. Kay. January 15th.

1,154. "Circuit Controlling Apparatus." Western Electric Co., Ltd. (F. T. Woodward, Belgium). January 15th. (Complete.)

1,157. "Telephone Systems." Siemens & Halske Akt-Ges., E. A. Laidlow & T. Pettigrew. January 15th. (Addition to 18,498/12.) (Complete.)

1,158. "Apparatus for Recording Number of Telephone Calls." A. J. FitzGerald and E. G. FitzGerald. January 15th.

1,163. "Electric Dinner or Service Lifts." F. Hodgson. January 15th.

1,169. "Wireless Telegraph or Telephone Systems." W. H. Shephard and A. E. McKechnie. January 15th.

1,174. "Combined Starters, Dynamos, and Ignition Timers for Use with Internal-combustion Engines." G. R. Wadsworth. January 15th. (Complete).

1,176. "Contact-Clock Switch Device for Altering the Times for Switching." Allgemeine Elektricitats-Ges. January 15th. (Convention date, January 15th, 1913, Germany.) (Complete.)

1,181. "Method of Producing Movements of an Indicator or the Like in Electric Aparatus or Other Instruments." W. Lubach. January 15th. (Complete.)

1,187. "Two-Rate Electric Meters for Either Continuous or Alternating Current and with Prepayment or Not." M. Poinelli. January 15th.

1,227. "Dynamo-Electric Starting-Mechanism for Internal Combustion Engines." H. Lucas & W. C. Turner. January 16th.

1,228. "Dynamo-Electric Starting-Mechanism for Internal Combustion Engines. H. Lucas and W. C. Turner. January 16th.

1,238. "Electric-Current Regulators." P. Fincato. January 16th. (Convention date, January 16th, 1913, Italy.) (Complete).

1,241. "Metal Conduits for Electrical Conductors." R. N. Cunningham. January 16th.

1,248. "Resistance Apparatus for Electric Motor Starters, Rheostats, and the Like." W. Geipel and C. J. Margerison. January 16th. (Complete.)

1,252. "Incandescent Lamps." G. M. J. Mackay. January 16th. (Convention date, September 8th, 1913, United States). (Complete).

1,290. "Insulated Electrical Conductor for Signalling in Mines and Similar Places from Any Point on Length of Conductor." W. Harrison & F. J. Rae. January 17th.

1,295. "Electrical Resistances." I. Vilasto, T. Clark & W. Watson. January 17th.

1,319. "Support for Electrical Conductors." C. Hamilton. January 17th.

1,341. "Dynamo-Electric Machines" A. H. Midgley & C. A. Vandervell. January 17th.

1,347. "Metallic Compounds and Processes of Producing the Same." British Thomson-Houston Co., Ltd. (General Electric Co., United States). January 17th.

1,362. "Starting Rotary Converters." Phœnix Dynamo Manufacturing Co., Ltd., & R. Pohl. January 17th.

1,363. "Coin-Actuated Mechanism." R. C. Griesbach and Venner Time Switches, Ltd. January 17th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

22,036. Alarm Devices for Use with Wireless Telegraph Systems. W. H. Shephard and A. E. McKechnie. September 27th.

24,563. Electric Ignition Devices. W. Mordey. October 26th.

24,971. Electric Candle Lamps. H. Garde. October 31st.

27,310. Daylight Signal Lamp. A. J. Stevens, A. A. Lyon and Goldenlyte, Ltd. November 27th.

29,774. Electric Cable Connecting-boxes or Apparatus. British Insulated and Helsby Cables, Ltd., and R. W. Blades. December 27th.

29,839. Vacuum Valve Tube Rectifiers. W. J. Mellersh-Jackson (Caldwell). December 27th.

29,874. Device for Recording Telephone Calls. G. H. Parry. December 28th.

1913.

19. Gear for Electrically Operating Machine Tools and the Like. J. P. Hall. January 1st.

80. Electric Incandescent Lamp-Holders. S. W. Martyn. January 1st.

91. Coils, particularly Coils for Electrical Purposes, and the Method of Manufacturing the same. M. Helm. January 1st. (Convention date not granted.)

212. Casings for Electrical Switches. P. S. Turner. January 3rd.

316. Telegraphy. E. S. Heurtley. January 4th.

331. Processes of Electric Welding. G. Grüchtel. January 6th.

333. Sparking Plugs. J. H. Runbaken. January 6th. (Cognate Application, 15,587/13.)

974. Chemical Reactions in Gases by Means of Electric Arcs. J. Y. Johnson. (Badische Anilin & Soda Fabrik.) January 13th.

1,855. Electric Measuring Instruments of the Mercury Motor Type. British Thomson-Houston Co. and A. P. Young. January 22nd.

2,170. Electromagnetic Typewriters. J. Schnyder. January 27th. (January 29th, 1912.)

3,883. Automatic Transmitters for Telegraphic Signals. Creed Bille & Co. (Bille). February 14th.

4,091. Machines for Winding Coils, particularly Coils for Electrical Purposes. M. Helm. February 17th. (Convention date not granted. Divided application on 91/13. January 1st.)

6,891. Synchronous Dynamo-Electric Machines. E. Rosenberg. March 20th

7,059. Electric Incandescence Lamps. H. Zschocke. March 25th.

7,213. Trolleys or Collectors for Electricity. M. E. Drake and D. B Burnett. March 26th.

8,675. High Potential Electrical Insulators British Thomson-Houston Co (General Electric Co.). April 12th.

8,865. Electric Controlling Valve for Air-Brakes. H. Gallusser April 15th. (April 17th, 1912.)

8,964. Ignition Dynamos. C. T. Mason. April 16th. (Addition to 8,128/13

10,157. Form of Electric Annunciator and Circuit Changer. E. E. Moor April 30th.

11,579. Selector Arrangement for Several Stations Lying on a Commo Line. C. Beckmann & Akt. Ges. Mix & Genest. May 19th.

11,737. Spark Plugs. L. J. Dirand. May 20th. (October 29th, 1912.)

12,131 Electric Motor Control System for Machines with Reciprocatin Motion. "Vulkan" Maschinenfabriks-Akt. Ges. May 24th. (June 7th, 191

13,344. Advertising or Sign-Displaying Apparatus. K. Euker. June 9th

14,091. Casing for Pocket Battery Lamps. C. R. Zumpe. June 18th.

16,376. Coin-freed Prepayment Devices for Telephone Systems. Sieme and Halske Akt. Ges July 16th. (July 17th, 1912.)

17,927. Optical Pyrometers. Siemens Bros. & Co. (Siemens & Halske Ak Ges.). August 6th.

18,819 Electrically-Propelled Road Vehicles. E. Cross. August 19th.

20,912. Commutator Truing Devices F. G. Ludwig. September 16th.

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CABLES AND STRATEGY.

SINCE the laying of the British-owned Pacific cable in December, 1902, events have moved rapidly in the world of telegraphy; and the need for completing the girdle of the globe by a series of cables, all State-owned and State-operated, continues to be a matter of discussion throughout the Empire. It is a theme that can easily be employed to stir up healthy sentiment, for it suggests an effort to strengthen the ties between the scattered peoples of the King's dominions, and it leads naturally to a desire to improve the defences of the Empire by extending, widening and securing the lines of communication. In 1901, for example, the Ottawa Board of Trade addressed to various bodies representing trade and commerce, a circular letter expressing their conviction that—"The British possessions throughout the world should be directly connected by State-owned cables under the control of the Post Office." They urged that it would be the means of fostering trade and stimulating commercial activity, and that it would be "a bond of Imperial unity of inestimable value." This appeal was not in vain. Earl Grey, then Governor-General of Canada, paid a high tribute to Sir Sandford Fleming who, for a quarter of a century, had devoted his energies to cheapening the telegraph service of the Empire and to developing an all-Red cable system, when he expressed himself as being hopeful that the advocates of such a system would soon find their ideals realised. Good work was also done by Sir Charles Tupper and by Sir E. Sassoon in furthering this endeavour, and they succeeded in the praiseworthy task of securing communication between the Mother Country and British territories bordering upon the Pacific. It was a substantial beginning to an all-Red line; but there the scheme stopped. Almost 12 years have elapsed since that British Pacific cable was laid; and it remains—a link, and nothing more. It is reasonable to inquire whether that isolated link is to form part of a chain, or whether it is to be left as a reminder that in the twentieth century the Empire lacked statesmen of knowledge and force enough either to complete the work of the men who by common consent had a clear notion of how an Empire should be developed and defended, or to declare the work of those men to be misconceived and futile.

When sentiment is given its appropriate place—that is to say, when it is admitted as an impelling force, but not as a guide to policy—it has to be admitted that there are two sides to the question of constructing a universal network of cables all State-owned and State-controlled. The case, from the point of view of the convinced advocate of State control, is admirably summarised in an article in the current *Quarterly Review* by Mr. Charles Bright, but the article would have been considerably enhanced in value if the arguments of those in favour of private ownership had been stated and discussed more fully. Mr. Bright says that inter-Imperial telegraphy should not be regarded merely from the financial standpoint. He points out that the inland telegraph system of the United Kingdom is conducted at a loss, and he asks us to believe that the loss is justified by the advantages accruing to the public. He urges, in fact, that inter-Imperial telegraphy serves national, Imperial, and strategic ends, and that it acts as a powerful help to inter-Imperial trade. What the public really want to know, however, is why it is necessary to conduct State telegraphy at a loss, to what extent the loss is due to mismanagement, and to what extent it is the result of the evils of vote-catching by successive Governments. When the history of the loss is studied, it is seen to be but sorry evidence in favour of State-ownership. Fortunately the case for State-ownership can be placed upon firmer and higher ground, for there is no valid reason why State-owned cables should not be operated as successful commercial undertakings.

Mr. Bright uses the old argument of the strategic value of submarine cables with considerable effect, and there can be no doubt that this aspect of the matter deserves careful attention; but here, again, he leaves out of account some points of extreme moment. He rightly says that the mere fact that a cable is landed on British territory does not meet the important requirements of constant control, but he falls into the error of supposing that "such control is ensured by ownership and self-management alone." When contemplating a condition of war, as in this instance, the word "control" acquires new and vital significance. In war, ownership and self-management do not give control; in war, on the contrary, it is control which gives ownership, and it is defence alone that gives control. In other words, a State-owned cable would require defending no less, but perhaps rather more, than a private-owned cable. From the strategic standpoint, a State-owned cable has, nevertheless, exceptional value, for its landing places can be selected at points along a coast easy to defend; and, moreover, State ownership ensures that the precise route of the cable is known to the State, and that consequently, in time of danger, there is at least a chance to pick it up, where possible and desirable, and to transfer it, if necessary, to a landing place unknown to the enemy. There is good reason to study by every possible means to secure the financial soundness of any State-owned cable scheme that may be put forward within the Empire; for the cry is, as in the days of the early railway negotiations, that a monopoly has been given to private owners, and that the people are the victims of the bargain. If a State-owned cable is to be used fairly to break down an apparently unfair rate, it should itself be shown to be a financial success when working at the reduced schedule. Unless this criterion is applied, the project degenerates into the old game of vote-catching, which has made State ownership in general what it is.

Under modern conditions, it is probably not in time of war, but during the days or moments immediately preceding war, that cables and wireless telegraphy would have their main strategic value. In time of war we must be thankful if we have them working; but it would be prudent to reckon without them. The State-owned cables would probably carry us a few hours further into the stress of things than the private-owned cables, and their strategic importance would thus be greater. In the circumstances, therefore, it is remarkable that so little progress has been made with the all-Red scheme. It becomes even more remarkable when it is remembered that in December, 1902, the submarine cable industry was almost entirely in British hands. To-day the total length of submarine cables is about 280,000 nautical miles, of which 230,000 nautical miles are worked by private companies, and about 50,000 nautical miles by Government administrations. The State-administered cables of Germany, Spain, France, Japan, the Dutch East Indies, and the United States, together amount to rather more than 26,000 nautical miles; the Pacific Cable Board is accountable for 7,837 nautical miles, but Great Britain and Ireland own less State-administered cable than any one of the countries here-named. We may safely entrust this question of strategy to the Committee of Imperial Defence. It suffices here to have shown that if State-owned submarine cables are essential to readiness for war, Great and Greater Britain are at a disadvantage. A more cheerful view of the matter may perhaps be taken when the Dominions Royal Commission, which is now seeking evidence throughout the Empire upon this and allied matters, has completed its task; for, judging from the report so far published, it is doing its work in a very thorough-going manner.

THE COST OF A STRIKE.

At a time when the industry with which this paper is concerned is threatened with a Labour war, it may be useful to consider a few points which are not often brought to the minds of those engaged in the fray.

A strike may be disastrous to both masters and men, and should not be embarked upon lightly.

We often wonder whether the average working man is really very much concerned with the so-called "policy" of those who order him to throw down his tools and come out on strike. "You and I" take a certain amount of interest in politics. We rejoice or lament over the defeat or return of a particular candidate; but the victory or defeat—even of a Government—makes but little difference to our daily life. We fancy that, notwithstanding the reported speeches of the Labour leaders, the average working man is as little concerned with the agitation carried on by the officials of his Union.

When war is declared by the Labour leader, and a strike or lock-out supervenes, we are persuaded that five out of six workmen are reluctant to abandon regular employment and good wages. Although the agitator who makes his living by agitation does not dwell much upon the subject, the cost of a strike is great, and notwithstanding numerous endeavours at concealment, it is gradually becoming known to those whose wages are being continually taxed to provide strike funds. Let us look, for a moment, at a few of the items on the debit side of a Trade Union balance-sheet. When a strike commences the income of the Union, of course, is reduced, and it may come to a full stop.

To provide strike pay it becomes necessary to sell land or realise other investments. A forced sale generally means a low price. Nor do the strikers by any means recover in the form of strike pay the whole of their contributions to the Union funds. There is a continual drain on the exchequer even in the piping times of industrial peace. Offices have been built or rented regardless of expense. A secretary has been paid a handsome salary which, when joined with the perquisites of his office, enables him to make a very comfortable living. Numerous clerks, albeit they are probably not paid at Trade Union rates, have been drawing weekly emoluments for doing clerical work. Then the Union funds have been disappearing in other directions. Loans or gifts have been made to other Unions. Delegates have been sent to congresses, and their expenses, including the expenses of their lunches (the latter being, we understand rather a heavy item) have been paid. Finally, large sums from the Union funds have been devoted to political pro paganda purposes.

The whole cost of a strike, however, is not to be ascer tained by a glance at a bank pass book on either side o the conflict. There are many other items of expenditure or loss which, though not so apparent as entries in cash book, are none the less real.

A strike inevitably tends to encourage the use of labour saving machinery. The employer tries to get his own bac in one way or another. It also tends to divert orders. I it is known that there is no work being done at factory A owing to a strike, those who want electrical machinery wi apply to factory B, and if the goods supplied are suitab and the price reasonable, factory A may run the risk o losing a customer for good and all. An instance o "diversion of custom"—to use that phrase metaphorically ccurred in the recent Dublin strike. Carting goods has een the life work of hundreds of waterside characters in Dublin. Obedient to the orders of James Larkin, these men threw up their work or refused to handle tainted goods ome five months ago. What was the result? Anyone walking down Long Acre during the last few months of 913 might have seen the unwonted spectacle of brand new eavy motor lorries emblazoned with the names of well-nown Dublin firms coming forth from the premises of arious dealers. Those lorries have been shipped to the rish capital, to the permanent injury of the foolish men who have listened to the vapourings of an irresponsible gitator.

In "counting the cost" there is one other matter which the would-be striker would do well to bear in mind. Two great trikes have recently occurred in the United Kingdom in which the men have been hopelessly beaten. It has been hown that in the unskilled labour market, at any rate, a trike can be broken by a little determination on the part f employers. It may well be that the employers in other rades, profiting by the example of these other disputes, may etermine to fight to a finish whatever the cost. And there an be no two opinions as to what the end will be.

Central Station Salaries. The daily Press has been making more or less sensational "copy" during the past week on the prospects of London being without light and power, tramways and tube railways, onsequent upon the threatened strike of electrical workers. t has been led to adopt that course by information supplied o it by somebody or other to the effect that the central-tation men controlling the power stations would "in all robability support" the members of the Electrical Trades nion in the event of the latter downing tools. Only a mind that knew very little of the A.E.S.E. and of the men it represents could fall into such an error. And yet we ourselves confess to having been led last week into uestionings regarding the course adopted by the central-tation men. We cannot forget that the proceedings at he mass meeting of the E.T.U. last week began with the eading of two advertisements, one for an assistant ngineer for a hospital, and the other for an improver for switchboard, both carrying very absurdly low remunera-ion, and that the chairman said that "this is the thing he E.T.U. set out to combat in 1889." We may be per-mitted to question the accuracy of that statement—1889 s a long while ago. Nor do we forget either with what ounds of applause the mass meeting of workers received the nnouncement by a subsequent speaker, to the effect that he "Association of Electrical Station Engineers are going o collaborate and co-operate with the E.T.U. in any policy r method which may be deemed desirable to deal with this articular body of employers." Now we think that this was quite enough to mislead even ourselves as to what he central-station men were prepared to do in certain ventualities. We suspect that the terms in which the tatement was made were quite unauthorised, and that he E.T.U. was making the most of the prestige-giving onnection with the A.E.S.E. To some minds the act that the secretary of the A.E.S.E. seconded the mendment on the following night may have suggested hat the agreement between the two organisations was ot an imaginary one. We believe, however, that the ntention in the main was to get the masters' resolution ut of the way. That end was attained. The scale ssued by the E.T.U. included "shift engineers £3 per week." How many such men are members of the E.T.U.? The London Electrical Masters' Association Committee included several representatives of electric upply authorities (we learn that they have since etired), but London central-station workers were not properly represented in the hall, and the attitude was correctly taken up that the meeting was incompetent to deal with the terms and conditions of employment for such officials. This consideration doubtless influenced the secretary of the A.E.S.E. in seconding the amendment, but how the A.E.S.E. is going to act with authority in negotiating with the L.E.M.A. concerning wiremen's wages and conditions we fail to see. It is hardly for us to say what the A.E.S.E. should do under all the circumstances, but we may express the opinion that the Association stands to gain more for its members both in status and in remuneration, by continuing to pursue its original methods. It will do its cause little good by encouraging a sensation-loving Press to lead an impressionable public into believing that central-station staffs are going to leave the community without its electrical life-blood. London is not Paris, and our central-station officials would be ill-advised to follow the example of Herefordshire schoolmasters.

The Half-Watt Lamp. Our "Correspondence" columns this week afford ample evidence, not only that the arc lamp is not "dead," but that arc lamp makers are very much alive—and kicking. When we offered a welcome to the half-watt lamp, we indicated roughly the position that it would occupy in comparison with the flame arc, not with a view to disparaging the latter or suggesting its extinction, but rather to define the respective spheres of utility of the two types of lamp. We clearly stated that the flame arc lamp had the higher efficiency, and that where energy cost more than 1d. per unit the flame arc would be the cheaper, and we allocated to the half-watt lamp the lighting of streets where the flame arc would be too large a unit. Unfortunately, arc lamp makers appear to think that we have over-stated the merits of the half-watt lamp, and to suspect us of unduly favouring the latter. In point of fact, it is a matter of indifference to us whether one or other is preferred; provided that a lamp is *electric*, we are content, and as we do not wish to be forced into the position of "taking sides," we refrain from working up the case for the half-watt lamp, though, notwithstanding the excellent figures put forward by one of our correspondents for the flame arc, there is much that could be said on the other side. It will suffice for us to point to the great development already achieved with the one-watt lamp, and to remind our readers that local conditions will always have an important influence in deciding the choice of lamp, apart from efficiency and cost. There is plenty of room for both.

Mr. Solomon questions the validity of his own figures. We took these from the report of the discussion in the *Journal* of the Institution, which is usually submitted to the speakers for revision before publication, and as they were identical with our own report, we had no reason to suppose that they were hasty or unreliable; so far as we are aware, no one but the author has questioned their accuracy at the time.

As regards the "errors" suggested by Mr. Solomon, we did not lose sight of the points mentioned. The filament of the half-watt lamp is concentrated into the smallest possible volume, so that as a light-source it approximates to an arc, and using "suitable globes or reflectors" the half-watt lamp lends itself admirably to scientific distribution of the light according to the requirements of each case, without great loss of efficiency.

The cost of renewals was dealt with in the last paragraph of our note. Not only do we expect the life of the half-watt lamp in practice to exceed the average named by the makers, but also, in the light of past experience with all kinds of lamps, we look for reduction in the price as manufacturing conditions permit of it.

THE DEMANDS OF THE ELECTRICAL TRADES UNION.

By R. W. WEEKES, Whit. Sch., A.M.Inst.C.E., M.I.E.E.

As requested by the Editors, I have carefully studied the demands of the Electrical Trades Union, as recently issued, and compare them below with the rules which have been adopted by the Electrical Contractors' Association, and which bear the date, January, 1912.

To facilitate comparison, the two sets of rules are divided into sections and placed side by side, which enables the new demands of the Union to be easily seen.

In this article I propose to deal with wiring work only, as to widen the scope to "charge" electricians makes the field to be covered too large.

Working Rules for the Employment of Workmen by Electrical Contractors in the L.C.C. Area.

Adopted by the Electrical Contractors' Association.

Area.—The area under which these rules shall obtain is to be taken as the area covered by the London County Council.

Working Hours.—The recognised minimum working hours are those of the London Master Builders' Association, namely :—

The minimum working hours in Summer being 50 per week for 39 weeks.

During 13 weeks of Winter, commencing on the second Monday in November, the minimum working hours being 44 per week.

Wages.—The following are the recognised minimum rates of wages, and shall be observed as such :—

Charge hand	10d.
Ordinary wireman	9d.
Pipe fitter only	8d.
Engineer fitter	9d.
Electrical fitter	9d.
Cable jointers	9d.
Plumbers	11d.

Mate or general labourer, 6½d.

Charge Hands.—A foreman in charge of a minimum of four men shall be recognised as a Charge hand and paid as such.

Overtime.—Overtime shall be paid after a full day's work of 10 hours at the rate of time and a quarter up to 8 p.m., time and a half from 8 o'clock to 10 o'clock, and after 10 o'clock double time. On Saturday, time and a half from 1 p.m. to 4 p.m., after 4 p.m. and Sundays, double time. Christmas Day to be paid as Sundays. Each day to stand by itself.

Night Gangs.—Workmen engaged on a "night gang" shall be paid 1d. per hour in addition to the ordinary rate of wages, provided that workmen on a night gang shall not have been employed during the preceding day. The hours worked without overtime rates not to exceed 10 per day of 24 hours. Meal times during the night to be one and a half hours. Double time to be paid from Saturday midnight to Sunday midnight.

Travelling Time and Expenses.—Out-of-pocket expenses and extra travelling time shall be allowed to men when sent from office or works to the outlying job.

Payment of Wages.—Wages shall be paid on the job, but if otherwise arranged, walking time at the rate of three miles per hour shall be allowed to get to the pay table.

Electrical Trades Union.

London District Working Rules.

1. These Rules shall apply to all contractors, sub-contractors, and their workmen.

13.—The term "London District" to mean a 12-mile radius from Charing Cross.

2. Fifty hours shall constitute a week's work (excepting shift men), but when members are working on jobs where the hours are less, the money shall be made up to equal 50 hours a week. Nine hours shall constitute a day's work for the first five days of the week, and five hours on Saturday.

Rates of Wages.

5. The minimum rates of pay shall be in accordance with the following scale :—

Electrical fitter and wiremen	11d. per hour
Armature winders	11d. ,,
Cable jointers...	11d. ,,
Plumber jointers	1s. ,,
Joiners' mates	8½d. ,,
Meter fixers	£2 per week
Coil or magnet winders	9½d. per hour

All charge hands to receive a minimum of 1d. per hour extra.

	£	s.	d.	
Shift engineers	£3	0	0	per week
Switchboard attendants	2	5	0	,,
Accumulator erectors and attendants	2	5	0	,,
Power and dynamo attendants ...	2	5	0	,,
Arc lamp trimmers	1	18	0	,,

The total number of hours worked shall not exceed 56 per week.

3. Overtime worked on the first five days of the week to be paid for at the rate of time and a half for the first four hours, and double time after till starting time next morning. If the work continues after 12 midnight, the member shall be paid up to starting time next morning. Half an hour shall be allowed for tea, and one hour for supper if working after 12 midnight.

All overtime worked on Saturday and Sunday till starting time on Monday morning to be paid for at the rate of double time.

Each day to stand by itself.

No member shall be allowed to work more than one night in succession, viz., that after working one night members must cease work at the usual time of leaving work next day.

No member shall be allowed to work overtime unless absolutely necessary, when members in the district are unemployed.

4. Night-shift work to be paid for at the rate of time and a half, all time worked after nine hours to be paid for at the rate of double time.

6. All members (except inside workers) working over one and less than 12 miles from the shop to be allowed travelling time and third class ordinary railway fares. Country expenses to be not less than 2s. 6d. per day in England, and not less than 3s. per day in Scotland or Ireland. Travelling time and third class railway fares to be paid for the journey from shop to job and from job to shop.

Inside workers shall be allowed walking time for any distance under one mile, and not less than one shilling per day for over one mile and under three miles from shop. Not less than 1s. 6d. per day outdoor money to be paid and travelling time and third class ordinary railway fares allowed for any distance over three miles and under 12 miles from shop.

7. All members working on any dirty job must receive not less than 1s. per day extra. All members working on any dangerous job must receive 2s. 6d. per day in addition to outdoor money.

Members sent to work on jobs on the Continent of Europe must receive not less than 1s. 3d. per hour in addition to £1 10s expenses.

8. District Holidays to be:—Easter Monday, Whit-Monday August Bank Holiday, Christmas Day, and Boxing Day. N holiday shall entail more than two days' loss of time. Th rate of pay for Bank Holidays shall not be less than time and half, Christmas Day and Sundays not less than double time.

9. Payment of wages shall commence as soon as practicable afte the time of leaving off, and be paid on the job or place of employment; but, if otherwise arranged, walking time at the rate o three miles per hour shall be allowed to get to the pay table. An workman kept waiting for his wages beyond 20 minutes to receiv time and a half for all time kept waiting from the time of leavin off work. Not more than one day's wages shall be kept in han as back time.

Notice of Determining an Engagement.—One hour's notice to be given on either side. Weekly wage employés to give and receive one week's notice. Wiremen running casing to receive one hour's grinding money.	10. One hour's notice to be given on either side on determining an engagement. All wages due to be paid at the expiration of such notice, or walking time if sent to shop. Weekly employés to give and receive one week's notice. Members running casing to receive one hour's grinding money in addition to one hour's notice.
	11. Employers shall provide, where practicable and reasonable, the following conveniences:— (*a*) A suitable place for the workmen to have their meals on the works, with a labourer to assist in preparing them. (*b*) A lock-up where tools can be left. (*c*) A grindstone for the use of workmen. (*d*) The provision of proper sanitary accommodation. 12. Sub-letting for labour only to be prohibited.
Apprentices.—All apprentices shall be properly indentured for a term of not less than three years, and all improvers, after serving as apprentice and improver, or apprentice only, or improver only, a total term of seven years, shall be recognised as fully-qualified wiremen or mates, and be paid the full rate as such.	No corresponding rule.
Assistants.—On each job there must not be a greater total of mates, apprentices and improvers than the total of fully-paid wiremen and fitters.	
	14. All members working in shops where the conditions are better than this card demands must uphold the established conditions of the shop.

Rate of Wages.—It will be noticed that the Contractors' Association wages are given as minimum, and it is of interest to see how these, and those now demanded by the Electrical Trades Union, compare with the rates adopted by the London County Council. It must be remembered that this Council schedule what they believe to be the standard wages as agreed between the employers and the Union of the employés in the district in which the work has to be done.

The following schedule shows the three scales side by side:—

SCHEDULE OF WAGES.

—	Electrical Contractors' working rules, dated January, 1912.	L.C.C. schedules, 1907 and 1914.	Proposed by Electrical Trades Union.
Charge hand	10d.	—	1s.
Ordinary wireman ...	9d.	9½d.	11d.
Pipe fitter only	8d.	—	—
Engineer fitters ...	9d.	9d. to 9½d.	—
Electrical fitters ...	9d.	—	11d.
Cable jointer	9d.	9d.	11d.
Plumber's jointer ...	—	1s.	—
Plumbers	11d.	—	1s.
Mate or general labourer	6½d.	6½d.	—
Joiners' mate	—	—	8½d.
Armature winder ...	—	9½d.	11d.
Coil or magnet winder	—	7d.	9½d.
Hours of labour ...	50 hours for 39 weeks 44 hours for 13 weeks	54 hours	50 hours per week or equal money
Overtime first five days	10 hours' day, time and a quarter till 8 p.m., time and a half 8 to 10, after that, double time	9½ hours' day, 2 hrs. time and a quarter. 2 hrs. time and a half. after 4 hrs. double time	9 hours' day, time and a half for first 4 hrs., double time after till starting next morning; if after midnight, must be paid till starting time next day
Saturday...	1 p.m. to 4 p.m. time and a half, after that and Sunday double time		double time
Sunday		double time	
Night shift	1d. extra per hour	1d. extra per hour	time and a half

In my opinion, the "joiner's mate" in the Union's schedule is a misprint for "jointer's mate," and the wage asked, high for a labourer. In favour of the men it must be noticed that the schedule rates as accepted by the L.C.C. have not altered since 1907. In the same interval the other trades given in the L.C.C. schedules have gone up as follows:—

	1907.	1914.	Increase %
Carpenters	10½d.	11½d.	9.5
Plumbers	11d.	1s.	9.1
Smiths' fitters, hot-water fitters and gas fitters... ...	9d. to 10d.	9½d. to 10½d.	10.5
Engineer fitters ...	40s. to 43s.	40s. to 43s.	No change.

On the same basis the Electrical Trades men should be entitled to an increase similar to that obtained by the gas fitter, which is 1d. per hour.

I fail to see the grounds for the demanded alterations in overtime payments for the first two hours, as the present standard is accepted by most other trades. The demand for an increased rate per hour in the winter when, due to limited daylight, the working hours have to be reduced in building trades, in my opinion, makes estimating impossible. Also the demand for payment at double time for hours not worked if employed at all after midnight, is one that requires some modification. Thus, if the wireman stays until 1 a.m. to finish an urgent job, the Union asks that he should be paid for that hour 11s. On the other hand, it is not fair to turn a man off at 2 a.m. in London and expect him to start at ordinary rates at 6 a.m.

The night shift is not often wanted for wiring work, but there are cases where rewiring must be done after business hours. An increased cost of 40 per cent. seems to me to be prohibitive in such cases.

Grading.—The demands of the Union neglect the individual value of the employé, except in one small paragraph to the effect that a man receiving more than is now asked shall not be reduced when the wages of inferior workmen are increased. It is this difference in value which, in my opinion, has kept many of the best men out of the Union and enabled them to get now more than the standard rate of 9½d. per hour. The Union has suffered in two ways; first, by the lack of the support of these men; and, second, by having to pay the lower grade men unemployment benefits, as these men are naturally the first to be out when the wiring business is slack.

The London County Council rates recognise grading in trades such as hot water and gas fitting, and the subject is one which the Union could handle more effectively than the contractors, as its records should show what men by their superior knowledge of their trade can secure constant employment.

By establishing at least two definite grades, and taking care to admit only well-trained and responsible men into the upper grade, the Union would find its membership increase more rapidly than by a public attempt to get maximum wages for all, irrespective of the capability of the individual member.

Apprentices and Improvers.—It is through such training that the best workers are obtained, but this becomes absurd if the apprentices are not working with skilled men. The proper proportion of skilled men to apprentices and improvers should now be agreed definitely, and the contractor who evades such an agreement should be dealt with by his fellow contractors and by the Union. The pressure from fellow-contractors, supplemented by difficulties in obtaining skilled labour for special work when needed, should effectively check the infringement of the rule when settled.

To conclude the matter, it must be remembered that it is not the contractor who really finds the wages, but those members of the public who require electrical work done. Any increase is bound, after a few weeks, to raise the price of electrical installation work, and if the increase is unduly large, must reduce the quantity of work to be done.

In my opinion, a general increase of wages is warranted, but before it is given the following points should be settled, to ensure more harmonious working in the future :—

(*a*) The increase to apply equally to all employés, according to their grades, which at first might be assumed to be in accordance with their present wages.

(*b*) All contractors to accept this, and make a corresponding increase in their estimates.

(*c*) The proportion of apprentices and improvers to skilled workers on all jobs to be agreed.

(*d*) The contractors to deal strongly with any firm who cut prices by using only apprentices and improvers to do work.

(*e*) The Union to take up strongly the grading of their members, and to guarantee that the payment of a subscription shall not be the chief claim to membership.

I believe that speech-making is of no service whatever at the present time to either side, but that a small committee of men and employers, with an independent man as chairman, could settle the whole matter in a few hours. The representatives should be chosen because they are workers, not talkers, and the decision come to should be circulated as one document to all interested, without comment from either side. A ballot by post would prevent a recurrence of the speech-making, some of which, if reports are to be believed, has been equally discreditable to both sides. I believe that in this way a prompt settlement to the real interest of electrical business can be arrived at.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Half-Watt Lamp.

With reference to your Editorial notes in your issue of the 16th inst., we have heard so many times in our life that arc lamps are dead, that we have begun to doubt the possibility of their decease.

When metal-filament lamps were introduced we were told that enclosed arc lamps were doomed, though a few flame lamps might still be sold. That the demand for the enclosed type diminished is perfectly true, but the fact remains that we have sold very large numbers of them, and are still doing so.

The half-watt enclosed arc lamp as now made by us has equal efficiency and far better colour and lower intrinsic brilliancy than the half-watt metal-filament lamp, and as the life of these lamps can be put at least at ten years, with a nominal cost for repairs, with approximately the same initial cost as the half-watt metal-filament lamp, the latter is at a serious disadvantage. We should not like to ask our customers to buy an arc lamp every year, the maker of the half-watt metal filament must.

Of course, there is a public which says: "Hang efficiency," and only thinks of convenience and saving of trouble; even many central-station engineers use metal-filament lamps for outside shop lighting for this reason, when they ought to supply a lamp giving the most light at a minimum expenditure of energy, but you talk about efficiency, so cannot take up this position. The same short-sighted policy of some station engineers at the introduction of the metal-filament lamp has been the reason for many installations of high-pressure gas.

No metal-filament lamp lighting has yet been introduced giving results comparable to those of the best flame or enclosed arc lamps.

Referring again to the efficiency question, the metal-filament lamp generally gets so dirty that its efficiency is very much reduced, and we once heard an enthusiastic user, after declaring that he would not bother with the trimming of arc lamps, say that he cleaned his metal-filament lamps every day! He might just as well have spent his time in trimming arc lamps periodically only, and so have obtained a great gain in efficiency.

Even the man in the street has begun to notice the quick falling off in the brilliancy and the increased dirtiness of the globes in metal-filament lamps, more particularly for outside use.

For inside use where the matching of colours is under consideration, the enclosed arc lamp has nothing to fear from the competition of the half-watt metal-filament lamp.

We have mentioned the question of enclosed lamps particularly because it is obvious that most of the arguments in favour of these lamps are threefold more powerful when considering the flame type and the use of larger units.

per pro. **Engineering and Arc Lamps, Ltd.**
J. S. Hecht, *Director.*

St. Albans, *January 30th*, 1914.

With reference to your notes under our letter of the 23rd ult., on page 171 of your issue of the 30th ult., we would say that in taking the figures of Mr. Solomon's paper of nearly two years ago, for your comparisons of arc and half-watt lighting, you have omitted to take into consideration that the flame arc lamp of to-day is a great advance upon that of two years ago, and the comparison, therefore, is unfair.

The improvements in the present-day magazine flame lamp manufactured by us, as compared with its predecessors, are its higher efficiency (eight candles per watt), longer hours of burning (150 hours), complete freedom from deposits on globe interiors even after 300 hours, if required, the use of cheap and higher efficiency carbons, lower cost of maintenance, and chiefly in the formation of the polar light curve, whereby the greatest amount of light is given at a narrow angle from the horizontal, making for an efficient distribution of the light. This chief improvement has been brought about by, amongst others, the controlling of the special formation of the flame. A lamp as described above will give at 20° from the horizontal an actual net candle-power of eight candles per watt.

The costs of running a 400-watt lamp of this type for 4,000 hours per annum would therefore be :—

400 watts × 4,000 hours, at 1d. per unit ...	£6	13	4
34 trims, at 3d. per trim	0	8	6
Carbons, at ·125d. per hour	2	1	8
Interest on capital and depreciation, say ...	1	10	0
Replacements and attendance, say	0	10	0
	£11	3	6

For street lighting, therefore, it is quite admissible to regard this lamp as one of 3,200 candle-power, since this is given at the angle most necessary to increase the minimum illumination.

From these figures it will be immediately evident, by a rough calculation, that the half-watt lamp will bear no comparison whatever in point of cost for light delivered with the flame arc, presuming the same number of light units to be employed.

In comparing the two forms of lighting of flame arcs and the half-watt lamps, a further advantage accrues to the former, inasmuch as the polar curve of the latter is really unsuitable for street lighting.

We think you must be incorrect in stating that "the actual recorded average life" of the tungsten 1-watt lamps in street lighting is "several thousand hours," for on inquiry we are informed by one of the actual manufacturers that, at any rate for the high-candle-power lamps (which are those in question), the average life is 1,200 hours, and we cannot assume an average life of several thousand hours for the half-watt lamp when only 800 to 1,000 hours are claimed at present by the makers.

Since you mention the Holborn lighting as an example, we give below figures based on the same number of half-watt lamps having 1,000 hours' life each, instead of the 1-watt lamps actually employed, compared with 120 nodern magazine flame lamps of 400 watts consumption ach, at 30 yards apart, the minimum illumination of the atter being, we approximate, more than double that of the alf-watt lamps. Taking 4,000 hours of burning for each er annum, the costs would be as follows :—

Half-Watt Lamps.	£	s.	d.
0 ½-watt lamps 1,800 C.P., 72,000 units, at 1d. ...	£300	0	0
12 ½ watt lamps 400 C.P., 169,600 units, at 1d. ...	706	13	4
0 ½-watt lamps 1,800 (2,000) C.P., at 40s. each ...	160	0	0
48 ½-watt lamps 400 (600) C.P., at 24s. each ...	1,017	12	0
ttendance and cleaning, say 5s. each	58	0	0
	£2,242	5	4

"Oliver Pell" Magazine Flame Lamp.	£
120 400-watt lamps, 192,000 uni s at 1d.	£800
Carbons for 120 lamps, per annum, at ·125d. per lamp per hour ...	250
Interest at 5 per cent. per annum, and depreciation at 10 per cent. per annum on capital cost of, say, £1,200 ...	180
Trimming, at 8s. 6d. each	51
Replacements and attendance, at 10s. each ...	60
	£1,341

The saving by use of flame lamps, therefore, would be £901 5s. 4d. per annum.

As you will see, no interest on capital for lanterns, nor depreciation, nor breakage of lamps, &c., have been included in the case of the half-watt lamps, so were these items to be added, a still further saving could be shown by the flame arc lamp, and if "light for light" figures were taken, the saving would be enormously increased.

The more one thinks about the case, the more striking is the comparison in favour of the flame lamp, for the metal-filament lamp will admittedly have an average lower candle-power than its initial candle-power; and, further, if losses by absorption be considered, the comparison is still more striking.

We admit that the half-watt lamp will have its uses for side street lighting, where efficiency is of secondary importance, but we venture to repeat that where really efficient street lighting is required, it cannot possibly compete with the modern magazine flame lamp.

Trusting you will find space for so long a letter in your next issue,

Oliver Arc Lamp, Ltd.,
Wm. D. Pell, *Director.*

London, E.C., *February 3rd*, 1914.

I notice that in your issue of January 30th, in an editorial foot-note to Mr. W. D. Pell's letter, you quote, as authority for your comparison between the flame arc and the ½-watt lamp, some figures which I gave in the discussion on my paper on "Yellow Flame Arcs" in May, 1912. I would like to point out that these figures, which were given in reply to a point raised by one of the members, were worked out on the spot and do not therefore pretend to any great degree of accuracy; nor was it necessary in making a comparison between the flame arc lamp and the 1-watt tungsten lamp to figure the costs very closely, the margin in favour of the flame lamp being so very great.

It seems to me, therefore, unfair to use these figures as a direct basis for a comparison such as you made, and I think that in doing so you have fallen into two errors.

In the first place, if these lamps are to be compared as suitable light sources for street lighting, a comparison must be made on the basis of mean lower hemispherical candle-power, using in each case suitable globes or reflectors, a consideration to which I refer in the discussion which you have quoted, pointing out that the comparison on such a basis will be more favourable to the arc lamps.

The second error is to take my figures for the cost of lighting with one-watt tungsten lamps, and to convert these to figures for half-watt lamps by merely halving the cost of energy, omitting, therefore, to take into consideration the fact that the lamps themselves will be dearer, and the cost of renewals, &c., will undoubtedly be higher.

Maurice Solomon.

Witton, *February 2nd*, 1914.

[We refer to this subject in our leading columns to-day.—Eds. Elec. Rev.]

Continuity of Supply.

In reply to the letters of Mr. Watson and Mr. Nevill in last week's Review on the above subject, I should like to say that the misrepresentations of facts of which they accuse me, are hardly as glaring as they would have your readers believe. The facts upon which my first letter was based, I have every reason to believe are substantially correct. I enumerate them below :—

1. Bury.—It is admitted that the salaries paid by Mr. Watson, as stated in his letter, are quite up to the average, *i.e.*, 45s. to 50s. for shift engineers, but didn't he advertise for a shift engineer at 35s. only a few months ago? Upon this fact was my assertion made.

2. Wakefield.—Until some little time ago, the commencing salaries for shift engineers and switchboard attendants were 30s. and 10s. respectively; the fact that they are now 35s. and 15s. proves that things are looking up even at Wakefield, although seeing that the maximum load is over 1,500 KW., there is still room for improvement in the switchboard attendant's wages.

3. My grumble against the other concerns I mentioned was in reference to the practice of putting improvers in charge of shift in sub-stations where the capacity of the plant in many cases is from 2,000 KW. to 3,000 KW., and paying them the princely sum of 15s. to £1 per week.

In conclusion, I should like to assure Mr. Watson that I am not one of the down-trodden few, as I happen to be employed by a chief whose regard for the welfare of his men is at least equal to Mr. Watson's. I am, however, alive to the fact that the status of station engineers is not what it ought to be, and only by the united action of all shift-men, whether well paid or poorly paid, can we hope to succeed in improving their status.

Shift Engineer.

I read with interest "Shift Engineer's" letter in your issue of the 23rd inst., and heartily agree with all he says regarding the working conditions of shift men. But what about the working conditions of mains engineers? I am sure that if these men were to state their case, it would be found to be considerably worse.

The majority of mains engineers are required to locate themselves so as to be readily got at in case of emergency—many even having telephones in their houses. They are called out in all kinds of weather, at all hours, and have to do long spells without food. They also have to stand no end of abuse from consumers, &c.; their wages are little better than a shift engineer's, and they cannot be said to have any time of their own, while the shift men are at least free when off shift.

I know of a good many mains engineers in the employment of several large power companies in England and Scotland whose life is hardly worth living, and I should be pleased to hear them express their views on this subject.

While the A.E.S.E. has done a considerable amount of good work towards bettering the conditions of shift men, up to the present I have seen no attempt on its part to better the conditions of mains men. What this may be due to I cannot say, but perhaps Mr. W. J. Ebben will be in a position to explain.

One of Them.

London Electrical Trade Dispute.

The suggestion that the A.E.S.E. had thrown in its lot, or amalgamated, with the E.T.U. is without foundation.

The Press have greatly exaggerated the fact that the Hon. Secretary of the A.E.S.E., as a representative of employés at the London Electrical Masters' Association meeting, seconded a resolution proposed by a member of the E.T.U. (also a representative of employés), the gist of which was to refer the negotiations with regard to working rules and terms and conditions of employment of *all* electrical workers in the London district to the two organisations concerned, viz., the A.E.S.E. and the E.T.U.

Any statements with regard to future developments of the A.E.S.E. in conjunction with the E.T.U. are entirely premature.

W. J. Ebben,
Hon. Sec., A.E.S.E.

London, *February 2nd*, 1914.

The letter in your issue of last week, over the nom de plume "Employer," shows the spirit which makes the amicable settlement of differences between employer and employed impossible and so justifies Trade Unionism.

It strikes one very forcibly after the conciliatory tone of your leading articles that his statement that if the rules he mentions were drawn up with the idea of getting the men the sack they could not have been better, shows him to be of the type of employer who does not consider the welfare either of the trade or of his workers. Every man who judges the question impartially must admit that the wages paid in the electrical trade are scandalously low compared with other trades; personally, I am almost ashamed to say I am an electrician, though I like the line; but apart from comparisons with other trades, the increased cost of living is alone sufficient to justify the men in asking for an advance.

As to hours, I think 50 hours per week is the recognised rule for electricians and wiremen, and has been so for many years, at least by all the leading contractors. Perhaps he would like to tell us what he objects to in that; is it too many hours, or is it that he wants to keep his men as long as he likes without paying extra time? Or perhaps he has calculated that if he has three men and works them 12 hours a day instead of nine, he saves the amount of one man's State insurance.

"Dirty Money" is recognised by many employers and is perfectly justifiable in some cases, but it is a point that wants making clearer, or we may have wiremen spending their dinner hour up the chimney. Another rule that "Employer" objects to is on travelling expenses; he is at his best there. Just fancy a wireman following his work; he would need a caravan, and I suppose if he was on a job more than a couple of hours, he would have the police after him.

It seems to me only fair that a man should be paid his expenses, if he is sent a distance, and a shilling for time and fare for a three-mile journey isn't exorbitant. Another point about that is that it tends to keep work in local hands. The suburban rate of wages is generally lower than the London rate, as also are rent, rates, &c., and without any expenses to pay the suburban contractor could undercut his town rival every time, but if this rule is enforced he must either pay London rate or suburban rate plus expenses.

I have not seen the rules other than those in "Employer's" letter, and I am not in the Union. I am with you in hoping that this question may be settled without any trade disturbance, but if all the masters are like the one who wrote the letter quoted, we shall only obtain what is fair by combining.

C. S. Smith.

London, *February 2nd*, 1914.

Cost of Living in India.

In answer to a query on the above in your issue of November 7th, 1913, I may state that Calcutta or any part of Bengal is not exactly a health resort.

There are few comforts to be obtained except at exorbitant prices. A European has either to be a "sahib" or a "nobody," as there is no middle class here.

Your correspondent should see that his agreement is not one-sided, and that it can be broken on the payment of a penalty on either side. The minimum amount on which a bachelor should come out here is 500 Rs. (equivalent to £33 6s. 8d.) per month.

'Ad Some.

Calcutta, *January 13th*, 1914.

Protection or Tyranny?

In your issue of January 30th, I was particularly interested to notice, in Mr. Purse's letter, that he corroborates the statement one frequently hears at the present time—that so many orders for plant are being placed abroad, rather on account of the conditions under which members of the B.E.A.M.A. are willing to contract than on account of the high prices of British manufacturers.

If such be the case, then either the B.E.A.M.A.'s conditions are unfair, or the engineers and managers of our large public supplies are unwilling to depart from the conditions which previously existed—or both.

The question is not only of great importance to the electrical industry in this country, but is also of considerable interest to the general public (who, in many cases, are the real purchasers), and as most people, engineers and others alike, appear to be lamentably ignorant of the conditions desired or imposed by either side, it would be a great benefit to all parties if you could find room in your columns to publish the conditions of the B.E.A.M.A. as a basis for a general discussion.

Perhaps Mr. Purse would be kind enough to supply them?

Pollux.

February 2nd, 1914.

STRIKES AND CONTRACTS.

[FROM A LEGAL CONTRIBUTOR.]

THE prospect of a strike in the electrical trade necessarily causes the man who has contracts in contemplation or in progress to think of the precautions which may be necessary to avert disaster. His written agreement, of course, may protect him from being sued for a breach of contract which is really brought about by causes over which he has no possible control; but it may be said at once that in the absence of such protection he may be liable to serious penalties for delay, for it has been decided that where the contract makes no mention of strikes the mere fact of delay being caused by a labour dispute does not excuse a breach of contract. For instance, the charterer of a vessel, having undertaken to provide a full cargo of coals, is not excused by a strike of the colliers making it impossible to procure a cargo. Where, however, works have to be erected or machinery installed "within a reasonable time," it is conceived that the supervention of a strike might have effect to extend the reasonable period. In one case a bill of lading specified no time for discharge. During the unloading, a strike occurred which delayed the ship 25 days longer than otherwise would have been the case. In these circumstances it was held that the obligation on the consignees was to unload within a reasonable time, and the obligation was discharged if he unloaded in a reasonable time in the circumstances, assuming that those circumstances, so far as they caused delay, were not caused or contributed to by him.

It is of importance to know what is meant by the word "strike" in its legal sense. It has been clearly decided that a strike includes a stoppage which may have been more or less voluntary so far as the employer is concerned. Thus, a colliery company agreed to supply 4,000 tons of coal to one P. at the daily rate of supply of 16 tons. In the event of a strike the company was not bound to keep up the daily supply. A strike occurred owing to the company's workmen refusing to accept a reduction of wages proposed by the company, and this strike lasted for four months, during which the company delivered no coal. At the end of the strike P. refused to take any more coal. It was held that the strike was equally a strike although caused by a threat to lower wages; that the effect of the strike was merely to postpone deliveries; and that P. was bound to accept the coal remaining undelivered. It was also held that the delay was not such as to entitle P. to consider the contract at an end in the commercial sense (King *v.* Parker 1876, 34 L.T.N.S. 887).

Finally, it is useful for those who contemplate bringing pressure to bear upon a builder to know that he is generally well protected against strikes. For instance, the form of contracts approved by the Institution of Electrical Engineers contains this Clause (38) :—

> Provided always that if by reason of . . . . general or local strikes or lock-outs . . . . the contractor shall have been unduly delayed or impeded in the completion of the work, the engineer shall, on the receipt of a written request from the contractor, grant from time to time extensions, ... and such extensions shall be deemed to be in full compensation and satisfaction for every actual loss sustained, &c.

This clause will operate to protect the contractor who is affected by a strike similar to that which now threatens the electrical trade.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Cooking and Heating Apparatus.

Messrs. Krupka & Jacoby, Ltd., of Chapter Street Westminster, have recently issued a leaflet dealing with some new heating and cooking apparatus, for which they hold the sole agency in this country.

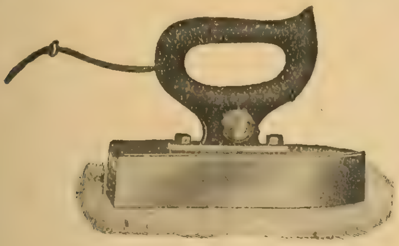


Fig. 1.—The "Perfect" Iron.

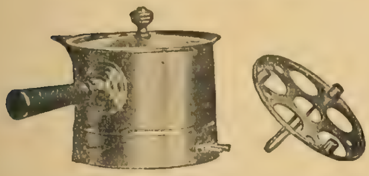


Fig. 2.—Cooker, with Egg-Boiling Attachment.

A variety of cookers, kettles, irons, &c., are listed, amongst which we may draw attention to the electric iron shown in fig. 1, which it will be noticed is fitted with a switch which enables current to be switched on or off locally, thus enabling it to be used with the minimum of trouble. Irons of similar type are supplied suitable for 100/120-volt and 200/250-volt, and are thus available for use on the majority of circuits.

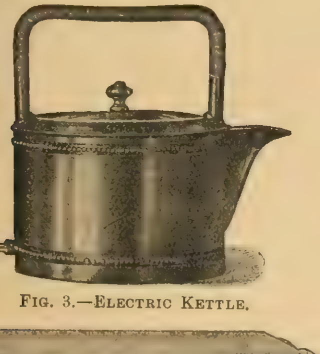


Fig. 3.—Electric Kettle.

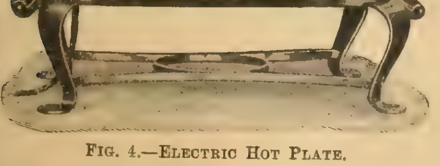


Fig. 4.—Electric Hot Plate.

We also illustrate a cooker with an egg-boiling attachment, a kettle made in either nickel or antique brass finish, and a hot-plate, 12 in. × 8 in. × 4 in. high, which are selected from amongst the apparatus mentioned.

A cheap water heater—the Munditi—is also listed, having a consumption of 200 watts.

A Street Lighting Fitting.

A new "Half-Watt" fitting employing the B T H. radial wave reflector has just been designed by the British Thomson-Houston Co., of Mazda House, Upper Thames Street, E.C. The reflector is made of stamped fluted steel, with a reflecting surface of white vitreous enamel. The upper surface is painted green. To accommodate the neck of the Mazda "Half-Watt" lamp, the reflector is fitted with a specially long gallery or housing. The fitting can be used with any form of street lighting post bracket or cable suspension equipment, and will take any size of Mazda "Half-Watt" lamp.

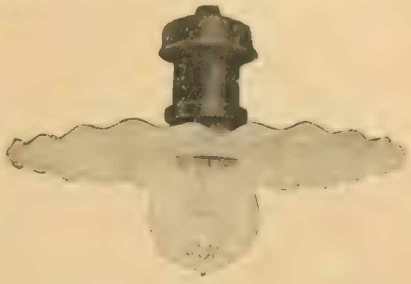


Fig. 5.—Mazda "Half-Watt" Lamp Fitting.

The radial wave reflector projects the maximum candle-power between the horizontal and an angle of 30° below the horizontal, and thus gives a fairly uniform illumination between the posts when they are correctly spaced.

The Ediswan "Downlite" Lamp.

We have received from the Edison and Swan United E.L. Co., of Ponder's End, Middlesex, particulars of their Royal Ediswan "Downlite" lamp, which is made with a separate close-fitting reflector (fig. 6), easily attacted and secured by an adjustable sleeve. The tungsten lamp filament is in the horizontal plane, in one continuous length, of grid form and spiralised, and the combined design of lamp and shade results in a concentration of the light downwards, as shown by the polar curve (fig. 7). While, it is claimed, increased light is obtained where it is frequently most desired, the opal reflector still gives a sufficiency of light in the upward direction.

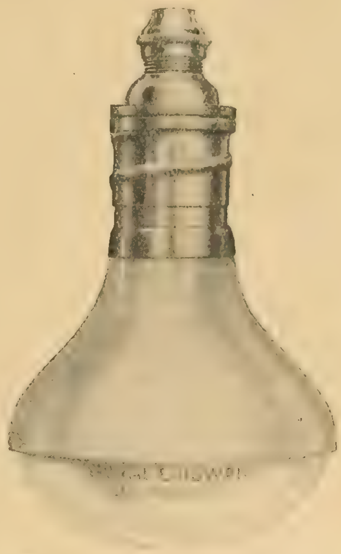


Fig. 6.—The "Downlite" Lamp.

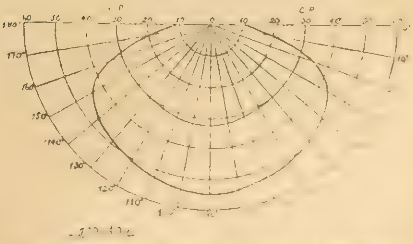


Fig. 7.—Polar Curve, "Downlite" Lamp.

The lamp and reflector can be placed at any angle required, and the lamp renewals are claimed to cost less with the separate reflector.

Credenda Heating Apparatus.

Fig. 8 shows the type of electrical heating unit arranged for use in the convectors manufactured by the **Credenda Conduits Co., Ltd.**, of Birmingham. The frame, upon which is mounted the heating strips, switches, terminals, and ruby lamps in the case of illuminated convectors, is of standard size, and is fixed in the case by the switch rings; clips are arranged in the convector cases to fasten the top of the frame.

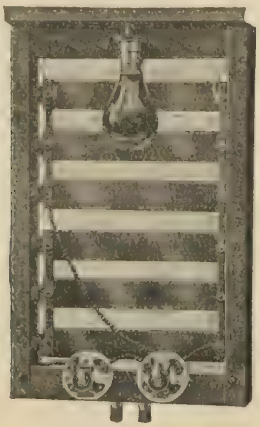


Fig. 8.—Credenda Heating Unit.

The Credenda heating strips are of nickel-chrome alloy wire wound on mica formers with metal ends; connections are made to screws insulated from the frame by steatite bushes.

The heating unit can be arranged for any standard voltage. It is only necessary to send the frame if a convector is required for another voltage.

The Wotan "Concentra" Lamp.

Messrs. Siemens Bros. Dynamo Works, Ltd., of Tyssen Street, Dalston, N.E., are introducing a new lamp called the "Concentra" Wotan lamp, with the filament arranged to give the maximum illumination in the downward direction; it takes 30 to 60 watts, at 90-260 volts. Fig. 9 shows how the filament is supported in the shape of a cone in a plain bulb; the same arrangement is employed in the lamp shown in fig. 10, which has a ribbed bulb and a white opal top, which further concentrates the light downwards, producing the distribution curve 2 shown in fig. 11, as compared with curve 1 for an ordinary lamp of the same voltage. The improvement in the polar curve for cases requiring a strong illumination is obvious.

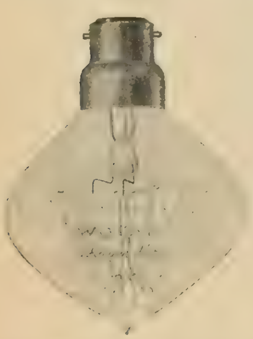


Fig. 9.—With Plain Bulb.

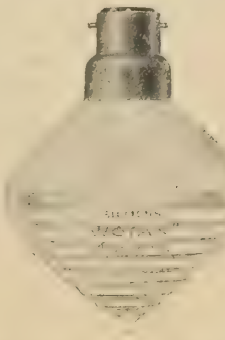


Fig. 10.—With Opal Top and Ribbed Bulb.

Wotan "Concentra" Lamps.

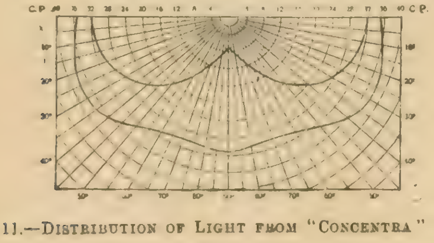


Fig. 11.—Distribution of Light from "Concentra" Lamp.

Osram "Axial" Drawn-Wire Lamps.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have brought out a lamp specially designed to give the maximum illumination in a vertical direction: as shown in fig. 12, the filament is arranged almost at right angles to the axis of the lamp, and an opal reflector fitting closely the upper half of the bulb, on which it is held securely by a brass ring, throws down the rays which would otherwise be expended in an upward direction. Thus a 30-watt 25-c.p. axial lamp is made to give nearly 50 c.p. immediately below the lamp, over an angle of about 60°. Where strong downward illumination over a small area is desirable, as over desks, tools, billiard tables, &c., these lamps should be found very effective.

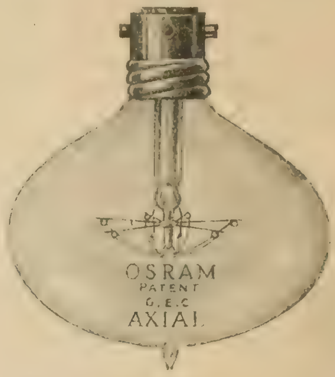


Fig. 12.—Osram "Axial" Lamp.

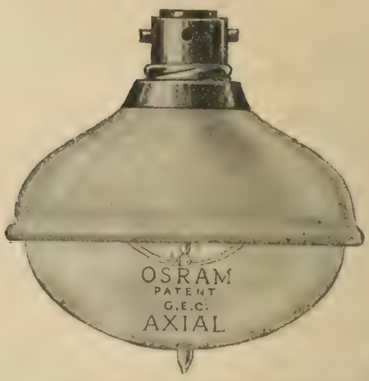
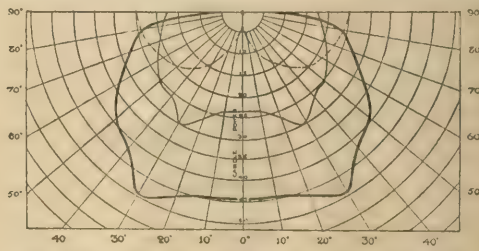


Fig. 13.—"Axial" Lamp with Reflector.



Curves shewing Light Distribution of 30 Watt. 25 c.p. Osram Lamps:—

- - - - - Osram Standard Lamp without Reflector

———— Osram Axial Lamp without Reflector.

———— Osram Axial Lamp with Reflector.

Fig. 14.—Polar Curve, "Axial" Lamp.

High-Speed Wireless.—High-speed demonstrations in wireless telegraphy were recently given by the Marconi Co. at their Clifden station, and were attended by representatives of the Post Office and Admiralty experts. The rate of speed maintained was 100 words a minute, which was, it is understood, the rate which the company had promised to demonstrate during these experiments. A further working was given at the remarkable speed of 145 words per minute.—*Financial Times.*

LEGAL.

Louis Schloss & Co. v. Cuzner.

In the City of London Court on January 27th, before his Honour Judge Atherley-Jones, K.C., a claim was made by Messrs. Louis Schloss & Co., electric lamp manufacturers, 3, Rangoon Street, Crutched Friars, against Mr. Everard Cuzner, 7, Park Road, Wimbledon, to recover the sum of £10 under a guarantee.

Mr. John Morley, plaintiffs' solicitor, said that in October, 1912, they were approached by the defendant with the idea of them employing a Mr. Cullen as their agent to receive and sell lamps in Brighton and the surrounding district. Some negotiations took place, and eventually the plaintiffs said they would not accept Mr. Cullen as their agent without some security for the payment of the lamps which they were going to supply to him. Some negotiations took place, and it was agreed that the defendant should guarantee Cullen's account up to £10. That was put into writing, and defendant wrote and said, "I shall be willing to guarantee his honesty up to, but not exceeding, £10." Cullen owed the plaintiffs various sums amounting to £22, and plaintiffs applied to him for payment, but there was no possibility of recovering it. As the intention of the parties was that the defendant should guarantee Cullen up to £10, the present claim was made.

Mr. Gubbins, defendant's solicitor, said that as there had been no dishonesty on Cullen's part the guarantee became inoperative, and therefore could not be sued upon.

Judge Atherley-Jones said he could not see how it was possible for the plaintiffs to go outside the written guarantee, and that unless there had been dishonesty, the plaintiffs could not recover.

Mr. Morley said that in his view there was an ambiguity about the documents, and there was a doubt as to the intention of the parties.

The Judge said he did not think there was much doubt about the meaning of the word "honesty."

Mr. Morley said that in his view the document was a guarantee on the defendant's part, in the event of Cullen not paying for the electric lamps supplied to him.

The Judge said that was not dishonesty.

Mr. Morley said he was not making any assertion of dishonesty against Cullen.

Mr. Schloss was called, and said when the arrangement was being considered between him and Cullen, the word "honesty" was not mentioned, and the form which the defendant had entered into was simply regarded as a guarantee, and not a provision against dishonesty.

The Judge said the plaintiff was trying to contradict the written document. Plaintiff wanted to alter the word "honesty" into meaning to guarantee Cullen's account.

Judgment must be entered for the defendant, with costs.

PARLIAMENTARY.

Standing Orders.

Considerable progress has been made by the Examiners of Standing Orders in regard to the Private Bills for the forthcoming session. In five cases there has been no appearance before the Examiners, so that the Bills drop. The only two which have any connection with electricity are those of the Brighton and Belfast Corporations, and these to only a very limited extent. The Brighton Corporation had a clause to extend the area of supply for electricity, whilst the Belfast Corporation wanted to borrow money for the laying out of certain lands which it took over when it acquired the Cavehill and Whitewell Tramways.

Newcastle-on-Tyne Tramways.—The Examiners have decided that the Standing Orders have not been complied with in the case of the Newcastle-on-Tyne Corporation Bill, which seeks to enable the Corporation to construct tramways in the Urban Districts of Long Benton and Weetslade, at a cost of about £60,000. The Bill will have to go before the Standing Orders Committee, which will decide whether it shall be allowed to proceed.

Sheffield Corporation Bill.—The Sheffield Corporation Bill, which seeks to extend the city area, was opposed by the Yorkshire Electric Power Co., and Mr. Cripps, for the petitioners, alleged that the notices were insufficient. By Clause 49 it was to be enacted that the local Acts, by-laws and regulations of the Corporation should apply to the extended portion of the city, and further, that the local Acts in force within the added area should cease to be in force. The Corporation could not extend their area without encroaching on the area of the company, and they were actually seeking to deprive the company of the statutory power which they had to supply in the area. Although the company were not at present supplying in the area sought to be included in Sheffield, they intended to do so when their mains were extended.

Mr. Jeune (examiner) found that the allegations were proved, and hence the Bill will now have to go before the Standing Orders Committee.

Yorkshire Electric Power Bill.—The following local authorities petitioned against the Bill of the Yorkshire Electric Power Co., alleging non-compliance with the standing orders:—The Corporations of Halifax, Huddersfield, Sheffield, Morley, Ossett, Leeds, Keighley, Doncaster and Rotherham, and the Urban District Councils of Horbury, Haworth, Southowran, Oxenhope, Slaithwaite, and Cudworth, and the Rural District Councils of Haworth and Cudworth.

The Bill contained a clause that notwithstanding anything in the Act of 1901, it should be lawful for the company to supply electrical energy for all purposes in the district of any local authority or any part of such district within the area of supply which at the date of the passing of this Act of Parliament did not form part of the area of any authorised distribution, and that for the purpose of affording a supply of electrical energy the company should have the power to break up streets and lay cables, &c.

Mr. Lees, on behalf of the Horbury U.D.C., said that the Bill was a first-class Bill, giving the company power to break up streets and roads, but no printed copy of the Bill had been deposited at the office of the memorialists as was required by the Standing Orders. He urged that proper notice was of the utmost importance to the road authorities, because the Bill would take away the protection given them by the Electric Lighting Acts.

Mr. Cripps, on the other hand, contended that the company now had power to break up the streets. The Bill allowed the old conditions with regard to the breaking-up of roads to remain, and the object of the Bill was only to give the company wider powers of supply.

The Examiner held that the powers sought were substantially new, and that the Standing Orders had not been complied with.

House of Lords' Bills.—Lord Donoughmore and Mr. Whitley, chairmen respectively of the Committees of the Lords and Commons, have, in conference with the Parliamentary agents, decided in which House the private Bills shall originate. Amongst those which will originate in the House of Lords, are the Bournemouth District Railless Traction, Bristol Corporation Tramways, Hightown Gas and Electricity, North and South Shields Railway, North Metropolitan Electric Power Supply, Poole, Sandbanks and Westbourne Railless Traction, Reading Corporation, Stone Gas and Electricity, and the Yorkshire Electric Power.

BUSINESS NOTES.

Fire-Alarm Successes.—Messrs. Associated Fire Alarms, Ltd., have sent us particulars of several recent instances of outbreak of fire which were so quickly announced by the automatic alarm installations (Pearson and May-Oatway systems) that serious consequences were averted.

Patent Restoration.—An order has been made for the restoration of patent No. 4,198 of 1905, for "Improvements in clutches," granted to J. H. Apjohn.

Book Notices.—*Handbook on Electroplating, Polishing, Lacquering, Burnishing, Enamelling.* Birmingham: Canning and Co. Price 2s. 3d. post free.—Messrs. Canning's well-known hand-book is now in its fifth edition, and contains 242 pages as compared with 207 in the last issue. We have on previous occasions emphasised the value of this handbook to the practical man; while it deals mainly with the firm's apparatus and supplies, it is not a catalogue or a price list, and the working instructions which are given are, in great part, perfectly general. Some 36 pages are devoted to the plating dynamo, vats, &c., after which the various metals are dealt with separately, the space allotted to the operation of electro-deposition amounting to nearly 90 pages. A chapter is given to the use of primary and secondary batteries—which are not recommended except for small jobs—and the rest of the book deals with the mechanical processes. Certainly it is a very useful work.

L'Année Electrique, Electro-thérapique et Radiographique of Dr. Foveau de Courmelles (Paris: Ch. Béranger; price 3 fr. 50) is now in its 14th year; as a record of interesting novelties in the electrical world—or worlds, for electricity nowadays has many spheres of interest—the work is unique. Naturally, with such a vast field of labour before him, the author may be excused for such little slips as "la municipalité de Marylbone Lane (Londres)," and Mr. "Wilmskurst," of Derby. He is equally at home with electric chickens and concrete poles; but his main theme is medical electricity, and to this two-thirds of the book is allotted.

L'Electricité Domestique. By Georges Mis. Paris: Dunod et Pinat. Price 2 fr. 50.—This is a "popular" book by an amateur, for amateurs; it deals mainly with the use of primary cells in connection with electric bells, and their installation, together with electric gas lighters, small glow lamps for occasional use, &c., and is illustrated with numerous diagrams of connections and cuts of apparatus.

Spon's Architects' and Builders' Pocket Price Book for 1914 (E. and F. N. Spon. Price 2s. 6d. net.) has this year been published without a diary, in order to afford space for additional matter. The prices are said to have been revised, and several sections have been extended, including the electrical section, which, however, only covers seven pages. As in previous issues, carbon-filament lamps are still included in the prices; several of the electrical tables are identical with those of the edition of 1910, and prices for electric lighting sets are based on the "16-c.p. lamp," which should, of course, be of the tungsten type, but, judging by the prices, is not. While some of the electrical tables are fairly correct, we must say that, on the whole, the prices given are misleading, being in many cases far in excess of the current values.

The Practical Electrician's Pocket-Book, 1914 (London . S. Rentell & Co. Price 1s. net), is 58 pages bigger than the last edition, chapters having been added by Mr. R. J. Wallis-Jones, on Electric Welding, and by Mr. F. S. Grogan, on Electric Heating and Cooking. Many other additions have been made, increasing the utility of the volume, which is now a well-tried and familiar friend, and needs no introduction.

The *Annuaire pour l'an* 1914, issued by the Bureau des Longitudes (Paris: Gauthier-Villars. Price 1 fr. 50 c. net), has been brought up to date, and contains special articles on international time and the deformation of images in field-glasses. There is also a mass of physical and chemical data, in addition to the usual astronomical tables.

In a communication to the *Journal* of the Institution of Electrical Engineers, Dr. T. F. Wall, who in 1912 showed how the circle diagram for the induction motor might be deduced from a consideration of the rotating fields due to the three-phase currents in the stator and rotor windings respectively, applies a similar method of treatment to the development of the circle diagram for the synchronous machine.

Nouveau Guide Pratique de l'Usager d'Acétylène.—By R. Granjon and P. Rosemberg. Paris: Office Central de l'Acétylène. Price 1 fr. 50.—This book is intended to bring together in a handy form for reference all the available information of practical value to the user of acetylene gas for lighting or heating. It is the second edition of a work issued a few years ago, which has proved very popular in France, where the gas is very widely used. As it is largely founded on replies to questions addressed to the authors by a vast number of users, there should be few difficulties met with in the application of acetylene to lighting and heating that cannot be solved by reference to its pages. Other applications are only briefly touched upon.

The Hill Publishing Co., of 6 and 8, Bouverie Street, E.C., who are just issuing a number of new electrical handbooks, have sent us their new catalogue of technical and scientific books, and will be pleased to send a copy to any of our readers.

"*Journal* of the Institution of Electrical Engineers." Vol. LII, No. 227. London: E. & F. N. Spon, Ltd. Price 3s. 6d.—The issue for February contains the following papers:—"Notes on International Standardisation of Electrical Machinery," by A. R. Everest; "Reactance and Reactance Coils in Power Circuits," by E. P. Hollis; "Electric Train-Lighting Systems," by T. Ferguson; "On a Variable Condenser with a Square Law," by W. Duddell; "The Theory of the Three-phase Synchronous Machine," by Dr. T. F. Wall; "Address to the Students' Section," by Dr. C. V. Drysdale.

"Practical Uses of the Wave Meter in Wireless Telegraphy." By J. O. Mauborgne. Price 4s. 2d. net. "Handbook of Electrical Methods." Compiled from the *Electrical World*. Price 12s. 6d. net. "American Electricians' Handbook." Compiled by T. Croft. Price 12s. 6d. net. London: Hill Publishing Co., Ltd.

"Sell's Directory of Registered Telegraphic Addresses." London: Business Dictionaries, Ltd. Price 25s. net.

"Lockwood's Builders' and Contractors' Pocket-Book, 1914." London: Crosby Lockwood & Son. Price 4s.

"Incandescent Electric Lamps and their Application." By D. H. Ogley. London: Longmans, Green & Co. Price 2s. 6d. net.

"*Journal* of the Society of Engineers." Vol. V, No. 1. January, 1914. London: The Society. Price 1s. 3d., post free.

"Charter, By-Laws and List of Members of the Iron and Steel Institute." Corrected to January 1st, 1914. London: The Institute. Price 1s.

"*Bulletin* of the Association des Ingénieurs Electriciens." Vol. XIII, No. 11. November, 1913. Liége: The Association. Price 7 fr. 50.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Spéciales." Vol. XVI, No. 2. December, 1913. Liége: Lahaye and Co. Price 1 fr.

Messrs. W. & G. Foyle, of 121 and 123, Charing Cross Road, London, W.C., have issued a new edition of their catalogue of technical books.

Catalogues and Lists.—MESSRS. H. W. BUTLER & CO., Craven House, Kingsway, London, W.C.—Two illustrated bulletins (8 pages). One shows electric traction motors, electric locomotives, motor winches, and other manufactures of the Jeumont Electric Plant and Cable Works; the other particularises Jeumont single, two, and three-phase variable speed motors and cables. The firm are sole agents for the Jeumont company.

MESSRS TURNERS & MANVILLE, LTD, Hopetoun House, Lloyd's Avenue, London, E.C.—Leaflet giving particulars, with illustrations and prices, of "Fiberene" buckets, which are claimed to possess electrical insulating qualities, to be lighter than wood, seamless, unshrinkable and non-absorbent, &c.

THE SUN ELECTRICAL CO, LTD., 118-120, Charing Cross Road, London, W.C.—Eight-page price list (Section 1) of incandescent electric lamps, including various makes of tungsten lamps and carbon lamps for lighting, also radiator, tubular, candle and battery lamps.

MESSRS. KRUPKA & JACOBY, LTD., 26 to 36, Chapter Street, Westminster, London.—Leaflet (H.C.A.) of four pages, containing illustrations and tabulated prices of electric cookers, warm-plates, kettles and teapots, also electric flat-irons, and water heaters for the manufacturers of which they are acting as sole agents.

THE CURZON STEAM METER CO., 18, Princess Street, Manchester.—12-page booklet (second edition) containing a full descriptive account of the Curnon steam meter, its principle of operation, uses, advantages, &c.

MESSRS. A. SEAGE & CO., Cambridge Switch Works, Hammersmith, London, W.—A number of illustrated and priced leaflets have been issued relating to Home Office bridge fuses, ironclad switches, fuseboards, accumulator and cinematograph switchboards, and knife switches.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—In order to avoid any possibility of their publicity literature getting out of date either in respect of design or price, the company have decided to issue quarterly "Progress" publications which will supplement the bound catalogues already in the hands of the trade and will give particulars of alterations and additions in convenient form. The object is to maintain continuity between the issue of one general catalogue and another. The first copy of "Progress" has just been received, and it brings the complete lists up to date to the beginning of October, 1913; since then other alterations have, of course, been made, and these will be announced in the next issue of the publication. Each notice in the present lists has a reference, printed in red, to the page in the catalogues to which the alteration relates. At the end a complete index is given to the catalogue page number, and the Progress sheet reference where information relating to any particular article may be found.

THE HOFFMANN MANUFACTURING CO., LTD., Chelmsford.—Eight-page circular No. 900, describing very fully their standard roller journal bearing, with sectional illustrations and tabulated sizes, prices and code-words. This short roller bearing is now listed for the first time, although the company have had such bearings running for over four years on heavy power station units.

THE A.E.G. ELECTRIC CO., LTD., 133-135, Oxford Street, London, W.—A collection of supply price lists in expanding binding cover detailing a variety of electrical manufactures, including fans, kettles and pots, radiators (luminous and convector types), electric irons, hairdresser's appliances, drawn wire and carbon lamps, carbons, flame arc lamps, boot cleaners, watertight fittings, electric signs, ½-watt lamps, &c. The lists are in an expanding cover, allowing additions to be made as issued.

ALLGEMEINE ELECTRICITATS-GESELLSCHAFT, Berlin.—Leaflets describing small rotary transformers, D.C.-D.C. and A.C.-D.C., for experimental purposes, giving ¾ and ½ ampere at eight volts, and a universal electric welding machine. Also pamphlet about the lighting of large workshops with flame arc lamps.

MESSRS. DAVID KILLOCH CO., 57, Murray Street, New York City, U.S.A.—Manual of wireless telegraphy and catalogue of electrical supplies and novelties.

Foreign Enterprise in Turkey.—A representative of a Viennese firm, who is an engineer, has recently been making several months' stay in Constantinople, and gives in the *Zeitschrift des Oesterreichischen Ingenieurs und Architechten Vereines* an interesting account of his impressions. Only scanty details find their way into publicity, he says, with regard to public works in the Turkish capital and Empire, and the Austrian Consulate has no engineer attached to its staff; therefore all news thence is more or less of a private nature and frequently unreliable. During his stay in Constantinople he has made it his business to investigate matters and submit comprehensive details, which, however, are not wholly exhaustive. His observations embrace town planning, water supply, sewerage, paving, buildings, bridges, navigation, wharfage, lighting, tramways, railways, telephones and sundry works, also irrigation schemes in Asia Minor. On the subject of lighting arrangements, he states that the present system (gas for Pera, in Dolma Baghtsché, and for Stamboul, in Jedikuli) is inadequate, and will shortly be replaced by electricity, the central station for which, at Silihdar, on the Golden Horn, will shortly be completed. The lighting of Scutari is in the hands of the Société du Gaz Scutari-Kadikeny, whose station is located at Courbali Deré, 3 km. from Kadikeny, but will shortly be shifted to Djadi-Boshan. With regard to tramways, the German Société des Tramways de Constantinople have suspended the horse traction on their lines Galata to Galata Serai and Chichli, Galata to Ortakeny, Emin Eunu to Top Capou, and Ak Serai to Yédi Koulé. The yearly traffic on these lines totalled about 10,000,000 passengers. On the other hand, the conversion of these lines to electric traction is making rapid progress, and before long the service between Pera (Tunnel Station) and Chichli will be opened. At Beschiktasch there is a temporary power station, which will later on be superseded by that of the Société Ottomane d'Electricité de Constantinople. Further, the following lines of the company have been sanctioned:—Ak Serai to Silivri Capou, Emin Eunu to Sirkedédji, Taxim to Dolma Baghtsché, Pancaldi Military School to Matchka, Férikeny to Azap Capou, Emin Eunu to Eyoup, and Ortakeny to Bébek. The constructive works for the Société d'Electricité were carried out by the French firm of Giros et Loucheur, and the erection of the works at Silihdar on the Golden Horn necessitated an expenditure of about 600,000 fr. On the line from Galatz to Ortakeny and Emin Eunu to Top Capou now run motor-cars owned by the Société d'Omnibus et d'Autobus.

With respect to the urban railways, the tunnel line from Galata to Pera has been for a long time worked by "The Metropolitan Railway of Constantinople from Galata to Pera." The traffic yearly is about 4,000,000 passengers. New urban railway schemes are being drafted by the "Chemins de fer Métropolitains de Constantinople et de sa banlieue," which company with others forms a traffic trust. An electric express line between Karakeny (Galata) and Rouméli Fener (Bosporus) is projected by the firm of Lenz & Co., of Berlin, plans and measurements of which have been published in No. 5 of the *Génie Civil Ottoman*, 1912. Ganz et Cie., Société Anonyme d'Eléctricité, of Budapest, also propose the construction of a line from Scutari to Kadikeny. As regards telephones, there is a network 40 kilometres in extent, underground, constructed by the Société Ottomane des Téléphones de onstantinople. With respect to the railways in the Turkish mpire generally there is little new to add. Their construction chiefly effected by the Régie Générale des Chemins de Fer et ravaux Publics, under its able head Otto Kapp von Gultstein, ho is ever active in surveys and plans for new lines in Armenia, esopotamia and Syria. Irrigation schemes in Asia Minor, ne construction of docks, &c., are carried out by the rm of John Jackson, Ltd., London, who have a branch the Place Chichané-Caracol, Galata, and by a French group, earson and Son and Fonquiau. Summarising his data, the writer oncludes with the statement that in Turkey France takes the ading place with about 3 million francs engaged; Germany is rging rapidly ahead with railways and other constructive works; hile England is little concerned to secure new concessions. A uotation from the *Deutsche Levante-Zeitung* is appended, which ncidentally reveals the feverish energy and lavish capital which ermany is dispensing in the "development" (*i.e.*, creating new dustries and supplying their machinery and other requirements) all forms of enterprise in Asia Minor.

Liquidations and Dissolutions.—The Stolz Elec-rophone Co. (London), Ltd.—By an order of January 22nd, Mr. . F. Whinney, of 4, Fredericks Place, Old Jewry, E.C., was ppointed liquidator in the voluntary winding-up of this company the place of Mr. E. Thorpe.

The Stolz Electrophone Co. (1913), Ltd.—A petition for ne winding-up of this company has been presented by Mr. A. yman, of 4, Heath Drive, Hampstead, shareholder and creditor, nd is to be heard on February 10th, in London.

The Globe Associated Cable and Telegraphic Services, td.—A petition for the winding-up of this company has been resented by various creditors, and is to be heard on February 10th, London.

The Ebro Light and Power Construction Co., Ltd. A eeting of creditors is called for February 10th, at Thanet House, 32, Strand, W.C., by the liquidator, Mr. R. H. Bentley. Claims ust be sent in by March 12th.

The Mexican Fuel and Power Co., Ltd.—A meeting will e held at Pinner's Hall, Austin Friars, E.C., on March 4th, to hear n account of the winding-up from the liquidator, Mr. R. C. F. hichester.

J. R. Cleworth & Co., electrical engineers, 77, Pear Street, alifax, Yorks.—Messrs. J. R. Cleworth and T. W. Howell have issolved partnership. Mr. Cleworth will attend to debts.

Messrs. Frederick Thompson and Hans Ochsenbein, trad-ng as Thompson & Co. at 15 and 16, Garlick Hill, E.C., as electrical nd mechanical engineers and commission agents, have dissolved artnership. Debts will be attended to by Mr. H. Ochsenbein, who ill continue trading at the above address under the title of "The eneral Cable Manufacturing Co.," for electric wires and cables, nd "Jeumont Copper Works," for drawn copper wires, commutator segments, &c. Mr. F. Thompson will trade at 48, Watling treet, E.C., as Thompson & Co., being London agent for the Yorkshire Cable Co., Ltd., and British agent for the Rex Meters.

Trade Announcements.—Messrs. Andrews & Co., 98a, St. Vincent Street, Glasgow, have been appointed sole agents or the Gleniffer Motors, Ltd., of Anniesland, Glasgow, for the sale f their petrol and paraffin electric sets.

Messrs. Humphreys-Davies & Co., of 5, Laurence Pountney ane, Cannon Street, E.C., announce that they have entirely evered their connection with the Machinery Users' Association Inc.). They have accepted the appointment of surveyors to the anufacturers' Association, Ltd., which has recently been formed or the purpose of advising users of machinery upon all questions onnected with the rating of tenants' machine tools and assessments upon mills and factory property for Imperial and local urposes.

The Resisto-Electrical Manufacturing Co., Ltd., have emoved from Walbrook, E.C., to 7, Gracechurch Street, E.C. New elephone No., "Avenue 6427" (2 lines).

Mr. John Richards, electrical engineer, whose head office is at urton-on-Trent, with branch offices at Leek and Longton, is bout to open an office in Macclesfield, at 34, Market Place.

Mr. George Sykes, for six years Yorkshire representative of he Union Electric Co., has severed his connection with this firm, nd has taken up a similar position upon the staff of the Phœnix ynamo Manufacturing Co., Ltd., Thornbury Works, Bradford.

The Midland Electric Manufacturing Co., Ltd., Birmingham, inform us that Mr. G. W. Humphreys has now ceased o represent their interests in South Wales, the agency having been ransferred, from the 1st inst., to Mr. C. W. Jordan, 23, St. Mary treet, Cardiff. The company have appointed Mr. C. Pegler, of bbeydale Road, Northfield, as their representative for the Midland ounties from the 1st inst.

The 150-Watt Mazda Lamp.—The B.T.H. Co. are ow listing a new size of Mazda lamp, taking 150 watts at 100-30 and 200-260 volts, to meet the demand for a lamp intermediate n size between the present 100 and 200-watt lamps.

Calendar.—A large wall calendar in metal has been eceived from Pirelli's, Ltd., of 144, Queen Victoria Street, E.C., ith a daily block of slips with large figuring in red. An interestng picture in colour will remind us that Pirelli tires are "sure f a good run."

New Works at Newport.—It is announced that the ritish Mannesmann Steel Tube Co. will shortly erect at ewport (Mon.) new works to employ 3,000 men. The cost of the uildings and plant is stated to be £750,000.

LIGHTING and POWER NOTES.

Aberdeen.—New Plant Started Up.—Members of the T.C. inspected the electricity works last week when a new 3,000-KW., three-phase, 6,600 volt turbo-alternator was started up. This machine runs at 3,000 R.P.M., and supplements a 1,[illegible] KW. turbo-alternator of the same speed. Three [illegible] KW. motor-converters have also been installed, to couple the A.C. and D.C. generating plant. Two ½-watt lamps have been installed in the power station.

Tramway Supply.—The Suburban Tramways Co. has agreed to the new arrangements by the T.C. for the supply of electricity, whereby the company is to take a minimum of 140,000 units per annum, at 1⅜d. per unit, on a five years' agreement from June next.

Accrington.—New Plant.—The Electricity Committee has decided to seek powers to borrow £33,530 for plant and extensions at the electricity works.

The electrical engineer has submitted a provisional tender for additional 2,000-H.P. gas-engine sets and other plant, amounting to £27,030.

The L.G.B. has sanctioned the borrowing by the Council of £2,500 for transformers in connection with the electricity undertaking.

Argentina.—The statutes of the Compania Eléctricidad de Corrientes, the Compania de Alumbrado Eléctrico de Rio Gallegos, and the Compania de Luz é Industrias Electricas have been approved.—*Review of the River Plate.*

Australia.—The agreement between Perth (W.A.) City Council and the W.A. Government, according to *Commonwealth Engineering*, stipulates that the latter shall build a 9,000-KW. (initial capacity) generating station, lay a ring main round Perth with the necessary H.T. switchgear and meters at not exceeding four points of delivery to the Corporation. The Corporation is to purchase all energy from the Government for 50 years, at a price not exceeding ¾d. per unit. The Government is not to supply within a radius of 5 miles from the G.P.O., and the Corporation has the right to supply in bulk to any Municipal Council or Roads Board. The Government supply will be three-phase at 6,000 volts and 40 cycles.

Bacup.—Street Lighting.—The Lighting Committee has decided that, provided satisfactory arrangements can be made with the Electricity Committee, the lighting of the main roads from Britannia to Bacup, and from Bacup to Waterfoot, be converted to electricity.

Barrow.—Street Lighting: ½-watt Lamps.—The T.C. has approved a large number of extensions to mains. It has also agreed to replace nine of the arc lamps in Michaelson Road with ½-watt tungsten filament lamps, placed alternately with the nine remaining arc lamps, so as to afford a comparison, and that, if the new lamps make it possible to improve the lighting without increasing the cost, the replacement of the remainder of the arc lamps should be proceeded with. The three-phase supply of electricity to the Furness locomotive works was reported to have commenced, and the works are now being entirely run by motors supplied from the Corporation mains.

Bawtry.—E.L. Scheme.—The electors have decided to support the E.L. scheme, introduced by Messrs. Best & Pullen, of Bradford.

Belfast.—Proposed New Plant.—The electrical engineer has reported to the Tramways and Electricity Committee that next December the normal load would necessitate the direct-current machinery for both tramway and lighting purposes, with the exception of one of the large units, being in operation simultaneously. As, in the event of one of these being out of commission, there would be no spare plant, he recommended the installation of a 1,000-KW. battery with boosters and switchgear. The matter was referred to a sub-Committee.

Bexley.—The application of the Foots Cray E.S. Co., Ltd., for a supply of electricity has been held over by the U.D.C., pending a settlement on the question of the extension of its plant.

Bispham.—The U.D.C. is objecting to the B. of T. against the granting of a prov. order for electric light to the Thornton Council.

Bradford.—An interesting point which is being tested in this city is the proposition that worsted yarn spinning by electrical power produces more even quality than is obtained by steam power. The electrical installations so far in the wool textile area hereabouts are mainly in the weaving sheds.

Bradford-on-Avon.—The clerk has reported to the R.D.C. that through a misunderstanding, notice of objection against the application by a company for a prov. order for E.L. had been filed, but when the agreement was filed, the Council's opposition would be withdrawn.

Braunton (Devon).—Proposed E.L.—An E.L. scheme for the village of Krowle, brought forward by Mr. J. Dennis, has been referred to the Lighting Committee, after favourable discussion by the P.C.

Brentford.—Workhouse Lighting.—The Engineering and Works Committee has instructed Mr. W. H. Massey to report as to the advisability of adopting E.L. at the Union buildings.

Bridlington.—The Electricity Committee has passed the following charges for electricity for heating and cooking purposes:—Up to 100 units per quarter, 2d. per unit; above 100 units per quarter, 1d. per unit.

Bristol.—School Lighting.—The Education Committee has decided, as each school needs re-decorating, to consider the question of having E.L. installed in place of gas.

Canada.—The estimated expenditure for 1914 at Edmonton includes $500,000 for extensions at the electricity works. A new power house, to contain one or two units, will probably be built. The estimated expenditure on the street railway system is $50,000.—*Canadian Electrical News.*

Chester-le-Street.—The Joint Hospital Board has decided to use electric power for the machinery and ironing at the laundry. The present machinery is to be adapted for the purpose.

Chiswick.—The E.L. Purchase Scheme.—The poll taken last week on the scheme for acquiring the undertaking of the Chiswick Electricity Supply Corporation resulted in a majority of 534 against proceeding with the Bill. Out of 8,000 electors, only 1,366 voted.

Colne.—The electrical engineer has reported that on account of the demand upon the Keighley Road cable, it was becoming necessary to proceed with the erection of a H.T. sub-station at Cotton Tree, but in the meantime it was essential to install a self-regulating booster at an estimated cost of £200. The matter was referred to a sub-committee.

Continental Notes.—Holland.—According to a return lately issued by the Koninklyl Instituut van Ingenieurs, there were 77 electric supply stations in Holland at the end of 1912, either completed or in course of construction, intended to supply current to 139 towns and villages. Particulars of only 52 were secured, 23 being owned by local authorities, and 29 by private companies. Steam forms the motive power in 33 of the stations, in 13 internal combustion engines are employed, while at six a combination of the two is in use. The total capacity of the 52 stations is 77,861 kw.

Russia.—The municipal authorities of Kieff have decided to acquire the electric lighting and tramway undertakings in the town from the concessionaires.

Among loans recently authorised, according to the *Board of Trade Journal*, are £116,400 for electric tramways, and £50,800 for electric supply extensions at Perm.

Germany.—On February 1st the new municipal power station at Spandau was started up, the bulk supply from the Berliner Elektricitä'swerke was discontinued, and the tariff was reduced 15 per cent. The Corporation is promoting a joint scheme in conjunction with neighbouring authorities.

The Prussian Minister for Railways has announced that, owing to recent improvements in electric train-lighting systems, all sleeping cars will in future be lighted by this means. Some of the ordinary coaches have already been equipped with electric lighting.

Roumania.—We hear that Messrs. Stone, of Dartford, are at present engaged in equipping a number of trains with their system of electric lighting for the Roumanian State Railway authorities.

Criccieth.—Proposed E.L.—The U.D.C. has decided to negotiate with the North Wales Power Co. for the supply of electricity. The Committee was authorised to consult an expert.

Deal.—The T.C. has decided to oppose the Deal and Walmer Gas and Electricity Bill. The Mayor said the Council would probably be able to obtain electricity in bulk from the colliery generating station at Tilmanstone, and ultimately from Snowdown, and distribute it on far more favourable terms than those proposed in the Gas Co.'s Bill.

Dover.—Public Lighting.—The T.C. has appointed a Sub-Committee to go into the matter of public lighting, and to consider the question of utilising electricity instead of gas. The agreement with the Gas Co. expires on March 31st next.

Dublin.—Annual Report.—The report of the Electricity Supply Committee shows that the net profits for the past financial year amounted to £7,767, compared with £11,670 in the previous year. The reduction is attributed to dearer coal and the effect of the Shop Hours Act. There was an increase of approximately 840,000 units sold. The coal consumed cost £17,483, as against £11,839 in the previous year. The Committee is strongly opposed to taking off the 10 per cent. added to the charges for energy three years ago. pointing out that the working expenditure is becoming greater each year, and the Council must face the provision of a reserve.

The Corporation has decided to oppose the Alliance and Dublin Consumers' Gas Co.'s Electric Supply Bill. The Bill authorises the company to supply electricity in Blackrock, Kingstown and Dalkey. The town clerk pointed out that if the Bill was passed in its present form, it might be taken as a Parliamentary declaration that the Gas Co. had power to supply electricity in all the gas areas, including the City of Dublin, and thus compete with the Corporation. Resolutions to oppose the Bill were also adopted by the Blackrock and Kingstown U.D.C.'s. The law agent of the former body pointed out that if the Bill passed in its present form, the company would be in a position to charge 8d. a unit for electricity. The Bill also provided for overhead mains and wires, while in the agreement between the Council and the Gas Co., overhead wires were only to be allowed in certain places.

Dundalk.—The first 10 months' working of the E.L. undertaking showed a deficit of £162; it is estimated that the undertaking will show a profit this year, and it will shortly be necessary to extend the power station to meet the demands.

Eastbourne.—Plant Extensions.—Reporting on the recent breakdown of two high-pressure feeders, the electrical engineer states that it will be necessary to lay one or two new high-pressure feeders from the works to the town, to construct two new sub-stations, and to enlarge six underground sub-stations; alter and add to the high and low-pressure switchgear in four or five existing sub-stations; extend the switchboard at the works; lay a new feeder to duplicate the supply to Willingdon and Hampden Park; and to provide additional fuse boxes and distributor cables in the shop district.

Elgin.—Proposed E.L.—At its next meeting the T.C. is to consider a motion as to the introduction of an E.L. scheme.

Ellesmere Port.—Proposed E.L.—The D.C. is considering an offer by Mr. E. P. Jones to supply electricity in bulk. Mr. Jones stated that he could supply current at about 1d. per unit, and the Council could retail it at 3d. or 4d. per unit. Inquiries have been made as to the probable demand for current, and the result is thought to be very satisfactory.

Haslingden.—Proposed Loans.—The T.C. has decided to apply to the L.G B. for sanction to borrow £7,200, made up as follows:—Mains, £3,700; services, £1,500; transformers, switchgear, &c., £2,000. The whole of the money is not to be spent at once.

Hebden Bridge.—On Saturday last a new 330-h.p. Diesel engine set at the Council's generating station was formally started up.

Hemsworth.—The R.D.C. has rejected an E.L. scheme submitted by Mr. T. Charlton, of South Elmsall, on the ground that a monopoly for seven years was stipulated for.

Holmer.—The B. of T. has informed the Hereford R.D.C. that the conditions attached to its consent to the Hereford T.C. supplying electricity to Holmer, cannot be regarded as reasonable, and the Board proposed to grant the Corporation's request. The conditions were that the Corporation would undertake not to have the parish incorporated in the city.

Holmfirth.—L.G.B. Inquiry.—The application of the D.C. for powers to borrow £7,500 for the provision of plant, and for approval to the appropriation of a portion of the market ground as a site for an electricity generating station, was inquired into by Mr. M. K. North on Tuesday, last week. A prov. order was obtained in 1912, and there was strenuous opposition by objecting ratepayers and the local gas company. Mr. Paddon, on behalf of objecting ratepayers, stated that the requirements of the law had not been observed in regard to the serving of notices on the owners of property adjoining the site for the generating station. He urged that the scheme only provided for a portion of the Council's area, and rather than go in for an electricity undertaking, it was the duty of the Council to utilise modern gas appliances for the improvement of the public lighting.

Ilford.—Loan Sanction.—The U.D.C. has received sanction from the L.G B. to a loan of £21,598 for the provision of a refuse destructor.

Knaresborough.—E.L. Scheme.—The D.C. has referred the E.L. scheme, which proposes the utilisation of the river Nidd to generate power, to a Committee for consideration.

Leigh.—Messrs. Courtauld & Co., the well-known silk manufacturers, are to build a new mill adjoining their present one, in which the 300 looms will be electrically driven. Two weaving and two cotton mills are also being erected, and are expected to favour the electric drive.

Leyland.—The U.D.C. has decided to oppose the Gas and Electricity Bill being promoted by the Leyland Gas Co.

Limerick.—The Corporation has referred to the E.L. Committee a letter from the L.G.B. stating that the latter cannot sanction a loan of £1,576 to meet a deficit on the working of the E.L. undertaking.

Liverpool.—Annual Accounts.—The income of the electric supply department on revenue account for the past year was £306,653, and the balance carried to net revenue account after providing for working and management expenses was £171.338. The estimated expenditure this year on capital account is £76.519. on reserve and renewal account £132,534, and on revenue account and interest and sinking fund £289,557.

Lytham.—A special meeting of the T.C. was held last week in opposition to the clause in the St. Anne's T.C. Improvement Bill, wherein the St. Anne's authorities ask for an extension from 1917 of its agreement with the Blackpool, Lytham and St. Anne's Tramways Co., for the running of the cars over the Lytham, as well as the St. Anne's areas. It was stated that St. Anne's was seeking to upset powers gained from the B. of T. after a three days' inquiry. The resolutions were carried.

London.—Bermondsey.—The B.C. is to petition against the Brighton Railway Bill. It is considered that it is open to serious objection, as none of the E.L. companies should be permitted to enter into agreements beyond the date when their undertakings are liable to be purchased.

Southwark.—The B.C. has decided to oppose the London Electric Supply Bill.

Fulham —The B.C. has approved the resolutions passed at the recent conference of municipal authorities owning electricity undertakings with regard to the proposals of the L.C.C. to further reduce the periods for the repayment of loans for electricity purposes.

Hammersmith.--The Electricity Committee has recommended the B.C. to lay a new cable to Hammersmith Road, at an estimated cost of £1,500.

St. Pancras.—The B.C. is engaged in a discussion with the L C.C. in regard to the period of repayments to be allowed on certain items in a loan of £9,843 for electricity purposes, applied for last October. The Council is advised to oppose the London Electric Supply Bill, and has decided to support the conference of municipal authorities dealing with the question of a bulk supply scheme.

Manchester.—Year's Output.—The total number of units generated at the Corporation's stations during 1913 was 136,820,180.

Merthyr Tydfil.—On the advice of the architect, the B. of G. has decided to have E.L. installed at Aberdare Industrial School; the estimated total cost is £490. Current will be taken from the Aberdare Council at power rates, and it is estimated that by installing a motor-generator the Board will save about about 1⅜d. per unit, against the cost of taking current from the Aberdare mains at lighting rates.

The T.C. has consented to the application for a prov. order extending the period for the compulsory purchase of the electricity undertaking for a further period of 10 years.

Oldcastle (Co. Meath).—Mr. L. J. Lawless, of Rathmines (Dublin), has been appointed consulting engineer in connection with the proposed E.L. scheme.

Reigate.—Electrical Exhibition.—The T.C. has decided to hold an exhibition of electrical appliances at the works on February 16th and following days.

Rochdale.—Two private companies have been registered during the last few days under the style of Tyre Yarns, Ltd., and Fabric Weavers, Ltd., and two new mills at Sudden and Castleton are to be erected forthwith. Each mill will occupy about 14,500 sq. yards. The new mills are to be run and lighted by electricity, and preliminary negotiations have been opened with the Rochdale Corporation for the supply of current. With the existing plant at Rochdale it would be impossible for the T.C. to do this, but when the extensions now in progress are completed, it will be in a position to cope with the large extra demand: land has, however, been leased to permit of a private generating station being provided if necessary.

Salford.—The Electricity Committee has adopted a report of the Works Sub-Committee, in which it is stated that, as the tests on certain turbo-generators show that they have failed to comply with the guaranteed efficiency relative to steam consumption, as provided in the contract, the whole of the plant should be rejected.

The Council is being recommended to amend the charges for lighting purposes, by abolishing, as from April 1st next, the existing concession, whereby users of current for power purposes are allowed to use current for lighting at the power rate up to 10 per cent. per quarter of their power consumption.

Stevenage.—The U.D.C. has decided not to oppose the N. Metropolitan E.P.S. Bill.

Sunderland.—Year's Estimates.—The estimates for the Corporation's electricity undertaking show that the year's revenue to March next will be £73,599, an increase of £4,055 as compared with the previous year. The working expenses are estimated at £35,132, and interest on, and redemption of, loans will absorb about £28,196. The estimated balance of £10,270 will be placed to the reserve and renewals fund, an increase of £1,836 on last year. The estimated output is 14,921,684 units, as against 13,592,621 units during 1912-13. The Electricity Committee suggests that the charge for incandescent street lamps should be reduced from 49s. to 46s. per lamp per annum, the same charge as is made by the gas company.

Tasmania.—The Hydro-Electric Power and Metallurgical Co. has been granted an extension of time to July 31th, 1915, in which to complete the works now under construction.

Taunton.—L.G.B. Inquiry.—An inquiry was held last week by Mr. A. G. Drury into the application of the T.C. to borrow £4,950 for extensions to the electricity undertaking. There was no opposition.

Uruguay.—The Board of Administration of the State electric power stations, has decided to undertake the works necessary for the supply of electric light and power to the districts of Colon, La Paz, and Las Piedras. It is expected that these services will be in operation within six months.—*Review of the River Plate.*

Venezuela. — Following the example of Caracas and Valencia, electric lighting is about to be introduced into several other towns in Venezuela. Among the places where concessions have lately been granted are Barcelona, Los Teques, and Ocumare.

Warrington.—The British Engine, Boiler and Electrical Insurance Co. is to be requested to prepare a specification for an electrical stoking installation at the Corporation gasworks.

West Yorks.—E.L. Proposals.—At its last meeting the Goole R D.C decided to support the application of the Yorkshire Electric Power Co., for powers to supply electricity for lighting purposes within its area. the Guiseley D.C. has resolved, before anything definite is settled, to arrange for a representative of the company to attend at its next meeting; the Halifax T.C. has resolved that the Mayor and the chairmen of the Finance and Tramways and Electricity Committees be instructed to take steps with a view to protecting the rights of the Corporation and giving it power to lodge a petition against the Bill; and the Gunthwaite and Ingbirchworth Council have decided to support the application.

The Leeds Corporation Parliamentary Committee has decided to present a petition against the Power Co.'s Bill, and the town clerk has been instructed to arrange a meeting of local authorities affected by the proposals.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. System.—The Tramways Committee has agreed to adapt four tramcars on the Mannofield route, and the cars on the Beach and Terry routes, to the P.A.Y.E. system.

Accrington.—The T.C. is to be recommended to apply to the L.G.B. for power to borrow £9,000 for extensions at the tramways depôt.

The three Corporations of Accrington, Rawtenstall and Haslingden, working the through tramway service between Accrington and Bacup, are in difficulty. They decided to accelerate the service to one of 10 minutes, but it was found, as compared with the former service, there was a great leakage in profits, amounting, in the case of Haslingden, to some hundreds of pounds. Haslingden was wishful, and Accrington willing, to revert to the 15 minutes' service, but Rawtenstall suggested if this were persisted in it might withdraw from the through running agreement. Rawtenstall, however, is influenced by the fact that the Lancashire and Yorkshire Railway Co. is competing with it by running a motor-rail service between Rawtenstall and Bacup.

Australia.—The returns of the Adelaide Municipal Tramways Trust for the year ended July 31st last show that 41,576,483 passengers were carried and 5,140,706 car-miles run. The total revenue was £309,642. The capital expenditure now stands at £1,350,710.—*Commonwealth Engineer.*

The annual report of the N.S.W. Tramways shows that the revenue was £492,830, an increase of £41,840 as compared with the previous year, and the expenditure £445,476, an increase of £37,817. Some 81 million passengers, an increase of 6 millions, were carried.

Barking.—The U.D.C. has accepted the terms of the Ilford U.D.C. for leasing the tramways from Loxford Bridge to Broadway.

Bingley.—New Tramways.—The extension of the Bradford Corporation electric tramways from the Nab Wood terminus to Bingley was formally opened on Tuesday. The extension is not quite complete. The remaining portion, from Bingley to Cross Flatts, towards Keighley, has had to be delayed in construction by difficulties in regard to road widening.

Bradford.—Railless Traction.—The Tramways Committee has decided to proceed with the equipment of railless traction systems on the following routes:—Odsal to Oakenshaw; Bankfoot to Dudley Hill; Laisterdyke to the "Junction," Bolton; Peel Park to Little Horton, and Forster Square to Bolton Woods, *via* Canal Road.

Burnley.—The Tramways Committee has decided to recommend the Council to authorise the carrying out of alterations at the car-shed at an estimated cost of £3,100.

Canada.—The Barrie (Ont.) Council has been authorised to construct an electric railway between Barrie and Midhurst.—*Canadian Electrical News.*

Continental Notes.—Norway.—An electric railway has been projected for some years between Trondhjem and Yonsvandet, and a survey of the route is now being made, probably with a view to its construction at an early date.

Sweden-Denmark.—It is reported from Stockholm that two Danish engineers have submitted to the Swedish and the Danish Governments a simultaneous application for a concession to construct a railway tunnel under the Sound between Zeeland and South Sweden. According to the plans, the tunnel would start from the island of Amager, outside Copenhagen, and run to the central railway station at Malmö, *via* the small island in the

Sound, the Saltholmen. The railway would be worked by electricity, and would be single track, except at the island, where a passing place would be provided. The estimated cost is five million pounds.

Bavaria.—A concession has been granted for the construction and operation of an electric rack railway to the summit of the Zugspitze (2,963 metres above sea level), the highest mountain in Germany.

Dublin.—An agreement was arrived at in the Recorder's Court, Dublin, on Friday, fixing the valuation of the Dublin United Tramways Co. at £41,000, for three years from January 1st, 1914.

Twenty persons were injured last Sunday owing to the capsizing of a tramcar.

East London Railway.—Speaking at the annual meeting of this company, Lord Claud Hamilton reviewed the seven months' working by electricity, pointing out that the expenditure, on converting the line, had amounted to £82,000; the average increase in monthly revenue during the period had been £440, but the November receipts were up £616, as compared with November, 1912. The number of passengers carried for the year ending October 31st was 4,869,000, as compared with 4,261,000 for the previous year.

Edinburgh.—Petrol-electric 'Buses.—After experimenting with various types of motor-'bus, the Tramways Committee has decided to recommend that single-decked 'buses be adopted, and to place orders for three petrol and three petrol-electric Tilling-Stevens 'buses.

Hull.—Proposed Loans.—The Corporation Tramways Committee proposes to apply to the B. of T. for a loan of £17,000, half the total cost, for the establishment of workshops and the necessary plant. The question of finding the balance is referred to the Finance Committee.

Indian Railway Electrification.—The probable cost of the electrification schemes in the Bombay area is put at £781,000, and it is estimated that electrification will bring about 9 per cent. additional traffic, worth £70,000 a year. Running expenses are estimated to show an annual saving of £5,158. An overhead trolley system is preferred, on account of the habit of the natives of walking on the tracks. The lines concerned are the Bombay, Baroda, Great Indian Peninsula and Port Trust Railways.

Ipswich.—Electric Vehicles. — For the past six months the electric supply department has been working up interest in the electric vehicle; this campaign was brought to a climax by a demonstration of a ½-ton Edison delivery van and a two-seater Edison run-about, which, by arrangement with the department, Messrs. Edison Accumulators, Ltd., sent down for the purpose. The amount of interest aroused exceeded the most sanguine anticipations of the department, and it is hoped that some of the firms that have been impressed will shortly become purchasers.

Kingston.—The town clerk has been instructed, in connection with the portion of the L.U.T. Co.'s Bill relating to the running of trailers, to ascertain whether the company would be prepared to include a clause excepting the borough from the operation of this section, as the Council is of opinion that they would be dangerous.

Liverpool.—Annual Accounts.—The Corporation tramway accounts for the past year show that the total revenue amounted to £690,899, traffic expenses absorbed £180,226, general expenses £61,361, and general repairs £121,185, leaving a net revenue of £244,101, which was increased by other items to £268,322. This sum was dealt with principally as follows:—Interest, £48,971; rent of leased lines, £4,869; sinking fund contributions, £60,310; contribution in aid of general rate, £100,000; and reserve, renewal and depreciation account, £54,163. The estimated expenditure on revenue account for the current year totals £598,752, being £54,973 in respect of interest, £63,779 in sinking fund, and £480,000 working expenses; on capital account £57,453, and on reserve, renewal and depreciation account £140,500.

Application is to be made to the B. of. T. for sanction to borrow £18,000 for the provision of additional tramway cars.

Middlesbrough.—Last week the Imperial Tramway Co. introduced a service of motor-'buses in connection with the tramway service between the Royal Exchange and Grove Hill.

Midland Railway Electrification.—According to the *People* the Midland Railway has decided to electrify its lines from St. Pancras to Hendon.

Nelson.—Railless Traction.—The Tramways Committee has decided to recommend the Council to adopt a railless traction scheme for the Walverden and Southfield districts.

Northampton.—The Tramways Committee has recommended the Corporation to refuse the offer of the Northampton E.L. and P. Co. to supply electricity for tramway purposes at ¾d. per unit for a specified term of years, or to accept £350 for a stand-by of 200 kw., and energy as might be required at ¾d. per unit.

Reading.—Railless Traction.—A poll of the ratepayers has sanctioned the extension of the tramways to the annexed portions of the borough, and the provision of supplementary services of railless trolley-cars and motor-'buses to Caversham and Tilehurst.

Sunderland.—Estimates.—The estimates approved by the Tramways Committee for the year ending March next put the total income at £74,864, as against £68,871 in 1912-13, and the net profit at £14,394, as compared with £11,293. The working expenses were estimated at £42,622, leaving a gross profit of £32,242. For the payment of interest on loans £6,837 is appropriated, and for repayment of loans £9,948. It is proposed to give £5,000 to the relief of the rates, and to allocate £9,394 to the reserve and renewals fund.

Uruguay.—It is reported that after lengthy negotiations, the Government is now disposed to sanction the electrification of the Tranvia del Norte, which in 14 years reverts to the State.—*Review of the River Plate.*

U.S.A.—A census lately taken of the users of electrical motor vehicles in New York shows that such machines are being employed in no fewer than 74 different trades. Brewers head the list with 19 firms and 322 vehicles, departmental stores following with 17 and 262 respectively, parcels delivery companies with 7 and 197, bakers with 8 and 154, and central electricity stations with 2 and 127.

It has been decided to electrify 113 miles of main line in the Rocky Mountains, on the Chicago, Milwaukee and Paget Sound Railway. The line will be operated on the 2,400-volt direct-current system, with overhead trolley construction; current at 100,000 volts A.C. will be transmitted to five sub-stations of from 3,000 to 4,500 kw. capacity. The electrification will correspond to that adopted by the Butte, Anaconda and Pacific Railway.

TELEGRAPH and TELEPHONE NOTES.

German Colonies.—It was recently found practicable to communicate between the Nauen station, near Berlin, and Togoland, and it is now stated that the German Imperial Post-Office authorities have granted a concession to the Telefunken Co. to work a wireless connection between Germany and the African Colonies. The connection is conceived in the sense that messages are first to be sent from Nauen to Atakpame station, Togoland; then forwarded to the Duala station in the Cameroons, and thence to Windhuk, in South-West Africa, whilst the traffic to Tabora station in East Africa is to be dealt with through the intermediary of the station in the Cameroons. It is said that these arrangements will render it possible for telegraphic communication with the German protectorates to be effected independently of foreign companies in the future. It is expected that the service between Nauen, Atakpame and Windhuk will be opened for public use in the second half of the present year, whilst the construction of the Tabora station in East Africa is to take place next year. The shares of the Telefunken Co. are in the possession of the A.E.G. and the Siemens & Halske Co.

Manchester and Liverpool.—Arrangements came into force on February 1st, according to which telephone subscribers in Manchester and Liverpool are enabled to obtain speedy connection without the formalities attending a "trunk" call, the two areas being in fact treated as one.

High-Speed Telegraphy.—The Postmaster-General has appointed a Committee to inquire into systems of high-speed telegraphy and to report thereon. The Committee will consist of Captain Norton, M.P., Sir John Gavey, Mr. John Lee, Mr. W. M. Mordey, Mr. A. M. Ogilvie, Mr. W. Slingo, and Mr. A. B. Walkley. Anyone desirous of giving evidence before the Committee should communicate with Mr. G. O. Wood, Secretary's Office, General Post Office, who has been appointed secretary to the Committee.

Wireless in Surveying.—An important frontier survey under the command of a British officer has been completed in Bolivia with the aid of wireless telegraphy, which was used to receive time signals from Porto Vallo, 120 miles from the base of operations. By this means it was possible to fix longitudes accurately without depending upon chronometers.

Wireless on Board Ship.—During the second half of 1913 the Marconi International Marine Communication Co. equipped an average of one fresh ship per day with wireless apparatus, thereby bringing the total number of vessels so far handled up to approximately 1,800 at the end of 1913, this figure being exclusive of warships.—*Financial Times.*

Some new steamers built on the Clyde have been fitted with installations of the Siemens "quenched-spark" system of wireless telegraphy. The guaranteed ranges are 200 miles by day and 330 miles by night.

Brazil.—A decree has been granted authorising Senor Américo Demaria to establish a public telephone service in Posadas, Santa Ana, San Ignacio, Apostoles, Concepcion, and adjoining towns. The term of the concession is for 30 years.—*Review of the River Plate.*

New Cable.—A new four-wire cable has been laid between Germany and England for telegraphic purposes, from Mundesley, in Norfolk, to Emden. The cable is 274·287 nautical miles in length, and has a total weight of 180 lb. copper per nautical mile. The gutta-percha covering is 150 lb. to the nautical mile.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney (New South Wales).—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

March 2nd. Sydney Harbour Trust. Circular Quay. Three electrically-operated semi-portal travelling cranes for Berths Nos. 1, 2 and 3, Woolloomooloo Bay. Particulars from Engineer-in-Chief of the Trust.

March 25th. N S.W. Railways and Tramways Department.—Five 1,000-kw. sub-station units to specification No. 124. Particulars at Electrical Engineer's Office, 61, Hunter Street, Sydney.—*Tenders.*

Adelaide.—February 11th. P.M.G. 50 cable terminals. See "Official Notices" January 9th.

Melbourne.—February 17th. P.M.G. Cable boxes. See "Official Notices" January 9th.

February 18th. 1,590 opalescent arc lamp globes for City Council. See "Official Notices" January 23rd.

April 7th. P.M.G. Accumulator batteries (Tudor) for radio-telegraph stations. Relays, non-polarised, Stores Schedule 996. See "Official Notices" to-day.

Melbourne.—March 5th. 20,000-volt and 1,500-volt underground cables and accessories, for Agent-General for Victoria. See "Official Notices" to-day.

Hobart.—March 2nd. For the Postmaster-General. Telephones, common battery, wall pattern, and table pattern, Schedule T 104. See "Official Notices" January 16th.

Austria. — Vienna. — February 20th. The K.k. Direktion für die Linien der Staatseisenbahn Gesellschaft invite tenders for the supply of an electric locomotive sliding platform for the Simmering Railway workshops. Plans, &c., from Abteilung IV/6, Zugförderung und Werkstattendienst, 3 Schwarzenbergplatz, Vienna I.

February 15th. Austrian State railway authorities, Pilsen. A number of electric motors for the new railway tender repairing shop.

Ballyconnell (Co. Cavan).—February 14th. Horizontal gas engine and suction plant; 18-kw. dynamo and motor dynamo; storage battery and accessories; switchboard and connections; overhead mains and street lamps, for Ballyconnell Electric Light and Power Co. See "Official Notices" January 30th.

Belfast.—February 23rd. Corporation. 12 months' supply of stores for Tramways and Electricity Committee. See "Official Notices" January 30th.

Belgium.—February 8th. La Société du Canal et des Installations Maritimes, of Brussels (59, Rue du Canal) are inviting tenders for the supply of three 2-ton electrically-operated cranes.

Birkenhead.—February 24th. Corporation. Continuous-current electricity meters (ordinary and pre-payment). House service fuseboxes. See "Official Notices" to-day.

Birmingham.—February 11th. Electrical stores for a year, for the Birmingham, Tame and Rea District Drainage Board. Mr. J. D. Watson, engineer, Tyburn, Birmingham.

Blackburn.—February 14th. Corporation. Twelve months' supply of stores for Electricity Department. Specification (deposit 3s. per section) from Mr. P. P. Wheelwright, Corporation Electricity Works. See "Official Notices" January 30th.

Blackpool.—February 18th. The Tramways Committee invites tenders for uniform clothing for the traffic staff for twelve months. Particulars from Traffic Superintendent's Office, Blundell Street Depôt.

Bolton.—February 23rd. Corporation. Twelve months' supply of tramway stores. See "Official Notices" to-day.

Bradford.—February 19th. Corporation. Cooling towers and induced draught plant. See "Official Notices" January 30th.

Bristol.—Docks Committee. One 2-ton electrically-driven overhead travelling crane. Specifications, W. W. Squire, Engineer's Office, Cumberland Road, after depositing £1 (returnable) with the Secretary, Queen Square.

February 12th. Corporation. 12 months' supply of electrical stores. See "Official Notices" January 30th.

Colchester.—February 7th. Electrical fittings for lighting, electrical equipment for cars, overhead equipment, car fittings, &c., for the T.C., for a year. Mr. R. C. Bullough, General Manager and Engineer of the Tramways, Magdalen Street.

Copenhagen.—February 21st. Municipality. Three 300-kw. motor generators or converters for sub-stations; also switchgear. See "Official Notices" to day.

Croydon.—February 16th. Corporation. 12 months' supply of stores for electricity department. See "Official Notices" January 30th

Greenock.—February 11th. The time for receiving tenders for the new 150-ton electric crane to be erected at the James Watt Dock, Greenock, expires on 11th inst.

Grimsby.—February 12th. Coal (fine slack from hard steam coal) for nine months, for the Corporation Electricity Works. Mr. W. A. Vignoles, Borough Electrical Engineer.

Halifax.—February 16th. Corporation. Stores and materials for the electricity department. See "Official Notices" January 23rd.

February 16th.—Stores for Tramways Department for a year. The Tramways Engineer, Tramways Office, Skircoat Road.

Hornsey.—February 24th. Corporation. Electricity meters, cables, cable stores, &c. See "Official Notices" Jan. 30th.

Ipswich.—February 17th and February 21st. Corporation. Paper-insulated cables for C.C. and A.C. three-phase systems. Fused mains disconnecting boxes and service boxes. See "Official Notices" to-day.

Keighley.—February 7th. Electrician's work for a year, for the Keighley and Bingley Joint Hospital Board. Mr. J. N. Clarkson, clerk, North Street, Keighley.

Leeds.—February 16th. City Tramways. Supply of materials including electrical sundries. J. B. Hamilton, Manager, City Square.

February 21st. Corporation. Twelve months' supply of coal and other stores, including a number of electrical items. See "Official Notices" January 23rd.

Liverpool.—February 12th. Corporation. About 100 standard traction 40-h.p. double-motor equipments. Mr. C. W. Mallins, General Manager, Corporation tramways.

London. — L.C.C. — February 17th. Installation at County Secondary School, Hilly Fields, Brockley, S.E. (223 points, 312 lights). See "Official Notices" January 30th.

St. Marylebone.—February 11th. Corporation. Underground cables, house cables, flexible cords, rubber goods, box compound and insulating materials, &c. See "Official Notices" January 9th.

Islington.—February 25th. Natural draught cooling tower and pipework for Lighting Committee. See "Official Notices" Jan. 30th.

St. Pancras.—March 2nd. Corporation. Supply of arc lamp carbons. See "Official Notices" to-day.

Fulham.—February 18th. Corporation. Twelve months' supply of electrical stores. See "Official Notices" to-day.

Shoreditch.—March 3rd. Corporation, Extra-high-tension and low-tension switchgear. See "Official Notices" to-day.

Madrid.—The Commission de la voic ferrée de Triano invite, in the *Gaceta de Subastas*, tenders for the supply of 2,100 metres of 20 mm. diameter cables for electric tramways.

Manchester.—February 10th. The Electricity Committee invites tenders for the supply, delivery and erection of one 7½-ton overhead hand-power travelling crane, operated from floor level, and gantries. Forms, &c. (one guinea, returnable), Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall, Manchester.

February 17th. Corporation. 12 months' supply of stores for Tramways Committee. See "Official Notices" January 30th.

Newport.—February 16th. Corporation. 12 months' supply of stores, for electricity and tramways department. See "Official Notices" January 30th.

New Zealand.—March 26th. The Dominion Portland Cement Co., Ltd.—Hydro-electric plant, Wairua Falls.—Section 1: Hydraulic equipment, including turbines (1,500 h.p. each), governors, penstocks, valves, &c. Section 2: Generators (1,000 kw. each), exciters, automatic regulators, &c. See "Official Notices" to-day.

Auckland—April 21st. The Harbour Board. 1-ton and 2-ton truck cranes. Specifications from London agents, W. and A. McArthur & Co., 18, Silk Street, Cripplegate, London, E.C.

Nuneaton.—February 21st. Corporation. One 600-kw. high-pressure, geared, direct-current turbo-generator, surface-condensing plant, pipework, &c. See "Official Notices" to-day.

Portsmouth.—February 17th. Corporation. Twelve months' supply of stores for the Tramways Committee. See "Official Notices" January 30th.

Pontypridd.—February 9th. Corporation. Stores and materials for the electric light and tramway department. See "Official Notices" January 23rd.

Portuguese West Africa.—H.M. Consul at Loanda reports that the electric lighting concession for Loanda has been granted to a Portuguese firm which is in touch with German houses. Although this firm will probably obtain the electrical fittings from Germany, H M. Consul understands that it might be worth while for United Kingdom makers of electrical plant and machinery to get into communication with the concessionaire. It is estimated that the undertaking will require a capital of £50 000, part of which still remains to be found. The name and address of the concessionaire may be obtained on application to the Commercial Intelligence Branch of the Board of Trade in London.—*Board of Trade Journal.*

Redditch.—February 24th. Urban District Council. 6,000 tons coal. See "Official Notices" to-day.

Rhondda.—February 17th. U.D.C. Consumers' electric supply meters for the Gas and Water Committee. See "Official Notices" January 30th.

Russia.—May. According to an advertisement in the *Times*, the Municipal Council of Marioupol invites tenders for the erection and running of an electric tramway in the town (Gouvernement d'Ekaterinoslaw, Russie). Communications, stating terms of contract, to be sent to the Administration Municipale de Marioupol, who will give all necessary information.

Salford.—February 16th. The Tramways Committee invites tenders for two years' supply of uniform clothing. Particulars (stamped envelope), General Manager.

March 4th. Corporation. Stores for the Electricity Department. Main traction switchboard. See "Official Notices" to-day.

Spain.—Tenders have just been invited by the municipal authorities of Orgoz (province of Toledo) for the concession for the electric lighting of the town during a period of 13 years.

February 13th. The municipal authorities of Puebla de Alcocer (Province of Badajoz) are inviting tenders for the concession for the electric lighting of the town during a period of four years.

Turkey in Asia.—March 14th. Forty years' electric lighting concession for Trebizond municipality. Population 50,000 to 60,000; 12 miles of street lighting. Houses mostly occupied by poorer classes. Water power (Deirmen River) available. An English translation of the conditions may be seen at the Board of Trade Commercial Intelligence Department in London.

Walthamstow.—February 25th. Corporation. Stores for electricity supply works and tramways. See "Official Notices" to-day.

West Ham.—February 6th. Corporation. Stores for the electricity department. See "Official Notices" January 23rd.

CLOSED.

Australia. — LAUNCESTON. — City Council. Sub-station equipment :—

Transformers and regulators, £2,061; H.T. switchboard, £1,423.—Australian G.E. Co., Ltd.
Underground feeder cable and joint boxes, £360.—Australian Metal Co.

Tenders.

BRISBANE.—6,000 dry cells, £825. — Brisbane Electrical Co. *Australasian Record.*

Belgium.—Eight concerns, six Belgian and two German, submitted tenders last week to the municipal authorities of Antwerp for the supply of six electrically-operated 5-ton cranes, the lowest offer being that of the Société Liegeoise pour la Construction de Machines, of Liége.

The municipal central electric lighting in the town of Tongres is about to be extended. Six concerns competed for the contract, the lowest offer (£2,363) being that of the Société Internationale d'Electricité, of Liége.

Bolton.—The Electricity Committee accepted the following tenders in connection with the construction of the coal-conveying plant at the new works at Back-o'-th'-Bank :—

Coal conveyor, chutes, weighers and suction ash-handling plant.—Babcock and Wilcox.
Capstans and bollards.—Crompton & Co., Ltd.
Weighbridges.—Wm. Hodgson & Sons.
Steelwork for the bunker and viaduct.—John Booth & Sons.
Excavating, concreting, &c., and carpenter's work for the bunker viaduct.—J. & N. Dickinson.
Electrical tubes and fittings.—Credenda Tube Co., Ltd.

Canada.—WINNIPEG.—The city contract for electric meters for 1914 has been awarded as follows, being the lowest satisfactory tender in each case, namely :—

Packard.—Single-phase two-wire meters.
Ferranti.—Single-phase two-wire meters, polyphase meters.
Canadian General Electric.—Single-phase three-wire meters.
W. E. Skinner.—Direct-current meters.

Canadian Electrical News.

Derby.—The T.C. has accepted the tender of Messrs. Taylor, Whiting & Taylor, of Derby, for installing the electric light at Pear Tree schools, at £128.

Germany.—The Siemens & Halske Gesellschaft, of Berlin, is reported to have secured a contract from the American Iron and Steel Co., of Lebanon, Pa., U.S.A., for the supply of two 20-ton electric steel furnaces. They will be constructed in accordance with the Frick-Kjellin-Rochling-Rodenhauser patents, and are expected to produce about 180 tons of special steel per day.

Grimsby.—The following tenders have been accepted by the T.C. :—

Berry, Skinner & Co.—For starting apparatus, the price for one starter or panel of each size being £3.
Horace Green & Co.—For the supply of motors for two years, the price for one motor of each size being £167.

Glasgow.—The Libraries Committee of the T.C. has accepted the offer of Messrs. Alex. Wylie & Co. (£286) for the electric light installation of Langside Library.

The T.C.'s Committee on Tramway Works and Stores has recommended acceptance of the following offers :—

Insulated Brooklyn bolts.—W. C. Yuille & Co., Ltd.
Insulated stud bolts.—W. C. Yuille & Co., Ltd.; J. Hally Craig.

Liverpool.—The City Council has accepted the following tenders :—

North-Eastern Steel Co.—2,000 tons grooved Sandberg silicon steel tram rails.
Walter Scott, Ltd.—400 tons Sandberg silicon railway section rails.
Sutton Heath and Lea Green Collieries, Ltd.—Annual supply of best quality steam slack to the Lister Drive power station.

Lochgelly, &c.—Messrs. Johnson & Phillips, Ltd., have in course of erection for the Lochgelly Coal and Iron Co., of Lochgelly, Fifeshire, 3,300-volt three-phase overhead lines for transmitting power to their various collieries. The same firm have recently completed a contract for the supply and erection of overhead cable, power distribution boards and connections for some new cement works at Rainham, Kent, and have also in hand a similar undertaking for some cement works in course of erection at Cliffe, near Rochester.

London.—L.C.C.—The Education Committee reports that Messrs. G. F. Ratcliff & Co., contractors for the installation of the electric light at the Hammersmith Trade School for Girls, having withdrawn their tender (£365 10s.), owing to an error, it has accepted that of Messrs. A. Hawkins & Sons, amounting to £444.

The same committee reports having accpted tenders for installing electric lighting at seven schools for £2,173.

SHOREDITCH.—The following tenders have been received by the B.C. for the supply of two 1,500-KW. and one 500-KW. converters :—

Name.	Original price.	Remarks.	Speed, 1,500 KW. R.P.M.	Speed, 500 KW. R.P.M.
Dick, Kerr & Co. ..	£11,278	Motor-generator.	300	500
Elec. Eng. & Equip. Co.	9,131	Do.	300	750
Bruce Peebles & Co. ..	8,947	Motor converters. Tender in order.	273	500
General Electric Co. ..	8,544	Rotaries. Exciters & cables not included.	300	750
British Thomson-Houston Co.	8,357	Rotaries. Exciters, boosters and cables not included.	375	750
Vickers, Ltd.	8,172	Rotaries. No exciters or cables included.	375	750
Brit. Westinghouse Elec. and Manufacturing Co.	7,765	Rotaries. No booster included.	375	750
Siemens Bros. Dynamo Works, Ltd.	7,760 and 7,520	Rotaries. Tender in order. Alternative tender.	600	1,000

After careful consideration of a report from the borough electrical engineer, the Lighting Committee states that it is of opinion that the Council would be well advised to give the contract to three firms, viz., Siemens Bros. Dynamo Works, Ltd., for one 1,500-KW. converter; Bruce Peebles & Co., Ltd., for one 1,500-KW. converter; and the British Westinghouse Electric and Manufacturing Co., Ltd., for one 500-KW. converter, all of whom have had experience in the design and construction of similar plant, and have quoted a price at which they would be prepared to supply one machine only. Under this arrangement, there would be several advantages to the Council, especially in view of the possible future extension of converting plant. The Committee recommend accordingly.

POPLAR.—The following tenders have been received by the B.C. for the maintenance of the whole of the incandescent street lamps :—

British Economical Lamp Co., Ltd.	£399	8	0	per annum
Scholey & Co., Ltd.	497	4	0	„
Crycelco, Ltd.	680	13	0	„
Bird & Hall	843	18	0	„

The lowest tender has been accepted, the terms quoted being 3s. to 9s. per lamp point for maintenance, according to voltage and candle-power, and 1s. 3d. to 4s. 3d. for make-up lamps. The Council holds the option of determining the contract at the end of one, two or three years.

Maidenhead.—The T.C. has accepted the following tenders :—

Thos. Ward, Ltd.—Two oil fuel tanks (40 tons capacity), £110.
F. A. Greene.—5-in. low-level pump and motor, £92 10s.; 6½-H.P. motor and fittings, £46 10s.; motor and reciprocating air pump, £49 15s.

Northampton.—The T.C. has accepted the following tenders :—

Brush Electrical Engineering Co., Ltd.—450-KW. turbine and generator (one disk and drum type, turbo-dynamo), £2,370.
Worthington Pump Co., Ltd.—Condensing plant, £1,522.
Brush Electrical Engineering Co., Ltd.—Switch panel, £68.
Premier Accumulator Co. Ltd.—250-cell battery (801 amperes at 1-hour rate battery capacity), £2,168; 10 years' maintenance contract, £159 per annum.

Rugby.—The E.L. Committee of the U.D.C. has accepted the tender of W. T. Henley's Telegraph Works Co., Ltd., for cable for extensions.

Shanghai.—We understand that the General Electric Co., Ltd., through their China company—the General Electric Co. of China, Ltd.—have again secured, for the third time, the contract for "Osram" traction lamps, from the Shanghai Tramways (International Settlement).

Southampton.—The following tenders have been received by the T.C. for the supply of a surface condenser at the electricity works:—

Worthington Pump Co. (accepted)	£707	Brit. Westinghouse Elec. Co. ..	910
Do. do. (alternative)	619	Do. do. (alternative)	800
W. H. Allen, Son & Co.	885	Willans & Robinson, Ltd. ..	980
Do. do. (alternative)	780	Do. do. (alternative)	715
Cole, Marchent & Morley, Ltd.	888	Mirrlees Watson Co. .. .	960
Do. do. (alternative)	798	Do. do. (alternative)	860
		Pollit & Wigzell, Ltd.	950

Warrington.—The Corporation has accepted the tender of Messrs. Babcock & Wilcox, Ltd., at £151, for a supply of feed pipes to the electricity works.

Watford.—The U.D.C. has accepted the tender of Messrs. Leigh & Co. for wiring the Council's cottages for electric light, at £26 2s. 6d.

Worthing.—The T.C. has accepted the quotation of the Anglo-American Oil Co. for the supply of 320 tons of fuel oil at 75s. 7d. per ton, to be delivered free at Worthing Railway Station as and when required.

York.—The Corporation has accepted Messrs. Chamberlain & Hookham's tender for meters above 10 amperes, prepayment and two-rate meters and Venner time switches.

For meters up to and including the 10-ampere size, with anti-vibrating device, the tender of the Reason Manufacturing Co., Ltd., is recommended.

FORTHCOMING EVENTS.

Greenock Electrical Society.—Friday, February 6th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Papers on "Cinematograph Supplies," by Mr. W. B. Smith, and "Faults in House Wiring," by Mr. McGibbon.

Institute of Marine Engineers.—Monday, February 9th. At 8 p.m. Discussion on "Fuel Test."

Institution of Post Office Electrical Engineers.—Monday, February 9th. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "A Modern P.O. Wireless Station," by Mr. F. Addey.

Association of Engineers-in-Charge.—Wednesday, February 11th. At 7.30 p.m. At St. Bride Institute. Paper on "Heating of Buildings by Low-pressure and Exhaust Steam," by Mr. Kenneth Gray.

Nottingham Society of Engineers.—Wednesday, February 11th. At Welbeck Hotel, Milton Street. Paper on "Defective Boiler Mountings," by Mr. F. W. Sisson.

Concrete Institute.—Thursday, February 12th. At 7.30 p.m. At Denison House, 296, Vauxhall Bridge Road, S.W. Discussion of paper on "Factory Construction," by Mr. P. M. Fraser.

Institution of Electrical Engineers.—Thursday, February 12th. At 8 p.m. At Victoria Embankment. Paper on "Some Railway Conditions Governing Electrification," by Mr. R. T. Smith.

(Birmingham Local Section).—Wednesday, February 11th. At 7.30 p.m. At the University, Edmund Street. Paper on "Some Railway Conditions Governing Electrification," by Mr. R. T. Smith.

(Manchester Local Section).—Tuesday, February 10th. At 7.30 p.m. At University, Physical Laboratory. Paper on "The Cascade Induction Motor," by Mr. L. J. Hunt.

(Newcastle Local Section).—Monday, February 9th. At 7 p.m. At Hugh Bell School, Middlesbrough. Paper on "Suggested Methods of Improving the Telephone Service," by Mr. W. Aitken.

(Scottish Local Section).—Saturday, February 14th. At 7.30 p.m. At the Grosvenor, Gordon Street, Glasgow. Annual smoking concert.

(Yorkshire Local Section).—Wednesday, February 11th. At 7.15 p.m. At Philosophical Hall, Leeds. Paper on "The Cascade Induction Motor," by Mr. L. J. Hunt.

Manchester Association of Engineers.—Friday, February 13th. At Grand Hotel, Aytoun Street. Fifty-eighth anniversary dinner.

Physical Society of London.—Friday, February 13th. At 8 p.m. At Imperial College of Science. Papers on "Moving Coil Ballistic Galvanometer," by Mr. R. L. Jones; "Vibration Galvanometers of Low Effective Resistance," by Mr. A. Campbell, and "Vacuum-tight Lead-seals for Sealing-in-wires in Vitreous Silica and other Glasses," by Mr. H. J. S. Sand.

Royal Institution of Great Britain.—Friday, February 13th. At 9 p.m. At Albemarle Street, W. Paper on "Production of Neon and Helium by Electric Discharge," by Prof. J. Norman Collie, F.R.S.

Saturday, February 14th. At 3 p.m. Lecture on "The Electric Emissivity of Matter (1) The Metals," by Dr. J. Allen Harker.

Illuminating Engineering Society.—Friday, January 13th. At the Trocadero. Annual Dinner.

North of England Institute of Mining and Mechanical Engineers.—Saturday, February 14th. At 2 p.m. At Newcastle-upon-Tyne. General Meeting

Junior Institution of Engineers.—Saturday, February 14th. At 6.30 p.m. Annual dinner.

Salford Technical and Engineering Association.—Saturday, February 14th. At 7 p.m. At Royal Technical Institute. Paper on "Swiss Mountain Railways," by Mr. A. A. Buss.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week:—

Monday, February 9th. "A" Company. Technical instruction, 7 to 10 p.m.

Tuesday, February 10th. "B" Company. Technical instruction, 7 to 10 p.m.

Wednesday, February 11th.—Recruits only. Infantry drill and technical instruction, 7 to 10 p.m. Rating examinations are held every Wednesday, from 6 30 p.m.

Thursday, February 12th.—"C" Company. Technical instruction, 7 to 10 p.m.

Friday, February 13th. "D" Company. Technical instruction, 7 to 9.30 p.m. Special instruction on Crossley engine, 7 to 8 p.m.

Saturday, February 14th.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Association of Electrical Station Engineers.—Since the remarks in our leaderette on central-station salaries went to press, the London branch of the above Association has held a meeting at Stone's Restaurant, Ludgate Hill, at which between 40 and 50 members were present. After very lengthy discussion, the changing character of the members' minds having been shown by a series of resolutions and amendments, the following resolution was passed, with several dissentients:—

"Owing to the fact that the L.E.M.A. does not appear to represent the supply authorities of London and Greater London, this meeting instructs the London Committee of the A.E.S.E. to circularise all supply authorities in London, asking them to form a Committee to discuss with the A.E.S.E. conditions of working hours of labour and rates of pay by March 2nd or convenient date."

We shall refer to the matter in our next issue, but having the real interests of central-station men at heart, we would seriously suggest that in a movement of this kind, most is to be gained by adopting a policy of deliberation and tact, and by remaining unswayed by the speeches of Socialistic agitators.

Fan Patents in the United States.—We are informed that after six years' litigation in the American Courts, the infringement suit instituted by the American Blower Co., of Detroit, against the B. F. Sturtevant Co., of Boston, was ultimately decided, and judgment given in favour of the American Blower Co. by Judge Ray, of the United States District Court, on December 22nd, 1913. The suit was in reference to an infringement of the patent rights of the centrifugal fan, which is known by the trade mark "Sirocco," and which was invented and patented all over the world by S. C. Davidson, of the firm of Davidson and Co., Ltd., Belfast, Ireland. The American Blower Co. control the patent rights of the Davidson fan in America, and the infringement complained of was in reference to a fan having blades similar to those of the Davidson fan, but with corrugations along the axial length, and described by the B. F. Sturtevant Co., who were making and selling it, as their Multivane fan. The Judge decided that the patents in suit disclosed invention and were valid, and that the infringement was clear, and gave the decree in favour of the American Blower Co., with costs. The case was not only a very protracted one, but included a formidable array of witnesses, amongst whom were the most brilliant scientists of America. The evidence forms a library of 10 volumes, aggregating about 3,000 pages.

Senghenydd Disaster Inquiry.—On Friday last the Home Office inquiry into the explosion and fire at Senghenydd Colliery was resumed at Cardiff, by Mr. R. A. S. Redmayne. Evidence was given that the use of electric lamps would tend to reduce the number of accidents from falls of roof and sides, and that lamps should be relighted only on the surface. On Saturday the inquiry was suspended until Thursday, February 5th. A special Delegate Conference of the South Wales Miners' Federation was held on Monday at Cardiff, to consider a number of proposals for new safety regulations prepared by the Council of the Federation, including one urging that electric lamps be adopted generally, and another, that the use of electricity for motive power in mines be totally prohibited.

Wages of L.C.C. Employés.—The Highways Committee of the L.C.C. reports that applications for alterations in conditions of labour were recently received from the undermentioned grades of employés in the rolling-stock section in the tramways department:—(1) Wiremen; (2) labourers; (3) brakesmen and re-wheelers; (4) plough repairers; (5) solderers; (6) magnet and coil winders; and (7) steam lorry drivers. The Committee, however, is of opinion that the requests should not be acceded to, and the men having asked that the matter may be referred to the appropriate conciliation board, it recommended that that course be adopted.

Institution and Lecture Notes. — INSTITUTION OF ELECTRICAL ENGINEERS.—The following corrected programme has been issued :—

February 12th, R. T. Smith. — "Some Railway Conditions governing Electrification."

February 26th, F. Lydall.—"Motor and Control Equipments for Electric Locomotives." (Note :—Mr. Lydall's paper on "Electric Locomotives," published in No. 222, Vol. 51, of the *Journal* will also be discussed at this meeting.)

March 12th, H. E. O'Brien.—"The Design of Rolling Stock for Electric Railways."

March 19th.—Discussion on "Electric Battery Vehicles."

March 26th, H. R. Speyer.—"The Development of Electric Power for Industrial Purposes in India."

April 2nd, H. G. Brown.—"Electric Signalling on Railways."

April 23rd, H. W. Firth.—"Electrification of Railways as affected by Traffic Considerations."

(STUDENTS' SECTION).—February 18th, W. H. Date.—"Illumination in Theory and Practice."

At a meeting of the SCOTTISH LOCAL SECTION, in Glasgow, the chairman, Mr. G. A. Robertson said that the Committee had arranged the following programme for the second portion of the session :—At Glasgow, on February 17th, Mr. Roger T. Smith would read a paper entitled "Railway Conditions Governing Electrification," the first of a series of papers on electrification which were to be read in London. On March 10th, at an informal meeting in Edinburgh, there was to be a discussion upon "Some Methods of Improving the Power Factor in Alternating Currents," and on February 24th there would be an informal discussion in Glasgow on "Battery Vehicles." On April 7th, in Glasgow, Mr. A. M. Taylor, of Birmingham, would read a paper entitled "Transformers for the Simultaneous Changing of Frequency and Pressure of Alternating Circuits." This was a very important paper On April 21st (the date of the annual meeting) they were to have a paper, by Mr. Peck, of Manchester, on "Reactances in Alternating Current Circuits."

At the monthly meeting of the SECTION in Edinburgh on Tuesday, February 3rd, Mr. B. Welbourn read his paper on "British Practice in the Construction of High-tension Overhead Transmission Lines"

At the meeting of the BIRMINGHAM LOCAL SECTION on Wednesday last week, a paper was read by Mr. T. Ferguson, A.M.I.E.E., on "Electric Train-Lighting Systems." The discussion was closed.

SOCIETY OF ENGINEERS (INCORPORATED).—On Monday, February 2nd, the premiums awarded for papers published during 1913 were presented, including a Society's premium, value £3 3s., to Mr. Wm. Yorath Lewis for his paper on "The Tram *v.* Bus Controversy." Mr. H. C. H. Shenton was then installed as president, and delivered his inaugural address, which he opened by referring to the need for better organisation of the engineering profession and the consideration that the Society was giving to the subject with the view of promoting the well-being of the engineer.

ASSOCIATION OF ELECTRICAL STATION ENGINEERS —The first annual smoking concert of the London branch was held at Stone's Restaurant on January 28th, and a large number of station engineers, representing 90 per cent. of the supply authorities in London, were present. A number of artistes who volunteered their services from amongst the station engineers, gave the assembled company a very enjoyable evening. The Hon. Secretary took the opportunity of stating details of his action at the London Electrical Masters' Association meeting the previous evening, and the reasons for the same.

At CHRIST'S COLLEGE, Cambridge, on January 30th, Mr. Hugo Hirst, chairman of the G.E. Co., lectured on "The Manufacturer and University men."

ASSOCIATION OF CONSULTING ENGINEERS (INCORPORATED) — The inaugural dinner of the Association was held on Monday last, at the Whitehall Club. A report of the proceedings will appear in a later issue.

Copper.—The end of January sees copper inclined to rise, in company with other securities. Messrs. Merton's statistical circular shows total deliveries for the month at 42,490 tons, not a high figure, considering present rates of consumption. English stocks were decreased by 1,089 tons during the month, French by 1,480, a large proportion. European visible supplies (including Rotterdam, Hamburg and Bremen, but excluding estimates for other ports) are now 25,944 tons, 3,576 tons less than at the end of January. During the month American deliveries have been very near average, Spain and Portugal over the average, Chile shipments slightly under, Australian a good deal below the average. Stock in American producers' hands for the end of December showed an increase of 19,424 tons on the figure for the end of November. The world's visible supplies at the end of December showed 70,341 tons, an increase of 22,187 tons on the figure for the end of November.

Appointments Vacant.—Switchboard attendant, for Portsmouth Corporation (30s.); electrical fitter for Government waterworks on the Gold Coast, age 25-40 (£300); assistant electrical engineer, for Singapore Electric Tramways, Ltd. ($300 month); switchboard attendant, for Lancaster Corporation (27s. 6d.). Particulars are given in our advertisement pages.

For Sale.—King's Lynn Corporation electricity department has for disposal four 90 B.H.P. gas engines, one compressed-air vessel, two vertical boilers, &c. Particulars are given in our advertisement pages to-day.

Fatalities.—At the inquest on a fitter, named Uttley, who was killed at the electric generating station of the Burnley Co-operative Society, it was stated that he had been called in to effect repairs to the engine. These had practically been effected, when he asked for the steam to be turned on. The society's assistant engineer turned this on at the boiler, but by some means no one was able to explain, the engine valve was slightly open, so that the steam came through and accumulated. Uttley, to fix a pipe, put a foot on a spoke of the wheel, evidently having forgotten his order about the steam, and the result was that the wheel began to revolve, and he received fatal injuries. The Factory Inspector said the safest course was to block all wheels until everything was ready for a trial. A verdict of "Accidental death" was returned.

The adjourned inquiry into the cause of death of the banksman, Charles William Walker, through an electric shock at the Digby Colliery, near Nottingham, was held on January 27th, and was attended by Mr. Nelson, of the Home Office. According to the *Sheffield Daily Telegraph*, evidence was given by George Ernest Dawson, assistant electrician, to the effect that he heard someone shout there was a man fast on the wire. Witness ran and found the man standing in an upright position with his left hand on the wire. He was unable to speak, and artificial respiration was tried until the arrival of the doctor. Mr. Phillips, manager of the Notts. and Derbyshire Electric Power Co., from which source the colliery is supplied, agreed with Mr. Nelson that a separate transformer should always be used for lighting ; that the pressure should always be as low as possible ; and that in every insulated circuit a fault detector of some kind should be installed. A verdict of "Accidentally killed" was returned.

A Repulsion Fuse.—A fuse which has been developed by the Metropolitan Engineering Co., Brooklyn, N.Y., consists of zinc ribbon bent in the shape of a U over a thin mica separator, with constrictions at the bend, so that upon rupture due to overload the fuse is broken in two parallel strips of equal length, one on either side of the separator, and each with its upper end free. Since the current in the parallel legs of the U flows in opposite directions, a force of repulsion is exerted between the two. The ends of these legs are fixed, but after fusion the ruptured ends are free, and movement is possible at the ends where the arc occurs. The force actually resulting is considerable, and can, for any definite condition, be calculated from the formula—

$$F = 4\ \pi\ I^2/100\ d = \text{dynes per centimetre},$$

where d is the thickness of the separator. and I is the current flowing. A 60-ampere fuse, by calculation from oscillogram records, would, under short-circuit conditions, generate a repulsive force as great as 190 lb. The greater the overload, the more widely the fused ends become separated, resulting in a prompt suppression of the arc. In addition to the fundamental principle of repulsion, two other principles are utilised, namely, the magnetic blowout and a tendency of the metallic vapours produced at the rupture to force the limbs of the fuse apart. The magnetic blowout is quite noticeable at moderate overloads, but is masked by the repulsive effect at great overloads. The effect of the expanding gas has been traced in some tests, but is not a very important feature. The complete fuse consists of a porcelain fuse-holder, an insulating barrier, a fuse element and copper contact plates.—*Electrical World.*

[The calculation appears to be at fault. By the formula given above, assuming that the short-circuit current I reaches $10 \times 60 = 600$ amperes, and that the distance d between the limbs of the fuse is 0·1 cm., the force $F = 0{\cdot}1257 \times 600^2/0{\cdot}1 = 452{,}500$ dynes. If the fuse is 10 cm. long, the total force tending to separate the limbs = 4,525,000 dynes = about 10 lb., and the effect of this is roughly equivalent to a force of 5 lb. exerted between the ends of the limbs. To obtain a total force of 190 lb., a short-circuit current of 1,000 amperes and a total thickness of separator of $\frac{1}{200}$ in. must be assumed, conditions which are certainly not practical. In point of fact, however, we believe the formula quoted gives values much in excess of the true force. We do not doubt that the fuse acts as claimed.—EDS. ELEC. REV.]

Educational Note. — NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—A scholarship will be offered for competition among graduates of the Institution in September next, tenable for two years, and of the annual value of £50. The scholarship will be awarded on the results of an examination held in Newcastle during the month of September in English, mathematics and experimental science. Every candidate must be a British subject and a member of the Graduate Section of the Institution of not less than one year's standing, and shall have served or be serving an apprenticeship on the North-East Coast. Particulars may be had from the Secretary, North-East Coast Institution of Engineers and Shipbuilders, Bolbec Hall, Newcastle-on-Tyne.

Electric Engine Starters for Motor-Cars. — We have previously referred to the fact that electric engine starters are being very extensively adopted in America, it being estimated that about 70 per cent. of the cars now being built in the United States are equipped with engine starters. The arrangement in which the pinion of the starter drives the engine through a gear ring on the fly-wheel is the most poplar method, it being found on 62 per cent. of the cars. In 15 per cent. of the cases the starter drives through chain or gearing on to the crankshaft, and in 13 per cent. the power is transmitted to the timing gear ; in the remaining 10 per cent. of the cars various special driving methods are adopted.

(*Continued on page* 235.)

RECENT DEVELOPMENTS IN ELECTRICITY SUPPLY IN HULL.

For some years past the increasing demand for electricity has been one of the features of modern industry, and it is a recognition of this fact which recently led the Hull Corporation to embark on a far-reaching scheme for developing its electricity undertaking.

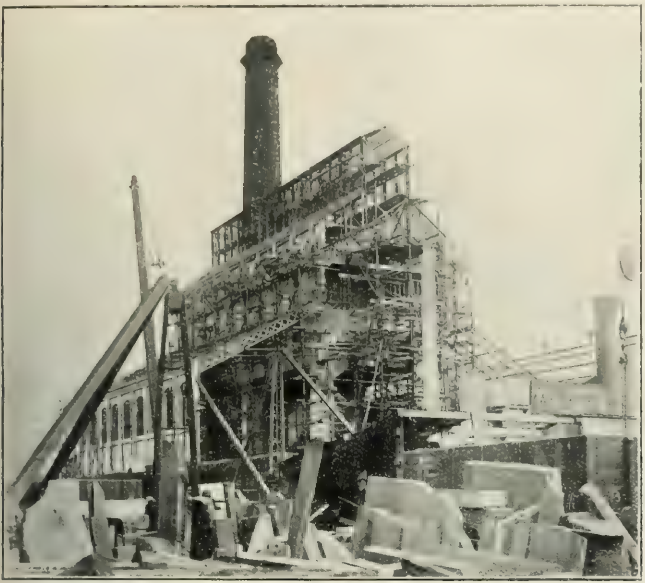


Fig. 1.—View showing New Reinforced Concrete Power Station under Construction, Hull.

Modern Hull, with its population of some 300,000, owes its progress not alone to its position as third port in the kingdom. Apart from shipping it is an important centre for flour milling, but its chief industry is probably seed crushing, oil extracting and refining, and paint, colour, &c., manufacturing. In addition, there are the engineering and shipbuilding trades, cement manufacturing and various miscellaneous industries, an outstanding example of which is Messrs. Reckitt's colossal business, employing some 4,000 hands locally.

From all of which it will be gathered that the Corporation was amply justified in taking the necessary steps to provide for the electrical future of the city and its surrounding neighbourhood.

The scheme of extensions, of which the initial stages have been undertaken at a cost of some £100,000, provides the city with a modern three-phase supply, with a system of ring-mains and sub-stations in the most important industrial areas, and supplements the existing H.T. direct-current supply, which has formed an outstanding and oft-criticised feature of electricity supply in Hull in the past. To do it justice, the H.T. direct-current system of supply generating at 2,200 volts, with rotary sub-stations dotted about the city, which can be started up, regulated and controlled, from the generating station, has reached a highly developed stage —thanks largely to the attention bestowed on it by Mr. Bell, the city electrical engineer—and has abundantly proved its reliability in service.

The development of the undertaking in recent years is ample evidence of the latter fact, but Mr. Bell's adoption of the three-phase system for extensions has been due most of all to the greatly decreased capital cost and increased flexibility of the latter system.

Hull, in its numerous docks and factories, offers many opportunities for power supply at a competitive price, for which the electricity department will in the future be most favourably placed.

The recent extension at Sculcoates Lane, which adjoins the older station there, and of which the first portion only has been undertaken, will, according to present intentions, contain eight turbine sets and 16 boilers.

Buildings.—These are of particular interest, being of reinforced concrete throughout, and including a spacious engine room, 65 ft. wide and 107 ft. long, which adjoins and opens into the older engine room; a boiler house of 100 ft. span and 90 ft. long, switch-house, offices, &c. Temporary ends have been provided to the present buildings which constitute about half the ultimate scheme.

As the subsoil consists of soft clay upon a bed of peat, it was necessary to pile the whole site, and 400 pitch pine piles were used for the purpose. The turbine and condenser foundations are of mass concrete resting on a cluster of piles; the engine house walls are of 5 in. thick, reinforced by ½-in. rods both vertically and horizontally, and stiffened by 24 in. × 12 in. pilasters at intervals, each of which contains a 12 in. × 6 in. steel joist. The feature of the boiler house is the bunker construction, which occupies the centre of the roof portion of the building, the first half being designed to hold some 2,000 tons of fuel. Owing to the boiler arrangement, only six reinforced concrete stanchions could be provided, each 5 ft. × 3 ft. × 44 ft. long, to support the bunker structure, which is 35 ft. wide, 33 ft. high, and 95 ft. long. The bunkers have 7 in. reinforced concrete sides and hopper bottoms with 18 in. outlets; the top of the bunker is formed

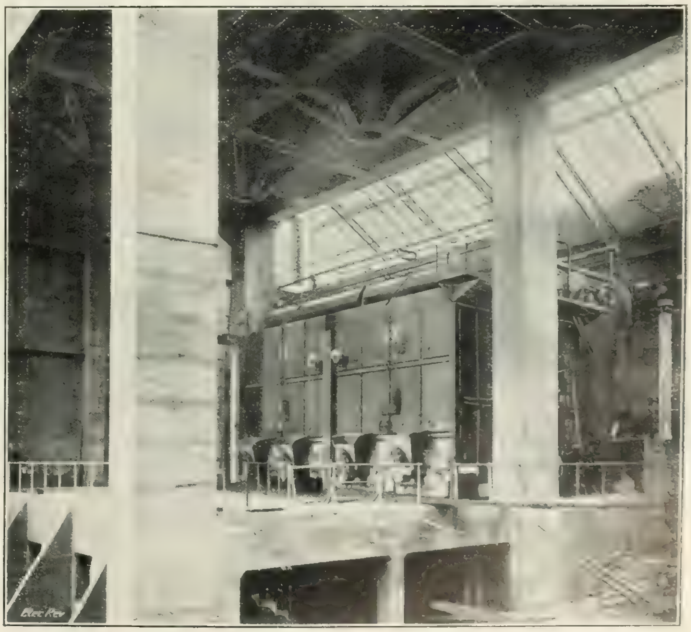


Fig. 2.—The Boiler House, showing Woodeson Boilers, Concrete Coal Bunkers, &c.

by a steel truss roof carrying a conveyor chamber 12 ft. 6 in. wide × 10 ft. 6 in. high.

Beneath the firing floor of the boiler house an ash basement is provided. The buildings are fireproof practically throughout, and were designed by the Hull city engineer.

A considerable area of land has been acquired adjacent to the present site, where it is intended to place cooling towers, store coal and when necessary build a further generating station.

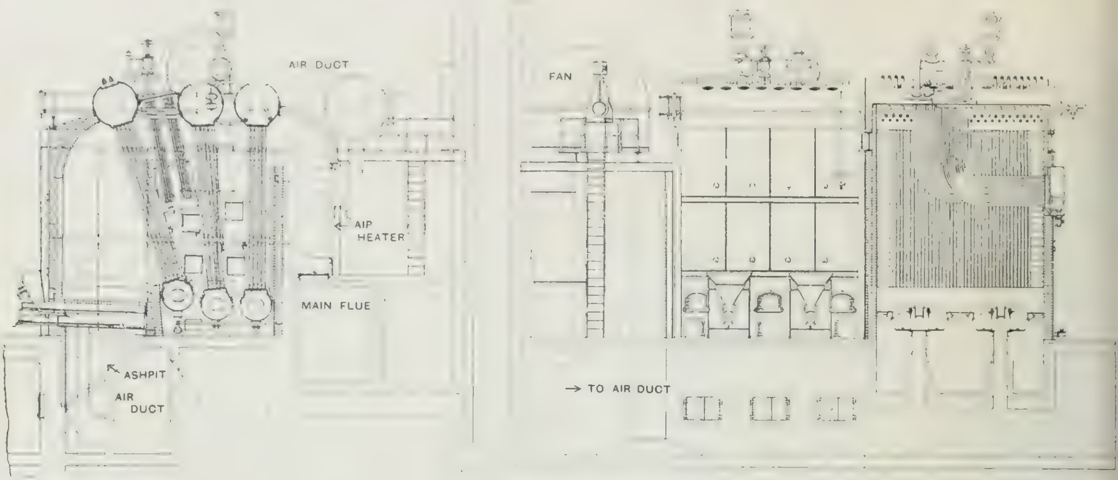


Fig. 3.—Sectional Views showing Arrangement of the Woodeson Boilers, Air Heaters, Forced-Draught Plant, &c.

New Plant.—In the boiler house, shown in fig. 2, are installed two Woodeson patent water-tube boilers, by Clarke, Chapman & Co., each having 6,100 sq. ft. heating surface and 105 sq. ft. grate area, and capable of evaporating 30,000 lb. of water per hour at 180 lb. pressure.

Woodeson integral superheaters are fitted, to give 170° of superheat to the steam, and Underfeed stokers, the latter working in conjunction with "Usco" air heaters, which are fitted in the flues at the back of the boilers; the air is drawn through these heaters by a 50-h.p. fan, which is sufficiently large for two further boilers, and is delivered under pressure and at a temperature of 250° F. to the furnaces. Fig. 3 shows the arrangement of the air ducts between the air heaters, fan and furnaces.

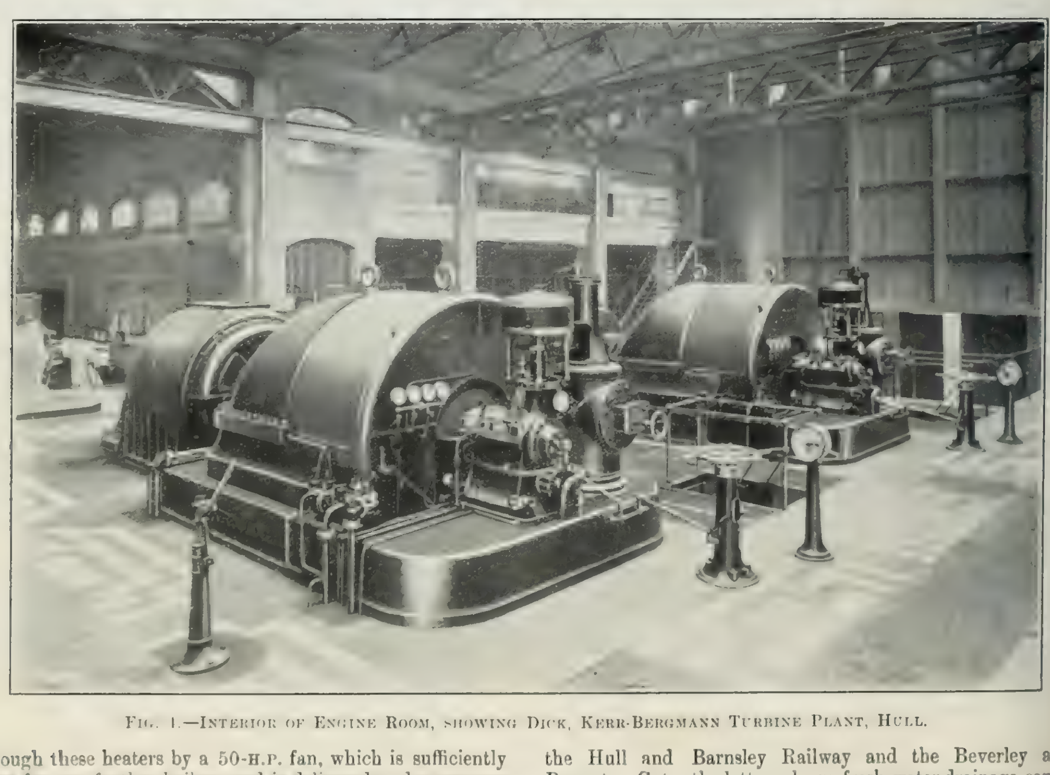


Fig. 4.—Interior of Engine Room, showing Dick, Kerr-Bergmann Turbine Plant, Hull.

The Woodeson boiler is of exceedingly simple construction, consisting in the main of three sections, each comprising an upper steam drum and lower mud drum, connected together by eight nests of 19 3-in. diameter straight tubes.

The tubes are all straight and of the same length and bore, and can be withdrawn through manholes opposite each nest of tubes; the tube sections are hung from girders, and are free at the bottom ends to allow of expansion. A good feature is the lofty combustion chamber which occupies the front of the boiler.

A semi-automatic ash discharge is provided for each boiler, the ashes falling into hoppers, from which they automatically discharge into trucks and are tipped into a storage hopper for subsequent removal by a grab crane.

The Sculcoates Lane generating station is conveniently situated for both fuel and water supplies, as it adjoins both the Hull and Barnsley Railway and the Beverley and Barmston Cut—the latter a large fresh-water drainage canal A coal siding runs into the works, and when the present initial boiler equipment has been extended sufficiently t justify it, a conveyor plant will be installed to supply th overhead bunkers from a hopper in the yard, which will be filled from wagons on the works sidings. The fuel used is South Yorkshire unwashed slack, costing 10s. 7d. per ton.

The feed-water supply for the entire plant, new and old, is obtained from the Beverley Cut, being both softened and filtered before use. In connection with the new boiler plant a Woodeson direct-acting steam pump, of 12,000 gallons per hour capacity, has been installed, which temporarily draws from the feed tank in connection with the old boiler house, and in the same way the gases from the new boilers are led through existing economisers to an existing 210-ft. chimney, although the designs for the new boiler house contemplate a steel stack midway along each side of the new boiler house.

We understand that at a later date it is intended to utilise a portion of the exhaust steam from the generating plant for direct feed heating, in view of the use of ejector condensers, and that designs have been prepared for this.

In the engine house two 2,000-kw. Dick, Kerr (Bergmann type) turbo-alternators are installed, as shown in fig. 4), in conjunction with ejector condensers, this type of condenser having been adopted throughout the old and new plants.

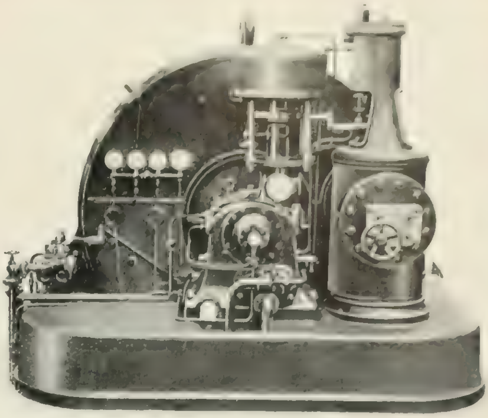


Fig. 5.—Governor Gear and Admission Valves, Dick, Kerr-Bergmann Turbine.

The turbines are of the impulse type, and run at 1,500 r.p.m., requiring 15 lb. of steam per kw.-hr. on full load. Four steam nozzles are normally open, governor controlled, while the steam admission can be hand regulated on a further series of nine nozzles. A small duplex steam-driven oil pump is provided to each turbine for flushing the bearings when starting or stopping, and by means of the action of an oil relay, the governor valve shuts down if the oil pressure system to the bearings fails.

The alternators, which are three-phase machines of the four-pole salient-pole type, generating at 6,600 volts and 50 cycles, are designed to give 2,000 kw. at ·8 power factor; in each case an extension of the main shaft drives a direct-coupled 13½-kw. 110-volt four-pole exciter.

(*To be continued.*)

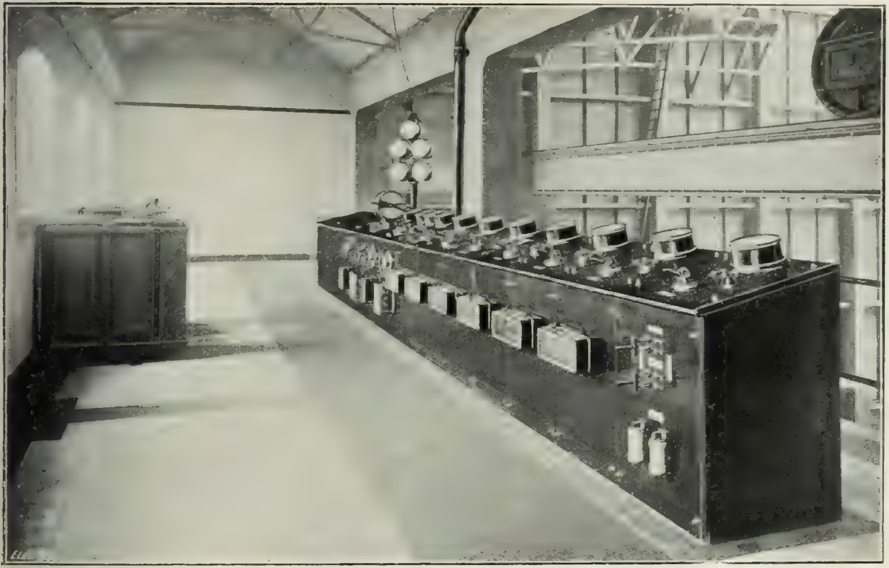


Fig. 6.—E.H.T. Switch Control Gallery, Showing Bench Board.

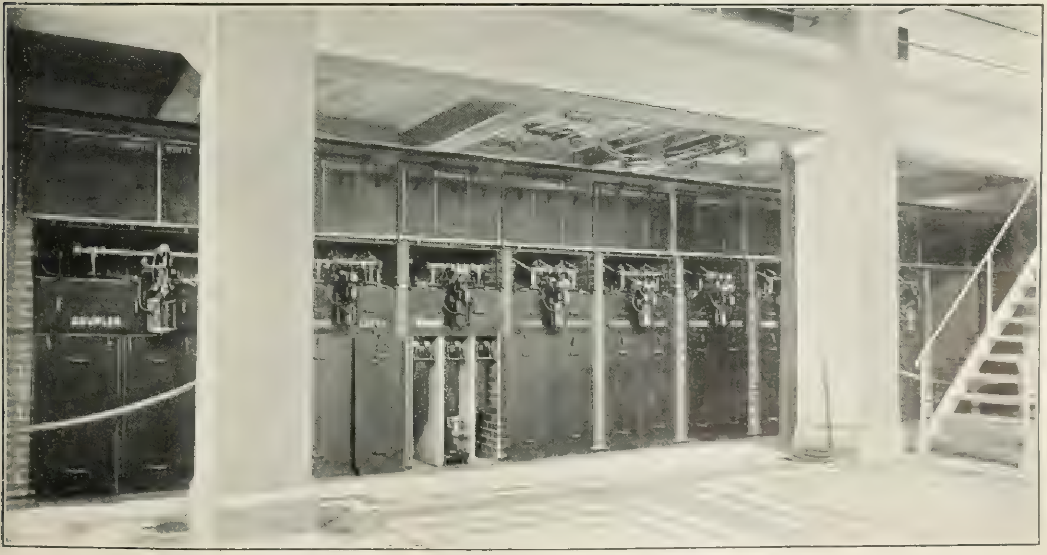


Fig. 7.—Westinghouse Three Phase Oil Switches and Cubicles, Hull.

THE NEW HOME OF THE CIVIL ENGINEERS.

By courtesy of the Institution of Civil Engineers we are able to print the accompanying view of the new building of that Institution as it will appear when completed. As our readers know, the former premises—25, Great George Street—were relinquished to make way for the new Government Buildings. The foundation stone was laid in October, 1910, by the then president, Sir J. C. Inglis. The main entrance of the buildings is in Great George Street, where it has heavy ornamental iron gates surmounted by a carved group supporting a shield which bears the arms of the Institution with the motto: "Scientia et Ingenio." The new premises will cover an area of about 22,700 sq. ft. For the electric lighting of the buildings Mr. E. W. Monkhouse has acted as adviser. With the exception of the lecture theatre, the lighting of the larger rooms, halls and corridors, electroliers will be used; in the lecture theatre concealed lamps are arranged in the cornice for reflected illumination.

New Building, Institution of Civil Engineers, Great George Street, S.W.

The picture illustrated is a perspective view of the north (Great George Street) and west (Princes Street) elevations. The architectural features at the north-west angle are yet unfinished. Completion is dependent on the termination of the lease of No. 1, Great George Street, the removal of which premises will also allow the projected widening of this part of Princes Street to be effected.

As constructional operations are still in progress, we defer our account of the electrical installation and other features of engineering interest to a later date.

The Moffat-Irving Electric Furnace.—A new type of furnace has recently been introduced by the Moffat-Irving Electric Smelters, Ltd., of Toronto. The ore, limestone and carbon are mechanically fed into the furnace in a finely-divided condition, the former two falling some feet to the hearth, through CO gas at a temperature of over 2,000° F., given off from the furnace, while the carbon is fed in at a lower level. Three-phase current is used, about 2,500 amps. at 70 volts pressure, and the power factor is approximately 90 per cent. The electrodes are hand regulated, and are of graphite, 5 in. in diameter. It is claimed that a superior quality of steel is obtained.

THE RUBBER MARKET.

The rubber market has shown a much more cheerful aspect lately, and there has been a decided growth of confidence regarding the position generally, thanks in no small degree to the improvement in sentiment. Rubber has been possibly worse hit by the fit of gloom which has overspread all the commodity markets, than anything else, but the tendency has within the last few weeks become more hopeful, and with the continued satisfactory statistical position, and the steady demand for material from the trade, the outlook is certainly far from being discouraging for holders of shares in plantation rubber companies. The feeling is indeed growing that the market may quite easily be on the verge of really good times, for demands have proved all absorbing, and there has been a great deal of resistance shown to the decline in prices at round about the present level. The knowledge that the slump in the price has put out of effective operation the bulk of the wild rubber countries as contributors to the world's supplies, is gradually forcing itself upon the minds of consumers of the material, and holders of shares, and it is indeed almost certain that there will be an appreciation of prices as the year proceeds based upon the actual strengthening of the statistical position. The possibilities indeed are considerable on the bull side of the market, and have been dealt with succintly by the leading authority on the article, the *India-Rubber World*, the Singapore correspondent of which journal has gone very thoroughly into the matter. He says that the yield of the mid-Eastern plantations for last year was about 45,000 tons, and would have been 50,000 tons but for the slump. If the low prices continue, no new areas will be brought into tapping at all in 1914, so that only a normal increase on the present tapped areas will ensue, yielding, say, 55,000, to at most 60,000 tons instead of 70,000 tons or more. The Brazilian output will, he says, be down at least 10,000 tons, the production of guayule rubber is no more for the present at any rate, while the Congo and East and West Africa will only produce a few thousand tons at most, in place of 20,000 tons odd. Borneo rubber and Jelutong are already simply wiped off the slate by the low prices ruling, and Central America will not produce anything approaching the estimated quantity. The present year has, therefore, opened with the prospect of a total crop of 100,000 tons to 110,000 tons in place of the 140,000 tons which manufacturers had been counting upon, and the inevitable result will be that prices must advance when once the buying impulse begins to be felt. There is hardly any chance of operations as regards the gathering of wild rubber being increased to any extent this year, for the collection of this material has ceased to spell anything but ruin to those engaged in it, and 1914 is likely, therefore, to be a bare year. The only wild rubber which, as things stand to-day, has a chance of surviving, is fine hard Para, every other kind having been practically knocked out by the price. There is another point, too, and that is that unless present prices improve, there is a certainty that some of the plantations will shut down altogether for a period, for it simply does not pay to tap the trees when rubber is selling round 2s. 3d. a lb. or so. Costs of production are naturally being reduced steadily, but considerable difficulties are being met with in some directions in this respect, and it will take time before there is an all-round reduction to an average of, say, 1s. 6d. a lb. Still the intention is, if possible, to bring down the costs to about 1s., and progress in this direction will continue to be made.

PROSPEROUS TIMES AND NEW INVENTIONS.

The curve relating the state of trade and the production of new inventions has yet to be drawn, and it would require a dogmatist of no mean order to lay down any hard and fast rule defining supply and demand in industrial inventions. At the same time there is such a thing as a law of probabilities, and we may fairly ask whether the recent happenings in the electrical industry have encouraged or discouraged inventive fertility, and following from this arises a further question as to the probable standing of the electrical industry in, say, two or three years' time.

The last few years in the electrical, as in many other manufacturing pursuits, have been a time of most remarkable prosperity, so that we call them the "boom years." It would appear that some of the prophets are of the opinion that this boom is drawing to a close. By this we do not necessarily mean that a period of depression is to ensue, but that possibly trade will not continue at quite such a high level as it has recently attained. In making this statement we are open to correction, but if this is the case it should be pointed out that just as the period of trade prosperity need not necessarily be world-wide, so the period of comparative depression may also be local to a country; in other words, while it is necessary to say that reaction must inevitably follow action, and hence we must be prepared inevitably for a partial drop, a wise economist, at any rate from his own point of view, will endeavour to localise the drop as far as possible, and endeavour so far as in him lies, to see that the locality at which the drop happens to occur, is not the one in which his own business operations are situated. For this reason the problem of the possible drop resolves itself once again into the elements of national commercial competition, and it is well to examine briefly the reasons which would tend to keep a good proportion of the total available world trade in British hands.

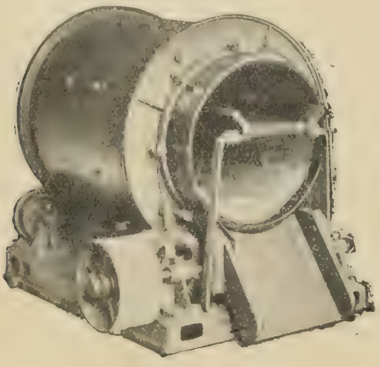
In this connection we may compare commerce to a system of parallel electrical conductors. Given a certain potential at the ends of such a system, the current flowing through the various branches of the system divides itself up inversely as the resistance in each branch. Suppose that the potential fluctuates, and it is required to keep the current in one particular branch as high as possible, it is obviously useful to reduce, as far as possible, the resistance in that branch. Transferring the analogy to terms of commercial economics, a certain world demand has to be met which may be likened to the potential. The various trade organisations of different countries are the different circuits through which the demand is supplied. The competition between them may be represented by the parallel action of such circuits. If we in Great Britain are under the impression that the world demand is likely to fall, obviously we must do something to remove every possible obstacle lying between the vendor and the purchaser. Now where various countries are each in a practically equal position, as regards manufacturing resources, to supply electrical goods capable of satisfying the needs of the market in a commercial manner the resistance of the various circuits, according to the analogy, can be said to be equal; that is to say, there is no reason why the current of trade should flow more strongly in one country than in the other. But if one country by wise prevision has made arrangements to give additional inducements to possible purchasers when the need arises, that nation stands a better chance of securing the larger volume of trade. We suggest that at this point a large proportion of the British firms fail to exercise that foresight which is necessary. Without attemping in any way to disparage the enterprise of a good many of our own leading firms, it is necessary to point out that on the Continent, and especially in Germany, a great deal of systematic attention is paid on the part of electrical manufacturers to research work, which, although not yielding direct results at the moment, is calculated to become very useful when strenuous conditions prevail, and when the customer has to be tempted either on the score of novelty, increased convenience, a slight improvement in efficiency or some other consideration, to branch out by buying apparatus differing slightly from that which is at the time regarded as standard. In other words, the most effective way of lowering the resistance between vendor and purchaser, when the commercial motive force is falling, is to have in readiness improvements and variations on standard practice calculated to arouse interest and the desire to purchase.

At this point the value of the inventor comes in. The inventor is frequently regarded as an obnoxious animal to be suppressed where possible, but he has his uses. An ignorant inventor is, of course, impossible, but the history of electrical engineering is studded with names of brilliant men who have through long years of discouragement and very slight, if any, financial assistance, brought out inventions which have laid the fortunes of commercial prosperity, not always for themselves, but certainly for the industry at large. It is this type of man—the well-trained engineer invested with that touch of imagination that converts a hint of the present into the success of the future—who has in other countries been incorporated into the research staff of important undertakings, and who has been supported in a systematic manner during the necessary period of investigation and modification, in the hope of ultimate success.

In this country such workers and the firms who make them possible are all too rare, and the recent trade boom may, unless attention is drawn in time to the danger, have the effect of inducing manufacturing firms to believe that the appliances which have sold so well for some period are the last word, and that it will be possible to continue to sell these appliances without further research. If prosperity has the effect of stultifying research and invention, it will be a very bad day for this country that we ever had any more money than we knew what to do with. In this connection it is rather an ominous sign that so much of the nation's wealth is being transferred to enterprises situated outside the limits of the country and even of the empire. At the present time the bank balances of many of the manufacturing concerns of this land are, we believe, in a very healthy condition. Unless our survey is mistaken, the rate at which firms are introducing appliances involving a distinct advance in our knowledge of electrical engineering is falling, and we suggest that the relation between the inventor and the manufacturer at the present time may be that the latter is more inclined to transfer his money to development work outside the kingdom than to expend it on research work for the purpose of building up his business in the future. If this is the case it is a very grave symptom which requires a strong counter policy, as we believe that without an active and most strenuous campaign in the direction of real and valuable research work, heavily backed financially by the resources at the command of many of our firms at the present time, Great Britain stands in some danger of falling into the second rank of electrical producers in years to come. Much has been said recently concerning co-ordination between our technical colleges, universities and manufacturing firms. Would it not be possible to translate words into action on such an important issue?

A MAGNETIC SEPARATOR.

An interesting type of magnetic separator which is made by the Hardy Patent Pick Co., Ltd., of Sheffield, consists of a cylinder placed with its axis not quite horizontal, but with one end higher than the other so that, when revolved, material introduced at the highest end will gradually make its way out at the lower end. This cylinder is placed upon rollers which allow it to be easily revolved and leaves the inside without obstruction for the passage of the material through it. Inside the cylinder are about eight magnets extending along the greater part of its length, and forming slightly projecting ribs inside it in the direction of its length. These magnets are excited by a dynamo with which they are automatically connected and disconnected during the rotation of the cylinder. The tray or shoot is fixed inside the cylinder near the top, but it is not connected with the barrel in any way. The electric connections are so arranged that while the magnets in the revolving cylinder are passing over the shoot, they are disconnected from the dynamo, and so drop on to the tray any pieces of iron or other magnetic substance which they have picked out of the material. During the remainder of their revolution with the barrel they are in connection with the source of electricity supply and thus are magnetised and are ready to pick out any magnetic substance.



Magnetic Separator.

It will easily be seen that in this process the material is turned over and over many times as it passes through the interior of the cylindrical separator, and it is estimated that a piece of iron, from entering one end of the separator, would have to pass over the magnets about 120 times before it could escape at the other end. It is thus impossible for a piece of iron to pass through the separator without coming into contact with the magnets, as these magnets will pick up and deposit on the tray pieces of iron varying from the size of a small nail to a weight of many pounds. It is stated that almost all the iron is picked out by the time it has travelled with the material about 6 in. from the entrance end of the cylinder, and as the barrel is about 6 ft. long, there is plenty of spare room for safety. The separator barrel is driven at a normal speed of about 12 R.P.M. by means of gearing from a first-motion shaft running at 210 R.P.M. The power required to drive the separator is about $\frac{1}{4}$ H.P., and that for the dynamo is about $\frac{1}{2}$ H.P. Several of these machines have been supplied to the British Admiralty, and they can be used for almost any kind of material. They are especially useful in connection with grinding machinery, as the loss entailed by breakages caused by iron getting into the grinding plant is well known.

Manchester Electro-Harmonic Society.—The fifth concert of the season takes place on Friday, February 20th. The artistes will be as follows:—Soprano, Madame Louie Fidler (Hallé Concerts); tenor, Mr. Sam Hempsall, London (Ada Crossley and Marie Hall Tours); flautist, Mr. J. F. Ridgway; entertainer, Mr. Harold Marsden; at the piano and accompanist, Mr. E. Bennett North.

DISTILLING TURPENTINE BY ELECTRICITY.

By G. BASIL BARHAM, A.M.I.E.E.

One of the lesser known uses to which electrical energy can be applied is the distillation of turpentine. Wherever fir trees are to be found which contain a sufficiently large quantity of turpentine and where electrical energy can be obtained at a sufficiently low rate, not only satisfactory, but highly profitable results can be obtained. In fact, it is not necessary for a supply of energy to be available at the forest, for providing the cost of carriage is not excessive, the trees, or, if the trees are of greater value for other purposes, the refuse, such as chips, sawdust, &c., can be brought to where electrical power can be obtained, and the turpentine can then be profitably extracted. It is claimed that the results of work which has been actually carried out in this direction have been eminently satisfactory. The turpentine, after tests by chemists and painters who have used the product both for inside and outside work, is pronounced to be equal, if not superior, to the turpentine distilled from the long-leaf pine of the southern counties of the United States. From one cord of the resinous wood treated it is claimed that the tar oil, resin, pitch and charcoal (the by-products) more than pay the cost of the distillation of the turpentine, which is sufficient to show the value of the process from a commercial point of view. Accounts differ as to the actual value of the amounts of by-products obtainable from one cord of wood, but in one distillery there were as follows:—Resin, 60 lb.; tar oil, 20 gals.; charcoal, 1,300 lb. The oil is used for wood preservative, and is also manufactured into shingle stain. The charcoal, having been coked and cooled in a can out of contact with the air, is very perfect and valuable for use as fuel. The plant in question is of sufficient capacity to treat forty cords of wood per day. It is claimed that one cord of wood, costing approximately £1, yields, when treated electrically, pure turpentine, tar oil, resin, charcoal and pitch to the aggregate value of £5. The cost of timber, treating and marketing the products amounts to total slightly under £2 10s., so that the plant in question is returning, roughly, about 100 per cent. profit.

The principal difficulties in the process of distillation which have to be encountered are, it appears, those connected with the necessary close regulation of heat. The close regulation which is rendered possible by the use of electricity suggested its adaptation to the purposes of distillation, and a plant was laid down in Vancouver some little time ago to deal with the fir trees of the North Pacific coast, which contain a very large percentage of turpentine.

Electrical energy was obtainable at a low cost on account of the abundance of water power, and the necessary equipment for dealing with three cords of wood per day was laid down. The neighbouring saw mills provide the raw material which is water borne to the distillery. As it is landed it is packed into cans, which, according to the statement of the engineer in charge of the work, are wheeled into the plant, picked up by an overhead crane, and dropped into a brick retort, one of several, which are placed together in order to avoid radiation. The top of the can forms a flange which fits into a groove around the top of the retort. This groove is filled with tar and forms a gas seal. Electricity at 110 volts is carried through wrought-iron strips threaded through the brickwork on each side of each retort. The current supply for each retort is controlled by an ordinary switchboard which carries direct-reading pyrometers, which register the temperature outside the can and also at the centre, thus showing the maximum and minimum temperature conditions.

It is pointed out by the engineer that flexible connections are provided to the pyrometers, and they can thus be changed as desired from can to can. Describing the action which takes place, he mentions that the turpentine vapour is taken from the retort through a removable copper pipe leading to a condenser, consisting of an upright copper pipe, down which a spray of water is passed through the ascending turpentine vapour, and which terminates in a tank at the bottom. This serves as a separator for the condensed turpentine an water, the turpentine floating on the surface. The excess of water is withdrawn from the bottom of the tank, and the turpentine is conducted to a storage system.

When a can is inserted, the temperature of the brickwork is about 250° C. Heat is rapidly absorbed, and the temperature is maintained by a current of 400 amperes, which is passed through for about two hours. When the temperature of the outside of the can has reached 150° C., and the middle of the can about 205° C., the turpentine has been substantially removed. In the process the pitch runs off, and is collected in the bottom of the retorts. The greater heat in the middle of the can is due to the decomposition of hydro-carbons in the wood.

At this stage the can is lifted and placed in the adjoining retort, and its place is filled by another canful of raw wood. The can from which the turpentine has been removed is then connected to another condenser, the temperature rises steadily without further application of electricity, and the decomposition gives off a product known commercially as tar oil.

Another important by-product is wood tar, which can be used for a variety of purposes. This drains down to the bottom of the retort, and is drawn off at frequent and regular intervals. The process is continued for three hours, at the end of which time the can is removed and allowed to cool on a sand floor, making an air seal. At this stage the contents of the can consist of charcoal. After this has been cooled, without being allowed to come into contact with the air, it is found to be of a specially tough and close-grained character. The by-products per 1,000 lb. of wood are said to be approximately :—Turpentine, 6·7 gallons; resin, 168 lb.; tar oil, 5·1 gallons; tar, 68 lb.; and charcoal, 323 lb. It is interesting to note that the treatment of each can requires about 90 KW.-hours.

A COMMERCIAL CRITERION OF GAS AND OIL ENGINE PERFORMANCE.

A FURTHER example of the strenuous efforts made by the gas industry to delay the rapid progress of the electric motor is to be found in the action of the Gas Light and Coke Co. and the South Metropolitan Gas Co., who have borne the whole cost of an expert survey, conducted during the last two years, to ensure that their consumers should get the best possible results from their engines and at minimum expense. Up to the present time, close upon 800 engines have been inspected, tested and reported upon by Mr. W. A. Tookey, who explained (in an interesting paper read before the Institution of Mechanical Engineers) the means whereby he had been able to improve the working of 66 per cent. of all the engines tested and to such an extent that, by simple running adjustments alone, the average increase effected in power per impulse was 27 per cent., while the average reduction in gas consumption per I.H.P.-hour was 13·3 per cent. The success of the measures adopted and the fact that they were applied without deranging the normal operation of the engines concerned, make Mr. Tookey's results of interest to every owner or operator of internal-combustion engines of any kind, whether use to drive workshop shafting or an electric generator. The essential stages in the inspection and tests are as follows: At a preliminary inspection, the size, type and make of engine are noted; its mechanical details and conditions are examined; and its valve settings are checked. Indicator cards are then taken on light and normal loads with the engine "as found." From the previous checking of the valve settings and the information afforded by "load as found" and "light spring" cards, it is possible to decide which, if any, adjustments are required to improve the performance of the engine.

Throughout the above extensive series of commercial tests the mixture strength of charges has been computed in terms of total cylinder contents (gas, air and residuals), expressed in B.TH.U. per cubic foot, and divided into the mean positive-loop pressure calculated from indicator diagrams. The quotient (mean pressure/mixture strength) thus obtained has been an invaluable aid in deciding what steps to take to improve engine performance. It is easy, by theoretical considerations, to justify this factor as a criterion of thermal economy, and to justify the statement that if Tookey's factor lies between 2·3 and 2·4 lb. per square inch mean pressure for each B.TH.U. calorific value in 1 cb. ft. of cylinder mixture, the engine concerned is doing well, and can seldom be improved in economy under ordinary working conditions by adjustment. Fully-illustrated instructions for the determination and application of the new factor are to be found in Mr. Tookey's paper. The simplicity of this criterion, and the fact that it is applicable to every type and size of internal-combustion engine, make it particularly useful for test-bed and running-test purposes.

A further important conclusion to be drawn from this unique series of trials is that mixtures worth 50 or 55 B.TH.U. per cubic foot of effective cylinder volume can be burnt efficiently in gas engine cylinders, so that, given close adjustment of ignition timing, pressures of 90 lb. or more per sq. in. can be used without risk of preignition, provided the compression pressure is not too high, and the cooling adequate. From this it follows that engines rated on 80 lb. m.e.p. possess a capacity for overload far greater than is generally conceded to them, but to realise this overload capacity it is essential that means of control of ignition and mixture combustion be provided by makers. Ignition tubes with timing valves, must be abandoned in favour of adjustable electric ignition. To maintain maximum efficiency, indicator cards should be taken at frequent intervals while noting the fuel consumption, and thence determining the value of "Tookey's factor."

A significant deduction can also be drawn from the survey. Of these 800 engines, two-thirds were running inefficiently; the average improvement effected by the adjustments made was over 13 per cent., and in some cases the owners were recommended to have the engines repaired in addition. It is evident, therefore, that the gas engine needs expert supervision if it is to be kept in good order; and what applies to two-thirds of the London engines no doubt applies equally to all the industrial gas engines in the country.

NOTES.

(Continued from page 228.)

Refreshments at Electricity Works Inspections.—At a recent meeting of the Aberdeen Town Council, Mr. Walker objected to refreshments being provided at the electricity works on the occasion of the annual inspection, remarking:—"We can go down there and visit the electrical department without the assistance of anything, spirituous or otherwise." Mr. Stewart Thomson said the visitation meant going a lot underground, and if provision were not made in the way suggested, they might have 1,000 volts passing through them. It was very necessary that that should be prevented.

Annual Social.—The staff of the General Electric Co., Ltd., Newcastle branch, held their annual whist drive and dance on January 30th, at the Masonic Hall, Shields Road, Newcastle. The company, numbering approximately 160, spent a very pleasant evening, dancing being kept up to 1 a.m. The whist prizes were distributed by Mrs. J. Spence.

International Rubber Congress. — At the International Rubber Exhibitions of 1908 and 1911 papers were read by planters, chemists and manufacturers on everything connected with the production of rubber, and discussions followed that brought to bear the experience of experts from every rubber-growing country in the world. Those papers and discussions were fully reported and reproduced in two books that form valuable works of reference on every question connected with the industry, in which is engaged many millions of British capital.

As the fourth Rubber Exhibition and International Rubber Congress opens on June 24th, the President, Mr. H. A. Blake, requests that any person who desires to read a paper on any subject connected with the growing, curing or manufacture of rubber, or the possible expansion of its uses, or to take part in the discussions, will kindly communicate as early as possible with the Honorary Secretaries of the International Rubber Congress, Exhibition Offices, 75, Chancery Lane, London, W.C.

Continuity of Supply.—Too late for our "Correspondence" columns, the following letter has come to hand:—

"I regret to note that you have published an anonymous communication as to the rates of wages paid by the Yorkshire Electric Power Co. without first ascertaining whether there was any truth in the statement. The rates paid by the Yorkshire Co. are as set out in the statement enclosed for your private information. I think you will have no hesitation in agreeing that the statement made by your anonymous correspondent has no foundation so far as the Yorkshire Power Co. is concerned.

"W. B. WOODHOUSE, *Engineer.*

"Dewsbury, *February 4th*, 1913."

[The rates mentioned in the statement referred to are certainly not open to criticism.]

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials—At the Birmingham City Council on Tuesday the Electric Supply Committee recommended that the salary of MR. R. A. CHATTOCK, the city electrical engineer, be increased from £1,200 to £1,500. Mr. Ellaway referred to the growth of the undertaking and Mr. Chattock's duties and responsibilities since he received his last increase in June, 1907; he also quoted figures regarding salaries in the Glasgow, Liverpool and Manchester electric supply departments to show that the proposal was not unreasonable. An amendment was moved by Mr. M. L. Lancaster referring the matter back to the Committee for further consideration, the speaker remarking that an increase of 25 per cent. at one step was extraordinary, and adding that the contribution to the rates from the undertaking was not at all commensurate with the capital expenditure. Mr. Stephenson moved a further amendment making the increase to £1,400. He remarked that Mr. Chattock was well worth £1,500, but he asked the Committee to accept his amendment because it was more likely to be carried than the original resolution. Mr. Ellaway having intimated his acceptance of Mr. Stephenson's amendment, it was carried by 57 votes to 35.

Mr. L. H. Cumberland, charge engineer at the Dewsbury Corporation electricity works, has resigned his position.

The Exeter City Council has increased the salary of the electrical engineer, Mr. H. D. Munro, to £475.

Mr. Harry Hoggart, installation inspector in the electricity department of the Blackpool Corporation, has accepted a post in the testing department of the South Lancashire Power Supply Co. Last week his colleagues at Blackpool presented him with a gold watch, a fountain pen, and a pocket wallet. Mr. W. W. Parkinson, works superintendent, handed him the gifts.

At Leeds on January 28th, Mr. Barnett Pasacovitch, senior engineer-in-charge at Nuneaton electricity works, was married to Miss Jane Cohen. The presents included a set of silver tea knives from the works technical staff, and a silver rose bowl and other useful articles from his colleagues.

Mr. A. J. Wray, who for the past 10 years has been managing engineer of the Banbury and District Electric Supply Co., has been appointed managing engineer of the Kidderminster and District Electric Lighting and Traction Co. Mr. G. D. Vickers, assistant engineer of the Birmingham and District Power and Traction Co., Ltd. (Shropshire, Worcester, and Staffordshire Power Supply Co.), has been appointed managing engineer of the Banbury and District Electric Supply Co., Ltd.

On the amalgamation of Heaton Norris with the borough, the Stockport T.C. is to be recommended to increase the salaries of chief officials and fix maximum salaries for each position. It is proposed to increase the salary of the electrical engineer from £500 to £600 by two advances of £50 each; and to increase the salary of the tramways manager from £300 to £350.

Mr. T. A. Taylor, mains superintendent of the Hammersmith B.C. electricity undertaking since 1909, has resigned his appointment, having obtained a similar position with the Sunderland Corporation electricity department.

Mr. C. W. Coppinger, shift engineer, and Mr. A. E. Ricketts, sub-station superintendent, at the Poplar electricity works, are to be placed on the staff in Class 5 at salaries of £150, rising by annual increments of £12 10s. to £185 per annum.

Subject to the usual sanction, the following increases are to be made in the salaries of the undermentioned employés at the Eccles electricity works:—W. Ashton, mains foreman, £2 12s. 6d. to £2 15s.; A. M. Mulliner, assistant electrical engineer, £150 to £160 per annum; E. J. Gilbert, station superintendent, £2 15s. to £2 17s. 6d.: C. J. Walker, switchboard attendant, £1 to £1 2s. 6d. at the end of a year's service. It is also proposed to advance the wages of switchboard attendants by annual increments at the rate of 2s. 6d. per week to £1 5s. per week, subject to the satisfactory performance of their duties.

At a meeting of the Salford T.C., on the 4th inst., the resignation of Mr. H. J. Hawkins, borough electrical engineer, was announced from May next, and the Committee recommended that applications for the vacant position be invited at a salary of £1,000 a year, and that the sale of salaries be amended accordingly. Under the present scale the maximum is £700 per annum. The recommendation was adopted by a large majority. Alderman Linsley, who supported the motion, said the present condition of the Electricity Committee was due to the cheeseparing policy adopted in the past.

The Council is recommended to increase the salaries of the three charge engineers at the electricity works from £190 to £200 per annum, and to fix a higher amount as the maximum for these positions.

Mr. Ernest E. Kell is resigning his position as repairs engineer to the St. Marylebone electric supply to take up an appointment as chief assistant electrical engineer to the Ceylon Government, and would be glad if manufacturers would forward catalogues to the Public Works Department, Colombo.

Tramway Officials.—Amongst a number of recommendations for increases of salary which are to be brought before the Manchester City Council are the following:—Mr J. Wood, assistant manager, tramways department, from £500 to £600 per annum; Mr. D G. Mallalieu, permanent way superintendent, tramways department, from £300 to £350 per annum. The total increases recommended amount to £3,493 per annum.

The Maidstone T.C. has on the recommendation of the Light Railways Committee, increased the salary of Mr. Lambert, tramways manager, from £200 to £250 per annum.

General.—At the offices of the A.E.G. Electric Co., Oxford Street, W., on Saturday, January 31st, Mr. T. Hammond, who has been in the employ of the firm for the last eight years as supervising erecting and contract engineer, was the recipient of the following presents:—Solid silver card case, presented by Mr. A. C. Goodman on behalf of the management and office staff; silver mounted umbrella, gent's dressing case and pigskin attaché case, presented by Mr. Parsons on behalf of the foreman, wiremen, and mates. Mr. Hammond is leaving the company to take up the management of the contract department for Messrs. Tyler Apparatus Co., Ltd., at 15, Gerrard Street, W.

Mr. Wilfrid C. Parkinson, late of the Magnetic Observatory at Eskdalemuir, and formerly of the Royal Observatory, Greenwich, who recently was appointed as Magnetic Observer under the Carnegie Institution of Washington, has been given charge of the magnetic survey of Australasia, and was to leave Washington for Perth, Western Australia, last month.—*Weekly Scotsman.*

An Aberdeen newspaper states that Mr. James Dawson, electrical engineer, who has been in charge of the electric lighting department of Messrs. John Blaikie & Sons, Ltd., for the past 16 years, has been appointed electrical engineer to the Duke of Richmond and Gordon at Gordon Castle. Mr. Dawson will also be in charge of the electric lighting of the town of Fochabers.

Councillor J. J. O'Neill has been elected chairman of the Electricity Supply Committee of the Dublin Corporation, and Alderman Farrell deputy chairman.

The University of Bristol has recently awarded Mr. Chas. F. Smith the degree of D.Sc. in the Faculty of Engineering, for research work embodied in various papers read before the Institution of Electrical Engineers, and other publications in the same region.

Mr. C. J. Jones, of the Willesden works of the British Thomson-Houston Co., Ltd., who is proceeding to take up an appointment with the company in connection with the electrification of the Argentine Railways, has been presented by his colleagues with a watch and case of pipes.

At the annual meeting of the Dee Conservancy Board, the acting conservator, Mr. Caradoc Williams, received a presentation in recognition of his work in successfully carrying out the scheme of lighting the Dee estuary by electricity. Mr. Kenneth Younghusband, the electrician of the works, was similarly recognised.

Mr. Fiennes O. Trotman, after 7½ years' service as mains and distribution supervisor in the electrical engineers' department of H.M. Dockyard, Devonport, has tendered his resignation, he having accepted an appointment as engineer on the contract staff of Messrs. W. T. Henley's Telegraph Works Co. Ltd.

Obituary.—Mr. W. J. Williams.—The death took place on January 26th, from pneumonia, after a short illness, of Mr. Walter John Williams, partner in the firm of H. R. Williams and Co., electrical engineers and contractors, High Street, Barnstaple. Deceased, who was only 37 years of age, had, with his brother, Mr. H. H. Williams, had control of the business for the past 15 years.

Mr. R. C. C. Yates, electrical engineer with the Southern Mahratta Railway Co. in India, was thrown from his horse and killed on February 1st. Mr. Yates, who was 30 years of age, had been in India five years.

Wills.—The *Times* states that Mr. John Walker Wilkins, of Kingston, civil and electrical engineer, who in the forties succeeded in sending electric signals without wires, left estate valued at £113 gross.

According to the *Financial Times* the late Mr. A. S. Giles, general manager of the Lisbon electric tramways, left £7,523 gross and £7,343 net personalty.

PASSING-OFF ACTIONS.

[BY OUR LEGAL CONTRIBUTOR.]

It frequently happens that those who are new to any particular trade try to get business by an attempt to catch a little of the popularity of their trade rivals. Goods which are popular with the public are often sold under a distinctive title, and an attempt is made to copy that title without infringing the law. Nor is the adoption of a title which is a colourable imitation of that used by a rival the only device resorted to. The "get-up" of goods may be imitated in a manner calculated to deceive the unwary.

The fact that there are numerous reported cases on this question seems to show that these attempts are frequently made, and that persons whose goods have acquired a genuine reputation are not always fully alive to the extent to which the law will give them protection. It is proposed, therefore, to set forth the elementary rules on the subject, using the case of Thorn *v.* Eugen Sandow which was decided some time ago, as a kind of preliminary example. The facts there were very simple. The plaintiffs had for many years sold cocoa in tins, bearing the label "Health Cocoa." There was evidence that these words had acquired a secondary meaning and were known in the wholesale and retail trade to be distinctive of the plaintiffs' cocoa. The defendants recently commenced the manufacture and sale of cocoa in London, not knowing of the plaintiffs' business, and placing on their labels the words "Health d Strength." The plaintiffs sued accordingly for damages for nfringement of trade mark and for passing off. The defendants ounterclaimed for the amendment of the register of trade marks y expunging the word "Health" as applied to the defendants' ocoa, on the ground that, being a descriptive word, it was not pable of registration.

Mr. Justice Neville came to the conclusion that the words Health and Strength" were calculated to inform the public that they ere dealing with Sandow (Ltd.); that no person would be deceived to thinking it was the plaintiffs' cocoa. Consequently, he refused grant an injunction or to give the plaintiffs any relief. On the her hand, he came to the conclusion that the word "Health" as plied to cocoa could not form part of a valid trade mark, and dered the register to be amended accordingly.

Numerous illustrations may be given of what has and what has ot been held to be a resemblance calculated to deceive. In one se (Parsons & Co. *v.* Gillespie & Co. (1898) A.C. 239) Parsons and ., of Sydney, in 1890 began to sell and continued to sell a preparaon of oats as "flaked oatmeal," and registered a trade mark in ew South Wales containing these words, which they claimed to the designation of their goods in the market. Gillespie & Co., in 94, applied to register in New South Wales a trade mark conining the words "flaked oatmeal," but were refused in consence of Parsons & Co.'s registration. They then put upon the arket a preparation of oats under the title of "G's flaked oatmeal." arsons & Co. commenced a suit against them to restrain them from lling any preparation, not being the plaintiffs, as "flaked oateal." The get-up of the plaintiffs' packets and the defendants' ckets were very different, and the defendant's name appeared in rge letters on their packets. It was held, at the trial, that the fendants had sufficiently distinguished their preparation from e plaintiffs' so that it was not calculated to deceive the public; d the suit was dismissed, with costs.

The plaintiffs appealed, when it was held that they had not roved that the term "flaked oatmeal" was identified with the aintiffs' manufacture, and that the defendants had done no more an they had a right to do in taking appropriate words of ordinary scription to indicate their preparation, and that their acts ere not calculated to pass off their manufacture as that of e plaintiffs, and it was not proved in point of fact to have ne so.

The true principle was thus laid down in the Court of Appeal in e case of Payton & Co., Ltd., *v.* Titus Ward & Co., Ltd. (1900), R.P.C. "When the plaintiffs' getting up of goods consists of two ally different things combined, namely, a get up common to the ade, and a distinctive feature affixed or added to the common atures, what has to be considered is not whether the defendants' t up is like the plaintiffs' as regards the common features, but hether that which specially distinguishes the plaintiffs' has been ken by the defendant. A defendant may take it more or less. is very seldom that he copies it. Of course he does not do that, t if he so nearly takes it, that when you look at it as a whole u can say that the defendants' goods are calculated to be taken r the plaintiffs' goods when properly looked at—if you can say at—then the plaintiff is entitled to succeed. But if you cannot y that, and if the resemblance consists only in that which is mmon to the trade, to hold that the plaintiff is entitled to cceed would give a monopoly of the common features."

It has been held, however, that a person copying the attractive atures of newspaper advertisements of his rival (such advertiseents not being registered as copyright or as designs) does not ereby injure any property of that rival, and incurs no legal bility. This decision was arrived at in a case where the fendant had copied an advertisement consisting of stereotyped tterpress surrounded by pictures of objects which were offered as emiums to purchasers, slightly altering the conditions applicable such premiums and substituting his own firm's name for that of e original advertiser (Wertheimer *v.* Stewart (1906) 23 R.P.C. 1).

Let us deduce a few principles from these cases which may be of e in connection with electrical goods. Suppose a firm established reputation for a particular kind of electric lamp called the Minimum Consumption Lamp." Upon the authority of Sandow's se (*supra*) it is clear that the phrase "minimum consumption" uld not be made the subject of a registered trade-mark because it descriptive of the merits of the article. Nevertheless, while they uld secure no monopoly of the use of the words "minimum conmption," it is clear that if, by long user, the public had become customed to lamps of a particular size marked with these words letters of a particular shape, against any person imitating the ape of the lamp and printing the words in such a way as to ceive, an injunction could be obtained.

But take another case. Suppose a man were to commence to anufacture boosters and called them "X.Y.Z. boosters." Suppose, rther, that he were to prevent others using these letters as plied to boosters, his attempts would fail; because he could t show that those who hunt the market for boosters, would entify him with the machines which bore the inscription .Y.Z."

More Electric Vehicles.—It is reported that the rol-Johnston Car Co., Ltd., of Dumfries and Paisley, in addin to building electric pleasure cars, are about to bring out an tric delivery van and lorry of 20 cwt. capacity.

NEW COMPANIES REGISTERED.

Etablissements Kirby, Ltd. (133,[illegible]).—This company was registered on January [illegible], with a capital of £12,000 in 700 6 per cent. cumulative preference shares of £10 each and 1,000 ordinary shares of £5 each, to acquire from Kirby, Beard & Co., Ltd., of 5, Rue Auber, Paris, certain processes, designs, &c., and to carry on the business of manufacturers of, and dealers in, motor accessories, electrical accumulators, &c., in the United Kingdom or elsewhere. The subscribers are:—A. [illegible], 5, Rue Auber, Paris, merchant, 165 preference and 800 ordinary shares; [illegible] Jackson, 230, Bradford Street, Birmingham, company director, 100 preference. Private company. The number of directors is not to be less than two or more than five; the first are C. G. Beard, A. [illegible] and A. Jackson; qualification, £100; remuneration as fixed by the company. Registered office, 230, Bradford Street, Birmingham.

Dorman & Smith, Ltd. (133,632).—This company was registered on January 29th, with a capital of £50,000, in £1 shares (15,000 preference), to take over the business of manufacturing electrical engineers, &c., carried on at Salford, Lancs., as "Dorman & Smith," and to carry on the same and the business of suppliers of electricity, &c. The subscribers (with one share each) are:—C. M. Dorman, Corrsgate, Beaufort Road, Sale, Cheshire, electrical engineer; R. A. Smith, Ambergate, Wilmslow Road, Alderley Edge, Cheshire, electrical engineer; H. G. Baggs, 18, Chambres Road, Southport, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are C. M. Dorman, R. A. Smith and H. G. Baggs (joint permanent managing directors, each of whom may retain office while holding £1,000 shares); the two first named are governing directors, and may retain office as such while holding £5,000 shares each. Solicitors, Payne, Galloway & Co., 28, Brazennose Street, Manchester. Registered office, Ordsal Electrical Works, Middlewood Street, Salford.

Telenews, Ltd. (133,617).—This company was registered on January 28th, with a capital of £1,100 in 500 "A" and 500 "B" shares of £1 each, and 2,000 "C" shares of 1s., to carry on the business of advertisers, advertising contractors and agents, manufacturers of, and dealers in, telewriters, telautographs, lamps, wires, cables, insulators, accumulators and other apparatus, &c., and to adopt an agreement with A. B. D. Lang, J. A. Powell, L. V. Cockell and J. M. Theobald. The subscribers are:—J. Graham, 22, Great St. Helen's, E.C., gentleman, 335 "A" shares; W. E. Stewart, 22, Great St. Helen's, E.C., East India merchant, 165 "A" shares. Private company. The number of directors is not to be less than two or more than seven; the first are A. B. D. Lang, J. A. Powell, L. V. Cockell, J. M. Theobald, J. Graham, F. English and W. E. Stewart; qualification, 10 shares; remuneration as fixed by the company. Registered office, 22, Great St. Helen's, E.C.

North British Electric Welding Co., Ltd. (133,610).—This company was registered on January 28th, with a capital of £4,000 in £1 shares, to carry on the business of fusers of metals, electrically or otherwise, for welding or repairs, metal workers, boiler makers, mechanical and electrical engineers, &c., and to adopt an agreement with L. S. Taylor and P. Hutchinson. The subscribers (with one share each) are:—L. S. Taylor, 610, Royal Liver Building, Liverpool, consulting engineer; P. Hutchinson, 610, Royal Liver Building, Liverpool, consulting engineer. Private company. The number of directors is not to be less than two or more than five; the first are L. S. Taylor and P. Hutchinson; qualification, 100 shares. Solicitors: Tyrer, Kenion, Tyrer & Simpson, 10, Cook Street, Liverpool.

Bangham & Brooke, Ltd. (133,557).—This company was registered on January 26th, with a capital of £3,000 in £1 shares, to carry on the business of dealers in metal and scrap, ironmasters, founders, smelters, shippers, shipbreakers, converters of iron and steel, engineers, electricians, suppliers and distributors of electricity, &c., and to adopt an agreement between Emma B. Bangham and E. H. Brooke. The subscribers (with one share each) are:—Mrs. E. B. Bangham, 86, Bryn Road, Swansea; E. H. Brooke, Red House, Mount Pleasant, Swansea, metal merchant. Private company. The number of directors is not to be less than two or more than three; the first are Mrs. E. B. Bangham and E. H. Brooke (both permanent); qualification, £50; remuneration as fixed by the company. Solicitor, E. Harris, 3, Fisher Street, Swansea. Registered office, Temple Buildings, Goat Street, Swansea.

Boardman & Garstang, Ltd. (133,559).—This company was registered on January 26th, with a capital of £300, in £1 shares, to carry on the business of electricians, electrical and mechanical engineers and contractors, garage keepers, suppliers of electricity for light, heat, motive power or otherwise, &c. The subscribers are:—H. Boardman, 109, Bold Street, Fleetwood, electrical engineer, 50 shares; J. M. Garstang, Westwood, Whiteside Way, Cleveleys, electrical engineer, one share; H. S. Boardman, 109, Bold Street, Fleetwood, 50 shares. Private company. The number of directors is not to be less than two or more than three; the first are H. Boardman and H. S. Boardman; qualification, £50; remuneration as fixed by the company. Solicitors, H. J. Widdows & Son, Leigh.

Ebonitis, Ltd. (133,683).—This company was registered on January 31st, with a capital of £10,000 in £1 shares, to carry on the business of manufacturers of, and contractors or agents for, the supply of hard plastic material suitable for making gramophone records (particularly the compound known as "Ebonitis"), manufacturers of records, electrical switches, and other goods, &c. The subscribers (with one share each) are:—J. E. Hough, Wakefield, Chatsworth Road, West Norwood, S.E., engineer; W. F. Robbins, 48, Denman Road, Peckham, S.E., clerk; T. Hough, 202, Upland Road, East Dulwich, S.E., engineer. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; qualification, 100 shares; secretary (*pro tem.*) W. F. Robbins. Registered office, 5, Willowbrook Grove, Camberwell, S.E.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Singapore Electric Tramways, Ltd.—A memorandum of satisfaction to the extent of £33,600 on various dates from January 16th to December 15th, 1913, of debs. dated November 30th, 1906, securing £150,000, has been filed.

Crompton & Co., Ltd.—Particulars of £100,000 debs., created by resolutions of January 30th, 1893 and November 23rd, 1894, and secured by trust deeds dated January 26th, 1895, and November 17th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged. The company's property, including freehold works at Chelmsford and various patents. Trustees: Ivor Bevan.

Universal Radio Syndicate, Ltd. (124,355).—Capital, £100,000 in £1 shares. Return dated October 15th, 1913. All shares taken up. 10s. per share called up. £50,000 paid. Mortgages and charges: Nil.

Stolz Electrophone Co. (1913), Ltd.—Debenture dated January 21st, 1914, to secure £171 9s. charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. Hyman, 4, Heath Drive, Hampstead.

Electrical Engineering and Equipment Co. Ltd. (115,089).—Capital, £10,000 in £1 shares. Return dated December 31st, 1913; 1,002 shares taken up, £1,002 paid. Mortgages and charges: Nil.

Fred Danks, Ltd. (122,376).—Capital, £30,000 in £1 shares. Return dated November 14th, 1913; all shares taken up; £30,000 paid. Mortgages and charges: Nil.

Varley Magnet Co., Ltd.—A memorandum of satisfaction in full, on October 1st, 1913, of debs. dated October 1st, 1913, securing £500, has been filed.

Electro-Mechanical Brake Co., Ltd.—A memorandum of satisfaction in full, on January 19th, 1914, of mortgage and further charge dated June 11th, 1908, and May 19th, 1909, securing £5,000, has been filed.

Barsi Light Railway Co., Ltd. (44,589).—Capital, £300,000, in £10 shares. Return dated November 4th, 1913. 20,000 shares taken up, £10 per share called up. £200,000 paid. Mortgages and charges: £140,000 4 per cent. deb. stock and £124,100 4 per cent. later extension debs., part of £125,000 issued (£600 having been redeemed).

Newman & Co., Ltd.—Debenture dated January 19th, 1914, to secure £250, charged on company's undertaking and property, present and future. Holder: T. C. Hamblett, Alexandra Road, Penn, Wolverhampton.

Blackpool and Garstang Electric Light Railway Co., Ltd. (62,150).—Capital, £10,000 in £5 shares. Return dated January 2nd, 1914. 361 shares taken up. £4 per share called up. £1,707 paid (including £323 received on application for further shares, not allotted), leaving £60 in arrears. Mortgages and charges: Nil.

CITY NOTES.

Yorkshire Electric Power Co.

The directors, in their report for the year ending December 31st, 1913, state that the gross profit on the revenue account for the three years ending December 31st is as follows:—1911, £12,572; 1912, £12,710; 1913, £22,140. The net profit, after payment of mortgage interest for the same periods, is:—1911, £7,784; 1912, £7,361; 1913, £15,401. The balance brought forward from 1912 is £645, which gives a total of £16,046, and deducting the dividend paid on the preference shares to June 30th, 1913, of £3,308, leaves a disposable balance of £12,738. The directors recommend that this balance should be dealt with as follows:—Dividend for the half-year ending December 31st, 1913, at the rate of 6 per cent. per annum, on the amount paid up on the cumulative preference shares, amounting to £3,550; to general reserve fund, £5,000; carrying forward £4,188. The buildings, plant and mains of the company have been fully maintained. Considerable additions have been made to the horse-power of motors connected to the company's mains, and there has been a more than proportionate increase in the revenue during the year. The generating station at Barugh, in which waste gases from by-product coke ovens are used instead of coal, has been at work since October last; it shows a satisfactory saving, and is a valuable auxiliary to Thornhill. The generating plant, of 2,000 KW. capacity, is being supplemented by additional machinery, which will bring the total capacity of the station to 5,000 KW. The demand for the company's supply is rapidly increasing in the Barnsley coalfield, as well as in other portions of the company's area. Applications for the 6 per cent. preference shares of the company and the 5½ per cent. Waste Heat debenture stock have been continuous through the year. At the present date there remain unallotted £19,775 of the preference shares, and £6,320 of the debenture stock. In order to consolidate the capital of the company, the directors ask the shareholders to approve the further issue of £50,000 of the 6 per cent. preference shares, to be offered to the holders of the second mortgages of the company in exchange for their present holdings, any balance not so taken up being issued to the shareholders and others, and the remaining second mortgages paid off. Promises to exchange have already been received from holders of over £15,000 of these.

Smithfield Markets Electric Supply Co., Ltd.

The directors' report for the year 1913 states that the gross profit amounts to £5,764, compared with £4,005, and the net profit to £4,237, compared with £2,425 last year. A further sum of £400 has been placed to the debenture stock redemption fund (making a total of £1,741 to the credit of this account), and £2,500 to depreciation account. The available balance, including £954 brought in from 1912, is £2,291, with which the directors propose to pay a dividend at the rate of 2½ per cent. per annum on the ordinary shares, £1,500, carrying forward £791. The new plant has been running for the greater part of the year, but it has not yet been fully paid for pending the proper fulfilment of the contract guarantees. The other plant has been efficiently maintained, and it is satisfactory to note that a further reduction in costs has been effected. The cost of the plant and machinery displaced during the year has been entirely written off from the depreciation fund.

The meeting will be held on Tuesday next.

Mersey Railway Co.

The directors report that for the year ended December 31st, 1913, the train mileage run was 547,784 miles, as compared with 561,494 for the previous 12 months. The number of passengers conveyed during the year was 13,241,615, as against 12,745,311 for the previous 12 months, exclusive of season ticket holders. The total receipts in respect of railway working for the year have been £117,330, as compared with £112,376 for the previous 12 months. The working expenses, exclusive of the charges for pumping, ventilation and lifts, have been £57,019, equal to 48·88 per cent. of the traffic receipts, as against £53,739, equal to 48·10 per cent. for the previous 12 months. These charges for pumping, ventilation and hydraulic lifts, for the past year amounted to £7,266, equal to 6·23 per cent., as compared with £7,029, or at the rate of 6·29 per cent. for the previous 12 months. Under the scheme of arrangement scheduled to the Mersey Railway Act, 1900, as extended by the Mersey Railway Acts, 1906 and 1910, the payment of interest on the following debenture stocks, viz:—1866, 1871, 1882/3/5 and B, is contingent on the revenue of the company available therefor in each separate year. The auditors have certified that the revenue available for this purpose for the year ending December 31st, 1913, amounts to £20,202, as compared with £18,061, for the previous 12 months, and this amount is accordingly being distributed to the debenture holders, as follows:—

Interest at	4 per cent. on the 1866 debenture stock	..	£4,664
,,	3 ,, ,, 1871 ,,	.. ..	3,000
,,	3 ,, ,, 1882/3/5 ,,	.. ..	10,800
,,	12s. 4d. per cent. on the "B" debenture stock		1,735
	Balance carried forward	.. .. ..	2

The meeting will be held next Tuesday.

Dublin United Tramways Co., Ltd.

The annual report states that the amount available for division this year is £88,000. Ad interim dividends amounting to £35,595 were paid last August, leaving £52,445 now available. Out of this it is recommended that a dividend of 6 per cent. (less income-tax) be paid on the preference shares for the half-year ended December 31st, 1913, and that a final dividend at the rate of 5 per cent. per annum (less tax) be paid on the ordinary shares for the half-year ended December 31st, 1913, making with the ad interim dividend already paid a dividend on the ordinary shares, for the year 1913, at the rate of 5½ per cent.; setting aside £7,000 towards renewal of permanent way, and £3,000 for renewal of cars. The revenue account shows that the total receipts during 1913 were £297,731, as against £318,831 in 1912, a reduction of £21,100. The expenses showed an increase of £2,410. The directors point out that the restricted service necessitated by the partial strike of motormen and conductors in August last, and the general disorganisation of business owing to the labour disturbances of the last four months of the year, had a serious effect on the receipts.

Torquay Tramways Co.

As evidence of the progress of the undertaking, the following comparative statistics are given in the annual report:—

	1913.	1912.	1911.
Gross revenue ...	£33,564	£28,794	£22,949
Traffic revenue ...	32,214	28,112	22,635
Profit	15,782	11,755	8,895
Passengers carried	4,832,681	4,207,619	3,594,317
Car-miles	671,023	626,478	494,468
Average receipts per car-mile... ...	11·52d.	10·77d.	10·99d.
Ditto per passenger	1·60d.	1·60d.	1·51d.
Cost of energy per car-mile... ...	1·83d.	1·97d.	2·41d.

Deducting from the profit of £15,782, debenture interest at the rate of 5 per cent. on £118,000, and sinking fund charges for the redemption of prior lien debentures, there remains a balance of £9,182, plus £638 balance from 1912—£9,820. £2,500 is to be voted to the fund for reserve and renewals, £116 for depreciation on furniture, &c., and £126 for uniforms, and a bonus to the staff absorbs £195. Adding £6,000 for a 5 per cent. dividend on the ordinary shares (£120,000), there will remain £882 to carry forward to the current year's accounts. The undertaking has prospered since the company was able to substitute for the surface-contact system the overhead trolley system. An amount calculated roughly at £60,000 represents the cost of material left underground when the surface-contact system was superseded.

Monterey Railway Light and Power Co.—In consequence of conditions in Mexico, the directors have postponed payment of the interest on the 5 per cent. first mortgage debenture stock, due February 2nd, for the present.

South London Electric Supply Corporation, Ltd.
The directors announce a dividend on the ordinary shares for 1913 at the rate of 5½ per cent. per annum.

Continental.—France.—Among the new companies recently formed in France are the Société Electrique de l'Est, formed at Stenay (Meuse), with a capital of £6,000, to establish a central electric lighting station near that town; the Société Charentaise de Distribution Electrique (Paris, 5, Rue St. Vincent de Paul), capital £8,000; and the Compagnie Générale des Secteurs Electriques Français, capital £80,000, to establish central electricity supply stations in the Allier and Cote d'Or Departments.

The report of the last financial year of the Société des Exploitations Electriques, of Paris, shows a net profit of £17,180, as compared with £18,019 in the preceding 12 months; £16,589 is distributed to the shareholders in the form of a 5 per cent. dividend, leaving a small balance to be carried forward.

Russia.—The Gesellschaft fur Elektrische Beleuchtung (1886), of St. Petersburg, is increasing its capital from £421,660 to £527,080, with the object of extending its central stations in Moscow, St. Petersburg, and Lodz.

Finland.—The Swedish A.E.G., which company up to the present time has had an important export business to Finland, at the new year, owing to the increased volume of business, formed a subsidiary company at Helsingfors under the name of the "Allmänna Elektriska Aktiebolaget, in Finland." Apart from Finland, the company have now subsidiary companies of their own in Norway, Denmark, England and Spain.

Norway.—At an extraordinary general meeting of the Norwegian Electrochemical and Metallurgical Industry, A/S, it was unanimously decided to increase the present capital, £333,333, by £66 667, to a total of £400,000. The company carries on a financial and promoting business, and there can be no doubt that its activity will be considerably extended, the more so as the capital was increased by £161,000 just before Christmas, 1913. The new issue has already been taken up privately by several banks and financiers.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be quoted in the Official List:—

Commercial Cable Co.—£4,446 additional sterling 500-year 4 per cent. debenture stock.

Mississippi River Power Co.—$14,574,200 additional first mortgage 5 per cent. 40-year gold bonds, within Nos. M1 to 13,589 ($1,000), D1 to 166, 5,370 to 5,409 and 6,805 to 12,868 ($500), and C1 to 100, 2,103 to 2,197, 2,206 to 3,447 ($100).

South London Electric Supply Corporation, Ltd.—Further issue of £19,950 5 per cent. first mortgage debenture stock.

Prospectuses.—*Victoria Falls and Transvaal Power Co., Ltd.*—The list is to close to-day in a sale of £650,000—5½ per cent. second mortgage debentures, series B, at 92 per cent. There are issued £3,000,000—5 per cent. first mortgage debentures and £1,650,000—5½ per cent. second mortgage ditto, also £2,000,000 in preference shares and £1,000,000 in ordinary. The proceeds of the present issue will be used for extensions now in hand, which extensions are based on notified requirements already received from consumers. These extensions will bring up the generating capacity to 260,000 H.P., which, when in full operation, should increase the profit to £60.000 per month, on which estimate the service of the second debentures will be covered practically three times over.

Anglo-Argentine Tramways Co., Ltd.—On Monday last this company offered for subscription an issue of £1,500,000 of 5 per cent. debenture stock at 95 per cent. The issue is made to provide further capital towards the construction of the subways that have frequently been referred to in these pages, and for the general capital purposes of the company. It was announced that the list was to close on or before Friday (to-day), but as a matter of fact the list closed on Monday so far as the non-shareholding public were concerned.

Montana Power Co.—There has been offered for sale this week $10.000,000 first and refunding mortgage 5 per cent. sinking fund gold bonds 1943, at 94 per cent.

The City of Auckland, New Zealand, has been offering a 4½ per cent. electric power additional loan, to the amount of £224,500 in debentures at £100 each.

Metropolitan Railway Co.—The directors recommend a dividend on the ordinary stock for the past half-year at the rate of 1¾ per cent. per annum, carrying forward £8.200. A year ago the dividend was at the same rate. The dividend on the surplus land stock is at the rate of 2¾ per cent. per annum.

South America.—Although the total receipts in 1913 of the Société d'Electricité de Rosario only slightly exceed those of 1912, the net profits show an increase of £18,000, notwithstanding that the tramways have paid £11,000 less for energy, and that the charge for private electricity supply has been reduced by 25 per cent. The demand for energy for both lighting and power purposes shows steady progress, and consequently much better results are expected for the current year.

Japan.—The Yokohama Electric Co. reports a net profit of £43.582 for the last half-year. Of this sum £29.088 is being distributed to the shareholders in the form of an 11 per cent. dividend; £2,100 is being placed to legal reserve, £4 000 to capital sinking fund, £3,000 to dividend reserve, and £3,330 to bonuses, leaving a sum of £2,064 to be carried forward.

National Boiler and General Insurance Co., Ltd.—An interim dividend of 6s. per share is announced.

Parsons Marine Steam Turbine Co., Ltd.—An interim dividend of 6 per cent. for the half-year is announced.

South London Electric Supply Corporation, Ltd.—The directors recommend a dividend on the ordinary shares for the past year at the rate of 5½ per cent. per annum.

STOCKS AND SHARES.

Tuesday Evening.

To find an adjective that shall fitly describe the condition of Stock Exchange markets, as compared with that of a month ago might tax the vocabulary even of a professional journalist. It is beyond the power of the writer of such humdrum notes as these. Many men in the Stock Exchange call it miraculous and certainly the swiftness of the alteration in the financial situation is outside the experience of all but the most venerable members of the House.

Money is offered freely on the security of Consols at 1 [illegible] per cent. Day-to-day money can scarcely be lent at [illegible] per cent. There is no stopping the literally immense volume of money which is flowing into all the investment markets. It has but skirted the purely speculative areas, its attention being mainly confined to such stocks and shares as buyers and sellers are in the habit of paying for or delivering. Of course, a huge gambling movement has started side by side with the investment demand, so men are dealing in their 50 thousand or 100 thousand Consols with the same freedom as, in the ordinary way, they would speculate in a few hundred Kaffirs or Rhodesians. The only market of the House which has not participated in the revival is that devoted to oil shares, where interest is stagnant and the public cold.

The Electricity Supply list received a sharp fillip, by the declaration of a dividend of 12 per cent. on St. James', comparing with 10 per cent. for the previous year. This set the prophets discussing the chances of advances in other directions, and, at the same time, sent buyers flocking into the market. Most of the big London shares have risen, and the principal favourites are City Ordinary, where, of course, there is a speculative account to add stimulus to the dealings. The price of the shares rose £1 to 18, and it is hoped that last year's dividend of 9 per cent. will be followed by at least double figures. The County dividend of 6 per cent. is expected to be advanced to 7 per cent., and on the strength of this anticipation the ordinary shares rose [illegible] to 12½. Kensingtons hardened to 8, Metropolitans to 3⅞, London Electric to $1\frac{9}{16}$, while St. James' at 9½ are 12s. 6d. higher. Reference to the list will show that other gains have been secured, and the market as a whole is decidedly strong. The demand for Debenture stocks continues to be insatiable, and the quotations which are sent out are of chief interest to holders, because prospective buyers find that they can scarcely get hold of £5,000 stock in any one company. Fresh developments are taking place this week in connection with the coming Parliamentary session.

Crompton Debenture again soared, the price being 4 points higher at 80. General Electric Preference rose to ⅛ above their par price of 10. Other manufacturing shares are good, the rises including Callender's Ordinary, Henley's Preference, British Aluminium, and others. India-Rubber shares, exceptionally, gave way 10s., but this need not worry proprietors, because there is little doubt that if the markets continue in their present temper, the reaction will soon be wiped out. Rubber itself has again touched 2s. 6d. per lb. Babcock & Wilcox spurted to 64s.; gossip declares that Mr. Winston Churchill has an eye on the Sinking Fund for a few Navy millions. Which is as events may prove it to be.

The Colonial and Foreign list of electricity issues is as strong as the rest. The principal features are rises in Mexican Light and Power descriptions; the Common shares gained 4, and the Second Mortgage bonds have been in special request, the present price of 72 being 5½ up on the week, this coming on top of their 7½ points recovery in the week previous. River Plate pre-Ordinary stocks are better. Canadian General Common went up 6½ on the recovery in all the stocks and shares connected with the Dominion. The suspicion which recently overhung most things Canadian is in full flight, and the public are buying such issues as freely as other stocks and shares. Victoria Falls Preference braced up to 17s. Calcuttas are better, both as regards Ordinary and Preference.

The Home Railway market reflects the alteration in the mind of the investor. The reduction of the Bank Rate to 3 per cent. last Thursday, with the accompanying lowering of deposit rates to 1½ per cent., quickened the pace at which the tide of capital poured into the markets. The declarations of several good dividends cheered holders of the ordinary stocks, and the whole catalogue shows substantial rises as compared with a week ago. The Undergrounds have shared in the strength. Districts particularly have been in favour, but Metropolitans advanced, and the Underground Electric Railways bonds are all better. To-day (Tuesday) a trifling setback occurred, though it was insignificant in extent.

One of the features in the Traction department has been sharp rises in British Electric Traction stocks, the whole sextet advancing from 1 to 6 points. Rumour circulated the idea that the company is doing sufficiently well to pay, at any rate 5 per cent. on the Non-cumulative Preferred stock, which for 1912 received 3 per cent. Upon this, the price rose 6 points, while the company's Second Debenture stock went up 3. The 6 per cent. preferred at 17 is 2 higher, and the Deferred at 8 shows a rise of 2¼. London and Suburban First Debenture stock advanced 5. London United Tramways Debenture retained its previous rise at 66. In the prior-charge stocks there are many gains, District 4½ per cent. First Preference, for instance, putting on 8 points at 91. Metropolitan Electric Tramways Debenture rose 4, and Central London Assented stocks have again hardened.

The Anglo-Argentine Tramways Company has been offering—at 95—the balance of its 5 per cent. Debenture stock. For this there was a rush, and the lucky underwriters, who received 1½ per cent. commission, were able to sell firm stock at a premium before the allotments were out. The stock is certainly cheap enough at anything like 96, and will probably improve to the neighbourhood of par. The company's Preference shares are $\frac{1}{16}$ better in both cases. British Columbia Electric Deferred followed up its 12 points gain with another rise of 1½, and Calcutta Trams improved to 5⅛.

The Mexico Tramways group developed fresh strength, last week's big rises failing to arrest the buyers, who insisted upon having stock, and who took up the prices from 1 to 3 points. Rio bonds are better, the Seconds being 1½ higher at 97; and other securities in the same group displayed robust strength. Monterey Debenture was unaffected by postponement of the interest payments.

Whereas, a little while ago, new issues were regarded askance, and the cry went up that underwriters ought to make a ring with the purpose of boycotting them, the present conditions make Stock Exchange jobbers not only willing, but eager, to take fresh offerings of stock. The ease of the money market is the pivot upon which the whole situation turns. The authorities tell us that this may not merely be maintained, but may be accentuated by another fall in the Bank Rate; so that although a bull account has certainly been built up, even in investment markets, the buoyancy of money is relied upon to justify the buyers in holding their stock. New issues have to be advertised for a very short time before the lists are closed in sound, cheap stock. The new Melbourne Electric Debenture can be sold at 2½ premium.

The Telegraph rises of last week make futher progress, and it will be seen that there is a long string of advances to the credit of this market. The principal feature has been excited buying of Anglo-American Telegraphs, the Deferred stock swiftly jumping 1⅜ to 25½, while the Preferred put on 2¾. Direct United States rose 10s., and other Anglo-Americans were also good, the only dulness in this section being in American Telephone and Telegraph stocks, which were offered from the other side of the water. South American stocks and shares of all kinds found ready buyers, and the Brazilian position, for some reason or other, is declared to have altered for the better, just as the Mexican situation, which to the ordinary man might appear to be much the same as it was a month ago, no longer troubles the sleep of either speculator or investor.

The Eastern group improved with the rest; Indo-Europeans, Western Telegraphs, West India and Panama are all better. The Trust group is also firm, with Globe Preference ¼ up at 12¾. There has been substantial buying of Marconis, which took the price to 4$\frac{1}{16}$, from which it sagged slightly as profit-takers came in to sell. Marconi Marines have been in demand at 35s., upon anticipation that last year's dividend of 10 per cent. will be improved upon when the accounts for the current year are published. The markets all round are good; the important City failure at the beginning of the week had little effect, and in the price-lists overleaf it may be noticed that there are some 140 rises to about half-a-dozen falls.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month. £	£	No. of weeks.	Total to date. £	£	Route miles open.	Inc.
Bath	Jan. 28	2,671	— 229	4	2,671	— 229	..	..
Blackpool-Fleetw'd	„ 31	1,203	+ 28	4	1,208	+ 28	8	..
Bristol	„ 30	28,868	+ 1,568	5	31,190	+ 679	30·5	..
Brit. Elec. Trac. Co.	„ 23	193,182	+ 729	..	..	..	429·8	1·25
Chatham and Dist.	„ 29	3,206	— 898	4	3,206	— 893	14·98	..
Cork	„ 29	1,776	— 100	4	1,776	— 100	9·89	..
Dublin	„ 30	20,150	—1,930	5	21,646	— 2,157	54·25	..
Hastings	„ 28	2,585	— 300	4	2,585	— 300	19·8	..
Lancashire United	„ 28	6,058	+ 765	4	6,058	+ 765	42	8
Llandudno-Col. Bay	„ 23	601	+ 3	8	1,168	— 7	6·5	..
London United ..	„ 30	20,768	— 490	5	22,244	— 670	..	..
Tyneside	„ 31	1,782	+ 72	4	1,782	+ 72	11	..
Anglo-Argentine ..	„ 28	227,911	+ 8,741	4	227,911	+ 8,741	..	..
Auckland	„ 16	25,633	+ 3,980	28	135,588	— 3,874	25·42	1·81
Brisbane	Nov.	27,053	+ 2,743	..	287,071	+ 58,650	..	..
Calcutta	Jan. 31	18,228	+ 574	5	..	+ 677	..	..
Kalgoorlie, W.A. ..	Dec.	2,907	..	52	34,510	..	20·5	..
Madras	Jan. 31	3,876	+ 334	4	3,876	+ 334	15·25	..
Montevideo ..	Jan.	38,256	+ 195	13	102,095	— 72	..	..
Cen. London Rly.	Jan. 31	21,108	—1,857	5	26,347	— 1,713	6·78	·4
City & S. Lon. Rly.	„ 31	11,576	— 855	5	14,682	— 968	7·26	..
Dublin-Lucan Rly.	„ 30	467	38	4	467	[illegible]	7	..
L'pool Overh'd Rly.	Feb. 1	6,695	+ 2[illegible]7	5	8,408	+ 320	6·6	..
London Elec. Ry. Co.	Jan. 31	69,005	—1,045	5	74,190	670	21·25	..
Mersey Railway ..	„ 31	9,043	+ 88	5	11,829	+ 10	4·5	..
Metropolitan Rly.	„ 25	78,170	+ 6,200	4	73,170	+ 6,200	29·25	3·5
Met. District Rly.	„ 31	52,663	— 892	5	65,949	— 776	25	..

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, February 4th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	3d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£22 10	..
a Lead, Nitrate	„	£30 10	£1 inc.
a „ White Sugar	„	£28	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	82/-	7/- inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..

METALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
b Aluminium Ingots, in ton lots ..	per ton	£86	£4 dec.
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£112	£4 13 4 dec.
b „ Sheet, in ton lots ..	„	£112	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	⅛d. inc.
c „ Tube (brazed)	„	9⅝d.	⅛d. inc.
c „ „ (solid drawn) ..	„	8½d.	⅛d. inc.
c „ Wire, basis	„	7⅝d.	⅛d. inc.
c Copper Tubes (brazed)	„	10¼d.	..
c „ „ (solid drawn) ..	„	10½d.	..
g „ Bars (best selected) ..	per ton	£83	£2 inc.
g „ Sheet	„	£88	£2 inc.
g „ Rod	„	£83	£2 inc.
d „ (Electrolytic) Bars ..	„	£68 10	£2 inc.
d „ „ Sheets ..	„	£86 10	£2 inc.
d „ „ Rods ..	„	£74	£2 inc.
d „ „ H.C. Wire	per lb.	8¾d.	..
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/-	..
h India-rubber, Para fine	„	3/1½	½d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	51,5	3¼d. inc.
„ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£20 10	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small ..	per lb.	6d. to 3s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10⅜d.	⅛d. inc.
r Steel, Magnet, in bars	per ton	[illegible]	..
g Tin, Block (English)	„	£188 to £189	£14 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Blackpool and Fleetwood Tramroad Co.—According to the *Financier*, the directors have declared a dividend of 4½ per cent. and 2 per cent. bonus for the year, in addition to the interim dividend of 2 per cent. already paid. This makes a total dividend of 8½ per cent. £5,000 has been placed to depreciation reserve, and £2,500 to the general reserve.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors recommend a balance dividend of 1s. 3d. per share, making 5 per cent. per annum, for the year to December 31st. £5,000 is to be transferred to general amortisation fund.

Walter Scott, Ltd.—An interim dividend on the ordinary shares at the rate of 5 per cent per annum for the half-year ended December last is announced

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 3rd.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	$\frac{3}{16}$— $\frac{5}{16}$	..	Nil
Do. 5 % Pref.	1	5	5	⅝— ⅞	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75		6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	16 — 18	+2	..
Do. Do. Deferred ..	100	..	..	7 — 9	+2½	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	93 — 96	+1	6 5 0
Do. 7 % Non-Cum. Pr'f.	100	8	..	58 — 61	+6	4 18 1
Do. 5 % Perp. Deb. ..	100	5	5	93 — 96	+1	5 1 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	79 — 82	+3	5 9 9
Central London Railway, Ord. ..	100	3	3	59 — 61		4 13 9
Do. Gtd. Assented	100	..	4	84 — 86	+1	4 13 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	60 — 65	.	3 1 7
Do. Gtd. Assented	100	..	4	83 — 85	+2	4 14 2
Do. 4 % Deb.	100	4	4	97 — 99	+2	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	93 — 95	..	5 5 0
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½— ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 3
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	+1	6 0 6
London and Suburban, Ord. ..	1	..	..	¼— $\frac{5}{16}$	.	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅝— ¾	+$\frac{1}{16}$	6 13 4
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	77 — 82	+5	5 9 9

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 3rd.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	.	4 7 11
London United Trams, 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Metropolitan Railway Consol. ..	100	1⅝	1½†	15½— 16½	+ ½	3 9 9
Do. Surplus Lands	100	2¾	2¾†	64 — 66	+1	4 3 4
Do. 3½ % Deb.	100	3½	3½	86 — 88	+2	3 19 7
Do. 3½ % Pref.	100	3½	3½	83 — 85	+2	4 2 4
Do. 3½ % Con. Pref.	100	3½	3½	81 — 83	+3	4 4 1
Metropolitan District Ord. ..	100	Nil	..	33 — 33½	+1½	Nil
Do. 6 % Deb.	100	6	6	138 —141	+3	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	+2	4 4 3
Do. 4 % Prior Lien	100	4	4	94 — 96	..	4 3 4
Do. 4½ % First Pref.	100	4½	4½	90 — 92	+3	4 17 10
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	+1	5 2 2
Do. 5 % Deb.	100	5	5	88 — 91	+2	5 10 0
Potteries, Ord.	1	3½	..	⅝— ¾	..	..
Do. 5 % Pref.	1	5	5	[illegible]— [illegible]	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝— ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	3⅝— 3⅞	..	Nil
Do. "A"	1/-	..	..	$\frac{1}{32}$— $\frac{3}{32}$	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	116 —118	+1	5 1 7
Do. 4½ % Bonds	100	4½	4½	99 —101	+1	4 9 0
Do 6 % Income	100	6	6	95½— 96½	+2	6 4 4
Yorkshire (West Riding). Ord. ..	5	Nil	..	$\frac{1}{16}$— $\frac{1}{8}$	..	Nil
Do. 6 % Pref.	5	3	3	3¾— 4¼		4 11 3
Do. 4½ % Deb.	100	4½	4½	80 — 85	+1	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅞— 5⅛	+$\frac{1}{16}$	5 7 5
Do. 2nd Pref.	5	5½	5½	4⅜— 4⅝	+$\frac{1}{16}$	5 19 0
Do. 4 % Deb.	100	4	4	91½— 93½	+1	4 5 7
Do. 4½ % Deb.	100	4½	4½	96½— 98½	+2½	4 11 5
Do. 5 % Deb.	100	5	5	96½— 98½	— ⅛	5 1 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 —106	+1	4 14 3
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾— 11¼ xd	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	+ ½	4 13 9
Do. 5 % 2nd Deb.	100	5	5	98 —100	+1	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	92½— 94½	+2	6 7 0
Brisbane Trams Invt., Ord. ..	5	8	8	7⅝— 8⅛	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞— 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	119 —123	+1½	6 10 2
Do. Pref. Ord.	100	6	6	106 —110 xd	+3	5 9 1
Do. 5 % Pref.	100	5	5	102½—105½	+ ½	4 14 9
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	93½— 96½	+ ½	4 8 1
Calcutta Trams, Ord.	5	7½	5†	6 — 6½	..	5 15 5
Do. 5 % Pref.	5	5	5	5 — 5¼	+$\frac{1}{16}$	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝— ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5†	5	5$\frac{7}{16}$— 5$\frac{11}{16}$	..	4 0 0
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½— 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — $\frac{1}{16}$	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord. ..	1	..	..	⅜— ½	..	..
Do. Pref.	1	4⅜d.	6	⅞— 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1⅛— 1⅜	..	4 7 8
Do. 6 % Pref.	1	6	6	$\frac{15}{16}$— 1$\frac{3}{16}$	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅞— 5¼	..	5 14 3
,, Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	+2	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½—100½	+2	4 19 6
Mexico Trams Com	$100	7	7	76 — 79	+3	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	86 — 90	+2	5 11 1
Do. 6 % Bonds	100	6	6	85 — 89	+1½	6 14 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	5⅛— 5⅜	+ ⅛	8 18 0
Do. 6 % Pref.	5	6	6	4½— 5	+ ⅛	6 0 0
Do. 5 % 1st Deb.	100	5	5	93½— 95½	..	5 4 6
Perth (W.A.) Elec. Tr., Ord., ..	1	5½	..	1⅛— 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	+ ½	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101 —103	+ ½	4 17 0
Do. 5 % Mort. Bonds	100	5	5	96 — 98	+1½	5 2 0
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	100 —103	+2	4 17 0
Singapore Trams, 5 % Deb. ..	100	5	5	87 — 91	..	5 10 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	98 —100 xd	+2½	5 0 0
Un. Elec. Trams Monte Video ..	5	7	7	4½— 5	+ ¼	7 0 0
Do. 6 % Pref.	5	6	6	4⅞— 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	94 — 97	..	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord. ..	10	6	5†	9 — 10	..	6 0 0
Do. 4½ % Pref.	10	4½	4½	8⅝— 9⅜	+ ¼	4 13 6
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord. ..	5	10	9†	9⅛— 9⅜	+ ⅜	5 4 0
Do. 7 % Cum. Pref.	5	7	7	8⅝— 9⅛	+ ⅜	3 16 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	5†	4⅝— 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4¼— 4¾	+ ⅛	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	+ ½	5 0 0
Do. Do. 4 % Deb.	100	4	4	90½— 92½	+ ½	4 6 6
Chelsea, Ord.	5	5	4†	5 — 5½	+ ¼	4 11 0
Do. 4½ % Deb.	Stock	4½	4½	97 - 100	+ 2	4 10 0
City of London, Ord.	10	9	6†	17½— 18½	+ 1	4 17 3
Do. 6 % Cum. Pref.	10	6	6	13¼ - 14¼	+ ¼	4 4 3
Do. 5 % Deb.	Stock	5	5	116 - 120	.	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	99 - 102	+1	4 8 1
County of London, Ord.	10	6	5†	12¼- 12¾	+ ⅜	4 14 1
Do. 6 % Pref.	10	6	6	11¾— 12¼	+ ⅛	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	101½—103½	..	4 7 0
Do. 4½ % Second Deb. ..	Stock	4½	4½	99 102	+1	4 8 1
Edmundson's, Ord.	£3	..	..	¾— 1	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾— 4¼	..	7 5 5
Do. 6 % Non-Cum. Pref. ..	5	..	.	1½— 1⅞	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	+2	5 4 8
Folkestone	5	6	6	4½ - 5	+ ⅛	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅜— 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	+2	4 19 0

Hove	5	8	8†	8¾— 9¼	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	8†	7¾ - 8¼	+ ⅛	4 17 0
Do 4 % Deb.	Stock	4	4	84 — 91 xd	.	4 8 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	- 2	5 12 0
London Electric, Ord.	3	2⅝	..	1⅜ - 1⅝	+ ⅛	4 5 0
Do. 6 % Pref.	5	6	6	5⅝— 5[illegible]	+ ⅛	5 6 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 [illegible]
Metropolitan	5	4	4†	3⅞— 4⅛	+ ⅛	4 17 [illegible]
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜— 4¾	..	4 14 [illegible]
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 - 100	+1	4 10 [illegible]
Do. 3½ % Mort Deb.	Stock	3½	3½	81 - 84	..	4 3 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 - 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾— 10¼	..	5 14 [illegible]
Oxford	5	7	6†	6 — 6½	..	5 7 [illegible]
St. James' and Pall Mall, Ord. ..	5	10	10†	9½— 9[illegible]	[illegible]	5 2 7
Do. 7 % Pref	5	7	7	6⅝— 7⅛	..	4 18 [illegible]
Do. 3½ % Deb.	100	3½	3½	82 — [illegible]	..	4 [illegible] 4
South London, Ord.	4	5½	..	[illegible] 5⅜	+ ⅛	[illegible]
Do. 5 % First Mort. Deb. ..	100	5	5	98 101	..	[illegible]
South Metropolitan, 7 % Pref. ..	1	7	7	1$\frac{3}{32}$— 1[illegible]	..	5 14 4
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 - 96		4 13 9
Urban, Ord.	£3	Nil	..	[illegible]	$\frac{1}{16}$	
Do. 5 % Cum Pref.	5	3‡	.	2½— 3	.	5 0 0
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86 — 89	+1	5 1 3
Westminster, Ord.	5	10	10†	9 — 9½	+ ¼	5 5 3
Do. 4½ % Cum Pref.	5	4½	4½	5$\frac{1}{16}$— 5$\frac{3}{16}$	$\frac{1}{16}$	4 4 8

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 3s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 3rd.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6†	5⅛ – 5⅜	..	5 11 7
Calcutta, Ord.	5	8½	5†	7⅝ – 8	+ ⅛	5 6 3
Do. 5 % Pref.	5	5	5	5 – 5¼	– 1/16	4 15 5
Calgary Power, 1st Mort. Bds. ..	100	5	5	89½ – 91½	..	5 8 3
Canadian Gen. El. Com.	$100	7	8	114 – 118	+6½	6 15 7
Do. 7 % Pref.	$100	7	7	121 – 126	+2	5 11 1
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 – ⅞	..	7 12 0
Do. 5 % Deb.	100	5	5	90 – 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87½ – 89½	..	6 14 1
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 – 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	96 – 98	+1½	5 2 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 – 3/32	..	Nil
Do. 6 % Pref.	1	6	6†	11/32 – 17/32	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 – 104	..	4 16 2
Madras, Ord.	5	Nil	..	1½ – 1¾	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	101 – 104	..	4 16 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	70 – 74	+2	6 15 2
Mexican Lt. & Power, Common	$100	4	4†	51 – 54	+4	..
Do. 7 % Cum. Pref.	$100	7	7	86 – 90	+1	7 15 7
Do. 5 % 1st Mort. Gold Bds.	..	5	5	84 – 87	+3	5 15 0
Do. 5 % 2nd Mort. Bonds ..	100	5	5	70 – 74	+1½	6 15 2

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 3rd.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	64 – 69	..	..
Montreal, Lt., H. and Power ..	$100	9	10†	220 – 225 xd	+2½	4 9 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 – 20	..	..
River Plate, Ord.	Stock	10	..	207 – 217		4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	103 – 108	+2	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 – 103	+2	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	102 – 104	+3	4 6 7
Shawinigan Water, Capital ..	$100	5½	6†	139 – 144	–1	4 3 4
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ – 106½	..	4 14 9
Do. 4½ % Per. Deb.	Stock	4½	4½	97 – 100	+1	4 10 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	95 – 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 – 89	..	5 12 4
Victoria Falls Power, Pref. ..	1	6	6	13/16 – ⅞	+1/32	6 17 2
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 – 105	..	5 14 8

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 3rd.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	11/16 – 15/16	..	8 12 4
Do. 6 % Pref.	1	6	6	11/16 – 15/16	..	7 7 8
Babcock & Wilcox	1	16	14†	3⅛ – 3⅜	+5/32	4 18 6
Do. Pref.	1	6	6	1 5/16 – 1 7/16	..	4 8 6
British Aluminium, Ord. ..	1	..	..	1 1/16 – 1 3/16	..	..
Do. 6 % Cum. Pref.	1	6	6	13/16 – 15/16	+1/32	6 8 0
Do. 5 % Prior Liens Debs. ..	100	5	5	94 – 97	..	5 3 0
Do. Deb. Stk.	100	5	5	85 – 88 xd	+1	5 13 8
B.I. & Helsby Cables	5	10	8†	8¾ – 9⅜	+ ⅛	5 6 8
Do. Pref.	5	6	6	6⅛ – 6⅜ xd	+ ¼	4 14 1
Do. Deb.	100	4½	4½	100 – 103	+1	4 7 3
British Thomson-Houston, Deb.	100	4½	4½	92 – 95	..	4 14 9
British Westinghouse, Pref. ..	2	Nil	..	1 5/16 – 1 7/16	+1/16	Nil
Do. Deb.	100	4	4	68 – 71	+1	5 12 8
Do. 6 % Prior Lien	100	6	6	102 – 105	..	5 14 6
Browett, Lindley, Ord.	1	..	..	2/- – 3/-	..	Nil
Do. Pref.	1	..	..	8/- – 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 – ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	78 – 83	..	6 0 6
Do. 4½ % Deb.	100	4½	4½	39 – 43	..	10 9 4
Do. 4½ % Second Deb. ..	100	4½	4½	23 – 27	..	16 13 4
Callender's Cable	5	15	5†	11½ – 12	+ ½	6 5 0
Do. Pref.	5	5	5	4⅞ – 5⅛	..	4 17 9
Do. Deb.	100	4½	4½	97 – 100	..	4 10 0
Castner-Kellner	1	20	22½	2 11/16 – 2 13/16	+ ⅛	..
Do. Deb.	100	4½	4½	103 – 106 xd	+1	4 5 1

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 3rd.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	79 – 81	+4	6 3 5
Dick, Kerr	1	Nil	..	5/16 – 9/16	..	..
Do. Pref.	1	6	6	23/32 – 27/32	..	7 2 2
Edison & Swan, A, £2 paid ..	5	Nil	..	0 – ⅛	..	Nil
Do. fully paid	5	Nil	..	1 – 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 – 62	+4	6 9 1
Do. 5 % Second Deb.	100	5	5	63 – 68	.	7 7 1
Electric Construction	1	5	..	9/16 – 11/16	+1/16	7 5 6
Do. Pref.	1	7	7	29/32 – 1 1/32 xd	..	6 15 7
Greenwood & Batley, Pref. ..	10	7	7	6¾ – 7¼	..	9 13 2
Do. Deb.	100	5	5	92 – 94	..	5 6 5
General Electric, 6 % Pref. ..	10	6	6	9⅞ – 10⅜	+ ½	5 15 8
Do. Deb.	100	4	4	88 – 98	..	4 6 0
Henley's, Ord.	5	15	10†	13½ – 14	..	5 7 1
Do. Pref.	5	4½	4½	4 13/16 – 5 1/16	+1/16	4 9 0
Do. Deb.	100	4½	4½	100 – 102	..	4 8 3
India-Rubber, G. & T.	10	7½	7½	11⅛ – 11½	– ½	6 10 5
Do. Pref.	10	5	5	9 – 9¾	..	5 2 7
Telegraph Construction	12	20	5†	38 – 40	+1	6 0 1
Do. Deb.	100	4	4	96 – 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 – 69	..	5 16 0
Do. B 4 % Cum. Pref. ..	100	..	..	51 – 56	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 3rd.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	6¼ – 6¾	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	93 – 96	..	5 4 0
American Telep. & Teleg., Cap.	$100	8	8	124 – 127	–3	6 6 0
Do. Collat. Trust	$1000	4	4	89 – 92	–1	4 7 0
Anglo-American Telegraph ..	Stock	3	3	65 – 68	+3	4 8 3
Do. 6 % Pref.	Do.	6	6	108½ – 109½	+2⅝	5 9 10
Do. Def.	Do.	30/-	..	24⅞ – 25¼	+1⅜	5 18 3
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	103 – 105	..	4 15 2
Chili Telephone	5	8	..	7⅜ – 7⅝	+1/16	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80½ – 82½	+1½	4 17 0
Cuba Telegraph	10	6	6†	8⅞ – 9⅞	+ ¼	6 8 1
Do. 10 % Pref.	10	10	10	15¾ – 16¾	+ ½	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3½ – 4	+ ⅛	5 0 0
Do. 10 % Cum. Pref.	5	10	..	7¼ – 7¾	+ ⅜	6 9 0
Direct United States Cable ..	10	4	4†	6⅞ – 7⅜ xd	+ ½	5 8 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 – 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	131 – 134	+3	5 4 6
Do. 3½ % Pref. Stock	Do.	3½	3½	78 – 80	+2	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	95 – 97	..	4 2 4
Eastern Extension	10	7	7	12½ – 13	+ ¼	5 7 8
Do. 4 % Deb.	Stock	4	4	93 – 95 xd	+1	4 4 4
Globe Telegraph and Trust ..	10	6	6†	11¼ – 11¾	..	5 2 2
Do. 6 % Pref.	10	6	6	12½ – 13	+ ¼	4 12 4
Great Northern Telegraph ..	10	20	5†	31½ – 33½	..	5 19 5
Indo European Telegraph ..	25	13	5†	58 – 60	+1	5 8 4
Mackay Companies Common ..	$100	5	5	83 – 87	..	5 15 0
Do. 4 % Cum. Pref.	$100	4	4	67 – 71	..	5 12 8

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 3rd.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph ..	1	20	20	3 13/16 – 4 1/16	+1/16	4 18 6
Do. 7 % Cum. Partic. Pref. ..	1	17	..	3¼ – 3½	+1/16	4 17 2
Monte Video Telephone, Ord. ..	1	6	6	¾ – ⅞	..	6 17 2
Do. 5 % Pref.	1	5	5	⅝ – ¾	..	6 18 4
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 – 101	..	4 9 0
Oriental Telep. and Elec. ..	1	10	10†	1⅞ – 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1⅛ – 1¼	+1/16	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87 – 89	+ ½	4 10 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 – 100	..	4 0 0
Reuter's	10	10	10†	9 – 10	..	10 0 0
Submarine Cables Trust	Cert.	6	6	123 – 126	+ ½	4 15 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96 – 98	..	4 11 10
United River Plate Telephone	5	8	6†	6¾ – 7¼	+ ¼	5 10 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ – 5⅜	+ ⅛	4 9 0
West Coast of America	2½	2½	..	1 3/16 – 1 7/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	95 – 98	+1	4 1 8
West India and Panama Teleg.	10	1¼	1½	2⅝ – 2⅞	+1/16	4 8 6
Do. 6 % Cum. 1st Pref. ..	10	6	6	9¾ – 10¼	..	5 17 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 – 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	97 – 99	..	5 1 0
Western Telegraph, Ltd. ..	10	7†	7	13⅛ – 13⅝	+ ⅜	6 2 8
Do. 4 % Debs.	Stock	4	4	95 – 97	+2½	4 2 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	95 – 98	..	2 11 10

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

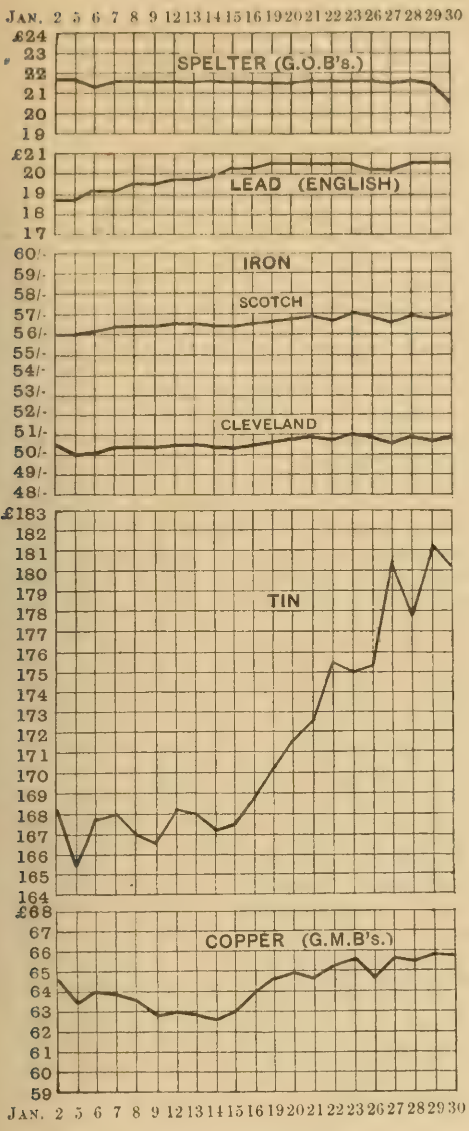
Bank rate of Discount 3 per cent., January 29th, 1914.

Central Suspension Lighting.—In connection with the Road Board's recent pronouncement in favour of central suspension lighting, and pending also the settlement of the compulsory powers which are being sought to attach fixtures to frontagers' buildings, the LONDON ELECTRIC FIRM, of Croydon, point out that existing tramway pillars may in many cases be utilised for carrying the span wire for the support of the arc or metal-filament lamps. As lowering gear specialists, they are prepared to undertake the carrying-out of schemes of this nature.

Electric P.O. Vehicles in U.S.A.—According to the *Electrical World*, the Indianapolis postal authorities recently hired two Waverley electric vehicles for parcel delivery work, owing to dissatisfaction with petrol delivery vans. The P.O. supplied the drivers, and the owners maintained the batteries. It was found that in a 8½-hour day the petrol cars delivered 136 parcels, with 135 stops, in 45 hours, while in a 7-hour day the electrics averaged 271 parcels, with 189 stops, in 18·75 miles. The cost per petrol car was $8·5, excluding wages, and for the electric truck $5·6. As the result of the satisfaction given, the postal authorities have asked the Waverley Co. to provide additional vehicles on the same basis.

METAL MARKET.

Fluctuations in January.



Osram and Robertson Social and Athletic Club.—The eighteenth annual dance was held at the Brook Green Works, Hammersmith, on Saturday, January 31st. About 300 members and visitors were present, and full justice was done to the excellent programme provided. Members of the works fire brigade were conspicuously in attendance, most of them displaying an imposing array of medals. Much skill and taste was displayed in the fancy dresses worn, and the Dance Committee had a difficult task to perform in allocating the eight lady's and three gentleman's prizes. The latter were distributed by Mrs. C. Wilson, and in replying to the vote of thanks vociferously accorded by the gathering, Mr. C. Wilson (manager) announced that the directors had empowered him to give financial assistance to any employé whose health demanded special attention or a seaside vacation. Mr. Wilson emphasised the fact that assistance so given was not to be regarded as charity, but as a fair payment made by the company to maintain the health and efficiency of its workpeople. We were pleased to renew on this occasion our acquaintance with the recently opened cosy staff club premises; these are proving self-supporting in every respect, and over 100 luncheons are frequently served.

Gas Again.—A German correspondent writes that at Essek a family of four persons were suffocated on January 29th by gas escaping from a leak in the street lighting main, although the house itself has no gas service.

REVIEWS.

The Science of Illumination. By Dr. L. Bloch. Translated by W. C. Clinton. London: John Murray. Price 6s. net.

As Dr. Bloch explains in his preface, the first part of this book is devoted to an explanation of fundamental principles; methods for determining mean spherical and mean hemispherical candle-power are then considered in some detail, and the final chapter deals with indirect lighting. It is interesting to note that the greater part of the experimental and practical data incorporated in this work have been obtained in the experimental lighting station of the Berliner Elektrizitäts-Werke.

As this is a translation of a German book, we have to congratulate Prof. Clinton upon his undertaking, for he has rendered the matter most clear and interesting.

At the outset the author explains all the photometric terms in a manner which can be easily understood by his readers; certain debatable points are discussed at length, as, for instance, Glare. The table at the conclusion of Chapter I should be of use to those who have only just entered upon the subject, since the connection existing between the fundamental units is clearly set out.

In the next chapter many methods are given for the measurement and calculation of luminous intensity, but to the average reader we are afraid that the calculus will prove somewhat of a bugbear, for knowledge of this section of mathematics is, in our experience, extremely limited; the careful student will, however, follow the steps with interest and obtain a very clear conception of the matter. The graphical construction of Kennelly's method is perhaps not quite so obvious as it might be, but can be fathomed by studying closely the attached figure. Rousseau's method is clearly put, and the mathematics of it concisely stated. To those whose duty it is to determine the mean spherical or mean hemispherical candle-power, we recommend Dr. Bloch's own formulæ, namely—

$$I_{\circ} = \tfrac{1}{8}\left(I_{30^\circ} + 2\,I_{60^\circ} + I_{80^\circ} + I_{100^\circ} + 2\,I_{120^\circ} + I_{150^\circ}\right)$$

$$\text{and } I_{\circ} = \tfrac{1}{4}\left(I_{30^\circ} + 2\,I_{60^\circ} + I_{80^\circ}\right)$$

where I_{30} &c., are the candle-power intensities at the indicated angles. We have used these formulæ for rough determinations and found them reasonably accurate.

It is pleasing to note that the author emphasises the fact that the luminous intensities of different sources are not always capable of direct comparison, and later on points out that conclusions arrived at in comparing the sources are never free from error and often entirely untrustworthy. Under the heading: "The Influence of Globes and Reflectors," Dr. Bloch again indicates possible sources of error in making comparisons. A detail which, however, has evidently escaped notice is the necessity of providing reflectors with either a matte surface or else a corrugated surface in order to prevent striations in the resultant illumination.

In view of the recent discussions on the question of street lighting, the views set forth are extremely interesting, and the conclusion arrived at is well worth consideration, namely, that the results are best estimated on the basis of horizontal illumination at a height of 5 ft. (1·5 metres) above the ground. For interior illumination, the author puts forward a height of 2 ft. 7½ in. to 3 ft. 3½ in. (·8-1·0 metres). The calculation of illumination is very fully dealt with, but we cannot credit that the calculations suggested are necessary; indeed, it would be impossible to find time to go through any but the most important schemes in such a thorough manner. The curves are instructive, but nowadays there are so many reflectors on the market with so many distributions that it would be necessary to have a luminous flux curve, as put forward, for each one, a most formidable task. The numerous examples using this "simplified" method are really necessary, in order to grasp the author's meaning, but, when compared with more simple charts and methods which have come under our notice, are tedious. Accuracy is to be desired, but when it is well-nigh impossible to detect a variation of two to one at intensities generally employed, it is doubtful whether it is worth while making intricate calculations which can be, and usually are, upset owing to variations impossible to prevent in a commercial undertaking, such as, for example, voltage, gas pressure, &c. This attention to detail marks the book as German and theoretical, and not at all commercial.

The author is under a misapprehension when he dwells upon the variation of illumination values with height of suspension and other details connected therewith. He apparently loses sight of the fact that for a certain intensity the lamp may be placed at almost any height, provided that it is equipped with the correct reflector. In fact, he takes no account whatever, in this portion of his book, of shade and reflector design, a matter greatly to be regretted in such a work. At the end of the chapter a few paragraphs are devoted to some interesting data on gas lighting and rough calculations of lighting costs.

Several portable photometers are briefly described, and in the following pages figures and curves of actual tests are displayed, together with deductions therefrom. Here, again, the detail is laboured to a doubtful point; the final table of results, however, should be extremely useful, since it embodies data upon all types of lighting units.

The final chapter is devoted to indirect lighting and contains some extraordinary statements; the matter and calculations are again in detail, but there is much to be gleaned and a perusal of these pages is well worth while. Unfortunately, the table of results given by Dr. Bloch deals only with arc lamps, and in this respect one misses data embodying the use of metal-filament lamps. The chapter finishes with a short paragraph on semi-indirect lighting. The appendices are a feature of the book, and much useful information is to be found condensed in the last few pages.

The references given in the footnotes throughout the work are particularly pleasing, and on this account one can with ease make reference to amplified dissertations. The book will be found useful by those who are interested in illuminating engineering, especially from a theoretical point of view, but it is doubtful whether it will find a very wide circulation in this country. Dr. Bloch and his translator are to be congratulated upon their colossal undertaking.

Electric Furnaces in the Iron and Steel Industry. By Dipl. Ing. W. Rodenhauser and I. Schoenawa. Authorised Translation and Additions by C. H. vom Baur. London: Chapman & Hall, Ltd. 1913. Price 15s. net.

There is no doubt that the application of electricity to metallurgical industries opened out the widest field of possibilities for industrial science. The electric furnace, which was only an idea at the end of last century, has now become a familiar aid to the metallurgist. Progress has been extremely rapid, a fact which is due both to the electrical engineer, and also to the needs of many advanced industries. Electrical heating was first used on a large scale in the production of aluminium and calcium carbide, and later of ferro-alloys. The success of the latter led to the introduction of the electric furnace in steel production, with even better results. The present volume deals exclusively with electric steel furnaces, and is the only book of its kind yet published. Previous authors have dealt with the subject of electrometallurgy in great detail, but none has confined himself exclusively to the production of iron and steel. This book, therefore, may be regarded as an epoch marker in a new industry. The book is designed, according to the author's statement, for the practical man; yet it explains the electric laws and phenomena involved, as well as the scientific principles upon which the work rests. The authors also hope to render the book of service to the general student of this branch of electrochemical engineering, and elucidate especially the principal laws on which the construction and operation of electric furnaces depend, without giving long mathematical discussions.

The authors have commenced a task which is almost impossible to carry out. The first part of the book is largely devoted to both mathematical and electrical principles. The nomenclature alone is beyond the grasp of the average practical man, and in spite of numerous examples, is of little value except to the advanced student and engineer. The various furnaces now in use are each described in turn, and a vast amount of valuable data is reproduced. The practical nature of this part of the volume renders it invaluable. It is written with the undoubted authority of a personal knowledge of both furnace construction and steel production. A vast amount of material has been brought together in a readable form, which has hitherto been hidden in publications inaccessible to most metallurgists. Part I begins with a historical review of the development of the electric furnace. This is necessary for the complete work, but contains nothing new. The arc furnace is first described in its various forms, including all the successful and well-known types. The following chapters are devoted to the various forms of the induction furnace, amongst which is described the one named after the author. This part of the book concludes with a list of firms using electric furnaces up to the date of publication, the type of furnace in use, the power consumption of each unit, and the class of steel produced. A very casual glance at this list is sufficient to show where progress is being made. England is almost unrepresented. By far the largest number of furnaces are installed in North America. This, of course, is due largely to the great number of waterfalls suitable for the development of water power in the country last mentioned.

The second part of the book treats of the materials of furnace construction and the cost of operation. It contains much valuable information resulting from practical experience, and will form a permanent work of reference to those interested in electric steel production. The third part of the volume is devoted to the electric smelting of iron ores for iron and steel production. This part is one of the most interesting, as it deals with an industry which is at the present time emerging from the experimental stage. Attempts are now being made to introduce the methods described into countries where water-power is plentiful, but where coal is scarce. When they are in operation huge tracts of now practically useless mineral-bearing lands will be thrown open for development.

The book is copiously illustrated, both with diagrams and photographs, and gives an excellent idea of actual working details. It is beyond all doubt a standard work, and must remain so for many years. The mathematics is of necessity complicated, and it is impossible to make it otherwise, in spite of the authors' statement to the contrary, in their preface. About 40 abbreviated signs are required for the various formulæ, which gives a fair indication of the nature of the mathematics. This difficulty, however, is wisely overcome by numerous practical examples, which constitute one of the best features of the book. The many practical difficulties arising out of the electric steel industry are discussed in detail, and the solution is given when known. The volume is full of valuable information from beginning to end, and the best thanks of all metallurgists are due to the authors.

Reduction in German Lamp Prices.—It is announced that, as a result of notice given by the A.E.G., the price convention existing between the A.E.G., the Siemens & Halske Co. and the German Incandescent Gas Light (Auer) Co. in regard to the new half-watt lamps has just been dissolved as a consequence of foreign competition. This rivalry has hitherto not been manifested by a reduction in the list prices, which have ranged from 15s. to 38s. for the high candle-power lamps concerned, but by an increase in the discounts, which already rise to as high as 30 per cent. It is explained in circles associated with lamp makers that the dissolution of the convention represents no incisive action, as it is desired to secure greater liberty of movement in relation to sellers of lamps and installation contractors. A similar purpose is sought to be served by the indirect reduction which has recently also been made in wire lamps for normal powers by three members of the Metallic Wire Lamp Convention, with the object of parrying the competition of the manufactures of smaller firms. In this case the list prices have scarcely undergone any change, but discount rates have been raised in some instances.

Wireless Operator's Heroism.—The wireless operator on the liner *Monroe* which was sunk in collision last Friday, named Ferdinand Kuhn, after sending signals for aid up to the last moment, put on a lifebelt; but seeing a woman without one, he gave her his own. Immediately afterwards the ship sank, and he was drowned. The woman was rescued.

BOOSTERS IN CONTINUOUS-CURRENT NETWORKS.

By H. M. TAYLOR.

In dealing with the question of distribution of continuous current in a town network, the difficulty of maintaining constant pressure in the suburbs is constantly felt. Again, the introduction of heating and cooking devices is rendering the trouble still more acute.

Small outlying districts using but, say 50 amperes, on each side of the three wire system can easily suffer to the extent of 5 per cent.

Additional feeders are too costly for such a case, and again, to be of any use, would have to be of very large section, or have feeder boosters inserted at the generating station.

Such districts, when entirely private houses, notice the effect far more than shop districts, as on snop closing nights—weekdays and Sundays—the consumers still have the usual number of lights on, but the bar voltage at the generating or sub-station is not so high, and every night the voltage varies throughout the evening.

Apart from the question of the voltage of the outers, quite a small out-of-balance will cause great neutral drop over such a long distance.

At Middlesbrough such a case arose in a district of large private houses taking a total of 50 amperes each side of the three wire system. Most of these were on a pair of 0.1 triple distributors, which left a three-way box in the network at a point situate 1,950 yards from the generating station nearest run, and 1,000 yards from the nearest feeder and nearest run. (See figure 1.)

Had a new feeder to this box been run it would have been put in at least 0.4 section to allow for future developments, and thus at its present light load it would have suffered severely from the alterations of the station bus-bar voltages on various days and at various points of the load. In fact, feeder-boosters would have had to be installed at the works. The cost of such a scheme would have been prohibitive. The case is very typical, and can be found on almost every network, and the cure should be of especial interest to the "Point Fives." This cure was brought about as follows:—

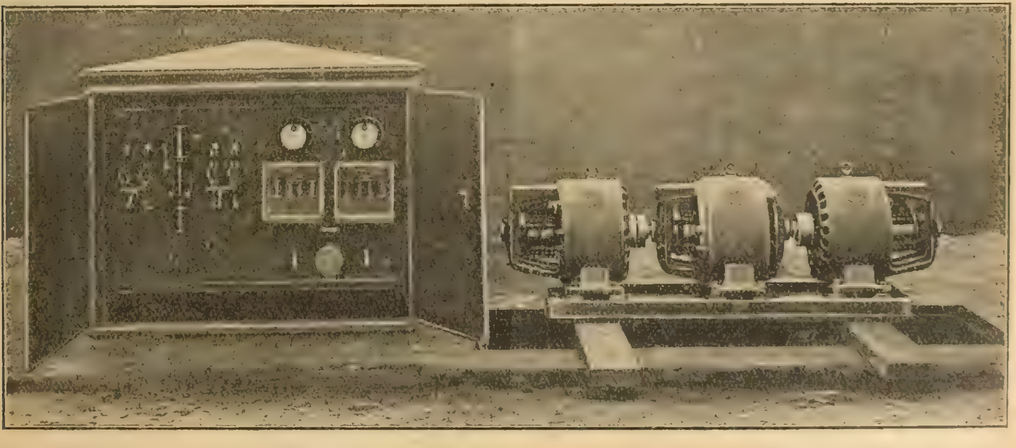


Fig. 2.—Feeder Pillar and Booster.

A booster set was fixed in a tank at point A. The booster consists of 2 100 ampere by 30 volt boosters, one on each side of the three wire system, driven by a 440 volt motor. At the side of the tank, which is under the footway, is a feeder pillar. The pillar contains disconnecting switches for the boosters, which also shortcircuit the booster connections, and two Taylor Scotson automatic voltage regulators which cause the boosters to keep the voltage at the required point.

The booster set is started and stopped by an automatic starter on the motor actuated by a time switch, as it is only proposed to run the boosters during lighting hours.

In some cases this time switch might be replaced by an automatic arrangement which would start the booster set whenever the voltage varied more than a selected amount, but it was felt that the time switch was more positive and preferable. The underground tank is ventilated into the pillar, and as this has been carefully designed, the effect is such that there is no danger of moisture in the booster tank causing a burn out of the set.

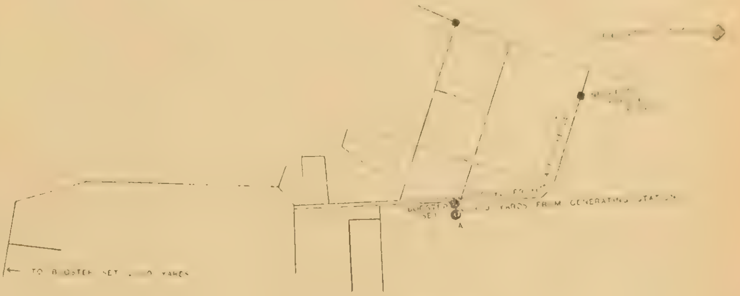


Fig. 1.—Boosted Network.

The effect has been that the Taylor-Scotson regulators maintain the voltage within ½ per cent. throughout the run. To show the necessity of the layout, the booster has at times to give up to 24 volts per side, indicating the condition of things (before it was fixed.)

The pressure maintained is 230 per side on a declared consumers' pressure of 220 volts. The time switch is set to stop the set when the load is sufficiently light, at present half an hour after midnight.

It may be argued that taking the current from the incoming cables to drive the booster would severely affect the voltage on those cables. Such current is quite small. With a boost of 24 v. by 50 amp. a side, or a total of 2.4 K.W. only, say 6 amperes is needed on the 440-volt motor. It is not proposed to leave the arrangement for all times.

When the district develops sufficiently to allow of a rotary sub-station being provided or even an alteration to the feeder system being justified, the layout may be moved to test the development of another outlying district, but at the present time no other arrangement could be faced on account of cost, nor would it have given such good results.

The system was designed by Mr. H. M. Taylor, Borough Electrical Engineer, Middlesbrough, and his assistant, Mr. R. H. Scotson.

The layout was assembled by the British Insulated and Helsby Cables, Ltd., the boosters being supplied by the Lancashire Dynamo and Motor Co., Ltd., and the Taylor-Scotson automatic regulators and switchgear by Messrs. Cox Walkers, Ltd., Darlington.

VILLAGE LIGHTING.

[COMMUNICATED.]

There has been during the past year or so a remarkable increase in the number of small towns and villages lighted by electricity. The two chief reasons are the advent of the metal filament lamp and the relaxation of the unreasoning prejudice against overhead wires that has prevailed in this country.

The writer started a supply in a village with 800 or so of population five years ago, when he saw that the new lamp justified the expectations that had been formed, and had come to stay. He has in these five years accumulated some experience in this particular branch, which differs, as has been pointed out in this paper, in material respects from the ordinary run of city and large town work. Having been appealed to several times for data regarding size of plant required, units used per lamp per annum, etc., by others who were contemplating the launching of similar schemes, he feels that a few notes on the subject might interest some readers.

It is as well to point out at once that there was no gas supply in existence in this village, which fact was certainly a point in favour; at the same time, in the few instances where there are gas undertakings in the district, in small towns or villages at all comparable in size with the one under notice, the price of gas runs out somewhere near six shillings per thousand feet, so that it does not follow that it would have been so very formidable as a competitor. He would certainly be a very daring speculator who would now contemplate the construction of a gas works.

At the same time, the idea of electric light being supplied cheaply enough to replace the existing paraffin lamps was treated with scorn and derision by a great number of the inhabitants, and looked on with doubt by almost all—it was not considered to be within the range of "practical politics."

However, a few of the leading inhabitants took enough interest in the idea to meet the propounder of the scheme, and listen to his explanation of the possibilities of the wonderful new lamp, illustrated with figures giving the number of hours' light obtainable for a penny on the basis of the proposed charge per unit, and, under the influence of the said figures, and of personal faith in their author, decided to raise a few hundred pounds, a very few, to give the idea a trial.

The first procedure was the formation of a company, limited of course. The legal work in connection with this was undertaken by a solicitor friend of one of the shareholders, for the lump sum of £25. Almost the first question to arise was the advisability or otherwise of seeking a provisional order. As the only substantial benefit of this would have been to secure compulsory wayleaves, and as the promoter of the scheme had already in his possession letters from the two road authorities, the County and Rural District Councils, giving their assent to the placing of poles upon the roads in approved positions, it was decided not to apply. Another satisfactory reason was, that it would have taken a large slice of the money promised, so large as to knock the whole thing on the head. By the way, there is a generally prevalent idea that a scheme of this kind could not be started without a provisional order. This is, of course, not so, provided that a provisional order granted to someone else does not cover the district.

An immediate start was made. The voltage decided on was 100, and the system 2-wire direct current. The low voltage may be explained by the fact that at that time the metal filament lamp was not available in the higher voltges. Wooden poles and bare wire, of course.

As to power, an oil engine was mentioned, but eventually, owing to special local circumstances, steam power was adopted, even on this small scale, and has continued to the present date, and it must be said that at the present cost of paraffin, steam, even with a small simple non-condensing engine, is cheaper by 50 or 60 per cent. The whole plant is of the very simplest, the switchboard being just the ordinary pattern arranged for battery charging, there being till recently only one feeder, controlled by D.P. switch and fuses on the board. Owing to extensions recently another feeder was added, which requires a slightly different voltage on its terminals.

It may be remarked that prior to the decision to proceed, a canvass was made of the tradesmen on the route along which mains were proposed, and enough favourable replies were received to warrant a start being made. Here the writer may interject his opinion that such a canvass is of little value, as, in the end, it is on its merits that such a scheme will gain or lose support, and there is little doubt that had anything untoward happened in the case of the first customer or two connected, the remainder would not have hesitated to cry off, and naturally so, for the wiring of premises costs something.

Concerning this point of wiring, the promoters decided to do nothing with free wiring in any shape or form, and every point wired in the village to this day has been done at the expense of the landlord or occupier. As to mode of wiring, after every system has been considered, things have settled down to a standard of wood casing, with an occasional job in twin V.I.R. lead-covered, and very little indeed of conduit.

Then came the question: Meter or no meter? Considering the present price of fairly good meters, the engineer plumped for meters, and they were adopted. They consist mainly of a well-known cheap motor meter, and an electrolytic penny-in-the-slot pattern meter. Despite the one or two drawbacks appertaining to the latter, such as a tendency to short circuit if not very regularly attended to, and the need of frequent renewals, it has been very useful in attracting a certain class of consumer, and there are several in use, especially in cottages of a rental of half-a-crown to five shillings per week. Meter rents are charged of ninepence per quarter on the motor meters, which are seldom over 2½ amps. in size, and a shilling per quarter on the slot meters.

In these small plants, one trouble is that labour costs come very heavy in proportion to the number of units generated, and this is unavoidable, as a small plant of say 10 H.P. needs as much attention almost as one of 50 H.P. or 100 H.P. This being so, the writer advocates the putting down by all means of a plant of such size that it need never be run in the day-time, the battery and generator being so proportioned that a run from dusk to 10 p.m. or so, at full, or nearly full, power, does all that is needed. This obviously tends to economy in both labour and fuel. Here, of course, reference is made to plants having a purely lighting load, and no day load.

With regard to motive power, paraffin, which would perhaps be looked on as most suitable for the size of plant under consideration (say 10 to 18 H.P.) has become so dear that with it the fuel cost per unit comes out rather high; the crude oils are cheap, but apparently the price depends on the personal whims of a few people who manipulate it at their pleasure, and this seems to the writer sufficient reason to fight shy of this source of power so long as there is any other source about as cheap. There remains the suction gas engine and the semi-portable superheated steam engine. The writer must confess to a partiality for steam, especially as in the kind of scheme under consideration probably only one engine would be put down, the increased capital charges entailed by having two engines being a factor to be seriously considered. But it is doubtful whether such engines are to be had for such small powers, and if so, at sufficiently low prices.

The suggestion is here thrown out that as a stand-by, a high speed petrol engine, even a second-hand car or boat engine, might be installed. The capital cost would be very low, and durability and economy, in the case of an engine for emergency use, such as this one, would be of comparative unimportance. Before leaving this subject, it may be as well to point out that in districts where coal is fairly cheap, and water plentiful, even the old type of semi-portable steam engine, with an ejector condenser attached, can produce current at less than a penny per unit for fuel, including the raising of steam.

To revert to the particular scheme mentioned, this has now run for nearly five years, current being available day and night, without any failure whatever. The Osram lamp was the only suitable lamp available at the start, and this lamp has been used practically throughout. There are many of the original lamps still in use, and the fear entertained at first, of frequent lamp renewals discouraging consumers by their cost, has turned out quite unfounded. An account has been kept of every lamp sold for replacement, and it is found that, for every 100 lamps installed, 15 renewals were sold each year, but it must be remembered that a fair proportion of the total at any time would be comparatively new lamps, so that the figure mentioned will be on the low side. However, it has been established that the cost to consumers of lamp renewals has been quite trifling.

Comparing the cost of current with that of paraffin oil, it can be said right away that, even at a price double that obtaining in large towns, it has proved much cheaper, and, of course, when trouble, dirt, &c., are taken into consideration, there is absolutely no comparison. Electric light would be used in every house without exception, large and small, in the place to-morrow, as far as the cost of current is concerned. It is only the wiring question that is in the way.

Many questions have been addressed to the writer by persons contemplating similar schemes as to the power required, average size of lamp used, and units consumed per lamp installed.

These are evidently vital questions, and on the replies to them depends the commercial practicability of the schemes. Briefly, as far as his own experience goes, electric lighting is practicable in any fairly busy village of a population of 600 or so upwards. This means with a concern "on its own bottom," and not taking a supply from a neighbouring large town, in which case the conditions are quite different. It also implies paying reasonable wages for the class of work to be done, and the time put in; it makes a great difference if the man in charge has some other like occupation to fill up his time in the case of a very small plant.

It is found in the village supply mentioned that the sizes of lamp most in use are the 15-watt, 20-watt and 25-watt. The latter are found sufficient to light living rooms, where a single lamp is used; in the case of three-light fittings, generally three 15 or 20-watt lamps are used, and it is noticed that the three are seldom on together, two being quite enough as a rule. Very few lamps indeed are required larger than 30-watt. The average wattage per lamp installed is 20, and for every 100 lamps installed the maximum load at the switchboard has been 0.7 K.W. The load curve is of such a contour that a generating set capable of dealing with this maximum load, without withdrawing from the battery at the time of the peak, is found to be large enough to do all that is required within the limits previously mentioned, dusk to 10 p.m. When worked out for any particular case the size of generating set may seem low, but this in any case is the writer's experience, and there is no reason to believe that the habits of inhabitants of villages in different parts of the country vary very much. The tendency, so far as seen, is to put in plant far too large, thereby unnecessarily increasing fuel and capital charges. The clientele in the example under notice consists of private houses, mostly fairly small, houses and shops combined, such as one sees in the country, five public-houses, two small works, and three places of worship. The units consumed per annum per lamp installed in this mixture are 10, and the number of lamps installed per consumer is also 10. Sorting the different classes out to some extent, the units per annum per lamp are as follows:—

Private houses, wired throughout, including upstairs	5
Private houses, wired downstairs only	8½
Houses and shops combined	13½
Public-houses	17

These figures may be of some use to others contemplating like installations; but it is necessary to point out that these figures were obtained on a 100-volt system, and as probably nearly all new schemes would be at 200-volts or over, a percentage should be added in view of the lower efficiency of the higher voltage lamp.

A word or two might be said re cost of repairs. During the five years or so that have elapsed since the initiation of this scheme, the repairs item has been really negligible apart from replacements of battery plates, which have amounted to somewhere about ⅛d. per unit. Although there have been some exceptional storms in this period, not a pole nor wire has flinched in the mains and services. Altogether, the expenses under this heading have disappointed the promoters on the right side.

A suggestion was made in the ELECTRICAL REVIEW some months ago that a qualified man might in many cases supervise groups of these village plants, a man at lower wages, not necessarily even a mechanic, being put in charge of each. This plan would ensure a reasonable cost of operation, and yet provide for expert supervision. This had also occurred to the writer, and he believes that it would have a great deal to do with the commercial success of such schemes.

One small point is worthy of mention. Current being necessarily somewhat dear on these small jobs, it is to the suppliers' interest in the end to see that wiring is done so as to get the greatest efficiency in the way of *effective* light per unit sold. It has frequently been the writer's experience that a lamp placed too high, and also having an unsuitable shade, has been the cause of dissatisfaction, whereas the lowering of the lamp, and the substitution of a plain conical nine or ten-inch white opal shade, the same c.p. being used, has effected a complete transformation. Where ornamental shades have been insisted upon, it has been the practice to call the consumer's attention to the fact that he will need to use more current for the same effective light, and leave it at that; this procedure makes things clear, and often saves the supplier from unfounded complaints.

THE ELECTRICITY OF THE ATMOSPHERE.

Sir Oliver Lodge, in delivering the fifth Kelvin lecture at the Institution of Electrical Engineers on Jan. 22nd, chose as the title of his subject "The Electrification of the Atmosphere, Natural and Artificial."

Opening the lecture with some striking portraits upon the screen of the late Lord Kelvin at the principal epoch-marking points of his career, Sir Oliver proceeded to refer to the early researches carried out by Lord Kelvin in connection with the subject of his lecture. The method of measuring adopted in these pioneering experiments was by means of the portable electrometer devised by Lord Kelvin, provided with an upright rod extending from it and having a smouldering taper at its upper end. This instrument having been placed in the atmospheric space to be tested, acquired the potential of the air surrounding the taper, and thus the electrometer portion of the apparatus indicated the electrical pressure prevailing in that quarter.

This method of "connection" with the atmosphere, and another, by means of dripping water running from the portion of the instrument, were the two means adopted at the present day in connection with atmospheric experiments of this kind.

Lord Kelvin, in the course of experiment, found that in fair weather the atmosphere contained a positive electrical charge, while in disturbed conditions due to wind or rain, and sometimes dust clouds, the charge was reversed to negative, due probably to the frictional effect of such conditions.

At a height of 9 ft. above the earth's surface the electrical potential was found to be as much as from 200 to 400 volts above that of the earth, while on occasion it rose to from 2,000 to 4,000 volts, being at a high pressure during stable atmospheric conditions and less when a disturbed condition prevailed.

While the electrical pressure "gradient" of the atmosphere was about 1 volt per cm., the amount of the charge was exceedingly little, being only one-millionth of a coulomb per sq. km. area.

The earth itself, as was well known, contained a negative charge of electricity at its surface, but Sir Oliver was not prepared to say definitely whether this was the cause or was the effect of the atmospheric charge.

It was also uncertain whether the atmosphere as a gas could be said to be charged at all, or whether, as had been propounded, the charge was contained in microscopic particles of dust suspended in the atmosphere.

The electronic researches of recent years had thrown much light upon atmospheric electrification. The discovery that ultra-violet light rays projected upon zinc caused electrons to be given off led to the conception that the same effect was produced in the atmosphere by such rays from the sun. This was further substantiated by the occurrence of thunderstorms after a prolonged spell of bright weather. The electrified state of the atmosphere at a high altitude was also demonstrated by the glow that appeared during storm conditions at the top of elevated objects such as masts and trees, well known as "St. Elmo's Fire."

In support of the view that vegetation generally appeared to be intentionally formed for its growth by the discharge of electrical pressures, photographs of various kinds of tree leaves were shown on the screen calling attention to their spiky construction, in which form it was clear that they were ideally suited for electrical discharge.

Referring to the remarkable forms of lightning flash observable during storms, some striking photographs of such flashes were shown on the screen. The fact that the air became more conducting on the occurrence of an electrical discharge gave rise to numerous branch discharges from the main trunk of a lightning flash; thus, although the main stroke might be led to a lightning conductor, it was important to bear in mind that the off-shoots were by no means to be despised in arranging for lightning protection. A remarkable form of flash was shown in which the lightning had, as Sir Oliver expressed it, tied itself in two or three distinct knots, this strange effect, he observed, being due to the procession of the electrical discharge through those rain drops that happened to be nearest to the immediate electrified portions of the flash as it formed. The Euclidean statement of the shorter path between two points being a straight line was apparently, he remarked, *not* taken seriously by lightning.

Another interesting effect produced by a lightning stroke was a broad band similar in appearance to certain forms of the Aurora Borealis, which, it was pointed out, might have been caused by "blowing away" of the electrical charge from the main body in its progress.

As an example of how the effects of lightning discharge might extend beyond the main path, a case observed by one of Sir Oliver's assistants was mentioned, in which a large iron-roofed shelter was affected by the "return stroke" effect of a distant storm, and notwithstanding its well-earthed condition through the iron stanchions on which it was supported, the discharge was sufficient to hurl for many yards a man who had been standing against one of the iron supports, and had apparently been further protected, standing, as he did, on a wooden chair watching a football match.

One of the main causes of atmospheric electrical charge was the alpha and beta rays produced by the sun's rays, this view being further supported by the powerful magnetic storms which were caused by sun spots. This radiation, giving rise to negative electrons, produced both positive and negative charges, of which the positive reached the earth in the neighbourhood of the tropics immediately beneath the sun, while the negative, due to ionisation in the upper parts of the atmosphere, were deflected toward the Polar regions, and were the cause of the Aurora Borealis. This electronic state of the upper atmosphere was the cause of the deflection of the Hertz waves used in radio-telegraphy, making possible their course around the curvature of the earth, instead of allowing them to radiate into space as they would otherwise do. The fact also that metals contained electrons caused their opacity to radio-telegraphic waves.

Sir Oliver then proceeded to refer to the actual commercial possibilities that were before mankind if experiments on a large and practical scale were carried out in further studying the electrical conditions and laws of the atmosphere

Many of these had been demonstrated by laboratory experiments on a small scale; as, for instance, the coagulating of moisture drops in suspension by means of sufficient electrical charge to cause artificial rain. Thus in many arid regions round the tropics, owing to the insufficiency of the negative electrical condition, clouds laden with moisture constantly passed over, while the land beneath was parched for want of rain for the greater part of the year, and it had been suggested that with the means to deliver sufficient quantities of a negative charge into such clouds when desired, they could be made to deliver rain by the coagulation of their water particles.

He saw no reason why, with the many means available for sounding the heights of the atmosphere that were in present use, such as kites, sounding balloons and the like, an efficient conductor should not be sent up to such clouds and the desired charge applied.

The question of the quantity of the charge, he thought, was not as formidable as was generally assumed; once the coagulating action was set in motion, the increased conductivity of the air to which it would give rise would support further progressive action in itself. With regard to the type of electrical machine to be used for such work, they had many frictional electric machines that might be used, but there was still great room for improvement on account of the comparatively low speed of the mechanical members of such machines.

He himself had carried out extensive work on a practical scale upon the application of electrical charges to the atmosphere for the benefit of agricultural crops. In this work a positive charge was applied which acted as a supplement to the positive charges caused by the sun itself; thus, while the increase in the output of the crops treated over ordinary crops amounted to as much as 30 per cent. in ordinary seasons, in 1911, during which a great drought prevailed, no increase was recorded, the atmosphere having been sufficiently electrically provided, due to the sun alone. The charge was applied over the crop area to be treated by means of lines of No. 11 wire supported and insulated on poles 16 ft. above the level of the ground; between these lines cross wires of No. 24 wire were stretched. The pressure used was 100,000 volts, generated with power from a 2-H.P. oil engine. In this manner it had been found possible to increase the charged state of the atmosphere to 10,000 times its normally electrified state. It was also found that during windy weather the charged atmosphere was carried down wind sufficiently to show an effect upon other areas of the field, which fact in carrying out experiments it was necessary to take into account. The exact action of the charge upon vegetation was still undetermined, and such experiments needed the collaboration of the electrical engineer and chemist if they were to be of full value. There was reason to believe that certain plants of the leguminous kind would thrive better on the application of a negative charge.

A number of photographs of the equipment used in carrying out these agricultural electrical applications were shown on the screen; they consisted of various arrangements of electric "valves" of the vacuum type devised by Sir Oliver himself, in combination with induction coil apparatus, and an elaborate system of insulation, which, he remarked, had been one of the principal pioneering difficulties to overcome.

As exemplifying a directional idea rather than an immediate possibility of means by which the negative electrical charge gathered at the poles of the earth might be coaxed into regions where it would be of commercial use in the control of the weather and stimulation of crops, Sir Oliver pointed out that were the polarity of the earth to be modified by some such process as the construction of a girdle of conductors laid around the earth itself in some polar latitude, a heavy current might be conceived of, assuming the metallic core of the earth to be of high permeability, that would magnetise the earth sufficiently to bring about a substantial moderation of its polarity, sufficiently to attain the desired object. In view of the somewhat fantastic nature of this proposal at the moment, this statement should not, perhaps, be taken seriously, although with regard to the conducting girdle, men had already laid great enough length of railway metals on the earth, considerably in excess of the amount that would be required.

In conclusion, his lecture was to be taken more as an agenda of the direction in which valuable results were obtainable if experiments were undertaken on the requisite scale, than as a record of results already attained.

BRITISH PRACTICE IN THE CONSTRUCTION OF HIGH-TENSION OVERHEAD TRANSMISSION LINES.*

Discussion at Leeds.

Mr. J. E. Storr (Mirfield) said that for voltages lower than 3,000 he did not agree that cables were cheaper than overhead wires. As to the factors of safety allowed to the postal authorities, he thought they ought to be increased, in view of the frequent crossing of their wires with power wires. In view of the trouble and difficulty of finding capable men—at any rate at short notice—he found the oiled twine packing a difficult operation to make a sound job of, and if it was not made right it was a weaker job than if the pin was cemented in the insulator. For changing the direction of a line, he thought the "A" pole would be stronger to take the strain than the "H" pole, unless very extensive trussing was adopted.

Mr. Kay (Callender's Cable and Construction Co.) directed attention to the firm's patent pole, and showed the illustrations of its structure which were reproduced on pages 128-9.

Mr. H. E Yerbury (Sheffield) said the equipment of high-tension overhead lines had almost reached the standardised stage, and the greatest obstacle seemed to be the obtaining of wayleaves. Greater progress would be made if æsthetic considerations were not divorced from strict utilitarian considerations. It would be more satisfactory if it could be arranged for all E.H.T. wires to be erected on or adjoining main roads or railways. He would like to know what the disadvantages of reinforced concrete poles were apart from the weight. He did not agree with the author as to the deterioration and maintenance of steel tramway poles. He had recently had occasion to remove many, after a life of 12 or 13 years, and they had been found to be practically as new. He used bases to all his poles, which added to their life. The poles were painted every three years, and the bases were raised. Most of the corrosion took place on the surface of the road where the bases were not used. From what he had seen, he felt thankful that there was a reasonable Board of Trade to regulate schemes in this country.

Mr. Chris. Wade (Hull) said it would be a great help to overhead work if anything could be done to make the granting of wayleaves compulsory. He was doubtful of the efficacy of Mr. Welbourn's suggestions as to tarring poles, or as to creosoting at the bottom of the poles, and he did not think that the Powell process of preserving timber could be a serious rival of creosoting.

Mr. Lang expressed fears as to what the countryside would look like when the time came which Mr. Ferranti had forecasted.

Mr. W. E. Burnand (Sheffield) said he thought that Mr. Welbourn was wrong in putting so much stress on the pressure of the wind and ice as being proportionate to the diameter of the wire. The thickness of ice on the wire did not vary very greatly with the diameter of the wire. The pressure of the wind should be taken as varying with the square root of the diameter. As to insulators, there was a weak spot in many cases which could not be shown by the ordinary test, and a high-frequency test should be made in addition. The tests made by Himley and Thomas on this point showed that there was no direct relation between the relative puncture strength and the flash over strength of the insulator as tested by high frequency. It was quite easy to arrange such a test.

Mr. T. B. Johnson (Leeds) asked upon what the author founded his comparison of the strength of the A pole and the H pole.

Mr. W. Wraith (Leeds) asked if the author had made any experiments with reinforced concrete poles.

The **Chairman** (Mr. Woodhouse) said that with reference to the possibility of disturbance from wireless telegraphy which the author had alluded to, he believed there were thoroughly authenticated cases of trouble with overhead wires from wireless stations close to them.

Replying on the discussion, **Mr. Welbourn** said that his comparison and the costs of overhead wires and cables had received strong confirmation from independent engineers who had looked into the matter. The figures given were from actual existing scheduled contracts, both for cable and overhead work, and represented average conditions, and they showed that the higher the voltage and the higher the kilowatts the greater the saving that might be made. Mr. Storr was quite right in suggesting that the Post Office factor of safety should be higher than the other. In his comparison of the A and H poles the figures of the A poles were taken from Mr. Chris. Wade's paper before the Institution, which was admittedly the classic on that subject. In regard to the strengths of H poles he found the most extraordinary discrepancies of testimony. He had, therefore got his colleagues to look into the matter, and the result of a great deal of experience, and partly of calculation, was what he had stated. With regard to the novel pole of the Callender Cable and Construction Co., the main difficulty that he had respecting any steel structure—especially a tubular steel structure—was that that they could not get inside it to protect it from corrosion. The discussions in the Sections showed that there was the most extraordinary differences of opinion upon the use of high tensile strength steel. He thought there must be united pressure by local authorities upon headquarters. He was not aware that concrete poles had ever been used in this country upon high-tension lines. In regard to Mr. Burnand's observations on the effective diameter of wire and factors of safety, he did not think anybody was yet really satisfied on that point. They never knew the worst conditions they had to build for. He knew a case in which a Post Office line was 12 in. in diameter, which was, of course, quite impossible on a commercial basis.

Discussion at Manchester.

Mr. C. D. Taite strongly supported the author's suggestion of the appointment of an Overhead Lines Committee. He could not agree with the author's table of comparative costs of overhead and underground lines; usually he figured that underground cost approximately three times overhead, and in a particular case where duplicate lines were estimated for, the comparative costs were underground £2,600 and overhead £953, the pressure being 10,000 volts. The use of aluminium conductors instead of copper was open to many serious objections, amongst which could be mentioned the necessity for stronger poles and cross arms, wider spacing of the conductors due to increased sag, and special arrangements for connecting up with copper underground cables. Contrary to the author's recommendations, he used rigid clamps for tying-in conductors and had never had trouble. Some of the binders referred to in the paper appeared to require good weather and skilful erection in order to ensure satisfaction. He had always used oak cross arms, and instances had occurred where a line wire had parted from its insulator and yet maintained supply through being supported by the oak cross arm; had metal been employed a shut-down would have resulted immediately. Very little trouble had been experienced from lightning. Arresters of the static discharge type were in use, also a few aluminium arresters; the great trouble with the latter type was the need of constant attention, and until this was overcome, they could not make much headway.

Mr. S. J. Watson said that in regard to the comparative costs of overhead and underground construction he agreed with the author's figures rather than those quoted by Mr. Taite. A duplicate 6 600-volt three-phase line using 0·15 sq. in. conductor, which he had installed, showed that the comparative costs were £2,400 underground and £1,250 overhead. The only serious difficulty connected with the overhead system was the question of wayleaves. A case in point was a 200-yd. span for which a wayleave could not be obtained, necessitating a considerable detour which cost an additional £1,200. He preferred the three-conductors-per-pole system. Where earthing wires were used they should be of the same material as the line conductor, and placed at the tops of the poles so as to give more protection from atmospherics. Mr. Trotter's triangular guard was an excellent device, especially for three conductors, and could also be applied to six conductors. Copper always had a definite scrap value, but in the case of aluminium the scrap value was obscure.

Mr. J. Lustgarten considered that the factors of safety given by the author for wind pressure were too high. His own experiments and American practice showed that the pressure per sq. ft. of projected area was given by the formula $\cdot 00021\, d^2 D$, d being diameter of conductor and D velocity of wind in miles per hour.
He took a wind velocity of 100 M.P.H. = 14·6 lb. per ft.,
and for 60 M.P.H. = 6 „ „
The sag of wires in cases where poles were on different levels could be derived from the following formula :—$S_1 = S\,(1 + 4\,S/H)^2$, S being the sag when the poles were on same level. H being the difference in level of top of poles, and assuming no wind. Regarding the spacing of conductors for different line pressures, the formula held good up to 100,000 volts :—d cm. = 25 + 2·5 KV (R.M.S.).

Mr. J. S. Peck, referring to the formation of ice on line conductors, said it was unusual to allow a factor of safety which took care of this simultaneously with the maximum wind pressure. The tendency in the States was to work with a much lower factor of safety than quoted in the paper, and hitherto the cases of trouble due to pole breakage were few. Insulators which were very satisfactory on wooden pole lines were not necessarily so on steel towers. Protective devices for railroad crossings and public roads were gradually becoming more simple in construction. Regarding the protection of steelwork from corrosion, the practice in the States was galvanising, and in one case known to the speaker, galvanised work had stood well for 20 years. A good rough estimate for spacing of wires on account of voltage was 1 ft. per 10,000 volts, and for mechanical reasons 1 ft. per 1,000 ft. of span. Steel ground wires were in general use in the States, and they were also used as stay wires for the poles.

Mr. Hollingsworth said that in certain industrial districts he had replaced wooden poles by steel poles, and found no deterioration whatever after two years' service. "A" poles were much preferable to "H" poles, and on all lines mechanical clamps had been used with entire satisfaction. He wished to confirm Mr. Taite's remarks concerning the use of wooden cross-arms.

Mr. J. Medlyn took exception to the announcement that the powers conferred on the Postmaster-General by the Telegraph Acts were "almost useless." It was pointed out in the paper that annual charges in the case of overhead lines were greater than underground; this difference would be accentuated in thickly-populated areas. American practice showed that the erection of overhead power wires in cities had been overdone. The Post Office factors of safety of eight for poles and four for wires were not observed in all circumstances, deviation being quite permissible in the case of sheltered positions or very open positions. The gradual freezing of sleet sometimes increased the diameter of wires to 2 or 8 in.; a particular case was cited in which the ice taken from a 100-lb. per mile-wire weighed 12 oz. per foot. This meant a weight of 1½ cwt. per wire on a 66-yard span, or 3 tons total for all the wires in the span. Having regard to the low frequency of breakdowns of this character, the Post Office did not consider it economical to provide a factor of safety to take care of such cases. The effect of atmospheric conditions upon stay wires required careful consideration. Regarding the inclusion of telephone wires in underground transmission cables, he pointed out that whereas standard speech transmission could be obtained over 25 miles using conductors weighing 20 lb. per per mile with paper strip and air insulators, the use of rubber or gutta-percha insulation considerably reduced the distance. The termination of two wires on a single insulator was open to objection both in regard to surface leakage in wet weather, and spider webs, all of which interfered with ringing as well as speaking efficiency.

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* For abstract of the paper by Mr. B. Welbourn, see Electrical Review, January 16th, 23rd and 30th.

Mr. J. A. Morton referred to the B. of T. figures for windage and factors of safety, and said that if thess figures were good for the most severe cross-country work, then they were much higher than necessary for overhead lines in small towns and villages. The existing rules in many cases demanded such costly construction that developments were retarded, and even jeopardised, in the case of small undertakings. They practically debarred the use of standard single-wood poles, which were cheap, looked well, took up little space, could be solidly planted, and allowed the use of simple bracket-arms. Contractors were compelled to use very stout poles in order to get the required diameter. The result was high cost and ugliness. Regarding resistances in the earth side of horn arresters, the natural impedance of any overhead circuit was given by $\sqrt{L/C}$, and this varied in practice between 250 and 500 ohms. In any single horn gap the earth resistance should not be less than twice the natural impedence, otherwise the interruption of the earth current might set up high-frequency oscillations and cause damage. On the other hand, if the earth resistance were much greater than twice the natural impedance, it might be too great to afford relief to the line. He advocated legislation making it possible to obtain cross-country wayleaves quickly, and on reasonable terms.

Mr. J. Drummond Paton said that for a given line two tons of copper at £60 would be required against one ton of aluminium at £85. The necessity for longer poles, &c., had been referred to, but practice had shown that the increae in price due to this necessity was about 15 per cent., which did not approach the economy in conductor cost. Regarding scrap values, a case actually occurred where aluminium was sold at a price in advance of the original cost. Regarding the corrosion of aluminium, a very high standard of purity had been attained, and the corrosive effect had virtually been annihilated.

Mr. A. F. W. Richards said that he could not understand how the author made out the cost of an 11,000-volt line to be equal to that of one for 20,000 volts. He knew of cases where the circumstances were such as to make the cost of overhead work as much as underground. Aluminium should not be overlooked when its cost compared favourably with copper after allowing for longer poles and cross arms. Favourable comparisons could not be made under 0·1 sq. in. copper conductor, and since this was a large area for high-pressure working, it was unlikely that aluminium would come into general use for long high-pressure lines in the near future. Butt welding was the only satisfactory method of jointing aluminium, and probably for this reason the extended use of insulated aluminium cables had been prevented. Regarding line clips, he had recently inspected a large number of these after being in use on a 0·15 sq. in. standard copper line for nearly two years. The clips were of the rigid type, and in no case was there any sign of the glazing being chafed or chipped, nor was there any trace of crystallisation of the metal. The rigid clamp was in his opinion the best method of tying up conductors. The "Elder" suspender certainly got over the longitudinal movement of slings supporting cables, but the eyelet was an objection, and would sooner or later pull through the leather thongs. The speaker preferred the hook and wedge pattern, using a very broad seating for the cable itself. This broad seating consisted of a lead strip braided with served jute, which prevented the cable slipping through, but allowed the hook to slide along the suspension wire, thereby permitting the cable to be "drawn in" between poles without any trouble. Guarding was one of the most difficult problems of overhead work, and he considered that lines protected by a device such as the Merz-Price might reasonably be left unguarded on country roads. The triangular net guard was delightfully simple and effective.

The Author, in reply, said the comparative costs of overhead and underground work given in the paper were obtained from work actually carried out under difficult conditions, and a mean figure had been taken. Regarding aluminium, this was only recommended on account of the lower first cost of line. With regard to cross-arms, the Board of Trade were quite disposed to consider any particular case, and their regulations were intended to be a record of the best general practice. Rigid clamps might prove quite satisfactory for two years, as stated by one speaker, but the proper test would be eight or ten years' service. There was a growing movement in regard to wayleave concessions, and pressure would have to come from the local sections, as in London overhead lines were of little importance. The author had inspected a mountain line in Bulgaria where lightning storms had rendered much havoc until Moscicki condensers were installed. Since the introduction of these condensers, the trouble had almost entirely ceased. The use of steel poles in America had been successful, chiefly on account of the dry atmosphere, but in the British Isles the climatic conditions were such as to cause much trouble with steel structures. Maintenance charges had been referred to by Mr. Medlyn, and recorded figures showed these to be from 2 to 3 per cent. per annum.

A VARIABLE CONDENSER WITH A SQUARE LAW.*

By W. DUDDELL, F.R.S.

Continuously variable condensers are in considerable use, especially in connection with wireless telegraphy. In using these condensers for the purpose of measurement it often happens that the quantity to be measured is proportional to the square root of the capacity of the condenser; for instance, in wave-meters of the Donitz type, which consist of a fixed self-induction and a variable condenser, the condenser being set to resonance, the wave-length is approximately proportional to the square root of the capacity of the condenser. For this reason it would be convenient in many cases, if the capacity of the condenser were proportional to the square of the distance traversed by the moving part.

Rotating-sector condensers, consisting of a number of plates or sectors which move in and out between a number of fixed ones, are often used in wireless telegraph receivers. In this case the capacity, except near the extreme ends of the scale, is very nearly proportional to the angular displacement of the moving plates.

A number of experimenters have recognised the advantages, in certain cases, of what may be termed a square-law variable condenser; and various arrangements have been proposed and constructed to attain this result.

There are a number of possible combinations of curves which give the required results. We have two sets of plates to deal with, and in what follows it will be assumed that the moving plates are fixed to a spindle, and are capable of rotation through an angle of approximately 180°, and that during this rotation the moving plates enter between the fixed plates, at a constant perpendicular distance from the latter.

The capacity of the condenser is proportional to the area of the moving plates that are within the fixed ones, plus a small correction due to the edge effect. In its simplest form the problem is, therefore, to design the shape of the edges of the plates, so that the area of the moving plate enclosed by the fixed plate is proportional to the square of the angle through which the moving plate is rotated.

In choosing between the various types two considerations have guided the author to adopt the type shown in fig. 1. First, it is essential that the moving plates shall be mechanically strong; secondly, the capacity of the condenser when the pointer is at zero must be made as small as possible. It is usual with sector condensers, in order to make the capacity perfectly definite at low values, to line the case with conducting material, and to connect the fixed plates and the interior conducting surface of the condenser together. It is therefore necessary, in order to have a low zero capacity, that the moving plates should have as little outside surface, and should be kept as far away from the case as possible.

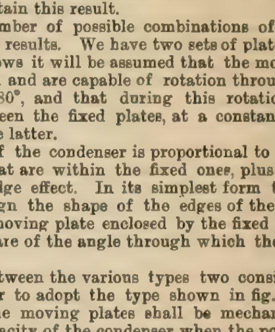

Fig. 1.

In this respect the type shown in fig. 1 is good, compared with other types. The calibration curve of the condenser can be very closely represented by a formula of the form—

$$\text{capacity} = a + b\,\theta + c\,\theta^2.$$

In an actual case, $a = 0·025$, $b = 0·0035$, $c = 0·0659$. Although it has not been possible to get the initial capacity "a" as small as one would like, nevertheless the condenser has proved very convenient in use.

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* Abstract of paper accepted for publication in the *Journal* of the Institution of Electrical Engineers.

ELECTRIC WINDING GEARS AT COLLIERIES.

At the meetings of the East and West of Scotland branches of the Association of Mining Electrical Engineers, Mr. James Gillespie, of the Pumpherston Oil Co., Mid-Calder, read a paper on "Electric Winding Gears at Collieries," which has given rise to much interest and discussion. The author, in the course of his paper, said that frequently they found that at a pit at which the entire output was holed, conveyed, hauled and finally screened by electrically-driven machines, an expensively-operated battery of boilers was retained solely for the generation of steam for the winding engine. There was every reason to believe that in a great many cases the electric winder offered the more economical system, and it was in all cases safer, more easily controlled and as rapid as its old-established rival—the steam winder.

Mr. Gillespie described at length the electric winders which had been installed at the Cobbinshaw Pit (Tarbrax) and the Briech Pit, belonging to the Pumpherston Oil Co. He said that the more modern electrical winder at Briech cost £3,000, and the costs might be tabulated as under:—

Power for 120,000 tons	£300
Interest at 5 per cent. on £3,000	150
Depreciation at 10 per cent. per annum ...	300
Wages for three attendants	375
Supervision, oil, stores, &c.	50
	£1,175

The rate of depreciation quoted above allowed for the set being free from debt in 10 years, although there was every reason to suppose that its useful life would be many times that period. The total of £1,175 worked out at 2·35d. per ton raised.

It would be safe to assume that a steam winder, including boiler, pipe range, feed pump, &c., could not be installed at a less capital cost than £1,500. It would consume 56 lb. per shaft-horse-power, or 2,125 tons of "duff" per annum. They might therefore tabulate the annual costs as follows:—

2,125 tons "duff," at 4s. per ton	£425
Interest at 5 per cent. on £1,500	75
Depreciation at 10 per cent. on £1,500 ...	150
Engine-keepers' wages (three)	375
Stokers' wages (two)	185
Stores, oil, firebars and supervision ...	100
	£1,310

This total was considerably in excess of the total for electric winding, the cost per ton raised being 2·62d., or 11·4 per cent. greater.

In these days of strenuous foreign competition, he considered it would repay any company working a number of small collieries, at a low margin of profit, to go in for electric winding.

At the monthly meeting of the East of Scotland Branch on Friday last, the author, in the course of a supplementary statement, said that the Ilgner system of winding which was in operation at the colliery at Breich, at first glance appeared to be somewhat complicated, but in spite of its several commutators, ran with such regularity as almost to induce the belief that the science of machine design had reached finality in this direction. The discussion was adjourned pending a visit by the members of the Branch to the winder at Breich Colliery.

At a meeting of the Mining Institute of Scotland, discussion was resumed on the paper by Mr. Willoughby M. Dunn, who described the electrical winding plant at South Kenmuir Colliery. A summary of the paper has already appeared in the Electrical Review. In opening the discussion, Mr. A. B. Muirhead, Glasgow, said that an electrical winder was applied to winding in a shaft of 20 fathoms depth, in the year 1890, and was still in use a year or two ago. The economic conditions prevailing in the coal fields of Germany and Belgium made it possible and desirable to introduce electrical coal winding long before the question was brought home forcibly to coal owners and officials in this country, but they had now reached that stage when the matter could be considered from many points of view. Shaft depths and outputs to be raised varied in almost every case, and on the other hand, the source of the electrical power and the conditions of supply varied considerably, and these played a most important part in deciding not only the system that might be adopted, but the commercial aspect of the question as well. He congratulated the author on his firm's courage in introducing this comparatively untried system into Scotland, and on the success attending the plant. He had paid attention to the system adopted at South Kenmuir Colliery, and had been attracted by the apparent simplicity of working and ease of control, together with the measure of reliability and obvious efficiency to be obtained by it. He was of the opinion that where commercial considerations justified its adoption, it would give satisfactory results. The purely rotary motion of the electrical motor combined with the ease with which the motion was controlled, made it an ideal machine for starting up against full load and gave it a great advantage over the heavier and more ungainly reciprocating engine. The steam winder must be placed near the boilers that supplied it with steam, but the electrical winder was independent of this restriction, and for this reason it was not fair to either type to make a comparison from the point of view of first cost only. The choice of the system of winding depended as much on the conditions of power supply as the conditions of winding, and both must be considered if the best result was to be obtained.

THE EMPLOYMENT OF POWER IN H.M. POST OFFICE.

At a meeting of the Scottish Local Section of the Institution of Electrical Engineers in Glasgow on January 18th, Mr. H. C. Gunton's paper was discussed. The paper was abstracted in our issue of January 9th, p. 77.

Mr. Pullen, postmaster, Glasgow, indicated that they hoped soon to have introduced in Glasgow a number of the ideas referred to by Mr. Gunton.

Mr. Wm. M'Whirter, Glasgow, thought the scheme submitted that night suggested a general Post Office electrification.

Mr. W. W. Lackie (Glasgow) pointed out that one could never dissociate the use of electrical energy in the Post Office from the name of Sir William Preece, who had the principal post offices throughout the country lighted by electricity, and thereby was of considerable assistance to the electrical industry when such assistance was much needed. The curves given by Mr. Gunton on hydraulic and electric lifts removed all doubt as to whether an electric or a hydraulic hoist was best for an ordinary office property, as the number of journeys in such a property was certainly 100,000 per annum. He demurred to the Post Office officials putting down a private station for themselves of comparatively small size. If the author looked further into the cost of electric cooking he would be saved the trouble of looking further at steam plant. With electric cooking installed the equipment would be complete.

Mr. A. Page (Glasgow) said that the battery must be a very large one indeed before it could take up 1,250 kw. Discriminating relays in their experience in Glasgow were not satisfactory and they were tending to do away with them instead of adding to them. How had the author found the earthing of the neutral point at 6,500 volts? They did not think that that was necessary in Glasgow, for they generally managed to get there when they had to earth upon one side, but that presupposed that the insulation on the other two phases was very good. The daily load factor was given as 70 and the weekly as 56 or 59 per cent. It would be interesting to hear what the yearly load factor was, as that was the factor which counted. The curves in connection with lifts might save them recommending electric plant in the future, and it might be better to leave the field to the hydraulic engineer. He did not think that there would be many cases of that kind, but one bad result led to a good deal of talking, and that must be avoided.

Mr. Stevenson (Glasgow) asked the author why he adopted different types of converting machinery in the various sub-stations.

Mr. Gunton, in his reply, said that the 1½d. per unit was the cost of every unit delivered for lighting and power. Their cost in Glasgow General Post Office was below this, and they used their exhaust steam for cooking purposes. They were, however, going to close down their station, and take a supply from Mr. Lackie. While they used exhaust steam for cooking, he had been following the matter closely, and he thought they would justify electric cooking as being cleaner. As to Mr. Page's points, the transference of the load to the battery was quite automatic. Synchronising was effected by telephone communication with the power house, and they never had any difficulty in switching in. In the case of the pneumatic plant, they tested for gas periodically, and when it was found they stopped pumping through the system and turned the connection with the vacuum into air instead of compressing the air again to the operating pressure. They had, in addition, fitted explosion doors and duplicate mains, and kept them quite free from oil deposits likely to cause spontaneous combustion. He had the two different types of transforming machinery in the sub-stations for two reasons. The pure alternating current was the most efficient. On the other hand, it had a low power factor. They wanted a continuous current for supply purposes, and continuous current was more suitable for driving compressors. They were faced with the fact that some offices wanted both. He used three-phase motors for driving lifts and conveyors, and then put all the continuous-current plant in one sub-station together with the battery. By using motor converters as a power factor corrector, they could have a high efficiency on the whole system, and at the same time the advantages of the battery as a stand-by.

Wireless Station Wrecked.—Wind and frost were the causes of a recent temporary breakdown of the wireless station just erected by the Hochfrequenz Maschinen A.G., at Eilvese, in Hanover. The antennæ were fixed to a 21-ft. wooden mast, surmounting a 250-m. high iron latticework tower. The result of a severe frost in the night-time was the coating of the wires with ice to fivefold the thickness of the wire, the weight of which under the stress of a violent eastern gale on the following day led to the downfall of the whole of the wood and wire superstructure. The action of the frost was unexpected, and measures will be taken to prevent the wires being similarly frozen in future. There is no question of interrupted service, as the station, not having yet left the hands of the contractors, is without its official licence. It is intended eventually to fix to the wooden mast a revolving light for the protection of the tower against, and as a landmark for, night-flying airships.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

GERMANY.—The Prussian Minister of Finance has issued a circular pointing out that the proper method of obtaining authoritative information as to rates of duty is to apply to the Directionsbehörde des Zollamts to whose district the goods are to be cleared for consumption. If, either in cases of great urgency, or when the matter appears to admit of no conceivable doubt, other Customs officers answer inquiries addressed to them otherwise than in the formal manner prescribed, it must be expressly on the understanding that the information given is not binding.

GREECE.—The Board of Trade have received details of the new rates of duty on certain goods imported into the old and new territories of Greece, in accordance with the Bill recently drawn up. The duties proposed are to be levied in the new territories as from the date of the introduction of the Bill into the Chamber. Article 3 of the Bill provides that the following goods which are free of duty under the existing Greek tariff should also be exempt from duty in the new territories :—Dynamos and inseparable accessories thereof ; industrial machinery and parts thereof ; metallic wires for telegraphs and electric bells ; rails and their connecting portions ; wire of iron, steel, or any other common metal unwrought. It is provided that exemption from duty may, by Royal Decree, be extended to other articles imported into the new territory, as far as such articles are free of duty under the Greek Tariff. All goods other than those specially provided for in the Bill, on importation into the new territories, are to pay a duty of 15 per cent. *ad valorem.* Other alterations in rates relate to goods which are not of interest to the electrical industry.

AUSTRALIA.—Recent applications for the alteration of the tariff, which have been made to the Inter-State Commission, include an application for the reduction of the existing duty of 6d. per lb. on trade catalogues, and one for the extension of a preference to British catalogues. Representations to the Commission in connection with tariff investigation must be on printed forms obtainable in London from the High Commissioner for Australia, Victoria Street, S.W. Such representations should be made as promptly as possibly.

VENEZUELA.—The Board of Trade report that a circular recently addressed by the Venezuelan Minister of Finance to the Venezuelan Consuls abroad, informs them that in cases where Consular invoices covering goods intended for shipment to the Republic are presented for certification shortly before the departure of the vessel, so that no time remains to ascertain whether such invoices embody all the particulars required, the Consuls are to warn shippers of the penalties incurred by reason of errors or omissions, and if the shipper accepting the responsibility, insists on the certification of the invoice in these circumstances, the Consul is to endorse the document as follows : "No revisada por haber sido presentada—horas antes de la salida del buque (Not revised owing to presentation—hours before the departure of the vessel)."

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

1,394. "Wire-Drawing Machines." R. D. CONNOR. January 19th.

1,395. "Methods of Protecting Electric Feeders and the Like." E. G. WATERS. January 19th.

1,405. "Continuous Current Generators." FRIED. KRUPP AKT-GES. January 19th. (Addition to 1,407/13. Convention date, January 31st, 1913. Germany.) Complete.

1,421. "Method of and Means for the Production of Light from High Tension Magneto Machines Used for Ignition Purposes." A. E. TWIDDY and J. STALLY. January 19th.

1,437. "Process for the Electrolytic Production of Malleable or Forgeable Iron." E. F. K. HARBECK and B. LAN. January 19th. (Complete.)

1,452. "Overhead Conductors of Electric Railways." KALMAN VON KANDO. January 19th.

1,495. "Racing Preventer and Regulator (Electrically Controlled) for Steam and Other Engines." I. SMITH. January 20th.

1,514. "Apparatus whereby the Position of a Sunken Vessel (such as a Submarine) can be Located and Telephone Communication Established Between Those in the Vessel and Those Above Water." A. BUTLER. January 20th.

1,548. "Telegraphic Printing Receivers." J. B. NIGRON. January 20th. (Convention date, January 21st, 1913, France.) (Complete.)

1,549. "Electric Switches, Commutators, and the Like." P. E. MORAND. January 20th.

1,553. "Manufacture of Cemented Mica Plates." MICANITE AND INSULATORS Co., LTD., and A. G. ELLIOTT. January 20th.

1,556. "Control of Moving Bodies by Radiant Energy." J. H. HAMMOND, JNR. January 20th. (Convention date, January 21st, 1913, United States.) (Complete.)

1,587. "Fittings for Electrical Conduit Systems." D. L. J. BROADBENT. January 21st.

1,606. "Life-Guards or Safety Appliances for Use with Electric Tramcars and Other Vehicles." H. EZARD. January 21st.

1,607. "Electric Desk-Lamps." M. J. D. CARTER. January 21st.

1,632. "Sparking-Plugs for Internal-Combustion Engines." J. J. WELDON. January 21st.

1,640. "Arrangements for Regulating the Torque of Polyphase Electric Motors." SIEMENS-SCHUCKERTWERKE G.M.B.H. January 21st. (Convention date, January 22, 1913, Germany.) (Complete.)

1,641. "Automatic Switches for Use in Telephone Exchange Systems." WESTERN ELECTRIC Co., LTD. January 21st. (Franklin Tuthill Woodward, Belgium.) (Complete.)

1,651. "Telephones and the Like." E. O'TOOLE. January 21st.

1,691. "Electric Lamps and their Fittings." H. E. SHEWARD. January 21st.

1,697. "Appliance for use in Radio-Active Treatment." G. BARNETT. January 21st. (Vernon C. Ward, United States.)

1,715. "Magnet Pole-Pieces of Telephone Receivers and the Like." A. MARR. January 22nd.

1,729. "Connections and Fittings for Electric Conduits." C. BIRCH. January 22nd. (Complete.)

1,748. "Electric-Lighting Systems for Moving Vehicles and Apparatus therefor Applicable Wholly or in Part to Other Purposes." J. NEALE. January 22nd.

1,757. "Electropathic Wearing-Apparel." S. J. ROSS and H. SCHOFIELD. January 22nd.

1,758. "Electric Ignition for Internal-Combustion Engines." G. INRIG and L. INRIG. January 22nd.

1,779. "Thermal Relay." H. FAIRBROTHER. (Thermo Electric Instrument Co., United States.) January 22nd. (Complete.)

1,786. "Fluid Rheostats." IGRANIC ELECTRIC Co., LTD. (Cutler Hammer Mfg. Co., United States.) January 22nd. (Complete.)

1,792. "Circuit Arrangements for Telephone Systems." SIEMENS & HALSKE AKT.-GES. January 22nd. (Addition to 22,013/10. Convention date, January 25th, 1913, Germany.) (Complete.)

1,828. "Steering and Other Compasses." W. D. WHYTE. January 23rd.

1,850. "Electric Cables." J. F. WATSON AND CALLENDER'S CABLE AND CONSTRUCTION Co, LTD. January 23rd.

1,851. "Manufacture of Electric Cables." J. F. WATSON AND CALLENDER'S CABLE AND CONSTRUCTION Co., LTD. January 23rd.

1,854. "Means for and Method of Changing the Frequency of Alternating Electric Currents." A. M. TAYLOR. January 23rd. (Addition to 8,853/11.)

1,856. "Typewriting Telegraph Transmitters or the Like." SIEMENS BROS. AND Co., LTD. January 23rd. (Siemens and Halske Akt-Ges, Germany.) (Complete.)

1,871. "Circuit Arrangements for Telephone Systems." SIEMENS AND HALSKE AKT-GES. January 23rd. (Addition to 28,751/13.) (Convention date, January 25th, 1913, Germany.) (Complete.)

1,877. "Electrical Instruments." R. D. GIFFORD AND NALDER BROS. AND THOMPSON, LTD. January 23rd.

1,890. "Means for Transforming Mechanical or Electrical Energy into Heat." PINTSCH'S ELECTRIC MFG. Co., LTD., AND C. H. VIDAL. January 23rd.

1,891. "Process of Rolling Metal." S. O. COWPER-COLES. January 23rd.

1,892. "Process for the Electro-Deposition of Lead." S. O. COWPER-COLES. January 23rd.

1,893. "Process for Coating or Plating Metal Sheets with Other Metals." S. O. COWPER-COLES. January 23rd.

1,968. "Telephonic Receivers." WESTERN ELECTRIC Co., LTD. (Franklin Tuthill Woodward, Belgium). January 24th. (Complete.)

1,969. "Telephone Systems." AUTOMATIC TELEPHONE MFG. Co., LTD., AND F. NEWFORTH, JNR. January 24th.

1,970. "Telephone Systems." AUTOMATIC TELEPHONE MFG. Co., LTD., AND A. B. SPERRY. January 24th.

1,972. "Dry Cell Batteries." C. W. SIMMONS. January 24th. (Complete.)

1,975. "Motor Controllers." G. R. RADLEY. January 24th. (Convention date, January 25th, 1913, United States.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

8,144. PROCESS OF MANUFACTURING RESISTANCES FOR ELECTRICAL HEATING APPARATUS. C. O. Bastian. April 4th (October 4th, 1912).

22,621. METHOD OF PRODUCING CONDENSATION PRODUCTS OF ALDEHYDES. E. C. R. Marks. (E. I. du Pont de Nemours Powder Co.). October 4th.

27,859. MANUFACTURE OF TUNGSTEN. C. Gladitz. December 3.

27,956. SWITCHING DEVICES FOR STARTING MERCURY VAPOUR OR OTHER ELECTRIC LAMPS, ELECTROMOTERS, AND THE LIKE. G. W. Johnson (W. C. Heraeus Ges.) December 4th.

1913.

43. APPARATUS FOR ELECTRICALLY OPERATING PLANING MACHINES, AND THE LIKE RECIPROCATING TOOLS. Lancashire Dynamo and Motor Co., A. P. Wood and R. S. McLeod. January 1st. (Cognate application 16,792/12).

416. CHANDELIERS AND LIGHTING FIXTURES. W. H. Fisher. January 6th. (January 6th, 1912.)

444. RESONATING RELAYS. H. von Kramer and G. Kapp. January 7th. (Patent of Addition not granted.)

465. MAGNETOMETERS, COMPASSES, AND THE LIKE. R. W. Paul. January 7th.

736. RADIATING SYSTEM FOR SIGNALLING BY ELECTRIC WAVES FROM AEROPLANES. Signal Ges. January 9th. (February 24th, 1912.)

790. MOTORS FOR USE CHIEFLY IN CONNECTION WITH TELEGRAPH TRANSMITTERS. J. S. Withers (Cox and Dicketts). January 10th.

791. AUTOMATIC TELEGRAPH TRANSMITTERS. J. S. Withers (Cox and Dicketts). January 10th.

843. LAMPS FOR MOTORS AND LIKE VEHICLES. R. A. Oldfield and J. and R. Oldfield, Ltd. January 10th.

1,223. AUTOMATIC TELEPHONE EXCHANGE SYSTEMS. Western Electric Co. (Wohler). January 15th.

1,278. ELECTROMAGNETICALLY-OPERATED DIAPHRAGMS FOR PRODUCING SOUND. E. A. Graham. January 16th.

1,281. SPARK PLUGS. C. H. Duffy. January 16th.

1,862. EARTHING CLIP. F. Townson. January 23rd.

2,361. ELECTRIC-CONTACT MAKERS. L. Clempson and A. E. Murrell. January 29th. (February 7th, 1913.)

2,417. INSTRUMENTS FOR MEASURING THE FLOW OF FLUID THROUGH A CONDUIT. British Thomson-Houston Co. (General Electric Co.). January 29th.

3,539. METHOD OF AND APPARATUS FOR INCREASING THE EFFECT OF VARIATIONS OF ELECTRIC CURRENT. A. C. Fuller. February 11th.

4,225. DEVICE FOR HOLDING A COIL OR COILS OF INSULATED OR OTHER WIRE WHICH IS BEING USED IN THE INSTALLING OF ELECTRIC LIGHTING, BELL, TELEPHONE, AND LIKE SYSTEMS. H. W. Brotherton. February 19th.

5,158. REGULATORS FOR DYNAMO-ELECTRIC MACHINES. J. R. Johnstone and T. Ferguson. March 1st.

5,199. ELECTRIC ARC LAMPS FOR PROJECTION. A. Schmidt. March 1st.

6,176. IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. W. J. Mellersh-Jackson (Stringham and Elmendorf). March 12th.

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION

READY IN A FEW DAYS.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

THE DEMANDS OF THE MINERS.

The Prime Minister received a deputation of the Miners' Federation of Great Britain on the 3rd inst. in regard to the minimum wage, and on the following day the same deputation waited upon Mr. McKenna, the Home Secretary, *re* the inspection of our mines. Also, during the same week, the South Wales Miners' Federation held a conference and considered some 17 recommendations for ensuring greater safety in coal mines, which, we presume, they will ask the Government to put into force.

We are glad to see that neither Mr. Asquith nor Mr. McKenna gave them very much encouragement—rather the reverse, in fact. The Premier had to admit that the Minimum Wage Act was a highly experimental piece of legislation, passed at a time of great stress, and to remove what was understood to be a particular case of hardship to the underground worker in an "abnormal place." It is very remarkable that the expression "abnormal" place is now seldom heard mentioned. Such places have all disappeared as if by magic; but we have heard of whole seams having to be closed altogether, because under the minimum wage it did not pay to get the coal out. So far as the great majority of miners are concerned, we believe the "minimum" has suited them very well indeed, but the fewer "good" workmen it has not benefited one iota. Some thousands of pounds are being paid every week by the coalowners of this country to "make up" the wages of the miner to the "minimum"; in other words, the miners of this country are taking out of the pockets of the coalowners (and, of course, it eventually has to come out of the pockets of the general public) some thousands of pounds every week for which they do nothing. And then they actually have the temerity to ask the Prime Minister to raise the minimum by 9d. per day! In addition to this, they also ask that all surface workers at mines be paid a minimum wage. Why? Mr. Asquith said that whatever claim the worker in an abnormal place might have had, he did not see how this could be applied to the surface workers, and if it were applied, a similar privilege could not very well be denied to men of the same class in factories or any other form of industry. We agree, as most people will also agree, that a workman employed at a colliery can have no more claim for special treatment than, say, the railway porter or any other workman. As a matter of fact, the underground worker—such is human nature, and the miner is particularly human in this respect—cares very little what his brother worker on the surface gets; but the surface worker is a member of the underground workers' Union, and as such helps to support the demands of the latter. At the end of the strike in 1912, the surface worker began to ask himself what he went on strike for, and we opine that the leaders found it just a little difficult to answer him. Hence the demand for a minimum wage for surface workers. But will the underground workers come out on strike to support the surface workers in their demand for a minimum wage? No! a thousand times, No! The general public need have no fear on this score.

Another demand was that it should be illegal for any workman to be evicted from his house during a dispute. We wonder why they did not ask at the same time that it should be illegal for an employer to fill any vacancy during a strike, and also that during the period of the dispute the workman should not have to pay rent or rates, and—but why go further? The whole of the demands are nothing but Socialistic absurdities.

In the interview with Mr. McKenna it was complained that the whole system of inspection was wrong, and that if the Home Office was going to take any part in saving the lives of the miners it must reorganise the whole system. How? By the appointment of a staff of inspectors selected by vote by the workmen and paid by the State. As Mr. Brace pointed out, the salary of these inspectors need not be high, say £150 to £200 a year, and, at the latter figure, would only cost a matter of £40,000. Mr. McKenna quite rightly pointed out that the workmen can appoint their own inspectors now, but this did not suit Mr. Brace, who is reported to have replied: "Only to the extent that they are inspecting one day, but they may have to earn their own bread to-morrow." We wonder if Mr. Brace meant to imply that when a workman was inspecting he undertook this duty gratuitously and out of the fulness of his heart for the hardships and perils of his fellow workman? Such is very far from being the case. The miner undertakes no duty such as this without being paid for it, and what a scramble there would be for the inspectorships! But what good would they do? A little over four years ago the number of inspectors was 38, to-day there are nearly 100.

To hear Mr. Brace and others of his class talk one would think the majority of accidents in mines were caused by the owners and managers wilfully breaking the rules and regulations of the Coal Mines Act for the sake of profit, and that if there were sufficient inspectors this would be stopped. If Mr. Brace is a practical miner, as we suppose he claims to be, he knows, in his heart, that such a suggestion is a vile calumny. Neither owners nor managers want accidents; if not from the humanitarian point of view, then at any rate from the material one of costliness. It would be a good thing, if, instead of appointing inspectors, the owners were forced to appoint overmen and deputies vested with police powers, so as to ensure the rules and regulations being strictly carried out by the workmen. But obviously such men as these could not be selected and appointed by the workmen, and we do not suppose that this suggestion would meet Mr. Brace's ideas.

In regard to the suggestions put forward by the South Wales Miners' Federation, one of these is to this effect:—"Workmen to have the right of appointing and controlling colliery firemen." Why did they not at once say "Manager"? "Workmen to have the right to initiate prosecutions against colliery officials for breach of rules, in the same manner as the right given to officials to prosecute workmen." They have this right now if they will only first obtain the sanction of the Home Secretary. But the most absurd of all was: "The use of electricity for motive power in mines to be totally prohibited," though evidently some little sense returned to the delegates, for this was withdrawn and deferred for further consideration at the annual conference in March.

There was, however, one sensible suggestion, and we are glad to see that the miners themselves are making it, viz.: "That we press for the use of electric lamps in mines, provided that a gas-testing lamp is available for use in every working face." There is not the slightest objection to the latter clause, as there is unfortunately no other means of testing for gas available at the moment. The electric lamp will do much towards reducing the number of accidents by means of the better light it gives, but the most important thing about it is that it is a real safety lamp, and in this respect its introduction is one step towards the prevention of these terrible disasters, such as we lately had at Senghenydd.

CENTRAL-STATION SALARIES.

A few weeks ago, when referring to the importance of maintaining continuity of supply and the possibility of militancy adopted by central-station employés leading to trouble, we remarked that it was not surprising if workers of this class, like those following other callings, went the length of indulging in threats if their grievances were not properly considered. We did not, however, mean to suggest that the making of threats was likely to hasten the redress of those grievances.

Sometimes one feels better after an outburst has given relief to pent-up feelings. We hope that it may be so in the present case, for central-station men should bear in mind the thought that continuity of threat may serve to justify in the eyes of Parliament the demand of supply authorities for penalties ensuring continuity of supply.

We were privileged last week to attend a London meeting of the Association of Electrical Station Engineers, and we watched its proceedings with considerable interest but not without some concern. It is impossible for 40 or 50 such officials to meet together in these days without all sorts of different views finding expression. To our way of thinking, the Electrical Trades Union has been showing a remarkable eagerness to draw the central-station men into its net, and it was said at the A.E.S.E. meeting, by one who was obviously spokesman on behalf of that Union, that if they could arrange matters between the A.E.S.E. and the E.T.U., the former would have at their backs the great financial strength of the latter, with its 7,000 members. If this means anything, it is that the wireman in provincial obscurity will have the privilege of maintaining the shift engineer in the Metropolis by means of levies, the while the central-station official kicks his heels on the wrong side of the station walls. That is at once both interesting and humiliating to contemplate.

Our "Correspondence" pages have long shown that there are two very different types of men in central-station work. There is what we may describe as the professional man, who believes in status, and there is another who is out for higher remuneration and is indifferent concerning status, dignity, and so forth. Is it unfair to say that the former expects to rise to higher positions, and that the latter, because of his circumstances, will not object if he be classified a workman, so long as he can at once get more money or better conditions? For either of these classes to permit themselves to be led spider and fly fashion by socialistic vapourings concerning ideal States of the future, when they are dealing with present problems, would be sheer absurdity. The man who pours weak ridicule upon such things as status, and wants to see the Middle Class stamped out, is unlikely to aid the cause which the A.E.S.E. was established to promote. If only the spirit of moderation be fostered, the Association has a great opportunity for continuing the upward movement in wages and salaries, for which its own existence and certain other factors were responsible. Because in certain cases the requests of individual central-station assistants for better scales of remuneration may have been turned down by municipal committees and boards of directors, it does not follow that the only thing to do is to fly into a rage and make imperative demands through their organisation.

Surely there is room for combined representation along well-tried diplomatic lines. Such is always to be preferred to ill-expressed demands which are punctuated by irritation and other bad feelings. That "a man is known by the company he keeps," occurs to one at once in connection with the suggestion that the A.E.S.E. should be prepared at a favourable moment to co-operate with the E.T.U. Happily, that proposition was not approved by the executive. If one thing is clearer than another in this recent series of discussions, it is that the central-station engineer who is anxious for status will not get it by too close an alliance with the E.T.U., however excellent that organisation might be from the workers' (we use the word quite inoffensively) point of view.

We do not know how far the temper of the little gathering of last week may be regarded as representative of that of the 400 A.E.S.E. members enrolled in the London district. Still less are we able to say how far it represents the opinions of the 1,500 in the United Kingdom who are either enrolled as members or have lodged their applications. A little suggestive advice regarding a house divided against itself, and the folly of a king going to war under certain circumstances, may not be untimely. Also, one might suggest that, before threats are made, it is as well to know just where you would stand in the event of its being necessary to carry those threats into effect. The last state of the Association might be worse than the first.

As in the past, so now, we wish the central-station staffs, whether through their organisation or in other ways, a full measure of success in their movement to raise their status and secure a settlement of the various grievances to which they have periodically given full expression in our pages. But we cannot for one moment feel that they have anything whatever to gain by indulging in strike talk. Not only is it *infra dig.*, but it is unwise. Let us put a few plain questions, and leave those interested to answer them :—Could a strike possibly remove certain of the factors making for low remuneration ? If all the A.E.S.E. members were to strike would it be impossible to "keep the wheels turning" ? Would the non-militants in the A.E.S.E. support their militant fellow members by "coming out" ? Are there not hundreds of men eager to get into central-station work ? May be some of our readers will think we treat this matter more seriously than it deserves. To that we would reply that we are dealing with the spirit that is prevalent, and the mere suggestion that members of the A.E.S.E. would ever take such drastic measures as are indicated above can only harm the interests of the central-station man. We advise the Association to suppress strike agitators and pursue its work legitimately, but as firmly as it pleases, along the peaceful way.

We believe that the majority of electricity supply "chiefs" are not averse to paying fair and proper remuneration to their staffs, and to considering favourably the movement for better conditions. Many of them have been through the same mill as their assistants and know both the duties and the handicaps. Their efforts might be strengthened by the existence of a strong and respected A.E.S.E., and committees and boards of directors who have sometimes turned down applications from station staffs, might through them be brought into line. The Association of Municipal Electrical Engineers in the London area already has the whole subject of station employment in hand, and the A.E.S.E. has during the last few days written to all London supply authorities asking for a Committee to be appointed, as stated in the resolution which appeared in our last issue. We hope that as a result of these and other deliberations, it may be possible to see exactly what the position is in London, and if grievances really do exist, that something may be done to remove at any rate some of the causes of "The Present Discontent."

The Copper Position.

Under the influence of more encouraging news, especially in so far as the financial markets were concerned, copper sustained a decided improvement with a good extension of speculative interest accompanied by more liberal buying on the part of consumers. The last European figures certainly gave the market direct encouragement, for they really made a capital showing, the European visible supply during January sustaining a reduction of about 3,600 tons; but the stimulating influences were partially discounted by the growth of apprehensions lest the next United States returns should disclose a further increase in the stocks of copper held at the American refineries. The fears on this score were responsible indeed for quite a sharp set back in the prices of warrant copper towards the end of last week. The outlook is certainly not as clear as it might be, but, on the whole, there are encouraging signs which it would not be wise to ignore. One of the most important of these is the continued activity which prevails in electrical connections where, although things are not at their apex, a high level of manufacturing activity is nevertheless being maintained in Europe, while it is impossible for American trade to remain in the despondent condition reflected by the official returns for the month of December. Even while the Unites States production of copper is being affected unfavourably by the strike which still continues in the Lake Superior region, certainly production is getting back to the normal there, but it will take time before output resumes its old level, for workmen are dribbling back to their employment, and only part of the furnaces at the smelting works are in operation. The upheaval in Mexico is another restraining factor upon production, and it cannot be expected that industrial operations in this quarter can be resumed upon anything approaching a satisfactory scale for months to come. There seems no reason to anticipate much higher prices for copper in the early future, but, on the other hand, a gently fluctuating market within the extreme figures recently witnessed. The considerable relaxation in the money market is a matter of great importance in considering the future of trade. Easy money is, of course, a symptom of industrial depression, but it is necessary for money to be cheap for trade to revive, and the extent and rate of the revival depend largely upon the requirements of consumers and the confidence which they feel regarding the basis of business. If America should recover rapidly from the depression which has been the chief characteristic there for a good many months, a sharp change might easily be witnessed in European conditions. Generally, the worst should have been seen here in a good many connections, notably iron and steel, and it is impossible to believe that a rehabilitation of confidence and industrial activity in one direction of the metallurgical industries should not meet with a response in others.

The American Copper Producers' Association returned the United States production during January as 58,826 tons, compared with 62,049 tons in December, a falling off of over 3,200 tons. The American consumption was on a larger scale, but still fell far below the average, being only 21,409 tons, against 9,794 tons in December, and 29,111 tons in January of last year. The exports constituted a record at 39,266 tons, against 32,831 tons in December, and 26,957 tons in January of last year. The net result of the figures is a reduction in the stocks of 1,950 tons to 38,971 tons, compared with 40,821 tons at the end of December, and 55,000 tons a year ago. The market took the figures well, and there was a sharp advance.

STATUTORY NOTICES.

By "INTERESTED."

System in business—that is, properly-designed system—is the means whereby trouble is escaped. Electricity works are quite as much open to damage incidental to badly-designed system as other trades. When all runs well, all is well; but when one small item in the huge organisation of a business slips askew, then the design comes in for serious strain.

Electricity supply undertakings are particularly susceptible to derangement by a dislocated system because statutory requirements are so exacting, and any slip in the process of complying with the numerous provisions of many Acts of Parliament not infrequently leads toward trouble more or less serious.

The mains and distributing departments offer the chief openings for trouble in connection therewith, and with a view to escaping these dangers, I present below particulars of a book containing five different patterns, so arranged that with this book in use the mains department of a metropolitan station cannot go far astray when carrying out house service connections. The forms are arranged in order, and by employing them in rotation, the systematic dispatch of the various notices is quite simple; they constitute a system whereby most, if not all, dangers to which one is liable in this particular direction can be avoided.

The whole of the Forms, Nos. 1 to 5, are printed on one page in copyable ink and bound in book form. Between the forms are perforations for the purpose of detaching or tearing them off at the proper time. A brief summary of the duties relative to the various patterns will not be out of place, but the diagrams themselves explain better their precise purpose.

Nos. 1 and 2 are for the purpose of forwarding the required 24-hour notices to the G.P.O. and the L.C.C. before opening ground.

No. 3 is the jointer's instruction sheet from the mains engineer. Thereon will be found all the necessary information relative to the particular job in hand.

No. 4 is the customary notice or order for the reinstatement of ground opened whilst putting in a house service.

No. 5 is the counterfoil retained in the book for the purpose of reference.

With regard to laying new mains, the following two forms will serve as useful guides:—

No. 6 is a handy form with which to serve the various authorities with monthly notice of intention to open ground for the purpose of laying mains, and No. 7 is a suitable form ordering the opened ground to be reinstated.

BOROUGH OF ——— ELECTRICITY DEPARTMENT.

............day of............191......

To The Clerk, L.C.C.
Spring Gardens,
S.W.

Please note that we intend to open ground and lay an Electric Light Service to ....on, or about ....next, the..................................

Signature..................................

No. 1.

BOROUGH OF ——— ELECTRICITY DEPARTMENT.

............day of............191......

To The Superintending Engineer, G.P.O.
74, North Side,
Wandsworth Common, S.W.

Please note that we intend to open ground and lay an Electric Light Service to ....on, or about .... next, the ....

Signature..

No. 2.

Connection Sheet No.............................

J.O. No...................................
Consumer's Name..
Address ....
....
Service Cable....................[ ]" Section ....
To Join ....| |" Section Main ....
Meter, Type ....Amps..........No..........Reading...............
Fuse Box, Type..
Service Box, Type..
Issued..Engineer.
Length of Service Cable ....
Excavation ....By..............................
Paving ....
Connection Made ....
Jointer's Name ....

No. 3.

BOROUGH OF ——— ELECTRICITY DEPARTMENT.
House Service.

............day of............191......

To The Surveyor————

Please note that we have this day opened ground as follows, and the same can now be reinstated.

Position.	Description of paving.	Measurements.

Signature..................

No. 4.

Consumer's No.........................
Name ....
Address ....
....
Connection Sheet Received.
Date......................................
Issued to Jointer.
Date......................................
Post Office Notice Served.
Date......................................
Reinstatement Notice Served.
Date......................................
Details of Measurements.
....

No. 5.

....
....
London.

(The Electric Lighting Acts, 1882 and 1888.)

Notice under Section 13 (Sub-sec. A) of Order of Intention to Execute Works.

To

PLEASE TAKE NOTICE that, after the expiration of one Month from the service of this Notice, the Metropolitan Borough of ...., Electricity Department, in exercise of the powers conferred by the above-mentioned Order, intends to commence the execution of the works hereinafter described, that is to say:—

DESCRIPTION OF WORK.

Dated this day of , 19

For the Metropolitan Borough of.................,
Electricity Department,
Engineer................

(No. 6).

Please note that we have this day opened ground as follows and the same can now be reinstated:—

Name of street.	Dimensions of hole.				Superficial area.		Description of paving.
	Roadway.		Footway.				
	ft.	ft.	ft.	ft.	yd.	ft.	

....

No. 7.

NOTES ON DESIGN OF REGULATING RESISTANCES.

By L. BOOTHMAN.

Shunt Field Rheostats.—Divergent views are held by designers as to what constitutes the "total watt" or "summation watt" capacity required of a shunt field regulating resistance. For instance, in one manufacturing company's catalogue it is stated that the capacity required in watts is :—

1. "Square the mean of the maximum and minimum field amperes and multiply by the resistance of rheostat."

Another designer uses the following formula :—

2. Mean excitation voltage ×

$$\sqrt{\text{Maximum amps.}^2 - \text{Minimum amps.}^2}$$

A further variation is :—

3. Mean excitation volts ×

$$\left(\text{Maximum amps.} - \frac{\text{Minimum amps.}^2}{\text{Maximum amps.}}\right)$$

Each manufacturer knows by test the actual watts that can be dissipated in his rheostats for a given temperature rise. This, however, does not necessarily mean that it is the total watt capacity of rheostat required. The maximum watts that will be dissipated is at that point where the rheostat ohms inserted in circuit equals the field resistance. In a particular case this may occur with, say, one-third of the total rheostat in circuit. Each regulator is usually made up of a number of resistance units, each of a certain capacity, and the total number required determines the size of rheostat. Other considerations have to be taken into account, such as the heated air of lower units impinging on upper units, and reducing their capacity for a given temperature rise.

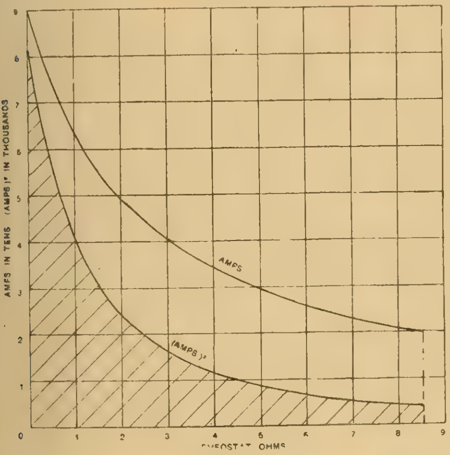

FIG. 1.

An empirical formula which I have found in practice to give accurate results, to obtain the size of rheostat in watts, is given by :—

4. Total rheostat ohms × max. amps. × min. amps. This is exemplified by the following actual examples :—

(A) Exciting volts, 220 ; maximum field amperes, 90 ; minimum, 20 ; rheostat ohms, 8·55.

No. 1 gives 25,800 watts ; No. 2, 19,300 ; No. 4, 15,400.

(B) Voltage, 100 ; 100 ohms field ; 100 ohms rheostat ; 1 ampere maximum ; 0·5 ampere minimum.

No. 1 gives 56·25 watts ; No. 3, 75 ; No. 4, 50.

(C) Exciting voltage, 125 ; maximum amperes, 500 ; minimum, 200 ; rheostat resistance, ·375 ohm.

No. 1 gives 46,000 ; No. 3, 52,400 : No. 4, 37,500 watts.

The accuracy of Formula 4 can be easily verified by Simpson's rule for areas. The shaded portion of fig. 1 represents the total watt capacity required for Example A, and from it the watts being dissipated at any point of the rheostat can be ascertained. In this example the resistance has been stepped out from the curve shown in fig. 2. Simple motor speed and generator voltage regulators may be stepped out from a curve with sufficient accuracy for commercial use. In technical books that have been published, elaborate methods, rarely used, are given for this stepping ; these necessitate actual tests on the machines, but purchasers cannot wait for the control apparatus after the machines are finished. This, and the desirability of using standardised units, militate against that procedure. Another point, for instance, is that the load on generators does not vary in such values that equal voltage changes occur, but the writers usually assume that it does so.

Potentiometer Rheostats.—Equal increments of current at each step, varying between zero and maximum, are the usual requirements. There are various approximate methods for obtaining the stepping, but the following formula gives it directly :—Let R equal total potentiometer resistance ; P, rheostat resistance in parallel with field ; F, field resistance ; E, excitation voltage ; C, current in field.

The field current at any step of the rheostat is given by—

$$C = \frac{E}{R - P + RF/P}.$$

All the above quantities being known, except P, the resistance at any step is given by—

$$P = \frac{\left(R - \frac{E}{C}\right) \pm \sqrt{\left(\frac{E}{C} - R\right)^2 + 4RF}}{2}.$$

It is only necessary to solve for a few distributed steps, then by plotting a curve the remainder can be read off directly. The maximum watts to be dissipated in the rheostat is at that point where R − P (resistance in series with field) equals field resistance.

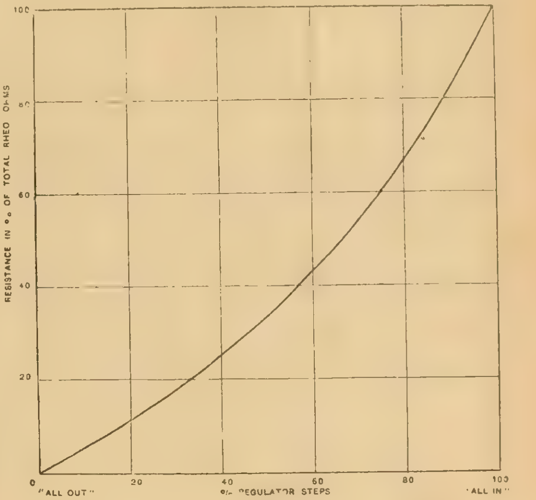

FIG. 2.

A safe rule in designing is to allow 2 to 4 ohms per volt of supply. The larger value gives a less constant watt loss, but suitability and cost depend on the range of units available.

On reversible potentiometer field rheostats it is advisable to reduce the last few steps in ohmic value. That is, to depart from equal current increments so as to reduce the field current to zero more gradually.

Copper as a Thermostat.—The *Electrical World* quotes some recent experiments of Dr. E. F. Northrup on the change of resistance of copper between 20° and 1,450° C., from which it appears that up to 1,080° C. (near the melting point of copper), the resistivity varies roughly according to the well-known straight-line law, but in the process of melting the resistivity is approximately doubled. From 1,100° to 1,450° C. a straight-line law is again followed, the slope of the line being practically the same as before. The abrupt doubling of the resistivity at the melting point could be utilised to control the temperature of an electric furnace in the neighbourhood of 1,080° C., provided that the copper conductor were properly protected.

D

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Alterations to Dynamo.

I am in charge of a D.C. generator giving 120 amps. at 255 volts, running at 750 R.P.M., belt driven, by suction plant and gas engine.

I desire to alter this machine to a battery-charging dynamo, also to run as motor for starting-up purposes, therefore I require a strong field.

Having tried the machine without the compound winding, I can get about 50 amps. at 250 volts only. I want to avoid running the machine at a higher speed, and also want to make the alterations efficient, and at low cost.

I proposed winding another set of field coils on the top of the present windings, of same gauge and weight, coupling the two sets in parallel.

H. P. W.

The 1/13-Watt Lamp.

In spite of the many statements now being published as to the efficiency of electric lamps, I am somewhat at a loss to know what measurement should be taken as determining the commercial candle-power.

Until recently metal-filament lamp makers used, largely to their advantage, the horizontal candle-power as their unit, while arc lamp makers adopted the mean hemispherical candle-power, but circumstances have changed and the present moment seems fitting to establish a correct standard practice.

The polar curve of the light-giving unit should be considered when it shows good resultant light distribution.

In a certain well-known flame arc lamp measured with both inner and outer globes in place, nearly 6,000 C.P. is regularly and constantly obtained at about 20° below the horizontal plane passing through the arc, with a consumption of 600 watts. Are my friends entitled to call this a 1/10-watt lamp, or should I advise them in view of its mean hemispherical C.P., to call it a 1/7 or 1/6-watt lamp?

Nitrogen-filled incandescent lamps seem to require always a globe to protect either them or the human eye; this globe unfortunately filters off a considerable percentage of the light. Would it therefore be reasonable to call the efficiency of the above flame arc lamp 1/11-watt, as the measurements stated were made with both the inner and outer globes in place?

I read in the printed particulars of the recent forms of tungsten lamps that during a period of 800 to 1,000 hours the candle-power will diminish 20 per cent. from the initial. Under these circumstances, since the flame arc lamp in question gives a constant light at all times, it would seem reasonable when comparing it with the tungsten lamps to call it a 1/12 or 1/13-watt lamp.

In the interest of honest trading and a desire to keep away from the law courts, I venture to ask your advice as to what the lamp in question should be called?

Justus Eck.

Chiswick, *February 7th*, 1914.

[Why not call it the "Excello"?—EDS. ELEC. REV.].

Electrically-driven Laundries.

I should be extremely obliged if any of your numerous readers could supply me with useful data showing comparative results of electricity against steam for the driving of laundries, and at the same time state actual cases where such electrical plant is in operation and can be inspected.

I am anxious to show by definite example that even where low-pressure steam is necessary for boiling purposes, electricity can be advantageously used for power.

Arthur J. Beckett,

Borough Electrical Engineer.

Bridlington, *February 9th*, 1914.

Protection or Tyranny?

I had not contemplated trespassing further on your valuable space, particularly to reply to an anonymous correspondent, who, I think in matters of importance, should acknowledge his contribution; nevertheless, in regard to the point that "Pollux" raises, this is one that has been ever in my mind, and I have looked in vain for the B.E.A.M.A. conditions to be published *in extenso*, and a full discussion on the same, although, perhaps, the serious inroads it would have made on your columns has been the obstacle.

If "Pollux" desires a copy of the "Impregnant seven" B.E.A.M.A. conditions of tender, I shall be pleased to let him have one or any number, as they come in shoals with every contract, so that it is no wonder I have them on the brain, as one contractor remarked. Others, as well as myself, have been hammering away at this matter in one form or another for many months; the B.E.A.M.A. steadfastly refuse to depart from the conditions they have laid down, and their members must stand or fall by them, and tell us to go to—wherever we like for our plant. Under these circumstances it appears useless to further discuss the matter with a view to coming to a mutual agreement.

F. W. Purse,

City Electrical Engineer.

Carlisle, *February 9th*, 1914.

The Electrical Trades Union.

I have read with interest Mr. Weekes's article on the demands of the Electrical Trades Union and the rules laid down by the Contractors' Association, and notice that Mr. Weekes specially points out to the E.T.U. that the grading is not what it ought to be. There is no doubt that there are hundreds of men employed as electricians who will not join the E.T.U. owing to their grading.

What benefit would it be for a man to join the E.T.U. who is in the position of electrician to one of the many large firms who have their own lighting and power plant, and whose salary is anything from £2 10s. to £4 per week; what grade would they apply to him (not wiremen, I hope)? He is capable of wiring and also responsible for the upkeep of motors, dynamos, and all repairs which are necessary for the running of a power plant. Should this man become unemployed, under the E.T.U. rules he would have to take up a wireman's job should there be a vacancy, or be debarred from all unemployment benefit; this, I think, is why the E.T.U. do not get the best men. When a man has made himself efficient to take up the position of electrician he does not want to start at the bottom again by taking up a wireman's job; it would be a great bar to him when applying for any vacancy for electrician. I think the E.T.U. by this time have had enough experience. I know many men who have left the society for this one reason, and the sooner the E.T.U. cater for the electrician the better for them.

I have seen it published from time to time that the A.E.S.E. are taking in the electrician, but by their title they cater only for the station engineer. Would it not be better called the Association of Electricians and Station Engineers? Then I think it would be advisable for Mr. Ebben, the hon. sec., to launch out in this particular field—they certainly want organising.

Mr. Weekes also points out that it is by apprenticeship that the best workers are obtained. I quite agree with Mr. Weekes. Perhaps it would surprise him to know that there is not one half of the wiremen in the E.T.U. who have served an apprenticeship; both the E.T.U. and the contractors are to blame for this.

The E.T.U. will accept men at 30 years of age who have been in the trade five years (or less). What has this man been doing these five years? Not serving as an apprentice but simply a wireman's mate, who keeps moving from one firm to another who are badly in want of men, and eventually he enters the E.T.U., who immediately make him a wireman, because they say it is much better to have him in the society than for him to be working for less than the standard rate. My opinion is that this has been the one drawback to the E.T.U., and it has kept the best men from joining, and instead of getting the society a good name, it has been the means of putting all men on one level, leaving the contractor to find out for himself whether he has got hold of just a man who can run wires and tubing where he is told, or a good all-round electrician. I have had charge of large numbers of wiremen, and to call quite 50 per cent. of them tradesmen is out of the question: the trained wireman is worth at least all that the E.T.U. demand. I have seen many wiremen absolutely at sea when left to themselves, and many have to depend on even the apprentice. This type of wireman wants removing then we shall have an Electrical Trades Union.

Late Member E.T.U.

THE GREAT STRIKE IN JOHANNESBURG.

THE CITY UNDER MARTIAL LAW.

BY R. TURNBULL MAWDESLEY.

Johannesburg, *January 21st*, 1914.

THE predictions made at the close of the Miners' Strike, which culminated in the disastrous happenings of July last, that only a temporary truce had been called, and that within six months we might look for even more serious labour troubles, unfortunately proved to be only too well founded.

Indeed, it was an almost uncanny prophecy in its chronological forecast, for the first practical overflow, following the volcanic mutterings, was the coming out of about 100 railway workers early on the morning of Thursday, January 8th. (It was on the evening of July 5th, 1913, that the Dragoons found it necessary to shoot down some people in the streets.)

The whole trouble arose primarily from difficulties on the Natal coalfields, which difficulties were augmented by the necessary dismissal of a few railway men, among them being, unfortunately, the secretary of the Transvaal Miners' Association. The dismissal of the railway men was brought about wholly by the great shortage of native labour, and as the whole Union had been in the throes of minor labour troubles for some months, it did not take much fanning to cause a general strike.

General information on these matters will have reached you long before this—but some details of the manner in which this strike has affected the electrical industry may prove of interest.

It may be said that the whole of Johannesburg is illuminated by the municipal tramways and lighting station; and although there is a small gasworks operated by the same department of the municipality, very little street lighting, and practically no private consumers, are supplied from it.

The water supply of Johannesburg is derived from bore holes, and the Rand Water Board takes energy from the power station to drive the bore-hole pumps. In consequence, a stoppage of the electrical supply not only threatened a water famine, bad enough in itself, but meant the greater portion of private houses, shops and thoroughfares being in almost total darkness. Such a calamity in a town in which 50 per cent. of the population is composed of semi-civilised natives, who break loose practically without invitation, was to be guarded against at all costs; and the authorities wisely decided to bring a detachment of the 10th Witwatersrand Rifles, some 200 strong, to the power station as a defence guard.

This regiment is an arm of the Union Citizen Defence Force, mobilised by General Botha at the outbreak of trouble; it took up its quarters in a building originally occupied by the gas plant (which, incidentally, is now being broken up for scrap). Since the afternoon of Saturday, January 10th, it has been continually on guard at the main entrances to the power station, boiler house, and car-sheds.

It will be difficult for the home people to understand the necessity for such strong measures, but it may be more readily appreciated when it is remembered that during the Miners' Strike in July last, a mob of strikers entered the station and forcibly compelled the drivers to shut down the whole plant.

The guard posts are fortified by sandbags and two Maxim guns; and there is a large searchlight for signalling purposes at the north-west corner of the works. The officers commanding are rigid in the enforcement of duties; no troops are allowed out of bounds, and no single person can enter the works without a permit signed by the commandant.

The outlook took a serious aspect at the beginning of the following week, and at midnight on Tuesday, January 13th, Lord Gladstone proclaimed Martial Law in Johannesburg and other affected centres. This means that no assembly of more than five persons is allowed; that no citizen must be abroad in the streets after 8 p.m. There must be no picketing, no "pulling-out" of workers, and no use of opprobrious terms such as "Scab" or "Blackleg."

The chief magistrate also issued an order to close all bars, wine and spirit stores and hotel bars, until further notice; and all these at present remain closed.

In consequence of the proclamation of Martial Law, the majority of the running staff have been sleeping and feeding on the power station premises, and it is satisfactory to note that no single man on the operating staff has gone on strike though the boilermen and drivers are mostly Union men. The repair and construction men have gone out in twos and threes their places being left vacant for the time.

After the railway workers had struck, the question of the coal supply for the power station assumed some seriousness. No trains were then running, and the amount of coal was reported to be enough for three full weeks' run at the beginning of the strike.

A meeting of the Tramways and Lighting Committee was called, and it was decided to stop the cars altogether on January 10th. The reason for this was twofold—partly to conserve coal for lighting, but principally for another reason altogether. This was the desire on the part of the authorities to prevent a host of men, women and children from concentrating in town, when there was every indication of danger. The morbid curiosity of women and children especially to witness the tragic side of life chases fear from their minds, and instils a certain feeling of disregard for their safety, almost akin to courage. If the cars had been in service on Sunday, January 11th, thousands would have congregated in the streets, and additional trouble would have been given to the military and police in keeping the peace of the city.

The whole of the cars were in the sheds from Saturday, January 10th, until Monday, January 19th, and then the strain eased a little, and a full service was again put on the roads.

During the cessation of the car service there was a movement on foot among the business men of the city to have a car service for an hour in the mornings and one hour in the evenings to enable people to reach their homes in the suburbs—but it came to nothing. In fact, so many strikers and others affected were prowling about that there was a distinct element of danger to the motormen and conductors.

It was authoritatively stated that the tramway men refused to work after dark, and probably painful memories of last July influenced them in this decision.

The Mayor, Mr. Norman Austey, very fairly remarked: "We could not ask the men to do what we should not like to do ourselves. It is only fair to them that we should arrange for them all to cease work."

Shortly after the strike was declared, it was rumoured that the strikers intended to dynamite the principal buildings, among them the power station and car-sheds. (It may seem that such a rumour could hardly be credited, but it must be remembered that last July the strikers dynamited the chief railway station of Johannesburg—burning it completely down—and other buildings, including the *Star* newspaper offices, were razed to the ground.) In consequence, the Government published an addendum to the Martial Law Regulations on January 14th, an excerpt from which reads:—

"Any person found near any public building, railway premises, railway bridge, or railway line, or near any telegraph or telephone line, or station, or near any power station, water works or any premises used in connection with the supply of light or water, shall, if called by any member of the forces employed, come forward with his hands held up and may be thereupon arrested. If he fail so to comply in any respect with the demand of such member of the forces employed, such member may *shoot the said person* without further warning."

It is an unquestioned fact that the chief railway station and the municipal power station are at the moment the centres of interest here—both places being guarded by armed military forces, who would make it extremely uncomfortable for any strikers bold enough to approach.

The streets leading to the power station are all roped across, and approach by any but the staff, is difficult. The writer was anxious to send you some photographs of the power house guard, but was unsuccessful, for obvious reasons, in securing even a snap-shot.

The following incident may serve to show the attitude of the strikers and the stern measures which are necessary to check violence:—

Under Martial Law no meeting of more than five persons is allowed, and some leaders of the strike movement who are at present at liberty (the remainder being in custody at the Fort), more than five in number, arranged to board a car at different stages, which they did. During the car's journey to a distant suburb, they held their meeting on the top deck quite undisturbed by the conductor, who had previously collected their fares, and descended in triumph at the journey's end.

So far as the writer has been able to ascertain, the power stations of the V.F. and Transvaal Power Co. have been running as usual.

At the time of writing, there is a rumour that the tramway men will strike unless paid in full for the time of their enforced idleness while the cars were stopped. In any case, the men are forced to work short hours, as the cars are compelled to be in the sheds before 8 p.m.

Thursday, January 22nd, 1914.

When the above lines were written yesterday it was hardly considered possible for the strike to be ended within a week, and yet so suddenly do matters materialise here, that to-day the strike is ended.

However, the writer would offer, with all the emphasis possible, the advice to anyone intending to come to the Rand, not to do so under any circumstances. Conditions are bad enough for those with work to do, but for anyone without South African experience, or weighty influence, it would be suicidal to come here. There are absolutely no vacancies anywhere, and many men of experience are leaving the country in consequence of the Labour troubles.

ELECTRIC PUMPING PLANT AT TILMANSTONE COLLIERY.

By H. J. WROE (Manager).

(*Abstract of paper read at a meeting of the* Association of Mining Electrical Engineers (London Branch), *February 6th*, 1914.)

The coal measures at Tilmanstone are buried under a considerable thickness of secondary strata, and directly overlaid by a sand bed 22 ft. thick. This sand bed, which was met with at a depth of 1,150 ft., was found to be heavily watered, and it was decided to install electrically-operated pumps.*

A pump inset was made at the 600-ft. level, and in it was installed a horizontal stationary Sulzer pump, direct coupled to an A.E.G. three-phase motor, wound for 3,000 volts, 50 periods. Two sinking pumps were suspended in the shaft on steel wire ropes. The control of the pumps was carried out from a switchboard mounted in the 600-ft. pump room. This switchboard consists of ten switch pillars built of sheet steel and totally enclosed. Three of these are feeder pillars, the 0·15 sq. in. paper-insulated shaft cables ending in cable-end boxes mounted in the pillars. One pillar was provided for the horizontal pump motor, and two pillars for each of the sinking pump motors. The two remaining pillars were provided for motor drying out, one being occupied by the necessary switchgear, the other containing a 150-K.V.A. step-down transformer fitted with tappings on the low-tension side. This arrangement makes it possible to dry out any motor that has been standing for some time, or a motor which has been submerged. The isolating links on the motor pillars are designed as change-over switches for this purpose. This transformer is also available for keeping in perfect working order any idle motor acting as a stand-by.

Each sinking pump motor was started by its own transformer, contained in a separate pillar, the adjoining pillar being provided with an oil switch, isolating links and instrument transformers. Owing to the interlocking connections, it was impossible to close the motor oil switch unless the starting transformer was in the starting position, but in case of emergency the motor could be stopped instantly by opening the emergency switch fixed on the frame of the sinking pump. The breaking of the emergency switch tripped the oil switch on the pump room switchboard.

The cables for the sinking-pump motors were carried from the switchboard along the water ducts to the cable drums, connection to the latter being made through slip-rings mounted on the cable-drum shafts. The pilot cable for stopping either sinking-pump motor was also carried in a similar manner to a small cable drum. Each cable drum was operated by hand through the medium of worm gearing, a screw brake being provided.

The high-tension sinking-pump cables were of the three-core rubber-insulated and double steel-wire armoured type, each core having a sectional area of 0·1 sq. in. The armouring consisted of specially fine steel wire to render the cable thoroughly flexible.

Each cable passed from the cable drums over the water ducts, and was carried over a series of hardwood rollers arranged in such a way as to give as large a bend as possible at the point where the cable entered the shaft. Each cable was connected to the pump motor by a suitable water-tight cable-end box, the end of the cable being brought up from below with a view to preventing moisture finding its way into the cable box.

Support for both the main and pilot cables was provided by clams resting on and bolted to the main clams carrying the pipe column. A special feature of the clam is the provision for liberating the cables without the necessity for removing the main pipe clams, and this arrangement proved a great advantage on several occasions.

The delivery columns consisted of 10-in. bore steel pipes clammed at intervals of 36 ft. to the pump suspension ropes, provision being made for the free movement of the ropes through holes in the clams.

The two sinking pumps, supplied by Messrs. Sulzer Bros., were of the centrifugal type arranged with vertical spindles. Each was capable of delivering 1,200 gallons of water per minute against a maximum manometric head of 870 ft., with four impellers. In order to prevent sand entering the water jackets for the bearings of the pumps and motors, the cooling water was passed through a filter; two filters were arranged in such a way that, by means of isolating valves, one could be cut off from the supply and cleaned out, while the other was at work.

Each sinking pump was coupled by means of an elastic coupling to a totally-enclosed three-phase squirrel-cage motor, capable of developing at 3,000 volts, 50 cycles, a continuous output of 500 B.H.P. at a synchronous speed of 1,500 R.P.M. The upper bearing of the motor carried the weight of the rotor, the weight of the pump shaft and impellers being taken by a step bearing on the pump.

The leading characteristic of the motor design is the combination of air and water cooling, the rotors being fitted with fans which equalised the temperature in the interior of the motor, and prevented the formation of heat pockets. The stator windings were water-jacketed, the cooling water being obtained from the first stage of the pump. The arrangement made by the makers for removing sediment from the base of the jacket consisted of a number of screwed plugs which could be removed when the motor was standing. These were replaced by gun-metal cocks, by means of which the water jacket could be flushed at frequent intervals while the pumps were at work, without interfering with the cooling water supply.

The pumps were designed specially to deal with the very sandy character of the water, and the whole of the internal wearing parts were made of, or armoured with, hard phosphor bronze. The percentage of sand carried by the water was at times very considerable.

The sand carried by the water through the pumps at a high velocity occasioned considerable wear and tear to the internal parts, and frequent renewals were necessary. As the various clearance spaces increased, so the efficiency of the pumps diminished, and when one of the two pumps showed signs of being under its work, arrangements were at once made to change the internal wearing parts. The whole of the internal parts of the pump, including the shaft, were withdrawn, and a complete new set of internal parts were then placed in position in the pump casing. This method is preferable to that of renewing on the spot only such parts as have become defective. On no occasion after adopting this method was any trouble experienced upon starting up. The old wearing parts sent to the workshop, were taken apart and carefully examined, those unfit for use being discarded, while those which admitted of it were repaired and re-assembled for further use. The gate valves controlling the pump deliveries were also found to be seriously affected by the sandy character of the water, and on several occasions it was found necessary to raise the delivery columns in order to allow of the gate valve being changed. With a view to avoiding the loss of time occasioned, the writer has suggested to the pump makers an arrangement wherein the gate valve is not placed vertically in the line of the delivery column, but is off-set from it in such a way that the valve can be removed without necessitating the raising of the column.

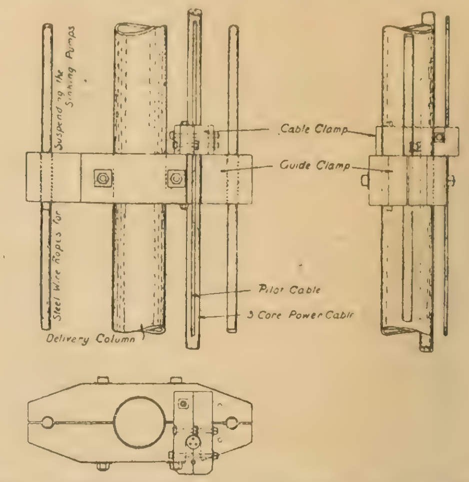

Fig. 1.—Guide Clamp and Cable Suspending Clamp for Sinking Pumps; Tilmanstone Colliery.

The pump, motor, pipes, clamps and cables were suspended on a 2-in. diameter flexible steel wire rope of 6/37 construction having a steel-wire core.

As the sinking pumps delivered at the 600-ft. level, the movements of the pumps were controlled from, and the pipe changing was carried out at, that point—that is to say, midway in the shaft. The upper end of the delivery column terminated in a flexible hose-pipe having internal and external armouring. The hose-pipe being 36 ft. long, and consequenty heavy to handle, it was secured to a wire rope which passed round a series of pulleys, the in-bye end of the rope being weighted.

With a view to initiating the switchboard and sinking pump attendants in their duties, and in order to obtain uniformity in the carrying-out of the various operations, two sets of rules were drawn up—one for the switchboard attendant at the 600-ft. level, the other for the use of the sinking pump attendant. These rules were strictly enforced. The successful carrying-out of the pumping operations at Tilmanstone is largely due to the care exercised in drawing up these rules, and to the admirable manner in which they were carried out by those connected with the working of the plant.

Three electric pumps, together with suitable switchgear, were installed at 1,140 ft. by Messrs. Sulzer Bros. Each pump is of the horizontal stationary six-stage type, rated for a normal delivery of 1,000 gallons of water per minute, against a manometric head of 1,300 ft. The impellers and guide wheels are made of specially hard bronze, and all parts of the pump along which water is flowing at a high velocity, are made of this special material. All internal parts which are liable to excessive wear are easily replaceable, at comparatively small cost.

Each pump is mounted on a common bedplate, and is coupled direct to a three-phase motor of the ventilated enclosed type, capable of developing at 3,000 volts, 50 cycles, a continuous output of 680 B.H.P. at a synchronous speed of 1,500 R.P.M. The rotor has slip-rings and brush-raising and short-circuiting gear. The motor is started by means of a liquid starter provided with separately mounted protective resistances. The bearings of the pumps and motors are ring lubricated, the bearings being water cooled. The switchboard is very similar to that at the 600-ft. inset.

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* For illustrated description see Electrical Review, February 16th, 1912.

During the sinking and unwatering operations, which lasted 10 months, not a single stoppage of the electricity supply occurred, and the sinking pumps and motors, in spite of the onerous conditions under which they worked, were used alternately in such a way that pumping was carried on continuously.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Out-Door Air-Break Switchgear.

Messrs. Laing, Wharton, Ltd., of 7, Great Newport Street, W.C., inform us that they have supplied a number of Vedovelli-Priestley air-break switches to the English, Scottish and Welsh power companies.

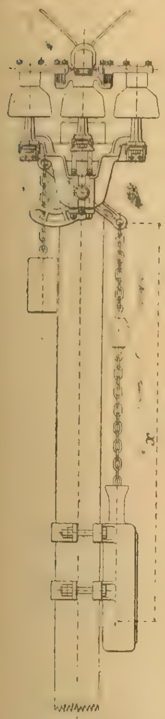


Fig. 1.—Air-break Switch.

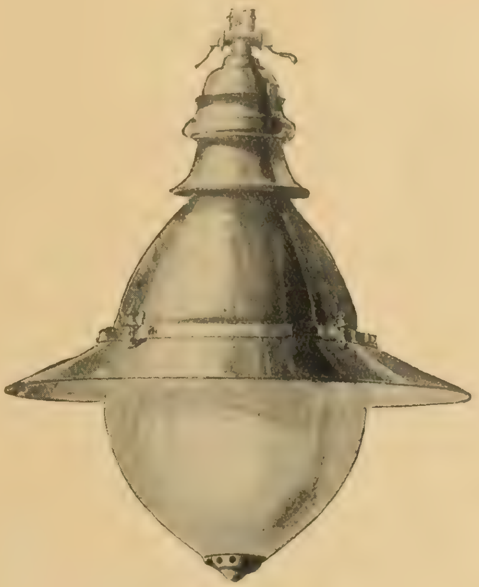


Fig. 3.—G.E.C. Half-watt Fixture.

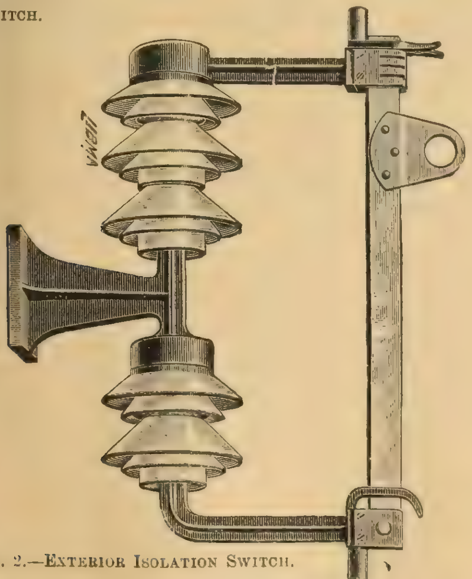


Fig. 2.—Exterior Isolation Switch.

This type of switch is, of course, much used on the Continent where, for instance, a three-phase 60,000-volt switch, to deal with 150 amperes per phase, controls the electric service to the Mont Cenis Tunnel.

Fig. 1 shows a very simple counter-balance weight method of operating these switches from ground level: an insulated chain running down the pole terminates in a cast iron box with lock door.

The chain is pulled down when the switch has to be closed and the loop at the end is passed over a retaining hook. When it is required to open switch, the chain is released when the counter balance weight pulls the switch into the open position.

Special features of the Vedovelli-Priestley switches are the lower supplementary laminated clip contacts which make contact after and break contact before the special sparking shoe has made or broken contact with the special sparking horns.

The exterior isolation switch, fig. 2, is in considerable demand in this country; it is built with insulators for up to 30,000 volts and with blades and contacts for from 150 to 1,000 amperes.

G.E.C. Half-watt Lamp Fixtures.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have recently issued a pamphlet (F1789) dealing with new fixtures rendered necessary by the introduction of the half-watt lamp.

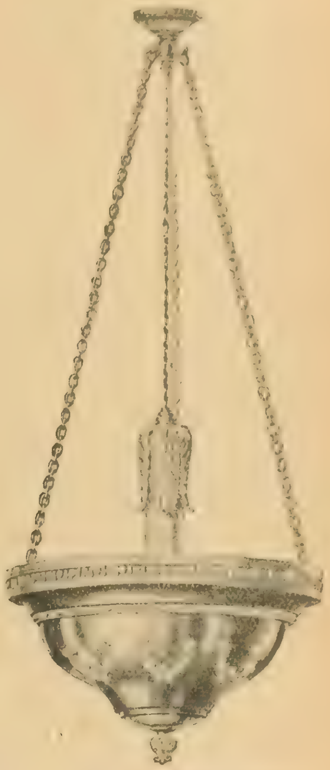


Fig. 4.—G.E.C. Half-watt Fixture.

The great brilliancy and naturally greater heat given off by the new lamps have necessitated paying special attention to the design of suitable fittings for both interior and exterior illumination, and the great variety of glassware, clear, opaloid, frosted, or satin finished, supplied by the firm, enables any desired class of illumination to be obtained.

"The Citizen" series of lanterns, of which we illustrate in fig. 3 "The First Citizen," adequately embodies the essential features of a half-watt fitting. Made of either green vitreous enamelled iron, or polished or green enamelled copper, it allows for triple ventilation, correct reflector curves, and right lamp position, whilst the "Superlux" glassware gives an efficient result, as well as a pleasing effect.

The interior fittings include some handsome new designs in artistic metal work, and many types are listed.

Several types of indirect bowls are listed, and attention may be drawn to the "Salle" and the "Salon" of which we illustrate in fig. 4, the latter; fitted with "Superlux" silvered glass mirror reflectors, these have a diameter and depth of 15½ × 8 in. and 19 × 11 in. respectively, and should give very pleasing results.

The list can be obtained from any of the company's branches, and the company are always prepared to advise as to lighting arrangements when required.

Two-Rate Tariff System without Time-Operated Control.

Messrs. Landis & Gyr, Ltd., of 28, Denman Street, S.E., write with reference to an abstract in the Electrical Review of November 21st, 1913, of a paper by Mr. H. H. Perry on the above subject. This paper describes how by means of an electromagnetic device an integrating meter may be cut out of circuit when the load exceeds a certain predetermined amount, and its place taken by another meter which registers the energy consumption at a higher price per unit. Examples of the arrangement were shown both for lighting and for power circuits.

They wish to point out that there are methods other than those described in Mr. Perry's paper, by means of which the time element can be eliminated from the two-rate system and the change-over clock dispensed with. They have protected by patents various systems (Patents Nos. 1,010/1912. 22,592/1912, 24,503/1912 and 24,954/1912), and already manufacture the instruments under these patents.

With their system, all standard electricity meters can be converted for use as double-tariff meters, and the operation of changing-over is performed by an electromagnet which can be worked either from a change-over switch or from an ordinary tumbler switch. In the latter case the change-over to the high rate depends upon the switching-in of the lighting circuits. The switch can be so connected that when the lighting circuit is switched on, the power-consuming devices are absolutely disconnected (as in fig. 5), or it can be arranged that when the lighting circuit is switched on, the power-consuming devices are switched over on to the high-rate side of the meter (as in fig. 6).

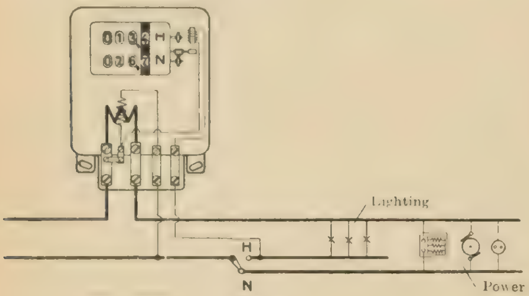


Fig. 5.

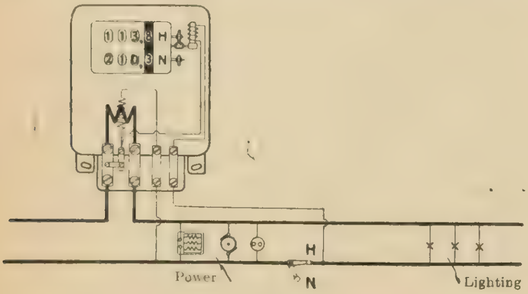


Fig. 6.

In order to eliminate the connecting wires between the meter and the switch, a special plug switch mounted in the terminal box of the meter can be used (see fig. 7). In this case, when the plug is in the row of contacts N the meter registers at the low rate, whilst, on the other hand, when the plug is put into the contacts H, the meter is changed over to the high rate.

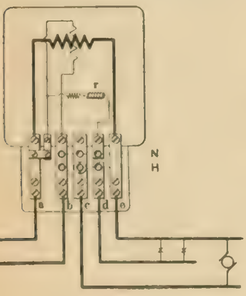


Fig. 7.

By simply removing the contact plug from the contacts H the meter can be used for operation from a contact clock (as in the ordinary time-element two-rate system) without any further alteration.

The firm point out that the great advantage of a double-tariff meter with hand control is that both the initial cost and the maintenance of a change-over clock are avoided. Hence their system is particularly suitable for small consumers when it is desired to keep the service costs down to a minimum. It encourages the use of small power-consuming devices during the day, and, therefore, tends to make the supply of electricity to small consumers more remunerative than has been the case hitherto.

Mazda Automobile and Battery Lamps.

Many changes have recently been made in the sizes and prices of Mazda automobile lamps; the sizes have been re-arranged in consultation with motor and car lighting equipment manufacturers, with a view to a more complete standardisation, and a consequently greater convenience of replacement.

A new price list (No. 2739) has just been published by the British Thomson-Houston Co., Ltd., of Mazda House, 77 Upper Thames Street, E.C., giving revised data and prices as now standardised by the leading lamp manufacturers of this country.

The range of Mazda automobile lamps includes headlight lamps, sidelight lamps, tail and dash lamps, interior lamps, steering-pillar lamps, &c. In addition, the new Mazda battery lamp price list covers special types of low-voltage lamps for motor-'buses handlamps and general battery service, illumination lamps and flashlight lamps, for all of which there is a considerable demand.

The automobile lamps can be employed for motor-boats, yachts, aeroplanes, airships, carriages, &c.

Mazda headlight lamps, with helical filaments, are suitable for all kinds of projection work, and have been used most successfully in magic lanterns and small cinematograph projectors. The arrangement of the helical filament is such that, in effect, it gives a very close approximation to the theoretical point source of light, which is the ideal for use with a parabolic reflector, when a parallel beam of light is required.

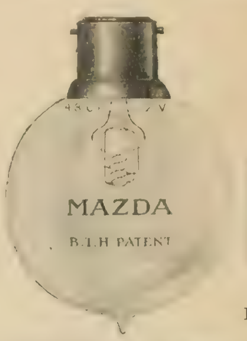


Fig. 8.—Mazda Automobile Lamp, Head-light Type, with Special Helical Filament.

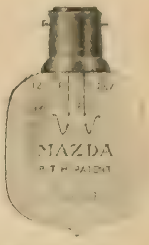


Fig. 9. — Mazda Battery Lamp, Specially Designed for Motor-'bus Service.

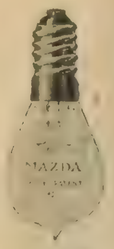


Fig. 10.—Mazda Illumination Lamp for Decorative Lighting.

The company states that Mazda automobile battery lamps, owing to the shortness and thickness of the filaments and the special methods of support employed, can be relied upon to give good service under the most adverse conditions.

B.T.H. Half-Watt "Eye-Rest" Fittings.

The British Thomson-Houston Co., Ltd., of Mazda House, Upper Thames Street, E.C., have now developed a range of "Eye-Rest" indirect lighting fittings for use with Mazda ½-watt lamps. There are nine of these new fittings, seven having metal bowls and two moulded composition bowls. Mazda ½-watt "Eye-Rest" fittings consist of standard bowls and suspensions with the addition of suitable ornamented housings covering the holder and neck of the lamp.

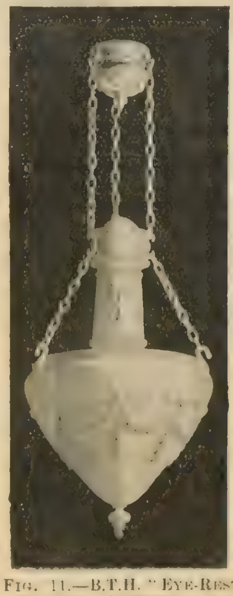


Fig. 11.—B.T.H. "Eye-Rest" Fitting Equipped with X-ray Reflector and Mazda Half-watt Lamp. Moulded Composition Bowl, Adams Design.

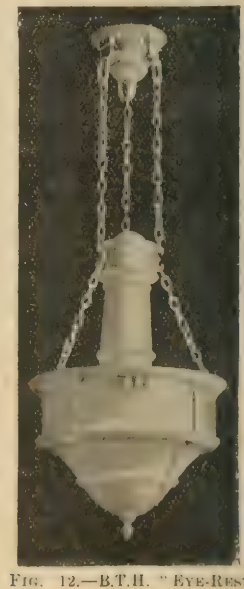


Fig. 12.—B.T.H. "Eye-Rest" Fitting Equipped with X-ray Reflector and Mazda Half-watt Lamp. Moulded Composition Bowl, Classical Design.

These modified designs of "Eye-Rest" fittings provide a most effective and decorative means of adapting the ½-watt lamps to interior lighting.

Even with the ordinary tungsten lamp, indirect lighting has made the most remarkable strides during the last few years, due to a greater appreciation of its comfort and hygienic advantages. The coming of the Mazda ½-watt lamp, by rendering indirect lighting twice as efficient as formerly, will undoubtedly increase its vogue.

Simplex Fan.

MESSRS. SIMPLEX CONDUITS, LTD., of 113, Charing Cross Road, W.C., supply the small direct-coupled motor fan shown in fig. 13, which is suitable for ventilating or exhaust purposes. A starter regulator is arranged in the base, and the whole apparatus is self-contained.

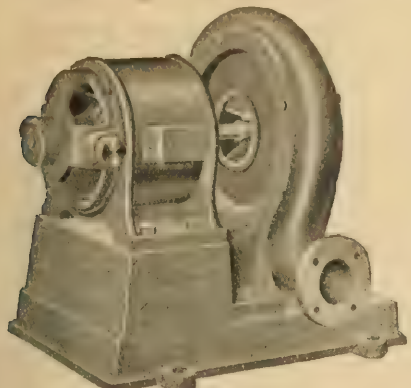


FIG. 13.—SIMPLEX DIRECT-COUPLED FAN.

The motor units are of $\frac{1}{8}$, $\frac{1}{2}$ and $\frac{1}{2}$ H.P., speed 2,500 R.P.M., and can be supplied for pressures up to 500 volts, and for either A.C. or D.C. circuits.

LEGAL.

THE NATIONAL TELEPHONE LITIGATION.

ON December 18th, Mr. Justice Sargant had before him, in the Chancery Division, an application by the Receiver appointed in the National Telephone Co.'s winding up for an order for the final distribution of the assets in his hands.

It was then stated by MR. PERCY WHEELER, who represented him, that there still remained for distribution some £65,000. The rights of the various stockholders had been determined, but the Receiver was unwilling to part with everything except by order of the Court, as there were still outstanding claims against the company. These were in the nature of unclaimed deposits made for a telephonic service, deposits made in respect of trunk calls remaining unexhausted, and cheques drawn by the company in favour of creditors which had never been presented for payment. His LORDSHIP then directed that further advertisements should be issued, and that the Master should report.

MR. WHEELER stated that that having now been done, he was in a position to take a final order.

His LORDSHIP said it was a matter for chambers, and he accordingly dealt with it in camera on Monday, February 9th.

STOLZ ELECTROPHONE (1913), LTD.

MR. JUSTICE EVE had before him in the Chancery Division, on Friday, February 6th, a motion on behalf of the plaintiffs in the action Stolz Electrophone Co. (London), Ltd., against Stolz Electrophone Co. (1913), Ltd., for the appointment of a receiver and manager of the defendant company.

MR. COZENS HARDY, K.C., in making the application, said there were two defendants, the second being Mr. Aubrey Hyman, who was manager of the defendant company. The matter was of some urgency, and it was desired to appoint Mr. Whinney Receiver of the property in dispute and manager of the business. The old company, the plaintiffs, were formed in 1909 and became possessed of a large and very valuable business, the nature of which would be seen from the prospectus of the defendant company. This contains a list of various patents which were connected with instruments for improving the hearing of the deaf and enabling persons who could hear to listen to plays and sermons at which they were not present. There were 175 branches and agencies in various parts of the world. Unfortunately, the business management of the plaintiff company had been unsuccessful, and before the independent shareholders came upon the scene and investigated the matter, the exact details of what had happened were by no means clear. What was known, however, was that the property which early in 1913 consisted of valuable patents and inventions had now come into the possession of the defendants. How that had become so he could not say. There was a suggestion it had been done under an agreement which had not been carried out. The view presented upon the evidence was that there was an intention to sell property to the new company for a certain price partly in shares and partly in cash, but it had not been carried out. On August 19th, 1913, there was a voluntary winding up on the ground of inability to meet the debts of the old company. A liquidator was appointed and last month the present liquidator (Mr. Whinney) was appointed in the winding up of the old company. Either the defendant company, continued counsel, had no right or title to the property at all, or if it had, and it should turn out contrary to what the present documents showed, that there was an agreement to sell, then there was an undoubted lien. The plaintiff company had a *prima facie* case of some interest in the property. The business was a very valuable one, and there was some [illegible] a day coming in.

Plaintiffs had that day, proceeded COUNSEL, seen the minute book of the new company, and it appeared from that that the second defendant, Mr. Hyman, had paid £171 to the company. Afterwards a debenture was given to him for that sum. He (counsel) said that was invented for the purpose of giving a consideration. Mr. Hyman issued a writ in a debenture-holder's action for a Receiver and manager, and the company consented to the appointment. Mr. Hyman did not stop there, but presented a petition for the winding up. He said he was a creditor first of all for this debenture, and then he said he had paid a former managing director for a large number of shares in the company. He applied for, and got, the appointment of the Receiver as provisional liquidator.

MR. BENSON, for Mr. Hyman, here pointed out that the application for a Receiver was not made by his client.

At any rate, continued MR. COZENS HARDY, those who were responsible for the business were closing down the branches of the plaintiff company's business, or the business over which the plaintiff company had a lien, and they were discharging the staffs, and dealing with assets over which the plaintiffs had a lien in such a way as entirely prejudiced the property. Mr. Whinney had, since his appointment, investigated the affairs of the company, and had formed a favourable opinion of its prospects.

His LORDSHIP: Were any shares of the defendant company allotted?

COUNSEL: I have no doubt a good many were.

His LORDSHIP: Were there any to your company?

COUNSEL: No; but some were given to shareholders.

His LORDSHIP said the purchase price was apparently to have been £50,000, and some shares had been given. That would be part of the purchase. He did not think they could appoint another Receiver. If they did, there would be a terrible wrangle as to who every article belonged to.

MR. COOPER, for the defendant company, opposed the motion; first, he said, because it was not necessary; secondly, because the plaintiffs had not shown they had a lien, and thirdly, because, even if they had, it was not a case in which the discretion of the Court should be exercised in that direction. There were already two officials of the Court protecting the assets, and they were quite adequately looked after.

MR. BENSON, for Mr. Hyman, also opposed the application.

His LORDSHIP refused the motion. He said he was sorry to see that in the history of both companies there seemed to have been conduct of an unfortunate character. The defendant company, he proceeded, were now in possession of this undertaking and assets, and they had themselves been unfortunate. There had been a distress levied against them, and they had applied to Mr. Hyman, who had advanced £171, which was utilised for the payment out of the distress. Having got the debenture, he found that to a certain extent he was badly off. It had been represented to him that £171 would free the company from its embarrassment, whereas the position of the company was such that it was only possible for him to take one course, first of all to get a Receiver of the assets appointed and to present a petition for the winding up of the company. An independent accountant was appointed Receiver of the undertaking and assets of the defendant company purporting to be charged by the debenture issue. The Receiver did his best to manage the business, and was carrying it on at the present moment. There was no proof whatever that he was not acting with the greatest prudence and wisdom in shutting down these agencies, and in the other matters which were committed to his care. The facts in regard to the contentions of the plaintiff company were altogether contrary to what they said was the case. The obligation lay on the plaintiffs to show that they had a better title to this property than those in possession, and it was for them to establish to the satisfaction of the Court that they had any lien over the assets. They had entirely failed to establish that, and the motion would be refused with costs.

CROMPTON & CO., LTD.

ON 6th inst., according to the *Financial Times*, Mr. Justice Warrington, in the Chancery Division, had before him a motion for a Receiver in a debenture-holder's action in this matter.

Mr. Clauson said that evidence had just been completed. The action raised certain special conditions in a trust deed, which, it was said, prevented the security becoming enforceable, notwithstanding liquidation. He asked that the matter should stand for a week.

His Lordship agreed.

BUSINESS NOTES.

Patent Applications.—Applications have been made for the restoration of the following patents:—

C. Vaughan and C. Birch, No. 9,537 of 1908, for "Improvements in and relating to metallic fittings for electric continuity system."

J. A. Stoneham (applicant), No. 14,503 of 1908, for "Improved process for cleaning the combustion spaces in internal combustion motors," granted to E. C. R. Marks.

Bertram Thomas and Eustace Thomas, No. 15,544 of 1909, for "Electrically-controlled brakes for cranes and the like"; No. 15,681 of 1909, for "Improvements in electric switches"; No. 15,682 of 1909, for "Improvements in electric collectors for maintaining connection between stationary and moving conductors."

Switchboard Contracts.—During last week the Walsall Electrical Co., Ltd., booked the following orders for switchboards:—

London County Council, the main charging switchboard for Whitechapel Fire Brigade Station.
Two main switchboards from the Metropolitan Railway Co. for two of their railway stations.
One main switchboard for Delagoa Bay.
Five switchboards for the Great Indian Peninsula Railway Co.

Book Notices.—"One and All Gardening, 1914." London: Agricultural and Horticultural Association. 2d.

"Questions and Solutions in Magnetism and Electricity." By W. J. White. London: Rentell & Co. Price 1s. 6d.

"Science Abstracts." Sections A and B. Vol. XVII, Part 1. January 30th. With Indexes to Vol. XVI. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Proceedings* of the American Society of Civil Engineers." Vol. XL, No. 1. January. New York: The Society.

"*Transactions* of the Illuminating Engineering Society." Vol. VIII, No. 9. December, 1913. New York: The Society. Price 75 cents.

"La Protection des Résaux et des Installations Electriques contre les Surtensions." By G. Capart. Paris: Dunod et Pinat. Price 9 fr.

"Annual Report of the Smithsonian Institute, 1912"; "A Comparative Study of American D.C. Watt-hour Meters," by T. T. Fitch and C. J. Huber; "Analysis of A.C. Waves by the Method of Fournier, with Special Reference to Methods of Facilitating the Computations," by F. W. Grover; "Special Studies in Electrolysis Mitigation," by E. B. Rosa and B. McCollum; "Windage Resistance of Steam Turbine Wheels," by E. Buckingham. Washington: Government Printing Office.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol. XXXI, January. Brussels: E. Bruylant. Price 1 fr. 75.

"State Purchase of British Railways: The Price to be Paid." Reprinted from the *Railway News.* 6d.

Dinner.—On the invitation of the directors about 270 of the employés of Messrs. Laurence, Scott & Co., Ltd., Norwich, including all who had been in the service of the company for ten years and upwards, met on 3rd inst. in celebration of the 25th anniversary of the inaugural dinner, which marked the success of the firm at the Newcastle Exhibition in 1888. Of the 40 who were at the first function in 1889, about a dozen were guests on the present occasion and could claim a practically unbroken record of attendances at the annual dinner in intervening years. The chairman of the company, Mr. Reginald Laurence, was absent owing to illness, and Mr. W. H. Scott presided. He was supported by his co-directors, Mr. Cecil Wilson and Mr. S. Cozens-Hardy. In the course of the speeches reference was made to the cordial relations existing between the directorate and the employés. As evidence of this, it was mentioned that out of the 80 hands employed in the early days of the business, prior to the building of the present works, more than half were still in the company's employ, and considerably over half of the total number employed ten years ago were present on this occasion. In an interesting historical survey, Mr. Scott gave figures indicating the rapid growth of the business, which now employs over 700 hands. He was particularly proud of the fact that the staff had been trained almost entirely at the works, and, as had been the case throughout the history of the company, was composed without exception of British subjects. He was glad that, in spite of the growth of the concern, he and his co-directors had been able to remain in close touch with the works, and that the personal element could still enter so largely into the management of the business. All arrangements for the dinner, and the musical entertainment following, were in the hands of a committee of the men.

Concert.—The staff and foremen of the Edison and Swan United Electric Light Co., Ltd., Ponder's End, gave their third and last smoking concert of the season on Friday 6th inst., in their works café, Ponder's End. There was the usual good attendance of nearly 100 members. Mr. E. P. Barfield presided, supported by Mr. J. E. Cooper, chief accountant. Mr. W. Davis, instrument foreman, made a humorous speech.

Catalogues and Lists.—Messrs. John Hudson and Co.'s Successors, 4, Victoria Warehouses, Mansell Street, London, E.—Twenty-four-page booklet giving particulars concerning "Manganesite." Copies will be sent to anybody interested in the making and maintenance of steam joints.

Messrs. Engineering and Arc Lamps, Ltd., Sphere Works, St. Albans.—Leaflet giving illustrated information and prices of their "Superarc" inverted lamp for illumination of interiors.

The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—New 32-page list of fittings for Aegma drawn wire lamps, including enamelled iron fittings for exterior lighting and reflector fittings for interiors.

From the Electrical Accessories Supply Stores, of Miletown, Sheerness, we have received a calendar for the year with monthly slips.

Armorduct Manufacturing Co., Ltd., Farringdon Avenue, London, E.C.—Price list of "Armorite" insulating varnishes, cloths, silks and papers.

Mr. R. D. Stewart, 61, Mansell Street, Aldgate, London, E.—Price lists of paints, enamels, grease, varnishes, &c.

Messrs. Siemens Brothers Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—"Siemens Industrial Lighting" is the title of a booklet just issued, in which particulars are given of the various types of lighting material supplied by the company; the booklet is intended to help all who are concerned with industrial undertakings, not only electrical engineers, and therefore the use of technical terms has been avoided as far as possible. Some brief "Illumination Notes" are given with the object of promoting correct ideas on the subject, and the illustrations are devised with the same end in view. Copies will be sent to any reader on application.

Edison & Swan United Electric Light Co., Ltd., Ponder's End.—Folder giving illustrations and prices of artistic electric light fittings.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Leaflet No. O.S. 1,785 gives particulars, illustrations and prices of Osram axial drawn-wire lamps for the lighting of office desks, billiard tables, showcases, special tools, and so forth.

Messrs. Belling & Co., Derby Road, Edmonton, London, N.—A publication issued by this firm discusses the value of radiant heat, and states the outstanding advantages of the Belling electric fire. A number of patterns of these fires are illustrated, and prices are given. A separate leaflet shows specimens of art porcelain enamel and electro-plate finishes. A small blotter and a large poster (40 in. × 26 in.) have also been prepared. Copies of all of these lists will be forwarded to electric supply companies, they having been issued in connection with the coming spring demand, springtime being one of the periods of the year when the householder's fancy turns away from gas and coal.

Messrs. G. St. John Day (Patents), Ltd., Bank Mill, Morton Street, Oldham.—24-page catalogue giving fully illustrated particulars and prices of their "1 part" and "Mumps" patent lampholders and accessories.

Messrs. Eastman & Warne, 241 and 243, Acton Vale, London, W.—24-page catalogue of "Hot-point" electric irons for domestic and laundry services, soldering irons, Eadisk electric disk cookers, "Belenus" branders and boilers, glue-pots and convectors. Prices, weights, dimensions and current consumptions, are stated.

The Trussed Concrete Steel Co., Ltd., Caxton House, Westminster.—Information relating to the Kahn system of reinforced concrete construction, with photographic views of a large number of public buildings, factories, warehouses, &c., built on that system.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—Twelve-page list (No. 527) giving particulars of fans and blowers, sewing machine motors, buffing motors, &c. Illustrations and prices appear of desk bracket and porthole types of fans, having blades from 10 in. to 16 in. diameter; a range of box-blade ventilating fans from 12 in. diameter to 6 ft. diameter, for use in exposed positions; and small motor generators for accumulator charging, and electric blowing experimental purposes, in outputs from 50 to 250 watts.

Messrs. Siemens Bros. Dynamo Works, Ltd., of Tyssen Street, Dalston, have sent us one of their ingenious "Wotan" puzzle knives, such as they are distributing among electrical dealers, engineers, &c.

Catalogues Wanted. — The Generating Plants Supply Syndicate, of 178, Charing Cross Road, W.C., invites manufacturers to forward catalogues with discounts of gas, oil and petrol engines, dynamos, batteries and switchgear.

Bankruptcy Proceedings.—W. N. Berry & H. Bamber (W. N. Berry & Co.), electrical engineers, Manchester.—Receiving order made February 2nd, on creditor's petition. First meeting, February 18th, at Official Receiver's offices, Manchester. Public examination, February 20th, at Court House, Quay Street, Manchester.

Australia.—The Australian Customs authorities have recently given a decision to the effect that "vehicles, or parts thereof—'buses, railless, electric trolley," are to be classified under No. 380A of the Tariff, the duty being 40 per cent. on foreign and 35 per cent. *ad valorem* on British vehicles.

Amalgamation.—A scheme is on foot under which the business of Messrs. Henry Pooley & Son, Ltd., will be sold to Messrs. W. & T. Avery, Ltd.

Trade Announcements.—Messrs. Ward & Cuningham have appointed Messrs. Holmwood Bros., of 86/88, East Street, Bedminster, Bristol, as their agents for the West of England and South Wales.

The conversion of the business of Dorman & Smith into a limited company, as announced in our last issue, took effect as from January 1st, from which date the new company is responsible for all accounts. The alteration will not in any way affect the management or scope of the undertaking, nor its constitution and control.

Mr. R. G. Linscott, who has previously represented the Pope Lamp Co. and the Cable Accessories Co., in London, has now taken up the agency of Messrs. Fyfe Wilson & Co., of Glasgow, for the Kelvin petrol engines and generating sets, and complete cinematograph outfits. Communications should be addressed to his offices at Commerce House, 72, Oxford Street, W.

The British Vacuum Ceaner Co., Ltd., announce that the first part of their large building extension commenced in the autumn of 1913, *i.e.*, the doubling of the factory, will be completed by end of this month, enabling them to give a larger output and prompt deliveries of their vacuum cleaners of all types, and to speedily handle all repair work. The new block of offices, which forms the second part of the building scheme, will be ready for use before the end of the year.

The Kingolite Co., Ltd., have fitted up their new workshops at Soho Square, London, and are prepared to supply opal tubes in all sizes from stock.

Dissolutions and Liquidations.—The High Peak Magneto Co., Ltd.—This company is winding up voluntarily, with Mr. J. E. Collier, of 90, Market Street, New Mills, as liquidator. A meeting of creditors is called for February 20th, at 32, Union Road, New Mills.

G. C. Milnes Voss & Co., Ltd.—A meeting will be held on March 16th, at 51, North John Street, Liverpool, to hear an account of the winding up from the liquidator, Mr. H. R. Graves.

Haynes & Davies, leather belting manufacturers, 107, Constitution Hill, Birmingham.—Messrs. G. Haynes & L. J. Davies have dissolved partnership. Mr. Haynes will attend to debts.

Taylor & Hutchinson, consulting engineers, Royal Liver Building, Water Street, Liverpool.—Mr. L. S. Taylor & P. Hutchinson have dissolved partnership, as and from January 31st.

Turkey.—The sale of electric lighting apparatus has begun to become important in Constantinople, where, as is announced, a power station will be completed in the early months of the present year, which will supply the whole city. In proportion as each such new departure is perfected, and when the public have been educated to the advantages of electricity, will the sale of electric materials increase. All the existing types of apparatus are in use, and there is no marked preference for any-one in particular. As regards the terms, deferred payment is the rule in these as in other classes of goods; there is, however, no fixed rule and some firms exact cash. Sales to good clients should always be made easy. Among the firms handling electrical goods at Constantinople to whom offers may be made are:—Fratelli Tiano et Co., Union han, Galata; Société Anonyme d'Electricité Ganz, 453, Grande Rue da Pera; Société Ottomane d'Electricité, 1, Rue Mertebany, Galata; Bérgmann Electricitäts-Werke and Siemens and Halske, 293, Grande Rue de Pera; Société Générale d'Electricité A.E.G., of Berlin; general representative, M. Max Wohl, Assei curazioni Glihan, Galata; Sydney Nowill & Co.; Kevark Bey han, Galata; Leon Faure et Cie., Rue Camando; and Société Anonym-Ottomane pour le Gaz et l'Electricité, Stamboul.

Spain.—The sale by public auction, at the instance of the Judge of the First Instance, of the Badajos Tramways, belonging to the Sociedad Honra Extremena, is announced for July 1st, at the upset price of 114,663.60 pesetas. The company is in bankruptcy.

LIGHTING and POWER NOTES.

Aboyne.—An objection has been lodged by Lady Cowdray against the E.L. scheme.

Ardee.—E.L. Scheme.—The Town Commissioners have decided to obtain tenders for an E.L. installation, which they intend to substitute for gas lighting.

Bacup.—Street Lighting.—The Electricity Committee has decided that the general principle of charging for current for street lighting on the basis of full maximum demand at £5 per KW. per annum and 4d. per unit be approved, without any charge in respect of establishment and capital charges of the undertaking, except by arrangement with the Lighting Committee, such charges to be met out of profit derived from the improvement in the diversity factor.

Ballater.—E.L. Scheme.—An objection has been lodged by the Dee Fishery Board against the proposed prov. order, on the grounds that a dam across the Gairn would injuriously affect the fishery. The promoter has instructed Messrs. Jas. Gordon & Co. to prepare a scheme to meet the objections.

Ballyconnel (Co. Cavan).—The Electric Lighting Committee has instructed the secretary to communicate with the Irish Agricultural Organisation Society, to ascertain whether the proposed E.L. scheme could be worked on co-operative lines.

Batley.—New Plant.—By the addition of a Ljungstrom turbo-generating plant, and two Westinghouse rotary converters at the electricity works of the T.C., the capacity of the installation will be increased from 800 KW. to 2,000 KW. The L.G.B. has sanctioned the borrowing of about £1,800 for new feeders required during the next three years, £990 for a new feeder main, £[illegible] for mains laid solid; £100 for armoured mains; £700 for services; and £60 for a feeder pillar. The tender of the Westinghouse Co. for the installation of the two converters has been accepted, one being of 500-KW. capacity, and the other of 250-KW. capacity. An agreement has also been come to with the Brush Co., for the supply of one Ljungström turbo-generator.

Belfast.—E.L. Charges.—At a meeting of the Electricity Committee on Monday a deputation was received from the Belfast and District Chamber of Trade. The deputation strongly objected to the accumulation of profits going to the relief of rates, and it was urged that the use of electricity should not be placed on the same footing as the tramway or gas undertakings, because there were comparatively few ratepayers who use electricity, and any profit ought to go to the reduction of charges. The deputation asked that when the arrangements were being made for next year, a reduction should be given off the accounts. A sub-Committee was appointed to report on the matter.

Bexhill.—Street Lighting.—The arc lamps in several streets have been replaced by fittings containing two 200-C.P. metal-filament lamps fixed nearer the ground.

Brighton.—The T.C. has reduced the charge for electricity for lighting basements of business premises separately wired from 4d. to 3d. per unit.

Bulkington.—Prov. Order.—The U.D.C. has withdrawn its objection to the prov. order being applied for by the Midland E.L. and P. Co., and has also decided to ask the Warwickshire and Leicestershire Power Co. at what price it would supply the district with electricity.

Burton-on-Trent.—New Plant.—The Gas and Electricity Committee has decided to obtain a new turbo-alternator at an estimated cost of £6,000.

Bury.—Street Lighting, &c.—The Joint Hospital Board has decided to seek powers to borrow £282 for the installation of electricity at Ainsworth.

The Corporation has appointed a sub-committee to consider the question of lighting the main roads by electricity.

Canada.—The improvements proposed at Medicine Hat during 1914, include a H.T. electric distributing system, $10,000; street lighting, $20,000, and a 1,500-KW. extension to the generating plant.—*Canadian Engineer.*

Chilton (Co. Durham).—Street Lighting.—The P.C. has decided to carry out electrical street lighting, the installation to comprise 56 50-C.P. lamps.

Colchester.—The T.C. has decided to offer £600 for a 325-KW. set, belonging to Messrs. Vickers, with a view to this being provided out of revenue over a period of three years. At the meeting of the Council on February 4th, it was stated that a new engine would cost about £2,000.

Coleraine.—Proposed E.L.—The U.D.C. has deferred the consideration of additions to the gas works pending the result of a public meeting which has been called to consider the question of the E.L. of the town.

Continental Notes.—France.—Applications have been made at the Prefecture des Hautes-Alpes for 13 different concessions of water rights for no less than 276,000 H.P. on the river Durance or its feeders. When these are granted, the power extracted from the Durance and its immediate feeders in the department des Hautes-Alpes will total 376,000 H.P. According to estimates, the development in a few years will reach no less than 850,000 H.P.—*Revue Pratique de l'Electricité.*

Among the new companies recently formed is the Société de l'Energie Electrique de Medoc, organised at Pauillac (Gironde) with a capital of £14,000 to establish a small central station for the supply of electricity in that district.

Coventry.—Loans Sanctioned.—The Corporation has obtained sanction to a loan of £16,000 for mains extensions and £4,000 for sub-stations and transformers.

Cranbrook (Kent).—Proposed E.L.—A ratepayers' meeting, on February 4th, adopted a resolution in favour of an E.L. scheme submitted by Messrs. Saunders, of Westminster. The scheme provides for an overhead installation, and would include the parishes of Wadhurst and Hawkhurst, each to have its own power station. The suggested price of current is 7d. per unit, with free service within 60 ft. of the main, and cottages supplied at a weekly payment, after free wiring and fitting with one lamp.

Dalkey.—The U.D.C. has decided to petition against the Alliance and Dublin Consumers' Gas (Electric Supply, &c.) Bill.

Dartford.—L.G.B. Inquiry.—On February 5th, Mr. H. R. Hooper held an inquiry into the application of the U.D.C. for a loan of £11,000 for plant, &c, primarily to supply electricity in bulk to Crayford—the West Kent Co., Ltd.—on a seven years' agreement. It was stated that the Council would make an annual profit of £320, and if the supply was available quickly, there was a probability of obtaining another customer with a profit of £615. There was some opposition to the terms of the agreement.

Deal. The local Chamber of Commerce has passed a resolution advocating the introduction of a supply of electricity in Deal and Walmer.

Devonport. — Hospital Lighting. — The Electric Power Committee of the T.C. has recommended that, subject to the whole of the hospital buildings being lighted by electricity, a main be laid, free of charge, at an estimated cost of £340.

Dewsbury.—Street Lighting.—The borough electrical engineer has been instructed to continue his experiments in the lighting of the Market Place.

Dover.—Bulk Supply, &c.—The T.C. has decided to ask the borough and county members of Parliament to support the new Bill of the Municipal Electrical Association seeking authority for local authorities to undertake wiring work, to deal in fittings, and to provide showrooms, &c.

With regard to the proposed bulk supply of current, the chief engineer of the South-East Kent E.P. Co. has informed the T.C. that before being able to give the most favourable terms to the Council, it would be necessary for the company to complete negotiations with the colliery companies.

At a meeting of the Electricity Committee on February 3rd, a letter was read from the St. Margarets P.C., asking what steps the Corporation was taking to bring electricity into the parish, and asking that if there was no prospect of the Corporation exercising its powers, the parish should not be debarred from entering into any scheme which might be prepared for the district. Alderman Lewis remarked that the matter was held over, as there was not sufficient demand for current. The engineer explained that the estimated cost of an overhead extension to St. Margarets was £1,500.

Dudley.—Sale of E.L. Undertaking.—On Monday the agreement was sealed on behalf of the Corporation and the Shropshire, Worcestershire and Staffordshire Electric Co. for the transfer to the company of the borough electricity works. The purchase price is £63,000, being the amount of the loans still outstanding, the instalments with interest to be paid as they become due; £10,500, of which £3,500 has been paid, and £7,000 will follow in 17 annual instalments; and £3,334 on account of recent capital expenditure. The works were commenced in 1899, and carried on at a normal profit until 1911, when a B. of T. award in reference to the price of current supplied to the tramway service confronted the Council with an immediate and probably recurrent annual loss.

Durham.—The T.C. has entered into a 10 years' agreement with the E.L. Co. for the supply of electricity to the sewage works.

Edinburgh.—The Reserve Fund.—The Town Clerk and the City Chamberlain have issued a report with regard to the proposal to increase the contribution to the electricity reserve fund from 10 per cent. to 15 per cent. The fund has been kept at its maximum, and at May 15th last amounted to £108,678. The Corporation's consulting engineer has advised that an additional power station will be required within the next few years. The capital expenditure will be approximately £125,000. In the years during which the works are in progress the ordinary expenditure account of the undertaking will become liable for interest and contributions towards the reduction of the debt in respect of that expenditure, and the Committee desires to meet these charges without increasing the present rate for electricity. The report points out that under a clause in the Bill framed by the Incorporated Municipal Electrical Association, the purpose of the Committee might be attained if it could be passed.

Epsom.—E.L. Charges.—The U.D.C. has adopted new rates for the supply of electricity to houses not exceeding a rateable value of £25 per annum. For two 25-c.p. lamps the charge is £1 6s. per annum; up to five 25-c.p. lamps, £2 4s. The rate for flat-irons is 10s. per annum.

The U.D.C. has decided to reduce the charge for electrical pumping at the waterworks to ·6d. per unit.

Farnworth.—The chairman of the Electricity Committee and the electrical engineer have been deputed to consider the plant extensions required at the electricity works.

Harrogate.—A keen controversy is in progress in the Press between advocates of gas and electricity in regard to the causation of fire. The gas manager alleged that "on a report of the London Fire Brigade it has been ascertained that fires caused by electricity average 1 to every 761 consumers, whilst those attributed to gas are only 1 to 2,200 consumers." The superintendent of the London Fire Brigade was written to by the electrical engineer, Mr. G. Wilkinson, and stated that the reports referred to were incorrect and misleading.

Ilkley.—Proposed E.L. Loans.—The L.G.B. has informed the D.C. that it will hold an inquiry into the Council's application to borrow £18,000 for electricity purposes as soon as possible.

Japan.—A scheme is under consideration to put down a plant of 2,600 h.p. to utilise the water-power of the River Natsui, near Kawasaki-Mura, in the Prefecture of Fukushima, to generate electricity. It is also proposed to establish a plant for the manufacture of carbide.

Kettering.—L.G.B. Inquiry.—An inquiry was held on the 10th inst. by Mr. H. Ross Hooper into the application of the U.D.C. for sanction to borrow £10,000 for plant and £2,000 for mains and services. The plant will consist of one Brush "Ljungström" turbine, direct-coupled to two alternators, giving a combined total output of 1,265 kw., with surface condenser, air and circulating pumps; one 1,200-kw. rotary converter, with switchgear, &c.; cooling tower and extension of engine room. There was no opposition to the application. A tender has been accepted from the Brush Co. for all the plant, with the exception of the cooling tower, subject to the sanction of the L.G.B.

Kingstown (Co. Dublin).—The U.D.C. has given leave to Mr. O'Brien to withdraw a motion in his name relative to the Dublin Southern District E.S. Co.'s Bill, and to substitute one, which was carried, declaring that an E.L. scheme to be undertaken by the Council is desirable, and instructing the surveyor and law agent to report on the subject. Mr. M'Cormick, in proposing an amendment that they bind themselves to no particular scheme, said he had not much confidence in municipally-worked schemes; the chairman of the new Electric Lighting Co. had a unique knowledge of his business, and there was no doubt that the company would be well managed. The amendment was lost.

Knaresborough.—E.L. Scheme.—Mr. G. Wilkinson, of Harrogate, has submitted the following information to the T.C. in reference to an E.L. scheme:—Estimated capital expenditure on water-driven plant, &c., £3,180, this plant being capable of supplying 40,000 units per year, which, if sold at 5d. per unit to 80 consumers, would realise £833. For meters he estimated a return of £24 per annum, making an income of £857. The cost of running the plant would be £545, leaving a profit of £312. No allowance is made for a reserve plant, and if the plant is gas driven—a method favoured by the Council—the cost is estimated at £1,420, which would reduce the yearly profit to £161.

Leigh (Lancs.).—Proposed Loans.—It has been decided to apply to the L.G.B. for sanction to borrow £10,225 for extensions at the electricity works.

Llanidloes.—E.L. Purchase.—The T.C. has decided to purchase the concern of the Llanidloes Electric Lighting Co. for £400, subject to the consent of the L.G.B. The E L. Co. holds a seven-year contract for street lighting.

London.—The announcement is made in the half-yearly report of the Tottenham District Light, Heat and Power Co. (the new title of the Tottenham and Edmonton Gas Co.) that arrangements are in progress for the supply of electricity in the Wood Green district. The plans for the necessary buildings, &c., are before the local authority, and orders have been placed for the more important items of plant. It is hoped that shortly after midsummer the supply will be available.

Lowestoft.—Meter Loan.—The L.G.B. has notified the Corporation that a loan for electricity meters would be sanctioned, for a period of five years, and it has been decided to apply for sanction to borrow £950.

Lurgan.—Proposed E.L.—The U.D.C. has decided to purchase the gasworks with a view to carrying out an E L. scheme for the town. The Council also decided to oppose the Bill presented by the Lurgan Gas Light and Chemical Co. applying for powers to supply electricity in the district.

Manchester.—The Corporation has entered into an agreement for the supply of electricity to the Bower Colliery, Hollinwood.

Middleton.—As an experiment, the Electricity Committee is supplying electricity to 30 houses in the Alkrington garden village at a fixed charge per light. At a meeting of the T.C. last week, Councillor Hilton said he understood the terms were £1 6s. per year, and it seemed that these houses were having preferential treatment. The matter was not on the minutes, and there was no further discussion.

Newport (Mon.).—The South Wales E.P.D. Co. has pointed out to the T.C. that a considerable portion of the area over which the Council proposes to secure electrical powers is situated in the company's area, and that unless the Council is prepared to withdraw the clauses so far as that area is concerned, or to take part of the proposed supply in bulk from the company on terms to be arranged, it will petition against the Bill. The town clerk replied that the Council might be disposed to consider a curtailment of the area if the condition as to a bulk supply was withdrawn, but the company intimated that it could not be satisfied with a mere curtailment of the area. The Council has decided to adhere to the proposals of the Bill, it being explained that the company's mains do not come within 3½ miles of the borough, and that the company is not entitled to supply electricity for light to houses.

Penmaenmawr.—Proposed E.L.—A canvass is being made by the U.D.C. to ascertain the number of ratepayers willing to take a supply of electricity if it is installed in the locality.

Oldham.—Street Lighting.—The Lighting Committee has had under consideration the question of adopting electricity for street lighting, and a trial is to be arranged for some of he newer tungsten lamps.

Electric driving is being adopted in the new portion of the Belgrave Spinning Co.'s mill in Honeywell Lane, current being supplied by the Corporation.

Portmadoc.—The proprietors of one of the Beddgelert otels, at the foot of Snowdon, have had a system of electric ighting installed, and this has proved to be so satisfactory, that he other two hotels of the locality have decided to follow suit.

Redditch.—The Electricity Supply Committee has ecommended the U.D.C. to engage a consulting engineer to report pon the electricity undertaking.

Sheffield.—Electricity Expenditure.—The general manager estimates that the expenditure on the electricity works uring the year ending March 25th, 1915, will amount to £138,397, ompared with £198,923 the estimated expenditure for the present ear. Mains are to be extended in various parts of the city at an estimated cost of £14,205.

Skipton.—E.L. Scheme.—The engineers for the proposed electricity undertaking at Gargrave having intimated that he R.D.C.'s request for underground cables would make the cheme abortive, a small Committee has been appointed to consider he matter. The R.D.C. has decided to oppose the Yorks. Electric Power Bill.

South Africa. — The Delagoa Bay authorities are urging the Lisbon Government to erect a power station at the ormer port at a cost of some £18,000, and capable of satisfying he present and future requirements of the harbour.

The municipality of Ficksburg (O.F.S.) will shortly be in the market for machinery and material for an electric lighting ystem, estimated to cost £8,000.—*B. and S.A. Export Gazette.*

Southampton.—The financial position of the electricity undertaking—which is in a very prosperous condition—has been exercising the minds of a section of the T.C. recently. The chairman of the E.L. Committee contends that the present policy (*i.e.*, of supplying cheap units, amongst other things) is unremunerative, and desired that the borough treasurer be asked to report on the inancial position. As a result of lengthy argument it was decided that the presidents of the Institute of Chartered Accountants and Municipal Electrical Association be asked to appoint an accountant and engineer respectively to report on the undertaking.

Stockport.—It was stated at a meeting of the T.C. on February 4th that several houses in course of erection at Heaton Norris could not be finished because electric light was wanted, and the Manchester Corporation would not extend its mains until it could get an arrangement with the Stockport Corporation. The chairman of the Electricity Committee said it was anxious to treat with Manchester for the supply of current to new consumers.

Stretford.—Plant Extensions.—The Electricity sub-Committee has been requested to submit a report on the question of plant extensions.

Tempo.—Street Lighting.—A deputation laid before the Enniskillin R.D.C. a memorial praying the Council to apply for powers to light the streets of Tempo with electricity. It was decided to publish the necessary notices.

Torpoint.—Proposed E.L.—The U.D.C. has decided to take a poll of the ratepayers on the proposed E.L. scheme.

Tunis.—A company has lately been formed with the title La Société de l'Electricité de Beja, to supply electricity in the town of Beja.

Wakefield.—Loan Sanction.—The proposed borrowing of £3,000 for electric mains, £500 for sub-stations, and £500 for transformers, has been sanctioned.

On and after April 1st the price of electricity for lighting is to be 4d. per unit, except where special rates exist. Consumers already supplied with electricity for lighting, will be supplied for heating and cooking for all but trade purposes at ½d. per unit.

Walmer.—The U.D.C. has decided to oppose the Gas and Electricity Bill being promoted by the Deal and Walmer Gas Co.

Walsall.—The Electricity Committee reports a loss of £2,695 on the past year's working, and remarks that this loss is under its serious consideration and it expects to be able to report thereon shortly. Meanwhile, on the suggestion of the consulting engineer, the Committee has decided to inspect modern generating stations in about four other boroughs. The Committee asks the Council to authorise the purchase, at an estimated cost of £200, of a 150-kw. transformer, and the necessary switchgear in order to supply electricity to Messrs. Eglington's Foundry, Bridgeman Street.

Warminster.—Prov. Order.—The R.D.C. has consented to the application of Mr. J. H. Edwards, of Bristol, for a prov. order for E.L. within a portion of the district on condition that the maximum charge for current is reduced from 9d. per unit to not more than 1d. per unit above the rate charged in the urban area. To this the promoter has acquiesed.

West Ham.—The borough electrical engineer anticipates shortly being able to complete his report with regard to new overground sub-stations, but in the meantime it is desirable to erect the most urgent one, viz., in Tramways Avenue, without delay. The Electricity Committee has authorised the work to be carried out.

West Yorkshire.—E.L. Proposals.—Decisions to oppose or withhold support from the Yorks. Electric Power Co.'s Bill have been come to by the Haworth, Burley-in-Wharfedale and Wath U.D.C.'s, the Keighley B.C., the Yeadon, Selby, Soyland and Darfield U.D.C.'s. The Clayton Council is deferring consideration of the matter; the Doncaster R.D.C. and Thurlstone U.D.C. are supporting, while Bradford is to seek protective clauses.

Whitefield.—Street Lighting.—The U.D.C. has sealed an agreement with the Lancs. E.P. Co. for public lighting at Common Lane.

Whitehaven.—Workhouse Lighting.—The B. of G. has accepted the offer of the Corporation to supply current to the workhouse at 4½d. per unit.

Wigan.—Proposed Loan.—Application is to be made to the L.G.B. for sanction to borrow £750 for transformers and switchgear for the electricity undertaking.

Wimbledon.—Electricity Charges.—It is proposed to reduce the charge for electricity supplied for power, heating and cooking purposes in the Maldens and Coombe area, from 2d. to 1d. per unit as from December 31st last. The electrical engineer has been instructed to report upon the desirability of revising the charge made for energy supplied to the Town Hall, and for heating the offices and Town Hall with radiators.

Worcester.—E.L. Charges.—At a meeting of the City Council on Tuesday, the Electricity Committee presented a special report of the engineer, making several recommendations as to important changes in the charge for electricity. The chief recommendations were—(1) that private houses should be offered alternative charges, a flat rate of 4½d. per unit, or a charge of 15 per cent. on the rateable value of the property, with an addition of ¾d. per unit, subject to a discount of ¼d. if the account is paid by a certain date; (2) that power consumers should be allowed to use current for lighting purposes at the same price that they pay for current for power purposes to the extent of one-tenth of the quantity they use for power purposes. At present the charge to power consumers is 2½d. and 1d. per unit for power, and 6½d. and 3d. per unit for lighting. The Committee proposed that the "maximum demand system," which is only in operation in 12 houses, should be abolished. The Mayor ruled that sufficient notice had not been given, and the proposals were deferred till the March meeting. The Committee was empowered to provide new switchgear for the Hylton Road station, at an estimated cost of £75.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Tramway Committee has decided to advise the Council to purchase King Street Barracks from the Aberdeen C.C. for car sheds and offices for the tramway department, for £2,000.

Barking.—We understand that the information given in our last issue, to the effect that the Barking Council had accepted the Ilford terms for leasing the tramways from Loxford Bridge to Broadway, is incorrect.

Bradford.—Railless Traction.—The following are the routes over which the railless traction system will run:—Odsal to Bankfoot, Bankfoot to Dudley Hill, Laisterdyke to Bolton Junction, Bolton Woods to Shipley, including loop *viâ* Stanley Road and Livingstone Road, All Saints' Road to Bolton Road, Thornton to Keelham, and from Denholme to Causeway Foot.

Bristol.—Proposed Tramway Purchase.—The Corporation has approved of the promotion of a Bill to empower it to work tramways in the city. The option with regard to the greater part of the Bristol system of electric tramways arises in 1915, and the Corporation desires to be in a position to work the tramways should it be decided to purchase them.

Burley-in-Wharfedale.—The Railless Traction Proposal.—The U.D.C. has invited the Leeds tramway manager to an interview with reference to the proposed extension of the railless traction system to Burley; there is much opposition to the scheme in the village.

Colne.—L.T. Railway Purchase.—The award of the arbitrator in the purchase by the Corporation of the Colne and Trawden light railways undertaking has reached the authorities. The arbitrator, Mr. A. J. Ram, K.C., has fixed the purchase price at £92,830, each side to pay its own costs. A meeting of the

General Purposes Committee was held on February 6th. when a report dealing with the matter was presented. When the negotiations were first begun the company asked £85,000 for the lines, while the Corporation offered £45,000. When the claim came before the arbitrator, it was agreed that those figures should not be mentioned to him, but a claim was put in for £170,000, whilst the witnesses for the Corporation put the value of the lines at £27,000. The company's claim of £170,000 included about £94,000 for present value and £76,000 for prospective profits.

Continental Notes. — Bosnia. — Plans are being prepared in respect of an electric railway to connect the towns of Sarajevo and Ilidze.

Holland.—Electric Traction Statistics.—According to a recent return, nine towns in Holland were provided with electric tramway systems at the end of 1912. Amsterdam leads the way with 141·5 km., followed by the Hague with 124 8 km., Rotterdam with 109·2 km., Leyden with 45·8 km., Utrecht with 30·5 km, Arnheim with 17·6 km., Nymegen with 17·4 km., Groningen with 15·7 km., and Haarlem with 8 km. In addition, there are the following inter-urban electric tramways:—Amsterdam-Haarlem-Zandvoort, 28·2 km.; Enschede-Glanerbrug, 14·5 km.; Utrecht-Zeist, 23·5 km.; Zeist-Driebergen, 10·4 km.; and Flushing-Middelburg, 19·2 km.

Farnworth.—Tramway Extension.—The Council has received sanction to the expenditure of £3,900 on the Buckley Lane tramways.

Hove.—Railless Traction.—The T.C. is recommended to agree to the Cedes Electric Traction, Ltd., erecting a trial installation of its system of railless traction in Goldstone Villas, George Street, and part of Church Road.

Huddersfield.—Proposed Tramway Extension—At a meeting of ratepayers at Netherton, a resolution was adopted empowering the South Crosland D.C. to open negotiations with the Huddersfield Tramways Committee for an extension of its tramway system from Lockwood, *via* Waodfield Road and the Big Valley, to the Bar House, South Crosland, a distance of about 2 miles.

Nelson.—Railless Trolley Scheme.—The Corporation has finally decided to provide railless trolley services in three districts, at an estimated cost of £6,678, allowing for four cars, and basing the cost of electrical equipment at £1,200 per mile, and £1,500 for the extension of the car-sheds.

North-Eastern Railway Electrification.—It is understood that a local trial will shortly be made on the newly-electrified line between Newport and Shildon, on which the H.T. D.C. system is being adopted. The electric locomotives are being built at Darlington, and are designed to haul about 100 20-ton coke wagons.

Ramsbottom.—Railless Traction.—At the meeting of the D.C. on Monday, the chairman referred to the inauguration of the railless traction system, and said the estimated total capital expenditure was £13,350. This was £3,000 more than the original estimate, but instead of three cars they would have six and a car-shed. They required an average income of £67 per week to make the system pay. The chairman was prepared for a loss of £300 on the year when the two new cars were ready. They were confident that the receipts would not fall far short of the amount required.

Rochdale.—Depot Extensions.—The Tramways Committee has agreed to extend the tramway depôt at an estimated cost, for buildings and plant, of about £10,000.

Sheffield.—Top-Deck Passenger Register.—The Tramways Committee has received a communication with reference to the installation of top-deck passenger meters, and it has decided, subject to the meters being altered to provide for registering the passengers leaving the front of the car, to fit six cars with these meters at a cost of £6 per car.

South Lancashire.—The South Lancashire Tramways Co. proposes, before next winter, to convert the whole of its cars into the "double-deck" type.

Stockport.—The Corporation has decided to oppose that part of the Bill in which the Manchester Corporation seeks authority to run omnibuses within and outside the city along roads in which tramways are owned by or leased to Manchester Corporation, or over which that Corporation has running powers.

Walsall.—The Tramways Committee proposes to allocate the net profit for the year, amounting to £1,480, as follows:—In aid of rates, £1,000; to a suspense account to cover the estimated cost of power brakes for five of the new cars, £480.

Westhoughton.—Proposed Tramways.—A special meeting of the D.C. will be held on the 9th prox., when a resolution will be proposed that the Council apply to the B. of T. for a prov. order to construct tramways, &c., within its area.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Government radiographic station at Cape Virgenes was destroyed by fire recently.—*Review of the River Plate.*

Intensive Telegraphy.—The unremitting efforts of the Post Office engineers to increase the carrying capacity of existing telegraph and telephone lines by every possible means are leading to material economies. We recently mentioned the adoption of sextuple Baudot on the telegraph lines between London and Birmingham. Advantage is also taken of the trunk telephone wires by superimposing, to increase their utilisation factor, and recently successful experiments, it is reported, have taken place between London and Southampton, with the Wheatstone apparatus working at 150 words a minute, the interference observed with the telephone service being practically negligible. The results hold out good prospects of increasing the facilities for telegraphic communication without laying additional wires.

Manchester-Liverpool.—Great satisfaction is expressed in commercial circles in Manchester and Liverpool at the immediate success of the new direct telephone service between the two cities. The new system came into operation on Sunday, and has since been very busy, the telephone traffic between Manchester and Liverpool being very heavy, even when the trunk call system was in use. It is understood that the junction system will be extended to all the towns within a radius of 25 miles from Manchester.

Sweden.—The German Postal authorities have informed the Swedish Post Office that there is a strong desire in Berlin and Hamburg for a new direct telephone connection to Sweden. A cable from Trelleborg to Sassnitz, Arkona or Zingst is proposed.

The Imperial Wireless Contract.—The Postmaster-General has given instructions that Mr. J. E. Taylor, who was reduced on account of a small purchase of shares in the Marconi company, shall be restored to his former rank of superintending engineer on the occurrence of the next vacancy.

We congratulate Mr. Taylor, who was severely dealt with for a slight indiscretion; the Postmaster-General stated at the time that he was satisfied that Mr. Taylor had never shown any disposition to favour the Marconi company.

Lord Ampthill has given notice that on Tuesday next he will move that a Select Committee be appointed to inquire into the transactions in Marconi shares in which Lord Murray of Elibank has been involved both in his private capacity and as Chief Whip of the Ministry, and into all matters relating thereto; the Committee to have power to examine witnesses on oath.

The Telephone Service.—The Postmaster-General has issued a statement to the Press regarding the present condition of the London telephone service, as indicated by the experience of a considerable number of large users; where the practice of doing business by telephone is most developed and most carefully studied, there is general satisfaction with the service. Out of 173 answers to inquiries, 125 expressed complete satisfaction, 36 were neutral, and only 13 mentioned complaints. Many spontaneous letters of appreciation have been received. Statistics show that in New York and Chicago, the only cities with more telephones than London, and with more highly developed telephone services than any other city, the average times that elapse before the operator responds are respectively $\frac{9}{10}$ and $\frac{1}{3}$ second less than in London. The average time occupied in clearing lines after calls is about the same in all three cities, and so is the percentage of calls interrupted by cut-offs. The proportion of engaged calls is less in New York than in Chicago and London, which both have a considerable proportion of overloaded flat-rate lines. Great attention is being given to increasing the efficiency of the operating staff in London.

Train Control by Telephone.—The Great Western Railway Co. is developing the use of the telephone for the purpose of train control. During the past year important schemes have been authorised, and there are now train-control systems in operation at Swansea, Newport, Tondu and Birmingham, while others are in contemplation for the Bristol and Cardiff divisions.

Wireless Telephony.—Recent experiments carried out by Mr. Marconi between Chelmsford and Bournemouth, a distance of 100 miles, with an improved type of transmitter, have yielded successful results, and he is about to place some trial installations on board ship. His chief aim at present is to improve the speaking conditions rather than to increase the range of communication by telephone. The receiving apparatus is of a simple character, but the transmitter is said to be very heavy.

Russia.—The Russian Budget Bill for 1914 include for the construction and repair of telegraph and telephone lines sum of 13,038,000 roubles.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—February 28th. U.D.C. Transformer, high and low-tension switchgear and instruments. Supply of cables and feeder pillars.

March 2nd. U.D.C. Service cable; D.C. and A.C. meters; joint boxes, &c. See "Official Notices" to-day.

Ardee (Co. Louth).—The Town Commissioners decided at their last meeting to invite tenders for the electric lighting of the town in substitution for gas.

Argentina.—February 20th. Municipality of Diamante (Entre Rios.) Erection of an electric supply station. Specifications from the Secretary of the Corporation.—*Review of the River Plate.*

Australia.—SYDNEY (NEW SOUTH WALES).—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" February 6th.

March 25th. N.S.W. Railways and Tramways Department.—Five 1,000-KW. sub-station units to specification No. 124. Particulars at Electrical Engineer's Office, 61, Hunter Street, Sydney.—*Tenders.*

MELBOURNE.—February 17th. P.M.G. Cable boxes. See "Official Notices" January 9th.

February 18th. 1,590 opalescent arc lamp globes for City Council. See "Official Notices" January 23rd.

February 28th. One 500-KW. D.C. generator and triple-expansion engine, also condensing plant and switchboard panel. For Hoffmann, Brick & Potteries, Ltd., 123, Queen Street, Melbourne. Specification, &c., may be seen at the Board of Trade Commercial Intelligence Department in London.

March 5th. 20,000-volt and 1,500-volt underground cables and accessories, for Agent-General for Victoria. See "Official Notices" February 6th.

April 7th. P.M.G. Accumulator batteries (Tudor) for radio-telegraph stations. Relays, non-polarised. Stores Schedule 996. See "Official Notices" to-day.

HOBART.—March 2nd. For the Postmaster-General. Telephones, common battery, wall pattern, and table pattern, Schedule T 104. See "Official Notices" January 16th.

PERTH.—March 7th. High-tension cables, telephone cable and accessories for the West Australian Government. See "Official Notices" to-day.

Austria.—VIENNA.—February 23rd. Tenders are required for the supply and erection of a locomotive sliding platform, with electric driving equipment, for the Krakau Railway Station. Plans, particulars, &c., may be obtained from the Abteilung für Bau und Bahnhaltung der k.k. Nordbahn Direction in Vienna. No security is required.

Aylesbury.—March 7th. U.D.C. Contract 2. Two 100-KW. Diesel oil engine D.C. generating sets, with static balancers, battery boosters and accessories. See "Official Notices" to-day.

Balearic Isles.—Tenders have just been invited by the municipal authorities of Bunola (Balearic Isles) for the concession for the electric lighting of the town during a period of ten years.

Ballyconnell (Co. Cavan).—February 14th. Horizontal gas engine and suction plant; 18-KW. dynamo and motor dynamo; storage battery and accessories; switchboard and connections; overhead mains and street lamps, for Ballyconnell Electric Light and Power Co. See "Official Notices" January 30th.

Belfast.—February 23rd. Corporation. 12 months' supply of stores for Tramways and Electricity Committee. See "Official Notices" January 30th.

Belgium.—February 20th. The municipal authorities of Ixelles, Brussels, are inviting tenders for electricity meters and low-tension armoured cables.

BRUSSELS.—February 18th. Supply and laying of the cable for the light railway line between Brussels and Haecht. Tenders to the General Director of the Société Nationale des Chemins de fer Vicinaux, 14, Rue de la Science, Brussels. Cahier de Charges, 5 fr.

Bexley.—February 25th. U.D.C. 500-KW. turbo-alternator, with exciter, condensing plant and pipe work, water-tube boiler and superheater, with mechanical stoker. See "Official Notices" to-day.

Birkenhead.—February 24th. Corporation. Continuous-current electricity meters (ordinary and pre-payment). House service fuseboxes. See "Official Notices" February 6th.

Blackburn.—February 14th. Corporation. Twelve months' supply of stores for Electricity Department. Specification (deposit 3s. per section) from Mr. P. P. Wheelwright, Corporation Electricity Works. See "Official Notices" January 30th.

Bolton.—February 23rd. Corporation. Twelve months' supply of tramway stores. See "Official Notices" February 6th.

Bootle.—February 18th. Corporation. 12 months' supply of stores and materials for the electricity department. Specifications from the Borough Electrical Engineer, Electric Light Station, Pine Grove.

Bournemouth.—February 19th. Welsh smokeless coal (washed peas), household coal and gas coke for the Corporation Tramways Department, for a year. Mr I. Bulfin, General Manager. Returnable deposit of £1 1s.

Bradford.—February 19th. Corporation. Cooling towers and induced draught plant. See "Official Notices" January 30th.

Burton-upon-Trent.—March 14th. Corporation. One 1,250-KW. three-phase turbine-alternator and condenser, pipe-work, valves and accessories. Extensions to high-tension switchboard. See "Official Notices" to-day.

Canada.—WINNIPEG.—February 20th. Overhead construction and line materials required during 1914. Plans and specifications from the City Light and Power Department, 54, King Street, Winnipeg.—*Canadian Engineer.*

Copenhagen.—February 21st. Municipality. Three 300-KW. motor generators or converters for sub-stations; also switchgear. See "Official Notices" February 6th.

Crete.—March 13th. Tenders for the concession for electric tramways and water supply, which must be accompanied by a deposit of £2,000. Conditions may be seen at the Board of Trade Commercial Intelligence Department in London. Tenders to Bureau de la Mairie, Canea.—*Board of Trade Journal.*

Croydon.—February 16th. Corporation. 12 months' supply of stores for electricity department. See "Official Notices" January 30th.

Edmonton.—February 25th. Electrical lamps for the B. of G. Mr. F. Shelton, Clerk, The Grange, White Hart Lane, Tottenham.

France.—February 28th. The French State Railway authorities in Paris (20, Rue de Rome). 26,400 electric rail connections, 13,000 metres of bare copper cable of a section of 200 sq. mm., and 300 metres ditto of 400 sq. mm. section.

Gateshead.—February 22nd. Complete wiring of cottage homes, Shotley Bridge (number of lights, about 400); overhead line, 1,600 yd. long between power station and cottage homes; and supply plant in the power station. Specifications, &c., £1 1s. obtainable from Messrs. Tennant & Barrs, consulting engineers, Cathedral Buildings, Dean Street, Newcastle-on-Tyne.

Gorton (Manchester).—March 3rd. Great Central Railway Co. Six months' supply of wires and cables for lighting, globes and shades, carbons, casing, accessories and lamps, telegraph materials, and various other stores. Specifications, &c., from Mr. W. Williams, stores superintendent.

Halifax.—February 16th. Corporation. Stores and materials for the electricity department. See "Official Notices" January 23rd.

February 16th.—Stores for Tramways Department for a year. The Tramways Engineer, Tramways Office, Skircoat Road.

February 16th. The Education Committee. Installation of electric lighting at West House. Forms of tender from the offices, 22, Union Street. Tenders to the Secretary (Mr. W. H. Ostler).

Hornsey.—February 24th. Corporation. Electricity meters, cables, cable stores, &c. See "Official Notices" Jan. 30th.

Ilford.—February 24th. Corporation. Twelve months' supply of stores for electricity works. See Official Notices" to-day.

Ipswich.—February 17th and February 21st. Corporation. Paper-insulated cables for C.C. and A.C. three-phase systems. Fused mains disconnecting boxes and service boxes. See "Official Notices" February 6th.

Leeds.—February 16th. City Tramways. Supply of materials including electrical sundries. J. B. Hamilton, Manager, City Square.

February 21st. Corporation. Twelve months' supply of coal and other stores, including a number of electrical items. See "Official Notices" January 23rd.

Leith.—February 16th. Coal supply for the Electricity Department from March 2nd, viz.: (*a*) 3,000 tons washed singles or washed dross, for three months, or (*b*) 11,000 tons of washed singles or washed dross, for 12 months. Burgh Electrical Engineer, Great Junction Street.

London.—L.C.C.—February 17th. Installation at County Secondary School, Hilly Fields, Brockley, S.E. (223 points, 312 lights). See "Official Notices" January 30th.

ISLINGTON.—February 25th. Natural draught cooling tower and pipework for Electric Lighting Committee. See "Official Notices" January 30th.

ST. PANCRAS.—March 2nd. Corporation. Supply of arc lamp carbons. See "Official Notices" February 6th.

FULHAM.—February 18th. Corporation. Twelve months' supply of electrical stores. See "Official Notices" February 6th.

Shoreditch.—March 3rd. Corporation. Extra-high-tension and low-tension switchgear. See "Official Notices" February 6th.

H.M. Office of Works. February 27th. Three years' supply electric conduit and fittings. See "Official Notices" to-day.

Battersea.—March 3rd. Corporation. Twelve months' supply of stores for electricity department. See "Official Notices" to-day.

Bolton.—February 26th. Corporation. Twelve months' supply of stores for Electricity Committee. See "Official Notices" to-day.

Macclesfield.—March 11th. Electrical goods for a year, for the Cheshire County Asylum, Parkside. Mr. Wm. Tingay, Asylum Clerk.

Madeira.—March 31st. General Council of Administration of the District of Funchal, on the Island of Madeira. Establishment of a central electricity generating station for the supply of the energy required for the operation of a tramway in Funchal and district.

Navan (Co. Meath).—Only one tender having been received by the Board of Guardians for the overhauling of the electric light installation in the workhouse, it was decided to readvertise the contract.

Newport.—February 16th. Corporation. 12 months' supply of stores, for electricity and tramways department. See "Official Notices" January 30th.

New Zealand.—March 26th. The Dominion Portland Cement Co., Ltd. Hydro-electric plant, Wairua Falls. Section 1. Hydraulic equipment, including turbines, 1,500 H.P. each, governors, penstocks, valves, &c. Section 2. Generators, 1,000 KW. each, exciters, automatic regulators, &c. See "Official Notices" to-day.

Auckland.—April 21st. The Harbour Board. 1-ton and 2-ton truck cranes. Specifications from London agents, Messrs. W. and A. McArthur & Co., 18, Silk Street, Cripplegate, London, E.C.

Nuneaton.—February 21st. Corporation. One 600-KW. high-pressure, geared, direct-current turbo-generator, surface-condensing plant, pipework, &c. See "Official Notices" February 6th.

Peterborough.—February 19th. Coal (1,000 tons of small nuts) for the electricity works. Forms of tender from Mr. J. C. Gill, City Electrical Engineer.

Portsmouth.—February 17th. Corporation. Twelve months' supply of stores for the Tramways Committee. See "Official Notices" January 30th.

Redditch.—February 24th. Urban District Council. 6,000 tons coal. See "Official Notices" February 6th.

Rhondda.—February 17th. U.D.C. Consumers' electricity supply meters for the Gas and Water Committee. See "Official Notices" January 30th.

Salford.—February 16th. The Tramways Committee invites tenders for two years' supply of uniform clothing. Particulars (stamped envelope), General Manager.

March 4th. Corporation. Stores for the Electricity Department. Main traction switchboard. See "Official Notices" February 6th.

Shipley.—February 24th. U.D.C. Steel girder tramrails and fishplates for the tramway department. Specification from Mr. W. H. Dawson, Engineer to the Council, Manor House.

Southampton.—February 14th. 12 months' supply of stores, including electrical, for the Harbour Board. Schedules at the offices of the Board, Town Quay.

Southend-on-Sea.—Corporation. Three electrically-operated coal trucks. Mr. R. Birkett, Borough Electrical Engineer.

Spain.—February 22nd. Municipal authorities of Almaden de la Plata (province of Seville). Concession for the electric lighting of the town during a period of 20 years.

The municipal authorities of Villamalea (province of Albacete) are about to invite tenders for the concession for the electric lighting of the town during a period of ten years.

Stockton-on-Tees.—February 18th. Stores for a year, for the Corporation Electricity Department. Electrical Engineer.

Swindon.—March 7th. Corporation. Twelve months' supply of stores for electricity and tramways departments. fuse and service boxes, &c., meters, oils, &c. See "Official Notices" to-day.

Walthamstow.—February 25th. Corporation. Stores for electricity supply works and tramways. See "Official Notices" February 6th.

Weymouth.—February 21st. Corporation. 12 months' supply of coal for the electricity works. Specifications from Mr. J. H. Bolam, Borough Electrical Engineer. Stavordale Road.

Wrexham.—February 28th. Meters, carbon-filament lamps, oils, coal and boiler solution, for the Corporation electricity department. Borough Electrical Engineer, Willow Road.

CLOSED.

Argentina.—The tender of the Sociedad Anonima Constructora Nacional for the installation of an electric power station at Campo de Mayo, at $42,612 m/n., has been accepted.—*Review of the River Plate.*

Australia.—P.M.G.'s Department :—

Five sections common-battery and multiple switchboard equipment to increase the switchboard at Brisbane from 4,740 to 6 940 lines, £7,729; and other telephone material.—Western Electric Co. (Aus.), Ltd.
Telephone material.—James Paton & Co.
Telephone material.—Lawrence & Hanson Electric Co., Ltd.
Carbons, diaphragms and fuses.—I.R., G.P. & Telegraph Works Co., Ltd.
Trembling bells, receivers, cords, strips, jacks and lamps.—British G.E. Co., Ltd.
Diaphragms, cords and strips.—B.I. & Helsby Cables, Ltd.
6,000 earth clips, £1 8s. per 100.—Shaw Wireless, Ltd.

Victorian Railways Department :—

Lead-covered, impregnated, paper-insulated copper cable.—Western Electric Co. (Aus.), Ltd.—*Australian Mining Standard.*

Birmingham.—The Great Western Railway Co. has lately placed a contract with Messrs. Stothert & Pitt, Ltd., for one 6-ton and two 20-cwt. electrically-operated jib cranes, for the Moors Street Goods Station, Birmingham.

Bournemouth.—The T.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for spare parts for new tramcars, at £431.

Bradford.—The Electricity Committee has accepted the following tenders for supply of additional plant required at the Valley Road Electricity Works :—

Chloride Electrical Storage Co., Ltd.—Two storage batteries, stands, &c., £14,100.
Phœnix Dynamo Manufacturing Co., Ltd.—Two battery booster sets, starting switches, and one milking booster, £3,176; two spare armatures for the foregoing sets, £295.
Bertram Thomas.—Switchgear for two storage batteries and for two battery booster sets, £2,627.
British Westinghouse Electric Co., Ltd.—Two 1,500-KW. rotary converters, transformers, switchgear, &c., £8,835.
British Westinghouse Electric Co., Ltd.—Surface condensing plant for new 5,000-KW. turbo-generator, £3,375.

The City Council Tramways Committee has accepted the following tenders for the supply of railless car chassis and equipment :—

Brown & Sons (Huddersfield), Ltd.—28 chassis (including spares), £8,786.
Siemens Bros. Dynamo Works, Ltd.—56 motors and 29 controllers, £3,834.
Dick, Kerr & Co., Ltd.—60 circuit-breakers, £123.
Brecknell, Munro & Rogers, Ltd.—28 junction-boxes, £30.
Electro-Mechanical Brake Co., Ltd.—30 resistances, £214.
Tramways Supplies, Ltd.—58 trolley bases, £333; total, £13,270.

The Town Hall Extension Sub-Committee has accepted the following tenders in connection with the construction of the principal staircase at the Town Hall :—

Electrical installation.—R. Crust, £96.
Balustrading, lamp standards and brackets.—W. Walker & Co., £820.
Leaded lights.—A. Seward & Co., £110.

Burnley.—The tender of the Davenport Engineering Co. to construct a cooling tower at the electricity works with a capacity of 180,000 gallons per hour has been accepted, at £655; also that of Messrs. F. W. Brackett & Co., Ltd., at £211, for a revolving screen for cleaning circulating water.

Cape Town.—The Corporation has accepted the tender of Messrs. A. Shaw & Co. for the electric lighting of Sea Point Bathing Pavilion, at £605. The wiring will be carried out with lead-covered and armoured cables.

China.—A contract has been secured by the Siemens China Electrical Engineering Co., for the installation of a modern mining plant at the collieries of the Chung Ching Coal Mining Co., in the Ihrien district of South Shantung. The plant will comprise an electricity generating station, a pumping plant, an electrically operated inclined lift and a number of coal-boring machines. The power station will be equipped with two horizontal steam engines coupled to 900-KW. 3,000-volt generators.

Clyde Navigation.—Messrs. Johnson & Phillips, Ltd., have in hand a contract for the Clyde Navigation Trustees for the supply and installation of power cables complete with distribution boxes, &c., at Meadowside Quay.

Dundee.—Messrs. Maxwell, Ltd., Dundee, have secured the electric lighting contract (£353) for St. John's Cross Parish Church.

Edinburgh.—The T.C. has accepted the tenders of Leylands Motors Ltd., for three single-decker motor-'buses, at £804 each, and of Messrs. W. A. Stevens, Ltd., for three single-decker petrol-electric 'buses, at £912 each.

Leeds.—The following tenders have been accepted by the Corporation Sub-Tramways and Electricity (Works) Committee :—

For track work.—D. Speight & Sons, £224 and £289; also W. Keighley, £646.
Extension of main switches at electricity works.—British Westinghouse Manufacturing Co., Ltd., £3,867.
Two-phase to three-phase switchgear at the electricity works.—British Thomson-Houston Co., Ltd., £2,985.
Economiser.—E. Green & Son, Ltd., £1,350.

London.—Messrs. Mitchells, Ashworth, Stansfield & Co., Ltd., have received an order for 2,500 Mascolite pads, 1 in. thickness, from the London and South-Western Railway Co., for use in the electrification of their suburban lines, for the electric power cables to rest on in passing over bridges, viaducts, &c., to prevent their damage by vibration.

L.C.C.—The Establishment Committee reports the receipt of the following tenders for the supply of electric charging apparatus at seven fire stations:—

	Alternating-current machine.	Continuous current machine.
Crypto Electrical Co.	£18 8 6	£20 8 6
Woolnough, Lang, Ltd.	18 14 6	21 10 6
Veritys, Ltd.	21 6 6	23 8 6
Union Electric Co., Ltd.	26 19 0	24 15 0
General Electric Co., Ltd.	35 0 0	32 15 0

Five of the stations are supplied with alternating, and two with continuous current, and the Committee recommends the acceptance of the tender of the Crypto Electrical Co., at £132 19s. 6d.

The Highways Committee has received the following tenders for the supply of 500 tons slot rails and 1,000 tons conductor rails, 6,300 tons track rails and fastenings, for the Council's Tramway Department:—

SLOT RAILS AND CONDUCTOR RAILS.

Frodingham Iron and Steel Co., Ltd. (recommended)	£13,150
P. & W. MacLellan, Ltd. (rails manufactured by North-Eastern Steel Co., Ltd.)	13,706
Watlington & Co., Ltd. (rails manufactured by Phœnix Actien Gesellschaft at Ruhrost, Germany)	14,137
Walter Scott, Ltd.	16,475

TRACK RAILS AND FASTENINGS.

	Carbon steel.	High silicon steel.
Watlington & Co. Ltd. (rails manufactured by Phœnix Actien-Gesellschaft at Ruhrost, Germany)	£39,293	£39,893
	(Tender not to specification)	
Bolckow, Vaughan & Co., Ltd.	39,796	41,296
	(Tender for special steel, £40,571)	
Walter Scott, Ltd.	41,920	43,470
P. & W. MacLellan, Ltd. (rails manufactured by North-Eastern Steel Co., Ltd.)	43,103	44,671
	(Not including bolts and nuts	
Barrow Hæmatite Steel Co., Ltd.	45,979	(No tender)

The Committee recommends the acceptance of the tender of Messrs. Bolckow, Vaughan & Co., Ltd., for the supply of carbon steel rails and fastenings, at £39,796, and that they be allowed to sublet to Messrs. Guest, Keen & Nettlefolds the supply of bolts and nuts.

BATTERSEA.—In connection with the prepayment electricity meters now being obtained for the housing estates, the Electricity Committee is entering into a contract with Messrs. Ferranti, Ltd., for the maintenance, &c., of the specialised meters for a period of five years.

WANDSWORTH.—The Guardians have received the following tenders for the provision of electric power to the "Wardle" drying machine at the St. John's Hill Infirmary:—

H. J. Godfrey	(accepted)	£59 10 0
A. Rasbmore		88 5 0
Farad Electrical Co.		92 5 0
Stegmann & Co.		97 10 0
Savage Bros.		104 10 0
H. & C. Davis & Co.		135 0 0
Tucker & Co.		148 10 0

Manchester.—The Electricity Committee has accepted the following tenders:—

British Westinghouse Co., Ltd., and Bruce Peebles & Co., Ltd.—Converting plant at several sub-stations.
Ferranti, Ltd.—Three 53-K.V.A. transformers for sub-stations.
W. T. Henley's Telegraph Works Co., Ltd.—Paper-insulated cables.
Johnson & Phillips, Ltd., Electrical Engineering and Equipment Co., Ltd., Chas. Macintosh & Co., Ltd., I.R., G.P. and Telegraph Works Co., Ltd., Callender's Cable Co., Ltd., W. T. Henley's Telegraph Works Co., Ltd., and the Western Electric Co., Ltd.—Cables.

The Tramways Committee has accepted the following tenders:—

Smith & Forrest.—Pitch.
Robert Carlyle.—General builders' work, extension of Hyde Road car-shed.
E. Wood & Co., Ltd.—Constructional steel and iron work, Hyde Road car-shed extension.
Brush Electrical Engineering Co., Ltd.—Tramcar trucks.
British Westinghouse Co., Ltd.—Tramcar motors.
Dick, Kerr & Co., Ltd.—Tramcar controllers.

The Corporation Fire Brigade Sub-Committee has accepted the quotation of the Postmaster-General for wiring and maintenance of Gamewell fire alarm boxes in Gorton and Levenshulme for a period of 10 years.

Salford.—The Watch Committee has accepted the offer of Mr. G. Longfield Beasley, London, for the maintenance, overhauling, &c., of the Gamewell police telegraphs and fire alarm apparatus in the borough for one year, for the sum of £33.

The tender of Messrs. E. M. Evans & Son for the maintenance of, and repairs and renewals to, the intercommunication telephone system at the Education Offices and the Town Hall, for three years aggregate, £49 10s.) has been accepted.

The Electricity Committee has accepted the following:—

H. Green & Co.—Two 7½-H.P. variable speed motors, £30 10s. each.
British Westinghouse Co., Ltd.—Two rotary converters and static transformers required in connection with the supply of electrical energy to No. 9 Dock, Manchester Ship Canal, £3,993.

New Zealand.—Tender Board:—

Five tons copper wire, 60 lb. per mile, £455; ¼ mile lead covered, silk and cotton insulated cable, £326.—P. R. Baillie & Co.
100 tons copper wire, 200 lb. per mile, £8,700.—Samuel Brown, Ltd.

—*Australian Mining Standard.*

Sheffield.—The following tenders have been accepted by the City Council

Herbert Morris, Ltd.—4-ton hand travelling crane for the tramways works, Queen's Road, £11[illegible].
Staveley Coal and Iron Co., Ltd.—10,000 [illegible] in. cast-iron pipes for the Electricity Department, [illegible] per ton.
E. Taylor.—Construction of foundations for turbo-alternator and auxiliary machinery at the Electricity Works, £1[illegible].

With reference to the tender of Messrs. Stuart & Moore which was recently accepted by the City Council, at £[illegible], to install their system of telephonic street alarms the Watch Committee reports that it has now been found that by altering the proposed routes of the cables, and making greater use of the existing cable ducts of the Tramways Department, it would be possible to reduce by 1½ miles the length of new cable ducts to be constructed by the Corporation, and thus save the latter a considerable sum. This, however, would mean that the length of cable, &c., to be supplied and fixed by Messrs. Stuart & Moore would be increased, and this has necessitated a revised tender being obtained from them, which amounts to £1,769. To this should be added £153 for "braiding" the cable. The Committee recommends the Council to accept the firm's amended tender.

Sunderland.—The T.C. on Wednesday accepted the following tenders on behalf of the Electricity and Lighting Committee:—

A.E.G. Co., Berlin.—E.H.T. fuses.
Cable Accessories Co.—Street lighting brackets.
B.I. & Helsby Co.—Cable.
Ferranti, Ltd.—Two E.H.T. switch cabinets.
Reyrolle & Co., Ltd.—One E.H.T. switch cabinet.
Phœnix Dynamo Co.—Re-winding two 750-KW. alternators.
T. Robson.—Steel ducts.
Babcock & Wilcox.—Links for boiler grates.
Brunner, Mond & Co., Ltd.—Alkali.

Tonbridge.—The U.D.C. has accepted the tender of the Medway Coal Co. for coal for the Electricity Works, until September 30th next (500 tons).

West Ham.—The tenders of Messrs. J. and B. Pearse and Co., and Messrs. Dillingham & Co., have been accepted by the Corporation for an annual supply of tramway uniforms.

Wolverhampton.—The T.C. on Monday accepted the following tenders:—

British Westinghouse Co., Ltd.—£2,204, one 1,000-KW. rotary converter.
Balcke & Co., Ltd.—£143, air filtering plant.
Rees Roturbo Co., Ltd.—£86, centrifugal pump.
Stirling Boiler Co., Ltd.—£6,269, two water-tube boilers.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, February 16th.—"A" Company. Technical instruction, 7 to 10 p.m.
Tuesday, February 17th.—"B" Company. Technical instruction, 7 to 10 p.m.
Wednesday, February 18th.—Recruits only. Infantry drill and technical instruction, 7 to 10 p.m.
Thursday, February 19th.—"C" Company. Technical instruction, 7 to 10 p.m.
Friday, February 20th.—"D" Company. Technical instruction, 7 to 10 p.m.
Saturday, February 21st.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

Official Tests with Fire Extinguishers.—The British Fire Prevention Committee devoted considerable time last year to an exhaustive investigation into the reliability of existing portable chemical fire extinguishers, in which inquiry it had the co-operation of a number of Government departments, corporations and institutions, who lent extinguishers which had been in their possession for periods varying from a few months to as long as 36 years.

The reports on these investigations have been issued by the Committee as Red Books Nos. 185 and 186, of which the latter may be deemed the more important, as it contains a comparative table of the results of tests with about 100 appliances. The great majority of the appliances under test were of British make, and all existent types of extinguishers (although not every individual make) were under investigation.

Out of a series of 57 extinguishers tested hydraulically, 10 failed at under 300-lb. pressure, and eight failed to withstand the Committee's official 350-lb. pressure test, while 33 passed the last-named test. Several burst at 200 lb. The working pressure generated by one of the extinguishers when the nozzle was closed was 310 lb. and in another case it was 340 lb., which plainly shows the wisdom of the Committee's insisting on a margin of safety for the future.

FORTHCOMING EVENTS.

Manchester Association of Engineers. Friday, February 13th. At Grand Hotel, Aytoun Street. Anniversary dinner.

Physical Society of London.—Friday, February 13th. At 8 p.m. At Imperial College of Science. Papers on "Moving-Coil Ballistic Galvanometer," by Mr. R. L. Jones; "Vibration Galvanometers of Low Effective Resistance," by Mr. A. Campbell, and "Vacuum-tight Lead-seals for Leading-in Wires in Vitreous Silica and other Glasses," by Dr. H. J. S. Sand.

Royal Institution of Great Britain.—Friday, February 13th. At 9 p.m. At Albemarle Street, W. Paper on "Production of Neon and Helium by Electric Discharge," by Prof. J. Norman Collie, F.R.S.

Saturday February 14th. At 3 p.m. Lecture on "The Electric Emissivity of Matter.—(I) The Metals," by Dr. J. Allen Harker.

Illuminating Engineering Society.—Friday, February 13th. At the Trocadero. Annual Dinner.

North of England Institute of Mining and Mechanical Engineers.—Saturday, February 14th. At 2 p.m. At Newcastle-upon-Tyne. General Meeting.

Salford Technical and Engineering Association.—Saturday, February 14th. At 7 p.m. At Royal Technical Institute. Paper on "Swiss Mountain Railways," by Mr. A. A. Buss.

Finsbury Technical College Old Students' Association.—Saturday, February 14th. At 6.30 p.m. At Caxton Hall, Westminster. Annual Dance.

Association of Mining Electrical Engineers.—Saturday, February 14th. At 5.30 p.m. At North Stafford Hotel, Stoke-on-Trent. Paper on "Design and Maintenance of Miners' Electric Lamps," by Mr. F. J. Turquand.

Friday, February 20th. At 7.30 p.m. At Royal Technical College, Glasgow. Paper on "The Manufacture of Electrical Cables."

Electro-Harmonic Society.—Monday, February 16th. At 8 p.m. At Holborn Restaurant. Concert (ladies' night).

Illuminating Engineering Society.—Tuesday, February 17th. At 8 p.m. At Royal Society of Arts, John Street, Adelphi. Discussion on "The Lighting of Picture Galleries and Art Studios," opened by Prof. S. P. Thompson, F.R.S.

Institution of Civil Engineers.—Tuesday, February 17th. At 8 p.m. At Great George Street, S.W. Ordinary meeting.

Friday, February 20th. At 8 p.m. Students' meeting.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, February 17th. At 8 p.m. At Rankine Hall, 39, Elmbank Crescent, Glasgow. Ordinary Meeting.

Junior Institution of Engineers.—Tuesday, February 17th. At 7.30 p.m. At City and Guilds of London Technical College, Leonard Street, Finsbury. Lecture on "Oscillatory Electric Discharges," by Mr. R. P. Howgrave-Graham.

Institution of Electrical Engineers (Students' Section).—Wednesday, February 18th. At 7.45 p.m. At Victoria Embankment. Paper on "Illumination in Theory and Practice," by Mr. W. H. Date.

(Newcastle Students' Section).—Monday, February 16th. At 7.30 p.m. At Armstrong College of Science, Newcastle. Paper on "The Design of Static Sub-stations," by Mr. W. Dixon.

(Manchester Students' Section).—Tuesday, February 17th. At 7.30 p.m. At Municipal School of Technology. Paper on "The Electrical Driving of Rolling Mills," by Mr. N. J. Cursetjee.

(Scottish Local Section).—Tuesday, February 17th. At 8 p.m. At 207, Bath Street, Glasgow. Paper on "Some Railway Conditions Governing Electrification," by Mr. R. T. Smith.

(Western Local Section).—Monday, February 16th. At 4.30 p.m. At South Wales Institute of Engineers, Cardiff. Paper on "British Practice in the Construction of High-tension Overhead Transmission Lines," by Mr. B. Welbourn.

(Newcastle Local Section).—Friday, February 20th. At 7 p.m. At Hugh Bell School, Middlesbrough. Discussion on "Coal and its use in Steam Raising," introduced by Mr. P. S. Thompson.

(Yorkshire Local Section).—Friday, February 20th. At 6.30. At Hotel Metropole, King Street, Leeds. Annual Dinner.

Dynamicables.—Wednesday, February 18th. At Trocadero. Dinner.

Institution of Mechanical Engineers.—Friday, February 20th. At 8 p.m. At Storey's Gate, S.W. Paper on "Some Modern Methods of Welding," by Mr. T. T. Heaton.

Electrical Engineers' Ball.—Friday, February 20th. At Hotel Cecil.

Greenock Electrical Society.—Friday, February 20th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Paper on "Power Station Design," by Mr. J. Punch.

Manchester Electro-Harmonic Society.—Friday, February 20th. At Albion Hotel. Concert.

Royal Institution of Great Britain.—Saturday, February 21st. At 3 p.m. At Albemarle Street, W. Lecture (II) on "The Electric Emissivity of Matter," by Dr. J. A. Harker.

University College, Nottingham.—Saturday, February 21st. At 3 p.m. Educational and Scientific Exhibition to be opened by Lady Henry Bentinck.

NOTES.

Lundberg Switching Competitions.—In November last a long list of certificate and prize winners in the competition of last summer was published in our columns. This list did not include all the overseas competitors, as a longer time had to be allowed for their papers to reach home. We are informed that the additions to the list of those who have passed are as follows:—

W. J. Harris, Royal Engineers' Office, Colombo. *Advanced.*
H. Keith, Punta Arenas, Chile. *Advanced.*
W. Jude, Antwerp. *Intermediate*
Drummond Hunter, Wellington, N.Z. *Intermediate.*
R. Drilhon, Pau, France. *Preliminary.*
H. H. Morgan, Bermuda. *Preliminary.*
Ardeshir Kaikobai Modi, Bombay. *Preliminary.*

Junior Institution of Engineers.—The annual dinner is to be held at the Holborn Restaurant on Saturday, February 28th.

Association of Consulting Engineers.—The inaugural dinner of the Association of Consulting Engineers was held at the Whitehall Club, Westminster, on Monday, February 2nd, under the presidency of Mr. G. Midgley Taylor, chairman of the Committee of the Association. The members and guests present numbered about 90. After the toast of "The King" had been duly honoured, "The Association of Consulting Engineers" was proposed by Mr. J. H. Balfour-Browne, K.C., who said that there was a necessity for the new departure which had been made in the formation of that Association. In order to maintain a profession at its highest level it was essential that it should have an external conscience in addition to the individual consciences of its members. Their society, with its rules for moral guidance, was a conscience of this kind. With regard to trade and commerce, the members of the Association of Consulting Engineers must stand in splendid isolation. The engineer was certainly serving God when he was working at his best, but the engineer commercialised was as certainly serving Mammon. The latter was the condition of the State and the municipal engineer, when he competed with private enterprise. He felt very strongly that new trades ought not to be handicapped by the competition of public departments which operated with funds provided by the very people with whom they were competing. Further, State and municipal engineers should not be allowed to compete with ordinary consulting engineers. They should devote all their time and attention to the work of the municipality, and be adequately paid for doing this duty. If they did devote their time and attention adequately to the work of the municipality, they ought to have no time for engaging in private practice. Apart from this, there was the danger in a municipal engineer acting in a consulting capacity, that he was liable to have a narrow outlook. The variety of the work engaged in by the consulting engineer was his strength, and was apt to give a judicious breadth to his decisions, which was invaluable to his client. The Association of Consulting Engineers was doing good work, both for itself and for the public, in keeping up the standard of the profession.

In reply, the Chairman said Mr. Balfour-Browne had described the aims of the Association with great exactitude. Its members did not seek to elevate themselves among their brethren. The Association was not a scientific society, and its members remained loyal to those societies to which they already belonged. The rules were very definite on this point, and it was not desired to usurp the functions of these high bodies. But no scientific association, having necessarily a very varied membership, could make rules which would be applicable merely to consulting engineers. So the Association had been formed for the better protection both of consulting engineers and of the general public. The lives of the community were as much in the hands of the engineer as in those of the doctor, and that was another reason why this Association had been formed as a body of professional men to work on professional lines, and to advise clients to the best of their ability irrespective of their own pockets.

The toast of "The Guests" was proposed by Mr. H. Percy Boulnois, who compared the inaugural dinner to a christening feast, and dwelt humorously on the infant troubles of "Dykes's Baby." The Association had been charged with being a Trade Union and a purity party. He did not object to either term. It was necessary that the consulting engineer and expert witness should be beyond suspicion. They had many precedents for what they had done. Both the legal and medical professions had their Trade Unions, and even the House of Commons was a society of the same kind. The toast was responded to by Mr. C. E. C. Browne, President of the Society of Parliamentary Agents; Mr. A. Bruce Anderson also replied to the toast in a humorous speech.

Mr. James Swinburne proposed the toast of "The Hon. Secretary and Hon. Treasurer of the Association," and remarked that Mr. Dykes had done a tremendous amount of hard work in forming the society. In connection with its formation there had been a great deal of difficulty in discovering exactly what a consulting engineer was. The difficulty of exactly defining the consulting engineer seemed to be insuperable, but it had been overcome. The Association were deeply indebted to Mr. Dykes and Mr. Lowcock for the work they had done on behalf of the profession. Mr. Dykes, in reply, pointed out that the success of such an Association depended upon the co-operation of its members. Every member should, therefore, do his best to made the Association known both to engineers and to the public, and to acquaint the secretary of ways in which the Association might be useful to its members. To form such an Association had meant a great deal of hard work, but the results were worth it. Mr. Lowcock also briefly replied to this toast, and pointed out that this dinner was not really a christening, but a confirmation. They would be pleased to hear that the Association was financially sound.

Mr. J. F. C. Snell, in proposing the toast of "The Hon. Solicitor," referred to the enormous amount of work that Mr. Wright had done in the preparation of the rules and articles of the Association and in getting its registration accepted by the Board of Trade. In this connection the work of Messrs. F. Gore-Browne and J. H. Wood should also be acknowledged. Mr. F. E. Wright, in reply, said he hoped that in due course the Association would make such progress that it would be necessary to employ him to submit a petition for the grant of a Royal Charter.

Mr. W. M. Mordey proposed, in a humorous speech, the health of "The Whitehall Club," and Mr. A. W. Johnson, in reply, said that it was fit and proper that the first social gathering of the Association should be held under the auspices of a club which for 50 years had been the home of consulting engineers in Westminster.

(*Continued on page 277.*)

RECENT DEVELOPMENTS IN ELECTRICITY SUPPLY IN HULL.

(Concluded from page 231.)

In our last issue we described the new concrete power station recently erected at Sculcoates Lane, and the boiler and turbine plant which has been installed there.

The H.T. switchgear in the new station is of the electrical remote controlled type, and was supplied by the British Westinghouse Co.

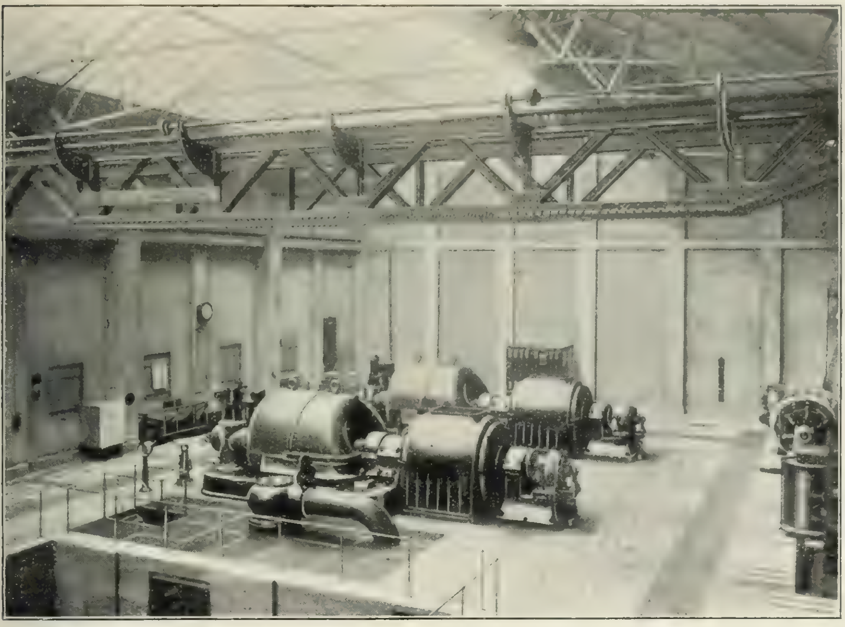


Fig. 8.—The New Turbine Plant, Hull.

Fig. 6 (page 231) shows the operating board of the bench type, with the exciter rheostats, which occupy a gallery overlooking the engine room, and are situated immediately over the H.T. oil-switches which are installed in brick cubicles on the engine room floor level, as shown in fig. 7 (page 231).

The oil-switches are solenoid operated, and of massive construction, having 20-in. breaks; they are of the single-pole type, each phase being in its own cubicle, with an oil tank made of boiler plate and provided with a special exhaust pipe with oil and flame baffles, to allow for the free discharge of the gases generated when the circuit is opened under abnormal conditions.

Duplicate bus-bars are provided, with two machine and six feeder oil-switches, and a coupler switch—with a 23-in. break — for coupling the bus-bars if desired. Voltage limiters are installed to prevent any undue rise of pressure due to surges.

The remote control circuits are energised from an existing battery in the older installation; and the system of engine-room telegraphs, Chadburn's ship mechanical type, successfully used in the old engine room, has been adopted in the new one.

Fig. 13 shows a near view of one of the Korting ejector condensers, operating in conjunction with a 60-H.P. motor-driven turbine pump, which delivers 160,000 gallons of water per hour at from 6 to 8 lb. pressure, and maintains a vacuum of 28½ in. The motor, a 450-volt D.C. machine, by the Lancashire Dynamo Co., is controlled from an ironclad interlocked starting switch pillar.

Water for condensing purposes flows from the Beverley Cut, previously referred to, into a concrete sump in the basement, from which the condensing water pumps draw their supply; a weed box is fitted in the suction of each

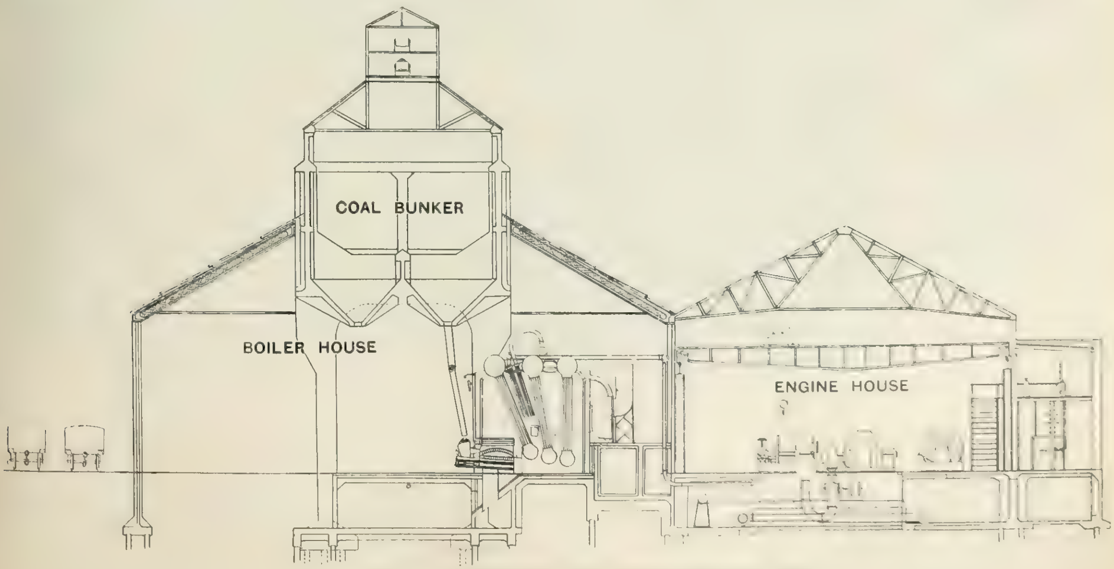


Fig. 9.—Sectional Elevation, New Power Station, Hull.

pump, the cover of which is secured by hinged bolts, to facilitate rapid dismantling.

We understand that at certain seasons of the year these boxes become choked with eels, which are abundant in the large dykes which drain the flat land in Holderness.

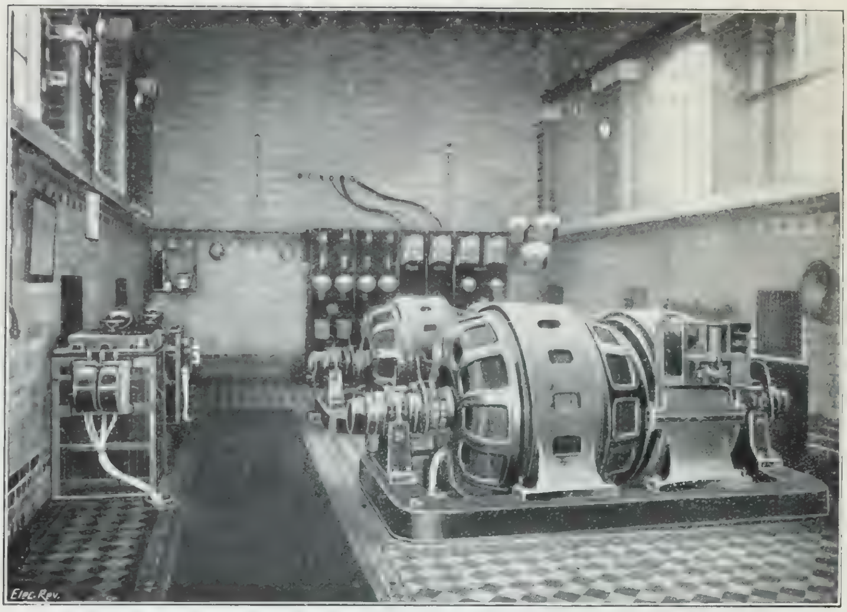


Fig. 10.—Interior of the Alexandra Dock Sub-Station, showing Motor-Converters, [illegible] D.C. Switchgear, &c.

There are also temporarily installed in the new engine room a pair of 500-kw. Peebles motor-converters, to link up the new three-phase and older direct-current plant; as occasion demands, these machines will be replaced by 1,000-kw. machines.

The motor-converters are shunt wound, and supply direct current at 460 volts pressure; the speed is 500 r.p.m.

Further, there is an auxiliary d.c. switchboard controlling the station power and lighting circuits, while a 20-ton hand crane spans the new engine room.

It will be seen that the plant has been laid out on simple lines and with a view to reliability in operation, while the facilities for extension in the future have been carefully studied.

The sub-stations are supplied through three-core ·15 sq. in. paper-insulated lead-covered and steel-tape armoured trunk feeders, supplied by Messrs. Siemens, and laid direct in the ground; the general lay-out of the three-phase mains system, with its sub-stations, as also the numerous sub-stations connected to the h.t. direct-current system of feeders (22 sub-stations in all), is shown in fig. 12, while we also illustrate two typical three-phase sub-stations.

The Peebles motor-converter has been used in various three-phase sub-stations supplied from the new plant, four of 200 kw. and four of 500 kw. (including those in the station) having been supplied.

The smaller machines are level compound wound, and run at 750 r.p.m., while all are designed to deal automatically with a 25 per cent. out-of-balance current on the three-wire network supplied by them.

One of the sub-stations, fig. 10, is situated at the Alexandra Dock of the Hull and Barnsley Railway Co., the plant including two 200-kw. Peebles motor-converters, together with three-phase switchgear by Messrs. Reyrolle, and direct-current switchgear by Messrs. Bertram Thomas; this supplies, amongst other plant, two electric belt conveyors on the Railway Co.'s deep water quay, each capable of loading 600 tons of coal per hour into ship. Another sub-station, which will be the largest in the city, is in course of erection at the North-Eastern and Hull and Barnsley Railway Companies' new Joint Dock now nearing completion; this dock will be the largest and most completely equipped dock on the East Coast, and some 2,000 kw. of converting plant is being installed, as it is expected that the connected power and lighting load at the dock will exceed 4,000 h.p.

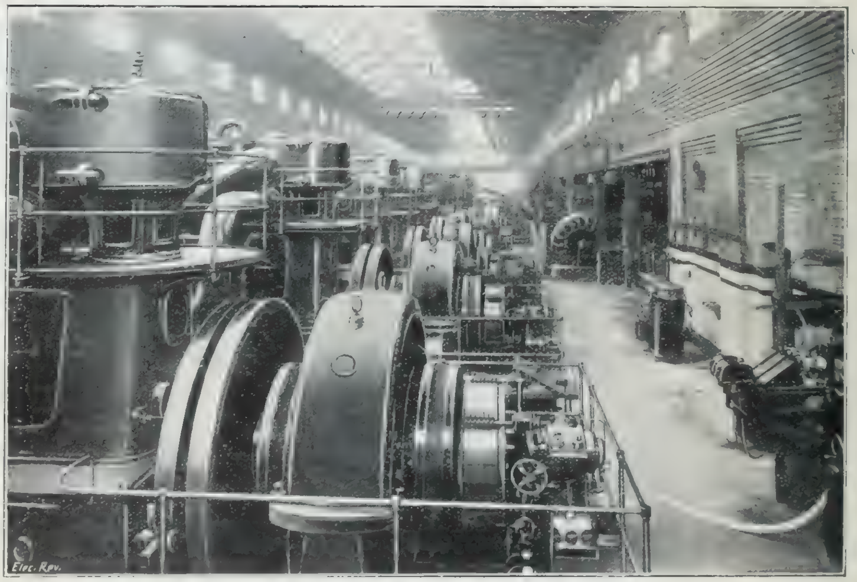


Fig. 11.—The Old Engine Room, Sculcoates Lane Station, showing h.t. Direct-Current Generating Plant.

Beyond the Joint Dock, outside the city boundary and lower down the river, is situated the Saltend Oil Depôt, on which site all the leading oil companies have taken leases. This also is being supplied from the three-phase service, but at extra-high-pressure, the railway authorities transforming the supply themselves.

We also illustrate the New George Street sub-station, with the first 500-KW. motor-converter in position; this sub-station, as also the others, has been built with a view to future extensions, and is designed ultimately to contain some 2,000 KW. of plant.

Owing to the limited space available, a special flat-back type of direct-current switchboard has been adopted in this and one or two other sub-stations where similar conditions obtained.

In each case a crane or lifting appliances are provided, and provision is made for unloading new plant in the building.

A number of static sub-stations are in use, the approved design including a lower transformer chamber with ventilating chimneys and an upper chamber containing H. and L.T. switchgear.

An interesting feature in connection with the rotary sub-station plant, both three-phase and H.T. direct-current, is the provision of plunger-type oil pumps, and forced as well as ring lubrication to all bearings. Experience has shown that with this safeguard the numerous direct-current rotary sub-station plants will operate satisfactorily, though unattended, and even the new three-phase plants are only visited at intervals. We may add that only one bearing in the 50 rotary plants in use has failed during 10 years.

The various H.T. direct-current and three-phase sub-stations are inter-connected and operated in conjunction with one another, there being at the present time some 5,000 KW. of 2,200-volt and 2,500 KW. of low-tension direct-current generating plant, installed in the original Sculcoates Lane station, which was built in [illegible] to supersede the first Corporation generating station in Dagger Lane, now used as a sub-station.

It may be mentioned that this plant includes [illegible] high-speed engines and 20 Lancashire boilers, and that the steam consumption overall averages some 20 lb. per KW.-hr., as compared with 15 lb. per KW.-hr. on full load of the new turbine plant.

It may be of interest to mention that the undertaking has some 4,300 consumers and a connected load of 16,382 KW.; the latter includes 9,000 H.P. of motors, 1,300 H.P. of which are hired out by the electricity department. The output sold for the year ending March last amounted to $10\frac{1}{2}$ million units, of which eight millions were supplied to motor users. The area of supply is about 12 sq. miles, and the feeders and distributors in use total some 230 miles. The department is up against a fairly aggressive gas competition from both Corporation and companies, and, with a view to popularising the domestic applications of electricity and demonstrating its advantages to the public, an up-to-date showroom has been opened in one of the main streets, a view in which we are able to include. In conclusion, we are indebted to Mr. Bell, the city electrical engineer, and to his chief assistant, Mr. Magoris, for offering us every facility in the preparation of this short article.

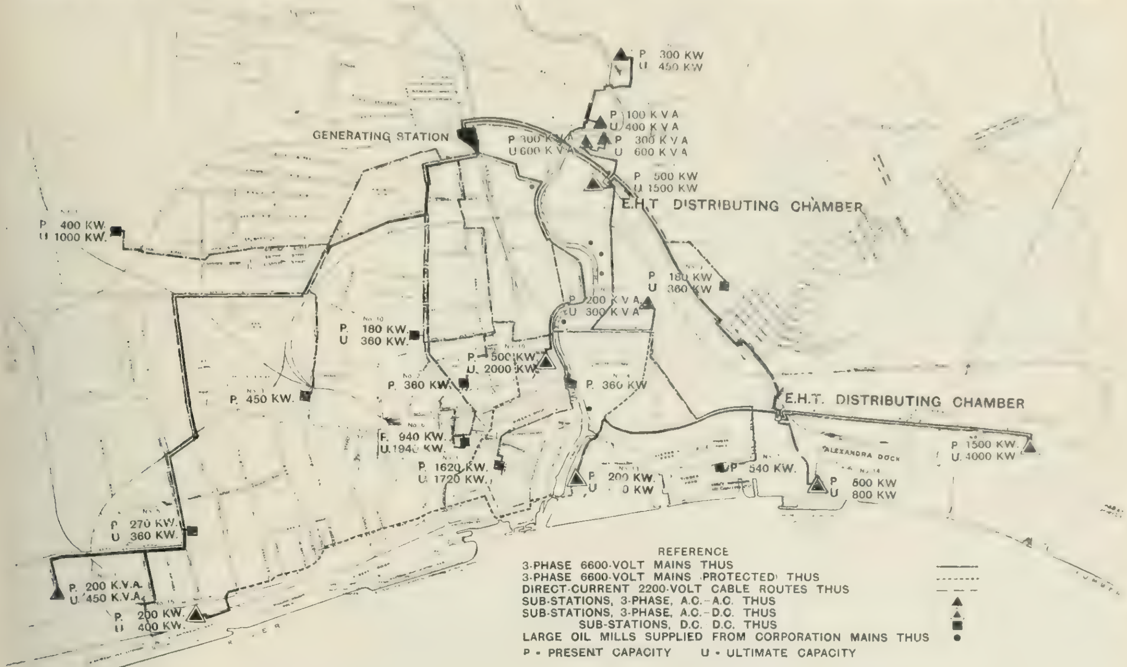


Fig. 12.—Plan showing Sub-Stations, 6,000-volt Three-Phase and 2,200-volt Direct-Current Feeders, &c., Hull.

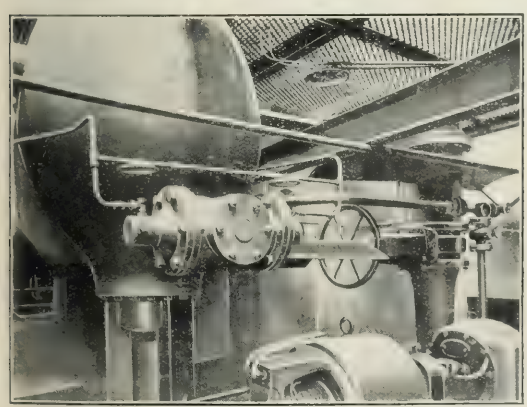


Fig. 13.—Ejector Condenser, Pump, &c., for Turbine Unit, Hull.

Fig. 14.—Interior of the Electricity Department's Town Showroom.

A 1,200-H.P. ELECTRICALLY-DRIVEN WINDER.

As our readers are aware, Messrs. Sandycroft, Ltd., have had great experience in winding engine construction, both steam and electric, and being both mechanical and electrical engineers, they are in a position to build, erect, and test the complete plant in their works.

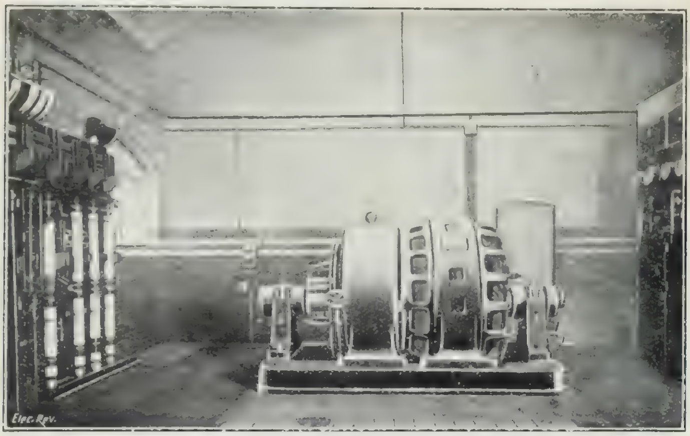


Fig. 15.—The New George Street Sub Station, Hull (see page 275).

We illustrate herewith a large electrically-driven double-drum main winding set for underground use, just completed by them for a mine abroad. The conditions and duty of the winder are as follows:—

The depth of wind is 4,000 ft.; the shaft is inclined 65° to the horizontal.

Weight of skip, 2 tons; weight of ore raised per trip, 3 tons.

Diameter of rope, 1⅜ in.; max. rope speed, 1,200 ft. per min.

Rope speed for shaft inspection, 75 ft. per min.

Max. horse-power, 1,200.

Two skips are used, one ascending and one descending.

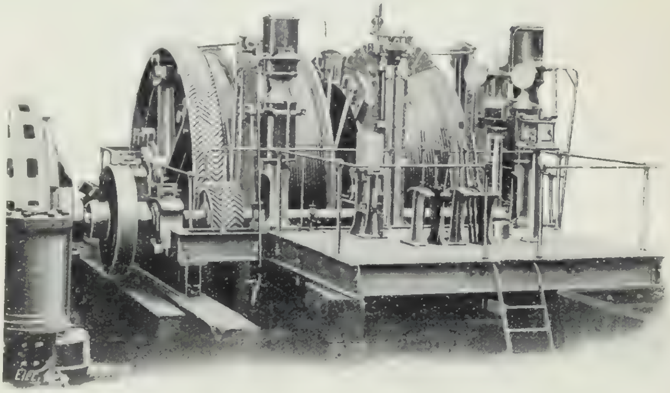
The drums are parallel, 12 ft. diameter and 3 ft. 6 in. wide between flanges, one being keyed on the shaft, and the other loose and operated by a clutch, so that the necessary adjustment can be made when it is required to wind from a different level. The drum sides are of cast-iron, with mild-steel lagging spirally grooved to receive the winding rope. Each drum side is made in eight sections, so as to provide for passing down a shaft 5 ft. 9 in. × 2 ft. 9 in. within the timbers.

The clutch is of the multiple-tooth type of cast-steel with machined teeth, and is operated by means of a hand-wheel and screw.

The drum shaft is 14 in. diameter of Siemens-Martin acid steel. The bearings for carrying it are 11 in. diameter × 20 in. long. The countershaft is 8½ in. diameter, and is fitted with a reversible flexible coupling at one end for coupling up to the motor.

Citroen gear wheels are used, of cast-steel with triple helical machine-cut teeth.

The brakes are of the vertical post type; automatic take-up gear is provided for taking up the wear on the brake blocks, and both brakes are operated by air-brake engines of the vertical type combined with oil cataract cylinders; the brakes are put on by weights, the brake engines holding the weights off when brakes are not operating or allowing the weights to act on the brakes to any desired extent, this being regulated by a lever on driver's platform.

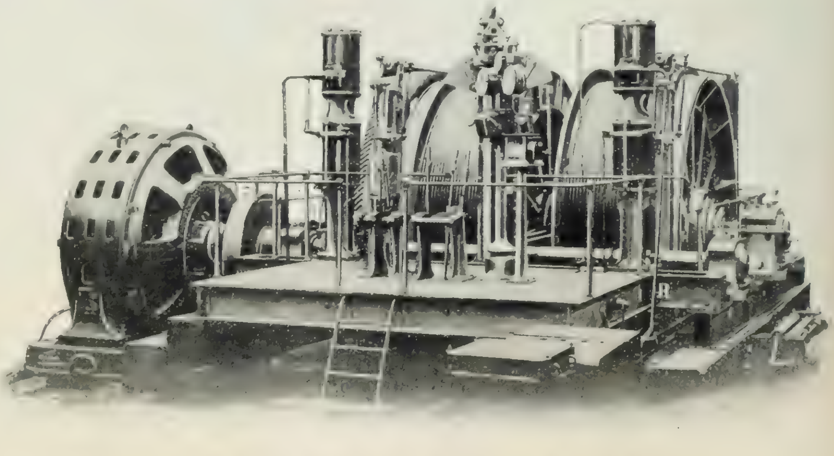


1,200-H.P. Electric Winding Engine, by Sandycroft, Ltd.

Gott's patent overspeed and overwind preventing gear of the vertical screw type is fitted, which also acts as the depth indicator; one of the vertical screws is driven from the fixed drum and the other from the loose drum, and in the case of overspeed, overwinding, or starting to wind in the wrong direction, a switch is tripped which operates a solenoid, by means of which the brakes are automatically applied and the current to the motor cut off, bringing the winding gear to rest.

If the current to the motor is interrupted through any cause, the above-mentioned solenoid operates a tripping lever which automatically applies the brakes.

If the air supply to the brake engines fails or falls below



Cascade Motor, Gearing &c. Sandycroft Electric Winder.

a certain pressure, the brakes are again automatically applied, and the current to the motor cut off; this is done by means of a small air cylinder, to the underside of which is connected an air pipe from the brake engine supply pipe.

A weighted trip lever is attached to the piston rod, and when the air is above a certain pressure this lever is held in its top position, but if the pressure falls, the weighted lever overcomes the resistance of the air pressure on the piston, and falls to its lowest position, at the same time operating the brakes, and cutting off the current supply to the motor.

On the driver's platform is an emergency hand lever, which, when operated by the driver in case of sudden need to stop the winder, trips the gear under platform, operates the brakes, and cuts off the current; the gear can be reset again by moving the emergency lever in the opposite direction, when winding can be resumed.

An interlocking gear is provided, by means of which the clutch cannot be taken out without the brakes are on, or the brakes taken off until the clutch has again been put in.

A recording apparatus is fixed on the platform, driven from the countershaft by chain gear; this records by diagram the speed and time of each wind, also the number of winds made. There is also a revolution counter, driven from the drum shaft.

The motor is of the Sandycroft standard slip-ring type, and is of specially heavy construction. It is capable of giving a continuous output of 400 B.H.P. and 1,200 B.H.P. during acceleration. It is wound for a 3,100-volt, 25-cycle circuit, and has 20 poles corresponding to a speed of 146 R.P.M.

The windings are rigidly supported at their ends to prevent distortion, and the insulation is of a special type to withstand the conditions found underground in India. The bearings are provided with means for adjustment in all directions, so that it is at all times possible to centre the rotor without any difficulty.

NOTES.

(*Continued from page* 272.)

Association of Electrical Station Engineers.—The following is a copy of a letter which has been sent by this Association to all the electricity supply authorities in Greater London:—

"Dear Sir,—I have been instructed by the London District Committee of the above Association to circularise all the electricity supply authorities and companies of Greater London, to request them to consider the advisability of forming a committee to discuss with the Association of Electrical Station Engineers conditions of working, hours of labour and rates of pay of the following grades employed in the generating, transforming and distribution of electricity, viz., charge engineers, mains engineers and assistants, switchboard attendants, sub-station charge engineers and assistants and others on the technical staff.

"This suggestion has been made with the hope that early steps will be taken, so that the matters referred to above can be fully discussed. The members of the Association have indicated that March 2nd might be a convenient date for a discussion should you consider this matter favourably, but would of course be quite willing to vary this date to suit the convenience of any committee that may be formed.

"Whilst aware of and appreciating the fact that the relations between some supply authorities and their employés are all that can be desired, yet it is thought that much good would result to the electrical supply industry generally if there existed a medium through which all questions between the supply authorities and their employés could be impartially and carefully considered, and also to define the various grades.

"Trusting to receive an early reply, I am, dear Sir, yours faithfully,

"W. J. EBBEN.

"*February 9th*, 1914."

In our issue of January 23rd one of our correspondents gave Mr. Ebben's address incorrectly. It should have been given thus:—7, Vernon Road, Stratford, London, E.

The E.T.B.I. Annual Dinner.—We wish to remind our readers that the annual festival dinner of the Electrical Trades Benevolent Institution will be held on Wednesday, March 25th next, at the Trocadero Restaurant; Mr. Hugo Hirst will be in the chair. The annual general meeting of the Institution will be held at the Institution of Electrical Engineers on Wednesday, March 18th, at 2.30 p.m. The Committee trusts that the members will attend in larger numbers than has hitherto been the case. Perhaps this early notice will enable them so to arrange that they may find it possible to meet at that hour.

Electricity Supply Rifle League. The clubs composing the above League foregathered with their friends, on Saturday evening last, at the Talbot Restaurant, London Wall, the occasion being the second annual dinner and concert the members and guests numbered 81. Sir Alexander B. W. Kennedy, F.R.S., the President, occupied the chair, and was supported by the borough electrical engineers of Shoreditch (Mr. C. Newton Russell), Hackney (Mr. L. L. Robinson), Ilford (Mr. A. H. Shaw), and Mr. Spencer Hawes.

After the toast of "The King" had been duly honoured, Mr. Robinson, in proposing "The Electricity Supply Rifle League" spoke of the continued success of this organisation and the friendly intercourse which had arisen by means of the shoulder-to-shoulder matches which had been a prominent feature of the past season's campaign. He also referred to the very successful open meeting which had taken place on the Hackney Club's ranges last Empire Day, when 35 competitors had a very enjoyable time. Another such meeting would, doubtless, be arranged. He coupled with the toast the name of Mr. Mathews, the honorary secretary of the League, who was unfailing in his efforts to promote the welfare of the competition.

The toast was accorded musical honours, after which Mr. Mathews thanked the company present for the hearty manner in which the toast had been received. He regretted that Stepney were withdrawing from the competition; on the other hand, three new clubs had entered from the City of London, County of London, and North Metropolitan (Brimsdown) Companies.

Mr. Russell proposed the health of the President, who, in responding, suggested that it was time they had someone else to fill the position which he held, and that one of the municipal engineers should have the post.

Mr. Shaw proposed "The Visitors," for whom Mr. Hawes responded in humorous vein.

The toast of "The Artistes" was proposed by Mr. Gaze in a few well-chosen words, and Mr. Stevens suitably responded. The musical arrangements were under the able direction of Mr. J. F. Heathman (Hackney).

During the evening medals were presented to the members of the Westminster team, who had again won the championship, the recipients being Messrs. W. J. D. Partridge (captain), W. A. Pearman (hon. sec.), H. A. Pearman, F. Winchcombe, E. Neville, R. Litt, G. Horley, W. Llewhellin.

A pleasant surprise was sprung upon the hon. secretary of the league (Mr. Mathews) by the presentation to him of a handsome chiming timepiece from the affiliated clubs in recognition of his untiring efforts in furthering the interests of the League, and the able manner in which he had undertaken the arrangements for the open-air meeting last year. In accepting the testimonial the recipient said that his efforts had been successful because he had been well supported by all the members of the various clubs.

The Lighting of Sanatoria.—Mr. E. T. Hale, F.R.I.B.A., at the Royal Sanitary Institute, on Tuesday, described the buildings he has designed, and the arrangements made for the King Edward VII Welsh National Memorial Sanatorium at Pont-y-Wal, South Wales, which will be the largest in the country. The lighting throughout and the power for driving all machinery will be by electricity generated in the power house. In the discussion, Dr. Robertson, Medical Officer of Health for Birmingham, expressed the opinion that electricity was the only lighting possible in sanatoria. He had tried other methods, but the constant draughts made them more or less failures.

Senghenydd Disaster.—The Home Office inquiry was resumed at Cardiff on Thursday last week by Mr. Redmayne. Evidence was given regarding the use of electricity at Senghenydd, and Prof. Thornton gave a demonstration showing how the sparking of a bell could be suppressed by a small modification of the construction of the bell.

On Friday, Mr. Robert Nelson gave evidence. He considered that there was not sufficient evidence to show definitely whether ignition of gas could be produced by the signalling apparatus with a pressure of 9 volts, but said it was common ground that 13½ volts would cause ignition. He distrusted all sparks that were visible, and held that in all cases where safety lamps were compulsory, open sparking should be prohibited. He stood alone as Adviser to the Home Office on the application of electricity in mines. The Commissioner sat again this week.

Foreign Trade in January.—The following are the electrical and machinery figures given in the official returns for January trade:—

	Month of Jan.	*Increase or decrease.*
IMPORTS.		
Electrical goods and apparatus, excluding machinery and uninsulated wire	£138,511	+ £2,319
Machinery	599,391	— 74,536
EXPORTS.		
Electrical goods and apparatus, excluding machinery and uninsulated wire	253,721	— 114,897
Machinery	3,387,733	+ 275,261

The Science of Illumination.—In the review on Dr. Bloch's book, published on page 243 of our last issue, the second equation was incorrectly stated. The term on the left-hand should be not I_0, but $I_{\triangledown}$, referring to the mean lower hemispherical candle-power.

Late Legal.—Osram Lamp Works *v.* Gabriel Lamp Co. —An important point to litigants in patent actions with reference to the obligation to answer interrogatories came before Mr. Justice Eve, in the Chancery Division, on Wednesday, when his Lordship heard a procedure in the action Osram Lamp Works, Ltd., against the Gabriel Lamp Co. (the Electrical and General Works, Ltd.), of 15, Victoria Street, Westminster. Mr. Hunter Gray, for the Osram Lamp Works, Ltd., remarked that in cases of this kind there was sometimes a difficulty in finding out how the particular article complained of was made.

His Lordship: These cases often go to the Court of Appeal, which does not lay down any particular principle.

Mr. Gray: I am going to ask your Lordship to deal with this one on its merits. The matter in question was a patent for making metal-filament lamps. They were made now from a metal called tungsten, and certain additions had been made to the metal in order to get a coherent filament. The patent related to that. The filament having been made, it was possible, by certain tests, more or less, to see how it was made, for when it was raised to a very high temperature certain ingredients more or less disappeared. His *prima facie* evidence was that these filaments had been analysed, and in the opinion of his experts they must have been made by a patented process. The evidence was very definite on that point. These filaments were manufactured abroad and sent over to this country, and the result was that the plaintiffs could not get inspection, and the agents who sold them here professed absolute ignorance as to how they were made, and refused to give the source. By getting evidence from abroad the plaintiffs would be able to say how they were made. The matter came before Mr. Justice Joyce, and he ordered the defendants to answer certain interrogatories. Counsel for the defendants, however, refused to give the name of the source, and defendants said they had made inquiries among their directors, and they could not give the information as to the method of manufacture.

The first interrogatory which the plaintiffs wanted to be properly answered was: "Were the lamps or any of them manufactured wholly or in part by the Compagnie Générale d'Electricité, of Paris?" That the defendants objected to. The next interrogatory was also important, and was: "Were the filaments prepared by mixing tungsten with some organic binding medium?" Defendants replied that they did not know.

Mr. Swan, for the defendants, said his clients were merely factors in this country.

His Lordship: I should think you would be only too anxious to tell Mr. Gray where the guilt lies, if there be any guilt.

Mr. Swan replied that his clients took up their attitude on a matter of principle. The identity of the suppliers of the lamps was not strictly a matter relevant to any question which was an issue in the action. The first interrogatory was only put in order to enable the plaintiffs to get information which might be of assistance to them in arriving at this process. In order for that to be of assistance to them, they must prove other facts.

Mr. Gray: My clients say that if they get the name of the firm from whom the defendants got these lamps, they will be in a position to prove what the process is. They may get to know there is no infringement, and thereby save the time of the Court.

His Lordship: The difficulty I feel is whether, as a matter of principle, such an interrogatory ought to be answered, because there may be many cases in which it is only enabling you to know where to start your inquiries. Is that the sort of thing to be extracted from a defendant at an early stage of the action?

Mr. Gray: The defendants are a limited company trading in an unlimited name. My friend does not say there is any hardship in telling; he is only here on principle.

His Lordship said it was possible the parties might desire to take the matter to the Court of Appeal, and he would therefore reserve his judgment.

Morgan Crucible Co., Ltd., *v.* Electrical Engineering and Equipment Co., Ltd.—In the Chancery Division on Wednesday, February 11th, Mr. Justice Eve had before him a motion for judgment in this action.

Mr. Hunter Gray, for the plaintiffs, said it was a motion for judgment in default of appearance. The action was for infringement of two letters patent. The minutes of the proposed judgment were in the usual form.

His Lordship: Very well. You can take the order.

Institution and Lecture Notes. — Birmingham Wireless Association.—A meeting was held on February 4th, which was addressed by Mr. H. von Kramer, on the "Railophone and the K.K. Detector," which were devised for the automatic prevention of collisions on railways, by bringing any train to a standstill which endeavours to pass a home signal at danger.

The essential feature of the "K.K." detector (which was described in our issue of October 11th, 1912) is a steel reed which when vibrating freely, has a frequency of 100 per second. This reed is placed between two similar magnetic poles which are acted upon by alternating current of 100 frequency induced from the track circuit. The normal condition of the reed is a state of vibration, contacts keeping open in the relay circuit connected to the vacuum hooter and brake. The arrangement for keeping the contacts open is very ingenious. Two non-magnetic reeds make contact with the steel one, one on each side, but being of a natural oscillation frequency of 20 per second, only make contact for one out of every five oscillations when the central steel reed is vibrating. This intermittent contact has the same effect as if the contact were quite broken. When a home signal at danger is being approached, a portion of the track circuit is shunted automatically by the signal itself, the reed ceases to vibrate, the contacts are closed in the circuit which operates the vacuum hooter, and the air entering the hooter passes into the vacuum brake system.

The system is now working satisfactorily on some German and Indian Railways, and is being installed by a leading English railway company.

Association of Electrical Station Engineers.—A meeting of the Manchester Branch was held on February 5th. The subject of the "Weekly Rest Day Bill" was first introduced, and the clauses which have special application to engineers in supply stations were read and discussed. The meeting expressed its entire approval of the aims of the Bill, and cordially welcomed the suggestions made by Lord Henry Cavendish Bentinck with regard to the best means of supporting it. The secretary was instructed to write the various M.P's. in the district, soliciting their support for the Bill. The recent events in London then came up for discussion, and a letter from the hon. sec. London was read, and was received with many cordial expressions of approval. A hearty vote was carried, thanking the hon. sec. London, for the thorough and painstaking way in which he had sought to explain the situation in London, and to clear the air of many unfounded rumours and unreliable statements. The following proposition was then carried without dissent: "That this meeting readily supports the London Branch in their contemplated resolution of entering into negotiations with the London supply authorities, and is prepared to co-operate with them in their endeavour to improve the conditions of station engineers." Numerous comments were then made on the clauses which the North Metropolitan Power Co. are inserting in one of their power supply Bills, penalising strikes of their employés, and an urgent resolution was passed and forwarded to the Executive for their immediate consideration.

Institution of Electrical Engineers.—At the meeting of the Manchester Local Section on Tuesday last, a paper was read by Mr. L. J. Hunt, on "The Cascade Induction Motor." The discussion was closed.

At a meeting of the Yorkshire Local Section at Leeds on Wednesday, Mr. L. J. Hunt read a paper on "The Cascade Induction Motor." The discussion was closed.

Royal Institution of Great Britain.—A series of afternoon lectures on "Heat and Cold," is to be given by Prof. C. F. Jenkin, M.Inst.C.E., on Thursdays, March 5th, 12th and 19th.

North Staffordshire Institute of Mining and Mechanical Engineers.—At a meeting last week at Stoke, Mr. Robert Nelson, H.M. Electrical Inspector of Mines, read a paper on the use of electricity in mines, specially addressed to colliery managers, and being a continuation of the paper Mr. Nelson read to the Institute in January last year.

Physical Society of London.—At the meeting held on January 23rd, a paper entitled "Some Characteristic Curves and Sensitiveness Tests of Crystal and other Detectors" was read by Mr. P. R. Coursey. The paper describes some experiments recently conducted on different types of wireless detectors, which were undertaken with a view to finding out whether any definite relation could be traced between the sensitiveness and characteristic (or volt-ampere) curves of a detector. Mr. W. Duddell, F.R.S., exhibited a water model of the musical electric arc.

At Cambridge, on January 30th, Mr. Hugo Hirst addressed a large audience on "The Manufacturer and University Men." He said that the tendency was more and more towards big trusts, and combines, and syndicates, which were crowding out the old-fashioned family firms. The larger buying capacities of Governments, municipalities, and public bodies all over the world, required a method of doing business formerly unknown, and men that were of education and social standing, the equals of the higher type of civil servants, would have opportunities to excel. Speaking of the national value of industrial business, he said that in modern times the flag followed trade, and not the reverse, as was the common belief, and assured his hearers that imagination and idealism played an important part in business. If our industries were to hold their own, we had, like other nations, to attract our most brilliant minds into business.

Institute of Marine Engineers.—Particulars have been issued of the Lloyd's Register Scholarships, which are awarded in connection with the Institute, and can be obtained from the Hon. Secretary, 58, Romford Road, E.

Mr. R. F. Laurence, of London, gave a lecture in the Hull City Hall on Monday evening on "Correct Illumination," for the Hull Corporation Electricity Department. The Corporation is making great efforts just now to popularise the electric light, and is communicating with all the best class of residents.

Inquiries.—A Colonial correspondent inquires for cork, felt, or other material suitable for the foundations of rotary converters, for the prevention of noise and vibration; and for thermostats suitable for use with water heaters, to cut in and out of circuit heating elements taking five or 10 amperes, 250 volts, direct-current. The thermostats to be controlled by the temperature of the water.

For Sale.—The South Shields Corporation has for disposal, by tender, one triple expansion open-type marine engine, with surface condenser and air-pump, coupled to one 200-KW. single-phase alternator, with direct-coupled exciter, particulars of which are given in our advertisement pages.

Fatality.—An evening paper reports that Mr. Charles Henry Scrivens, of Bristol, has been killed by coming into contact with an electric wire at Healy Falls, Ontario.

Annual Dinners.—On Wednesday last the Tunbridge Wells electricity staff held their tenth annual dinner. It was presided over by Mr. R. N. Torpy (borough electrical engineer), and proved a great success. The chairman of the Lighting Committee (Mr. Willmot) switched on the first "half-watt" lamp in Tunbridge Wells, flooding the room with brilliancy. Mr. Torpy had a good report to give concerning the progress of the undertaking, and stated that the apparatus connected during last November and December was greater than that connected during the whole of the preceding 12 months, and the increase in their maximum load was five times the increase of the previous year. He gave some interesting details with regard to the new "half-watt" lamp, and the effect it would have upon lighting stations, adding that they were prepared to face the situation with a bold front. Mr. Councillor Brown paid a tribute to the efficiency of the staff, and welcomed into their midst Mr. J. E. Pownell, who had recently come among them from Hampstead. A musical programme followed. The local wiring contractors turned up in strong muster, showing that good feelings are still maintained between the department and themselves.

Mr. C. D. Taite presided at the seventh annual dinner of the Lancashire Electric Power Co. held in Manchester recently, which was attended by about 140 persons. Mr. J. W. Barlow, clerk of the Ramsbottom District Council, in proposing "The Lancashire Electric Power Co.," declared that the company could do for the smaller authorities what they could not do for themselves in the direction of electricity supply, and small towns were thereby brought comparatively into line with cities and big towns, and the public benefited. His own Council had wisely associated itself in electricity matters with the company, and they were quite contented. He considered that the supply of electricity for industrial purposes was eminently conducive to the prosperity of a district, wherever used, and the company had been, and was destined still more to be, a most important factor in the prosperity of districts through which its mains were carried. The company had weathered the storms, prejudices had been overcome, and he hoped the future would be full of prosperity. Dr. Parshall, who responded, said the board of directors now felt that the enormous expenditure to which they had gone, amounting to some £600,000, was about to be justified by results. The toast of "The Guests" was proposed by Mr. H. C. Levis, a director of the company; and Mr. Fred. Howarth, of Farnworth, responded. Other toasts were honoured, and an excellent programme of music was submitted.

The B.E.A.M.A. Conditions.—The following letter came to hand after our "Correspondence" columns were closed:—

"With reference to the correspondence in your paper *re* the above, I think it is only fair to the B.E.A.M.A. to draw attention to the fact that the municipalities have brought the trouble on themselves.

"Before these conditions were framed by the manufacturers, some of the specifications and general conditions issued by Corporation engineers, in collaboration with the Corporation legal advisers, were so one-sided, that when trouble arose there was only one thing for the manufacturers to do, and that was—pay up and look as pleasant as possible. There was, however, such competition for municipal work, that little difficulty was experienced in getting manufacturers to sign the contracts, and if they raised any feeble protests about the almightiness of the engineer, it was parried by their being told that the clauses were for the most part merely formal, and that all they had to do was to carry out the work and receive payment. In some cases where the engineer had a broad and reasonable idea of his little place in the scheme of creation, this arrangement worked well, and it certainly had a tendency to make the contractor equally reasonable if he were not inclined to be so. Unfortunately, however, there is always with us the man who will have his 'pound of flesh'—hence the trouble. I think, however, that the boot is now on the other foot with a vengeance; at the same time, as one who has recently made a contract, I should advise any engineer, before he places a contract abroad, to use every effort to get modifications of the unreasonable clauses. I have found that this can be done, and with the exception of the terms of payment, the result appears to me to be satisfactory to both sides.

"A. Dimmack.

"Corporation Electricity Works,
"Swindon, *February 10th*, 1914."

We understand that, while the Association has not taken official action in the matter, its members are at liberty to reduce the margin of 10 per cent. on steam consumption guarantees for turbines to 2½ per cent. The stipulation was that the plant should not be actually rejected *in toto*, unless the consumption exceeded the guaranteed rate by 10 per cent.; but a penalty would be incurred in proportion to the excess percentage within that limit. As the large number of measurements necessary to the determination of the steam consumption could not be relied upon in the aggregate to an accuracy within 2½ per cent., it was felt that a stringent guarantee could not be given.

Neepsend Power Station, Sheffield.—On Monday last the Lord Mayor of Sheffield and members of the City Council paid a visit of inspection to the Neepsend power station. The visit marked the bringing into service of three additional boilers, and another 10,500 H.P. turbo-alternator. The opportunity was taken of inviting representatives of the various industries in the city, and a company of about 300 was present when the Lord Mayor opened the stop valve and set the machinery in motion.

The machinery in the engine house being in full use precluded formal speeches, but Mr. Alderman C. F. Bennett, chairman of the Electric Supply Committee, explained to the Press and others that his Committee desired to welcome the Lord Mayor and members of the City Council and the representatives of the manufacturers and trading industries of the city to view the power house on the occasion of the starting up of the latest additions to the plant.

The Electric Supply Committee, he said, believed that electricity was not only the light but also the power of the future, and they fully recognised the responsibility which rested upon them in connection with this great municipal undertaking. They believed that this power station was one of the best equipped, most efficient, and finest power stations in the United Kingdom. Its present capacity was 26,000 KW., and before the end of the year they expected it would be increased to 36,000 KW. by the addition of another turbo-alternator similar to, but still larger than, the one started by the Lord Mayor.

The capital expenditure of the whole undertaking was £1,130,656, and the cost of the station was over £200,000; when he told them that the station was designed, erected, and all the plant installed by their general manager, Mr. Fedden, without the slightest assistance from any consulting expert, he thought they would agree that they had a most efficient, capable, and satisfactory engineer and general manager at the head of their staff.

It was difficult to realise that in 1903, only 10 years ago, their total units sold were under three millions, while for last year they were nearly 22 millions, an increase of over 700 per cent. From this they might realise the progress which electricity was making. The demand was rapidly increasing, and this year they anticipated a rise to 27 millions.

After the ceremony the guests were conducted in small parties round the works, and much interest was shown in the general arrangements, and particularly in the labour-saving methods adopted with regard to the handling, or, rather, non-handling, of the coal. On returning to the engine room the guests partook of afternoon tea.

The additions to the power house comprise a new bay to accommodate six boilers, of which three are installed and in use, and an extension of the engine house to accommodate two additional turbo-alternators, one of which is now running, and the other is on order for next winter's load. Further excavations are in progress to prepare for an extension which will provide accommodation for an additional 30,000 or 40,000 H.P. of plant.

The number of workmen engaged on the site, the locomotives, cranes, aerial transporters, and other machinery present a scene of great activity, and suggest that electricity is making rapid headway in Sheffield, in spite of the severe competition with gas, to which reference has so often been made.

Time Signals by Wireless Telegraphy.—In our issue of November 7th last, we published correspondence which had taken place between Mr. F. Hope-Jones, chairman of the Wireless Society of London, and managing director of the Synchronome Co., Ltd., and the Secretary of the Post Office, regarding the proposal of the Postmaster-General to levy a tax upon the users of wireless receiving sets, such as the "Horophone," for the reception of the international time signals issued from the Eiffel Tower and Norddeich. Such apparatus could not be used for transmitting signals, but only for reception, and Mr. Hope-Jones pointed out that not only would the tax be unjust, seeing that the British Government had taken no part in the propagation of the time signals, but also in restraint of trade, as it would prevent watch and clockmakers from using the time signals for the purposes of their business, and, moreover, it would be impossible to enforce the tax, as the persons liable to pay it could not be identified. Mr. Hope-Jones has now received the following letter, in which the abandonment of the proposal is announced. It is understood that this result is largely due to the organised protest of the National Association of Goldsmiths, the British Horological Institute, and the British Science Guild, and the publicity given to the subject in the electrical and horological Press:—

"Wireless Time Signals.

"With further reference to your letter of December 16th last and previous correspondence on the subject of the issue of licences for the reception of time signals by wireless telegraphy, I am directed by the Postmaster-General to express his regret that it has not been possible to send you a definite reply at an earlier date, and to inform you that, in view of the representations made by you and others, he has decided not to require payment of an annual royalty for licences issued in respect of apparatus intended for this purpose. The fee of £1 1s., which is charged to cover the office expenses connected with the issue of the licence and the inspection of the installation, will, however, still be payable by applicants for such licences.

"I am, Sir,
"Your obedient servant,
"(Signed) E. Crabb.
"On behalf of the Secretary of the P.O.

"F. Hope-Jones, Esq., M.I.E.E.,
"32 and 34, Clerkenwell Road, E.C."

Appointments Vacant.—Mains superintendent for Hammersmith electricity department (£150); district representative for Woolwich Corporation electricity department (£130); station superintendent for Worksop U.D.C. (£80); borough electrical engineer (£1,000) for Salford. Particulars are given in our advertisement pages.

Provisional Orders Revoked.—In the *London Gazette* for February 6th notices of revocation of the following prov. orders by the Board of Trade were published :—

Leadgate, 1902, Order.
Stanley (Durham), 1902, Order.
South Bank in Normanby, 1902, Order.
Eston, 1902, Order.
Redcar, 1900, Order.

Annual Social.—Messrs. Gent & Co.'s employés held their fourth annual social and dance last Friday evening at the Queen's Hall, Leicester. Over 250 of the employés and their friends were present. The first part of the programme consisted of a concert, the artistes being drawn entirely from Faraday Works. After an interval for refreshments, a select dance programme was commenced, which lasted until a late hour.

Unions Against Amalgamation.—The *Daily Citizen* states that, on the proposal to amalgamate all the Unions of enginemen, crane workers, electrical workers, and kindred trades in one national federation, the Executive Council of the Northumberland Colliery Enginemen and Firemen has decided adversely.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Bristol City Council, on Tuesday, had under consideration the salaries of several members of the Electrical Committee's staff. The matter, with applications from numerous other city officials, had been relegated to a Special Committee, which recommended the following increases :—Mr. Faraday Proctor, engineer and manager; entered the service of the Corporation in 1893; commencing salary, £260; present salary, £800, reached in 1902; recommended an increase to £900, by two instalments of £50 each. Mr. F. W. Prosser, sales manager and secretary; entered the service in 1893, at £170; present salary, £300; proposed increase to £350, by two increments of £25. Mr. R. Parker, station foreman, entered service in 1893, at £130; present salary, £156, to be increased to £169. Mr. J. Daggan, outside foreman, entered service in 1894, at £130; present salary, £156, to be increased to £169. Ald. Pearson, chairman of the Electrical Committee, spoke of the growth of the undertaking and the valuable work of Mr. Faraday Proctor. The report met with very little opposition, and all its recommendations were carried.

The Dewsbury B.C. at its last meeting approved a recommendation that the salary of the borough electrical engineer (Mr. R. H. Campion) be increased from £375 to £400 per annum.

Mr. F. G. Jones, who has held the appointment of engineer-in-charge under the Plymouth Corporation electricity department for the past 12½ years, eight years as senior engineer-in-charge, has lately been promoted to the position of mains superintendent at Plymouth.

Mr. E. G. Baker, mains assistant to the Motherwell Corporation, has been appointed assistant distribution engineer to the Morecambe Corporation.

In accordance with the notice given, the Sheffield City Council is being recommended to increase the salary of Mr. H. E. Yerbury, the chief electrical engineer of the tramways department, from £500 to £550 per annum as from July 22nd last, with further increases of £25 per annum to a maximum of £600, after approved service; also the salary of Mr. S. E. Fedden, the general manager of the electricity works, from £800 to £900 per annum, and subsequently by annual increments of £25, to a maximum of £1,000. The Electric Supply Committee proposes to promote Mr. A. W. Bush to be first assistant in the publicity department, at an increased salary, and has appointed Mr. W. J. R. Fox to the post of canvasser, rendered vacant by the resignation of Mr. H. E. Betts, at a salary of £91 per annum. The Committee states that this rearrangement will result in the saving of £16 a year.

We learn from South Africa that Mr. R. Turnbull Mawdesley, who was recently assistant engineer at the Borough of Southwark electricity works, has been appointed assistant at the Johannesburg municipal power station at £12 per week.

The Worksop U.D.C. has increased the salary of Mr. H. A. Best, assistant engineer at the electricity works, from £120 to £130 per annum.

The Dover T.C. has appointed Mr. H. J. Penfold as junior charge engineer at the electricity works at £78 per annum.

The Hackney B.C. is being recommended to grant the following increases to its employés in the electricity department :—Mr. E. Mathews, testing engineer, from £130 to £140 per annum, and subsequently by annual increments of £10 to £180; Mr. E. Wilkinson, generating engineer, from £117 to £127 10s. per annum, rising by annual increments of £7 10s. to £150; Mr. W. Barham, electrical draughtsman, £180 to £187 10s., and by annual increments of £7 10s. to £210; Mr. J. Brooks, storekeeper, from £111 to £117 10s. to the maximum of £120 on April 1st, 1915.

On relinquishing the appointment of manager of the Sheerness Electric Power and Traction Co., Mr. C. W. Durnford has been presented with a case of silver tea-knives and a fountain pen by the staff.

Stockport Town Council on Wednesday last week increased the salary of the electrical engineer from £500 to £600 per annum.

Mr. H. Gregg, mains and distribution engineer to the Woking Electric Supply Co., Ltd., has resigned his position, after 13 years' service, on the staff of the company.

Tramway Officials. — Oldham T.C. has decided to increase the salary of the general manager of the tramways by £50 per annum.

Out of 120 applicants for the post of traffic superintendent of the Ayr Corporation tramways, Mr. J. Brown, traffic inspector of the Doncaster tramways department, has been appointed.

General. — Mr. John Key, for 13 years works manager to Richardsons, Westgarth & Co., Ltd., of Middlesbrough, who is leaving to take up a similar position at Kirkcaldy, was, on February 6th, presented by the staff and employés with an inscribed gold watch, with an ornamented gold pendant for Mrs. Key.

At the annual meeting of Nelson Tradesmen's Association last week, Mr. B. Schabatt, electrical engineer, was re-elected to the position of President.

Mr. R. E. Mitchell, Canadian manager for the Harland Engineering Co., Deansgate, Manchester, announces that after the 14th inst. he takes up the position as Scottish sales engineer, for the Electrical Apparatus Co., of London, residing at Glasgow.

Friends of Mr. S. W. Tucker will be pleased to hear that he has now resumed his duties as head of the order department of Messrs. Baxter & Caunter, Ltd., after a severe illness.

At Brompton Parish Church on February 4th, the marriage took place of Mr. Hugh Sharman, formerly assistant engineer to the Chelmsford E.L. Corporation, Ltd., and now of Canada, and Miss F. M. Smith, of Chelmsford.

Mr. Frank Ashton, foreman to Messrs. Crompton & Co., Ltd., at the Arc Works, Chelmsford, who is retiring after 30 years' service, has been presented by the apprentices and workmen with an easy chair.

Mr. Hugh L. Cooper announces that he has completed the water-power development of the Mississippi River Power Co. at Keokuk, Iowa, and that he will practice in general hydraulic engineering at 101, Park Avenue, New York City.

Mr. J. Elstone, who has left the Trafford Park works of the British Westinghouse Electric and Manufacturing Co., Ltd., has been presented by his late colleagues with a clock and pair of bronzes.

Obituary.—Mr. W. E. Cawte.—The death took place on February 4th of Mr. Walter E. Cawte, formerly in business at Taunton as an electrical engineer and contractor. He served his apprenticeship at the Taunton E.L. Works, and was 43 years of age.

We regret to record the death of Lady Bright, widow of the late Sir Charles Tilston Bright, of submarine cable fame. It is stated that the deceased lady was on board with her husband with the expedition which laid the first successful cable to Ireland, and that this is the only occasion on which a lady has been aboard during actual cable-laying operations. To Mr. Charles Bright, so well known to our readers, and to the other members of the family, we offer our sincere sympathy.

CITY NOTES.

City and South London Railway Co.

The directors report that the gross receipts of the railway, &c. during the year were £147,470, and the expenditure was £91,607 = £55,864, plus miscellaneous receipts (net) from rents, &c, £8,201, making the total net income £64,065. The balance brought forward was £2,588 and there had to be deducted interest, rentals and other fixed charges amounting to £28,951, leaving £37,702. Dividend on preference stocks require £42,500, less chargeable to capital under provisions of Act of 1913, £7,386. There is thus £2,588 balance available for dividend on consolidated ordinary stock. The interim dividend at the rate of 5s. per cent. per annum which was paid on the consolidated ordinary stock for the first half of the year ended December 31st, 1913, absorbed £1,850, leaving £738 to be carried forward. The dividends paid on the consolidated ordinary stock for the year 1912 were at the rate of 17s. 6d. per cent. with a balance of £2,588 carried forward, after setting aside £3,000 for renewals. The capital expenditure during the year amounted to £7,758. The following Bills will be submitted for the consideration of the proprietors at a special general meeting to be held immediately after the ordinary meeting on Wednesday next, viz. :—

A Bill to empower the Central London Railway Co. to enlarge a portion of their railway tunnels; to construct new subways and works; and for other purposes.

A Bill to empower the London Electric Railway Co. to construct new subways; and for other purposes.

In accordance with the powers conferred on the company by the City and South London Railway Act of 1913, the balance of the year's dividend on the 5 per cent. preference stock issued in 1903 will be charged to capital. The directors regret to report the death of Mr. W. F. Knight, who was secretary of the company from 1891 to 1912.

Metropolitan Railway Co.

The report of the directors for the year ended December 31st, 1913, contains accounts covering the whole period, and in consequence of the adoption of the new form of Accounts the usual comparison of figures cannot be given

The following is a summary of the receipts and expenditure on Revenue Account :—

The gross receipts of railway, etc., were £914,307, and the expenditure was £522,910—£391,397. Miscellaneous receipts (net) from rents, interest, etc., amounted to £176,441, making the total net income £567,838, plus £9,406 brought forward. Deducting interest, rentals, and other fixed charges, and appropriating to renewals £252,560 and to dividends on Preference stocks £211,182, there remains a balance available for dividend on ordinary stock, of £113,292. The interim dividend at the rate of £1 10s. per cent. per annum, which was paid on the Ordinary stock for the half-year ended June 30th, 1913, absorbed £48,163, leaving a balance of £64,829, which will admit of the payment of a dividend at the rate of £1 5s. per cent. per annum for the half-year ended December 31st, 1913, making £1 12s. 6d. per cent. for the year, and leaving a balance of £8,258 to be carried forward. The dividends paid on the Ordinary stock for the year 1912 were £1 12s. 6d. per cent., with a balance of £9,496 carried forward. The Electrical Depreciation Fund now stands at £65,821, and it is not considered necessary to make any further addition to that fund at the present time. A General Renewals Fund has, however, been created, and £12,500 has been transferred to it. The dividend on the surplus land stock is at the same rate as for 1912, namely, £2 15s. per cent. per annum. The high price of coal and other materials during the year, coupled with the enhanced rates of wages paid to the staff, have had the effect of seriously increasing the expenses, but as the result of economies in working and the opening up of new sources of revenue the same dividend as in the previous year is recommended. The competition of motor omnibus services continued to have an adverse effect upon the short-distance passenger traffic throughout the year, but there are indications that this competition is becoming less severe. Outside the competitive area traffic continues to develop, and the additional facilities for dealing with it which will be afforded by the widening of the line between Finchley Road and Wembley Park will assist materially in this direction. The season ticket business maintains the steady progress which it has shown for some years past, and the receipts from goods and mineral traffic also show a satisfactory advance. The policy of developing the company's surplus lands and properties and of utilising open spaces over the line has been continued, with the result that the rents again show the substantial increase for the year of £4,500. Compared with the year 1907, the rents have increased by the annual sum of £20,000. The Great Northern and City Railway was formally vested in the company's undertaking on July 1st last, and the receipts and expenses of that line from the date named are included in the figures now presented. The installation of special grates for the boilers in the generating station at Neasden has enabled the company to make use of less expensive descriptions of coal, and considerable economy has resulted therefrom. In order that the current for working the G.N. and City line may be obtained on the most economical basis, provision is being made for its supply from the Neasden generating station. Contracts have been placed and the works are in progress. They include the erection of a sub-station with the necessary equipment at Drayton Park, the installation of additional switchgear at the Moorgate Street sub-station, and the requisite connecting cables.

The East London Railway was opened for Electrical Passenger Train working on 31st March last, and a steady improvement in the earnings of that Railway is being shown. In accordance with an arrangement entered into with the Lessee Companies of the East London Line the Train Service is being provided and worked by this Company. A new Station was opened on the Uxbridge Branch at West Harrow for Passenger Traffic on 17th November last. It has already proved to be a great convenience to the public and will be an important factor in the development of building operations in the district.

The Directors have been considering for some time past what course should be taken to improve the earning capacity of the Hammersmith and City Railway—which is the joint property of the Metropolitan and Great Western Companies—and to develop the traffic upon it. As a step in this direction, an agreement has been entered into with the Great Western Company, under which the Line will in future be more directly under the management of this Company, and a number of improvements, including the construction of new Stations at Goldhawk Road and Uxbridge Road respectively, are provided for. There is every reason to believe that these measures will result in an appreciable increase of traffic.

Arrangements are being made with the L. and S.W.R. Co. for the running of a through electrical service of this Company's trains between the City and Richmond *viâ* the Hammersmith Line. The widening of the Line between Finchley Road and Wembley Park and the reconstruction of the Stations at Finchley Road and Neasden have advanced rapidly during the year. Sections of the widened Lines have been completed and brought into use, affording greatly improved facilities in the working of the Train Service.

The erection of the General Offices at Baker Street has been completed during the year, and the various departments which have hitherto been located at different parts of the line have been transferred to them.

The re-construction of Praed Street Station, Paddington, is nearly completed, and arrangements have already been made for the occupation of the new shops and tea-room at satisfactory rentals.

The arrangements with the Strand Hotel Co., Ltd., for the building by this Company of an hotel on the site created over and adjoining the new Station at Baker Street have necessitated the purchase of some further properties. These have now been acquired, and a contract for the execution of the work will shortly be entered into.

In order to afford increased facilities for through communication between the Company's Railway and the Baker Street and Waterloo Railway at Baker Street, an agreement has been entered into with the London Electric Railway Co. for the installation at joint expense of Escalators at that Station. A contract for carrying out the works has been let, and the necessary excavations are being proceeded with.

The [illegible] Watford [illegible] direction of the [illegible]

A resolution will be submitted at the conclusion of the ordinary business with a view to the creation of the capital authorised by the Metropolitan Railway Act, 1913.

The Bill promoted by the company in the last Session of Parliament for the acquisition of the Great Northern and City Railway by the company received the Royal assent on August 15th last, and the extension of that line from Moorgate Street to Lothbury was also sanctioned. After the purchase of the G.N. and City undertaking was arranged, the Great Northern Co. approached this company with a view to their becoming partners in the line, and the negotiations that ensued resulted in an agreement for the promotion of a joint Bill, which has been deposited and of which the following are the main objects :—

(1) The G.N. Co. at their own expense to construct a junction between their line and the G.N. and City Railway in the neighbourhood of Drayton Park, which will enable their main line suburban trains to be brought through to the City, and so accomplish the original object of the undertaking.

(2) The G.N. Co. to bear one half the expense of constructing the proposed railway to form a junction with the Metropolitan Inner Circle Railway and the extension of the line from its present terminus at Moorgate Street to Lothbury and the Bank.

(3) A joint Committee of the Metropolitan and G.N. Companies to take a lease of the G.N. and City line at a rent equal to the dividend on the stocks of the Metropolitan Co. issued as the purchase price to Shareholders of the G.N. and City Co.

(4) All profits earned above the rent to be divided equally between the two Companies.

Paisley District Tramways Co.

The directors' report for the year ended December 31st, 1913, shows that the revenue was £62,876, and the expenses were £41,476, leaving £21,400, less general interest £659, interest on debentures, including interest on debentures redeemed carried to sinking fund £3,200, debenture sinking fund £1,500. Including the balance brought forward (£2,444) there remains £18,485. Out of this £4,500 has been placed to general reserve account, 5 per cent. dividend on the preference shares absorbs £7,500, preference share sinking fund £2,000; and £1,620 was paid in ordinary interim dividend for the June half-year. £2,865 is to be carried forward. The traffic receipts show an increase of £4,129, and the expenses an increase of £5,807, as compared with the receipts and expenses for the year 1912. The increase in expenses, although partly due to running an additional service of cars and increase in local rates, was mainly owing to increased cost for the maintenance of the track and roadway. This is largely due to damage caused by the increasing heavy traffic of motor lorries and other heavy traffic. The matter is engaging the very serious attention of the directors, but they regret to say that during the current year they do not anticipate any relief in this respect. A dividend on the ordinary shares was paid for the first six months of the year at the rate of 2 per cent., but owing to this heavy expenditure they think it advisable not to pay any further amount this year but to increase the carry forward.

Year ending—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
Dec., 1911 ..	17·98	12,496,105	£54,857	1·05d.	1,167 523	56
Dec., 1912 ..	17 98	13,459,662	£58,329	1·04d.	1 264,323	60
Dec., 1913 ..	18·25	14,403,189	£62,459	1·04d.	1,349,462	60

Bristol Tramways and Carriage Co., Ltd.

The directors' report for the year ending December 31st, 1913, states that the gross receipts were £423,816, and the working and general expenses and renewals £343,583, leaving a net revenue of £80,234. From the net revenue amounts have already been distributed for debenture and other interest, 4 per cent. preference dividend, and 4 per cent. interim dividend on the ordinary shares for the June half-year, and it is proposed to appropriate the balance as follows :—Final dividend for half-year at the rate of 5 per cent. per annum (subject to income-tax), £11,771; addition to reserve fund for contingencies and renewals, £8,361. The interest on investments has been, as usual, carried direct to the credit of the reserve fund, and after deducting discount and expenses on the issue of debenture stock last year, the reserve fund stood at £239,203, but with the addition of £8,361 now proposed it will be further augmented to £247,565. The receipts from the tramways department show an increase of £13,146, or 5¾ per cent., whilst those of the carriage department have increased by £10,956, or 30½ per cent. The total number of passengers carried during the year on cars and motor-omnibuses was 56,790,399, an increase of 4,419,884.

"The motor constructional works at Brislington were completed in June, when many of the shareholders availed themselves of the opportunity of inspecting the establishment and realising the extent and completeness of its equipment, as also that additional efficiency had undoubtedly been gained by the motor works being wholly separated from the tramway car building works. The only unbuilt-upon land adjoining the motor works, containing a similar area of 4¼ acres, has recently been purchased for the purposes of future extensions. The branch businesses at Bath, Cheltenham, Gloucester and Weston-super-Mare continue to show satisfactory expansion, whilst the new motor-omnibus direct services from the centre of the city to Avonmouth and New Clifton have proved so popular as to necessitate the provision of more omnibuses on both routes, and these will be put into service at an early date. The company's system comprises 17 distinct tramway services and 15 motor-omnibus services; the latter will be further increased in the ensuing summer. A large additional number of pleasure char-à-bancs are also being constructed, as this branch of the business is rapidly developing. A Bill is being promoted "to empower the Corporation of Bristol to work any tramways purchased or belonging to them." There are no tramways belonging to the Corporation, neither have they as yet been able to decide whether or not to purchase any tramways. The Bill is, in fact, premature, and without precedent, and will receive the determined opposition of the directors.

Smithfield Markets Electric Supply Co., Ltd.

Sir Herbert S. Leon, Bart., presided on Tuesday at the offices, 57, Charterhouse Street, E.C., over the annual meeting of this company.

In proposing the adoption of the report (see Elec. Rev., p. 208), he said that the result of the year's working showed an improvement on that of the previous year, chiefly owing to the economies effected in the cost of production. The output was a little less than the previous year, but still it was maintained within about 1 per cent. This was owing of course to the keen competition of the Gas Company; but in spite of it they managed to hold their own pretty well. In the capital account the value of the plant and machinery had been written down by no less than £2,758. This value represented the old plant, taken out to make room for the new oil engines. The original cost of the old plant, less the amount realized on the sale, had been entirely taken from the depreciation fund; and to make up this the board had thought it wise to continue to build up this fund so as to always have cash available for such purposes. Under the head of revenue account the gross profits showed a substantial increase, amounting to 11 per cent. over the figure for the previous year; they would have been even greater but for the difficulty they had had to contend with in consequence of the new plant. On the other hand there had been a slight decrease in the receipts from the sale of current. The price received per unit was less, and they had also received less revenue from consumers. One could only assume reasons for these two things and he supposed they were due to the variations in the market trade conditions. Turning to net revenue account, before providing for depreciation and debenture stock sinking fund, it showed an increase of £812 over last year, and the amount available, including the amount brought forward during 1912, made it possible for the board to recommend a slightly larger dividend, namely 2½ per cent. as against 2 per cent. The cash reserves of the company showed an increase of over £2,000, against which it would be noticed that there was the liability to the Diesel Company, which would be paid when satisfactory fulfilment of the contract took place. There had been an increase in the number of lamps installed in spite of the competition of the Gas Company; but the returns per lamp still showed a tendency to fall. He would prefer not to make any prophesies as to future prospects, but the board continued to have absolute and complete faith in the superiority of the electric light over gas. Perhaps the race might be a long one, but electricity was bound to win. On the other side they had to face a probable rise in prices of all the necessaries which they must have in the working of the plant. Another thing, rather against them, which was looming ahead was the ½-watt lamp which, if it became commercially possible might inflict some loss upon them, although they hoped the loss would be only temporary. The moral of all this was that it was absolutely necessary for the company to go on building up its cash reserves so as to be able to meet all emergencies which might occur, and he thought the shareholders would agree with this.

Mr. J. Browne Martin seconded the motion.

Mr. Galloway said he saw there was a likelihood of the electrical supply companies of London being taken over by the County Council, but he did not see their company mentioned. He would also like to know if the Diesel oil engines were giving satisfaction.

The Chairman said they obtained their charter from the City Corporation and therefore did not come in as an electrical supply company under the County of London.

Mr. Galloway asked if it would not be an advantage if they were to be taken over.

The Chairman said that might be or might not, but as a matter of fact they were in a different position from the other companies. The Diesel oil plant was not working satisfactorily, but the board were trying their best to surmount the difficulties.

The report was adopted.

National Electric Supply Co., Ltd.

Mr. John Booth presiding at the annual meeting held at Preston on February 4th, referred to the increasing prosperity of the company. They had never before done so large a business nor made so much profit. The cost of fuel was £1,200 higher owing to larger output and higher prices. By means of the new battery they would be able to close down for 6 or 8 hours during the night, which should make a considerable saving. Sales of current for lighting increased by £1,227 and for power by £2,350. They had a balance to carry to the credit of net revenue account of £15,619, a gain of £1,632. Although they had more consumers, the amount received for current for lighting was still about £600 less than five years ago "before the advent of the metallic filament lamp." They had made up for the shrinkage in consumers' bills by the larger number of consumers for power, cooking and heating. The units sold were 2,478,706, a gain of 400,000 units. It was proposed to add £5,000 to reserve for depreciation, taking £5,5[illegible] off old meters and stock, and a dividend of 5s. per share on the ordinary shares was recommended, making 8s. for the year. Their prospects were never brighter. Every year there was a greater appreciation of the uses and benefits of electricty. The speaker went on to refer to the new half-watt lamps and their immense value for street lighting, "taking the place of the arc lamps which require constant attention." The time was rapidly approaching when no intelligent housekeeper would wish to be without an electric flat-iron, kettle and stove.

The report was adopted.

Mersey Railway Co.

The annual general meeting was held on Tuesday at Worcester House, Walbrook, E.C., Mr. J. Falconer, M.P., presiding.

The Chairman in proposing the adoption of the report (see Elec. Rev., p. 238), said that the figures for 1913 disclosed well maintained, steady progress in the development of the traffic. The passengers carried, as compared with 1912, showed an increase of 705,421 and the receipts an increase of £5,941. The expenditure also showed an increase, mainly due to the increased cost of coal and increased wages, of £3,517, so that the net increase was £2,424. Since they adopted electrical traction in 1902 the traffic had increased enormously. In 1902 the number of passengers carried was 6,850,000; in 1913 16,521,000, being an increase of 9,671,000, or equal to an increase of 141 per cent. The receipts for 1902 were £61,252 and for 1913 £122,631, showing an increase of £61,379, or practically 100 per cent. The amount available for payment of debenture interest, after meeting all the rent and other charges, was £46,977, which would be applied as follows:—Interest on the new first debenture stock, £26,776; the full 4 per cent. interest on the 1866 stock, £4,664; 3 per cent. on the 1871 stock, £3,000; and the full 3 per cent. on the 1882-3-5 stock, £10,800, which left a surplus for payment of interest upon the B stock—which was the last of the debenture stocks—of £1,735, which was equal to 12s. 4d. per cent. upon the amount of the stock. It would be seen, therefore, that they had now reached the stage of commencing to pay some interest upon their last Debenture stock. During the last month or two there had been a discussion in Birkenhead and Liverpool upon the means of carrying the traffic across the Mersey and he (the Chairman) had received a number of letters from shareholders asking what the position of the Mersey Railway was in regard to dealing with cross-river traffic. In the opinion of the board their railway occupied the best position both on the Liverpool and Birkenhead sides, which could be obtained for any railway connecting the two sides of the river; indeed in their view it would not be possible to lay out another tunnel or bridge which would be equally as convenient as their railway. The tunnel was not a tube, but a full size brick-lined construction, capable of taking the rolling stock of any of the English railways, and it had a double line. Its stability was shown by the fact that notwithstanding that it had been in existence 26 years, the cost of maintenance had been *nil*. The generating plant was located in a central position from which electricity could be supplied to the present railway and to any proposed extension. The large increase in the traffic which had taken place since 1902 had been dealt with without the slightest difficulty, and the increased traffic seemed to him to have been due to the development of the district—it was a great mistake to suppose that the increase had been taken from the ferries. Their attitude towards the ferries had never been one of hostility, although, of course, they were in competition. With regard to the future they looked forward to a continued increase in the cross-river traffic, which had been increasing at the rate of about half a million a year for many years, and at the present time they recognised that very special efforts were being made by the authorities in Birkenhead and Liverpool to encourage new industries. They believed that the tunnel was capable of dealing with three times the present volume of traffic without difficulty. At present they gave a three minute service, which could be safely increased if the needs of the traffic demanded it; and to sum up the position shortly, the capacity of the tunnel for dealing with both goods and passengers for a great number of years to come was practically unlimited. The adaptability of electrical working to the requirements of any service could not be better shown than by the fact that the increase in their traffic of 9½ millions had not to any extent put a strain upon their plant or system. While they had always refrained from prophesying with regard to future developments of traffic they had always looked forward to them and to the necessity of providing for them, and they were prepared to face with confidence any development that might take place either in regard to goods or passengers.

The Hon. R. C. Parsons, M.A., seconded the motion.

Replying to Mr. Gardner Williams, a shareholder, the Chairman said he had always refrained from any attempt to criticise the various suggestions which had been made with regard to the building of new tunnels or a bridge. With regard to the new turbine which had been put in at the power station it promised to do its work efficiently, so as to effect a substantial saving in the cost of working.

The report was adopted.

t. James's and Pall Mall Electric Light Co., Ltd.

HE directors, in their report for 1913, state that the connections, hich at the end of 1912 were 11,609 kw., have been increased to 5,119 kw., and 11,605,016 units were supplied to consumers. The entral Electric Supply Co., Ltd., has declared a dividend of 5 per ent. on the ordinary shares, in respect of which £2,500 (less tax) will n due course be payable to this company. The directors have carried 2,500 from net revenue account to the credit of contingency fund. he net profits for the year, applicable to dividends on shares, mount to £31,013, plus £2,210 brought forward. Deducting the nterim dividends paid in August last of 7 per cent. on the reference and 10 per cent. on the ordinary shares (requiring 13,500), there remains to be dealt with £19,783. The further reference dividend now to be paid will require £3,500, and a ividend on the ordinary shares for the second half-year of 7s. per hare, making, with the interim dividend paid in August last, a otal distribution of 12 per cent. for the year, will absorb £14,000, eaving to be carried forward £2,283. The directors regret the eath of the Right Hon. Alfred Lyttelton, K.C., M.P., one of the rustees of the debenture stockholders. The Hon. Robert H. yttelton has been appointed a trustee.

The meeting is to be held on Tuesday, February 17th.

The following is a statement of electricity generated, sold, &c., r the year ending December 31st, 1913 :—

Units generated and purchased	15,117,387
Units—Private supply	11,605 016
Used on works and storage battery	618,953
Total	12,223,969
Expended in transformation and distribution ..	2,893,418
Total connections in kw., December, 1913	15,119

Liverpool Overhead Railway Co.

HE directors report that for the year ended December 31st, 1913, e gross revenue receipts amounted to £91,168, and the working penses, including appropriation to reserve funds, to £59,876. he number of passengers carried is as under :—

	Year 1912.	Year 1913.
First-class	1,302 812	1,456,694
Third-class (including tramways) ..	6,971,299	7,517,715
Workmen (special return tickets) ..	3,894,774	4,208,912
Total	12,168,885	13,183,321

The great activity in the trade of Liverpool during the past year s resulted in a steady increase in the traffic of the railway, most every week showing an increase in receipts as compared ith the corresponding week of the previous season. The visit of e King and Queen last July, on the occasion of the opening of e new Gladstone Dock, gave the company the abnormally heavy affic of about 72,000 passengers by rail and tram, this being the eatest number ever carried on one day since the opening of the ne. Sir W. B. Forwood, who resigned the chairmanship of the mpany in January last year, found it necessary in October to cate his place on the board, in consequence of continued ill-ealth. Mr. Joseph U. Hodgson was elected to fill the vacancy. e receipts from passenger traffic were £89,488, miscellaneous ceipts £1,679 = £91,168, less working expenses and appropria-on to reserve funds £59,876, leaving £31,292. Deduct interest on benture stock and on calls paid in advance £6,649, general terest £161, provision towards cost of issue of debenture stock 340, making £24,142, plus £4,913 brought forward, leaving ailable for dividend £29,055, out of which interim dividends have en paid for the half-year ending June 30th last at the rate of per cent. per annum on the preference shares, and 2½ per cent. on e ordinary, leaving available for final dividend £18,991. Out of is balance dividends are proposed for the half-year ending ecember 31st at the rates of 5 per cent. per annum on the prefer-ce shares, and 3½ per cent. per annum on the ordinary shares aking 3 per cent. for the year), payable on and after February th next, leaving £6,275 to be carried forward.

The meeting will be held at Liverpool on February 17th.

National Gas Engine Co., Ltd.

IE directors report that the net profit for the year ended ecember, 1913, after providing amply for depreciation of build-gs, tools, &c., and allowing for management salaries and income-x, is £80,165. An interim dividend for the six months to June th, amounting to £28,500, being at the rate of 5 per cent. per num on the preference shares, and 7½ per cent. per annum on the dinary shares, was paid on July 31st, 1913, leaving a balance of 51,664, plus £9,339 brought forward. The directors recommend final dividend at the rate of 5 per cent. per annum on the pre-rence shares and 7½ per cent. per annum on the ordinary shares, th less income-tax, for the six months ended December 31st, 13. This will absorb £28,500, and leave £32,503, out of which e directors propose to place £20,000 to the reserve fund (making £50,000) and to carry forward £12,503. Mr. H. W. Bradley ving retired from the board in March last, Mr. J. Orme was cted in his place.

The meeting takes place at Ashton-under-Lyne on February 16th.

South Metropolitan Electric Light and Power Co., d.—The transfer books will be closed from February 16th to th, for the preparation of warrants for dividends, payable the th inst.

Companies Struck Off the Register.—The following companies have been struck off the register and are accordingly dissolved :—

Electric Power Plants, Ltd.
La Regionale Electrique de l'Ouest, Ltd.
Oil Fuel, Ltd.
Peckham Manufacturing Co., Ltd.
Rubberine, Ltd.
Solenoids, Ltd.
Titan Electric Co., Ltd.

Underground Electric Railways Co. of London, Ltd.—Subject to the confirmation in general meeting of the respective dividend announcements by the various companies in which the Underground Co. is interested, and subject to the final audit of its accounts, the revenue of the Underground Co. will enable it to pay the full interest to December 31st, 1913, on its 6 per cent. first cumulative income debenture stock and on its 5 per cent. income bonds, and to carry forward about £15,000 as against about £3,000 brought in from the previous year.

Listowel (Co. Kerry) Electric Light and Power Co., Ltd.—The directors' report submitted to the first ordinary general meeting showed that the expenditure during the year was £403, and the income £630, this being derived as to £570 from the supply of current to private consumers, and as to £60 from public street lighting, the latter sum representing a charge of only 3·6d. per unit to the local authority. Satisfaction was expressed by the shareholders that their first year's working had shown a substantial profit.

Giant's Causeway Electric Tramway Co., Ltd.—The directors reported to the annual meeting that the financial state of the company had been well maintained during the year. The number of passengers carried, and the receipts, had constituted "records." The number of passengers increased from 135,612 in 1912 to 155,115 in 1913, and the receipts from £3,908 to £4,636. The net profits had increased from £1,222 to £1,347. Very extensive renewals of the permanent way had to be undertaken during the year.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be quoted in the Official List :—

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Further issue of 10,000 ordinary shares of £5 fully paid, Nos. 137,501 to 147,500.

The Committee has appointed a special settling day as under :—

Wednesday, February 25th. Castner Kellner Alkali Co., Ltd. Further issue of 250,000 shares of £1, fully paid, Nos. 500,001 to 750,000.

And has ordered same to be quoted in the Official List.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—The directors recommend a dividend at the rate of 10 per cent. per annum for the half-year ended December 31st last, this making with the interim dividend to June 30th last, 9 per cent. for the year. For the previous year the total dividend was 8 per cent.

Torquay Tramways Co., Ltd.—The seventh ordinary general meeting of the shareholders of the above company was held on Thursday last week at the offices, 3, Laurence Pountney Hill, E.C., Mr. L. B. Schlesinger presiding. The proceedings were private.

Telegraph Construction and Maintenance Co., Ltd.—The directors recommend, in addition to the interim dividend of 5 per cent. paid in July last, a further dividend of 10 per cent., together with a bonus of 12s. per share.

Underfeed Stoker Co., Ltd.—A financial daily states that the directors have declared an interim dividend at the rate of 2½ per cent. per annum in respect of the year ended December 31st, 1913.

Mather & Platt, Ltd.—The directors recommend a dividend on the ordinary shares (including the interim dividend already paid) at the rate of 10 per cent. per annum for the year to December 31st, with a bonus of 5 per cent., both free of income-tax.

Electrical Distribution of Yorkshire, Ltd.—The directors' report shows a net profit of £2,569 for 1913, as compared with £1,903 for 1912. A dividend of 6 per cent. on the ordinary shares (the same as for 1912) is recommended, and £1,000 is carried to reserve.

Reduction of Capital.—THE SUNDERLAND DISTRICT ELECTRIC TRAMWAYS, LTD., AND REDUCED.—A petition for the confirmation of the reduction of capital from £170,485 to £51,497 has been presented and will be heard on March 17th in London.

Clontarf & Hill of Howth (Dublin) Tramroad Co.—A dividend of 3 per cent. per annum was declared at the shareholders' meeting, with 1s. per share bonus, less income-tax.

Oldham, Ashton and Hyde Electric Tramways Co., Ltd.—The directors have declared the half-year's dividend on the 5 per cent. preference shares.

Oxford Electric Co., Ltd.—The directors recommend a dividend of 7 per cent., less income-tax, on the ordinary shares for the year 1913. This is the same rate as for 1912.

Tyneside Tramways and Tramroads Co.

The directors report that the surplus of receipts over expenses for the half-year to December 31st is £4,349, plus £724 brought forward, making £5,071. After deducting interest on debentures, loans, &c. (£1,011), there remains an available balance of £4,062. The directors now recommend a dividend on the preference shares at the rate of 5 per cent. per annum, £601; a dividend on the ordinary shares at the rate of 2½ per cent. per annum, being at the same rate as for the corresponding half-year of 1912, £1,673; placing to the credit of reserve for renewals, depreciation and other contingencies £1,400, leaving to be carried forward £387. The traffic receipts for the whole year show an increase of £1,681.

The half-yearly meeting was held in Newcastle-on-Tyne on 10th inst., Dr. J. T. Merz, the chairman, presiding.

The Chairman, in moving the adoption of the report, stated that the revenue of £28,570 showed an increase of £1,681 on the previous year. Of this sum, £1,072 was received from ordinary traffic, and £627 on holiday traffic, the receipts from workmen's cars showing a decrease of £18. These figures contrasted with an increase of £792 on ordinary traffic, and a decrease of £144 on holiday traffic in 1912. The feature of the past year was the great increase of £800 on the holiday traffic, but the really best and most important fact was the gradual, but steady, increase in the ordinary traffic. The receipts had gone up, they were 9·52d. per car-mile, as against 9d. for the preceding year, but on the other hand, the expenses per car-mile had also increased from 6d. to 6·4d. per car-mile for 1913. That still showed a slight increase of profit from 3d. to 3·12d. per car-mile. He mentioned that there was a considerable increase in the cost of repairs owing to the gradual deterioration of plant, cables, connections, &c.

Mr. J. H. Armstrong seconded the adoption of the report, which was carried.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors, in their report for the year ending December 31st, 1913, state that the annuity payable by the Anglo-Argentine Tramways Co., Ltd., has been received, and the net revenue for the year has amounted to £67,168. Interim dividends have been paid for the nine months ending September 30th, 1913, absorbing £46,500, leaving a balance of £20,668. The directors recommend that this balance be disposed of as follows:—That in addition to the interim dividends already distributed, a final dividend of 1s. 3d. per share (making 5s. per share—5 per cent. per annum—less income-tax) be paid for the year ending December 31st, 1913, absorbing £15,500; that £5,000 be transferred to general amortisation fund, carrying forward £168. The amortisation fund for the debenture stock, with accrued interest to date, amounts to the sum of £15,749, and the general amortisation fund for the redemption of the share capital now amounts to £41,946.

Blackpool and Fleetwood Tramroad Co.—The report states that the net earnings for the year 1913, after the payment of debenture interest and fixed charges, were £21,042, making, with the amount brought forward, £24,069, from which has been paid interim dividend for the six months to June 30th, 1913, at the rate of 4 per cent. per annum, £3,000, leaving £21,069. The directors now recommend a final dividend of 4½ per cent., absorbing £6,750, a bonus of 2 per cent. on the share capital, absorbing £3,000, placing to depreciation reserve account £5,000 and to general reserve account £2,500, and writing down value of investments in railway stock £368, carrying forward £3,451.

Central Electric Supply Co., Ltd.—The report for 1913 states that energy was supplied to the Westminster Electric Supply Corporation, the St. James's and Pall Mall Electric Light Co., and the Chelsea Electricity Supply Co. to an amount of 28,635,820 units. The directors propose to pay a dividend at the rate of 5 per cent. on the ordinary shares for the year and carry forward £7.

Central London Railway Co.—Subject to final audit of the accounts, the directors have decided to recommend the payment of the following dividends:—On the undivided ordinary stock for the six months ended December 31st, 1913, at the rate of £3 per cent. per annum, making, with the interim dividend of £3 per cent. per annum paid for the first half of the year, a dividend for the year 1913 of £3 per cent. On the preferred ordinary stock for the six months ended December 31st, 1913, at the rate of £4 per cent. per annum, making, with the interim dividend of £4 per cent. per annum paid for the first half of the year, a dividend for the year 1913 of £4 per cent. On the deferred ordinary stock for the year ended December 31st, 1913, a dividend of £2 per cent., carrying forward £20.878. The same dividends were paid for the year 1912, with £27,218 carried forward.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets have suffered something of a halt. It was not very surprising, having regard to the furious pace at which the previous rise had been driven. Cessation of buying orders for gilt-edged stocks, coupled with a rush on the part of big borrowers to participate in the willingness of the public to lend money, put an effective brake upon the rise in Consols and similar securities. A good-sized account has been built up for settlement this week, and people in the markets, and out of them, waited to see how the settlement would pass off. The meeting of Parliament is not a bull point at any time. These, and other such considerations, came into play when the busy rush subsided; but it will be observed that many of the best-class stocks in our price lists overleaf continue to show steady upward progress.

A keen interest centres around the various developments which are going on in connection with the scheme for supplying electric current in bulk to London. The atmosphere is charged with contradictory rumours: every day produces fresh points of piquancy. The personal side, the commercial and the technical, are being marshalled in the controversies; and the immediate object upon which attention is centred is the Bill which the County of London Company is promoting and to which reference has been made here several times previously.

The Bill will probably be opposed by several of the Electric Companies themselves, which are concerned in the scheme, but it does not follow that the opposition will be necessarily hostile, because this course is essential for any other company to take in order to obtain a *locus standi*, for the sake of alterations which it may wish to see introduced into the Bill. Already there arises the cry that it looks as though some people were out for big plunder—which, by the way, is improbable, seeing that Parliament is not at all likely to pass the Bill unless satisfied that expenses and profits under it will be cut as fine as possible. A Committee meeting of engineers took place last week, when important matters affecting the technical side of the scheme were under consideration; and of their labours more will no doubt be heard by-and-bye.

Meanwhile, the share market is firm, although prices have given way from the best. City Lights rose to 19, from which they reacted to 18¾. Counties, after touching 13, eased off ⅛. The strongest feature of the market is the demand for St. James's, where the raising of the dividend has created a demand for the shares that has carried up the price to nearly 10. South Londons gained another half-crown, and similar rises took places in Charing Cross Preference and Edmundsons' Preference.

Cordial receptions continue to welcome the new issues, and although the best premiums are scarcely held, there appears to be plenty of demand for cheap stock. The Anglo-Argentine Tramway Debenture issue was well covered, and the price of the scrip is about ¼ above par—that is, over the issue price of 95. The company's 4 per cent. Debenture stock rose 1½. British Columbia Electrics are better, but the various securities connected with Mexico and Brazil have mostly gone back after their substantial improvements of the last fortnight.

Mexican Light and Power Common fell 7, and the other descriptions are 3 to 6 points lower. Monterey Debenture lost 5. Mexico Trams Common shares are 2 down, the bonds 3½ and 2. Rio Seconds lost their gain of last week, and Para Electric Railways shares have reverted to 5¼. Brazilian Tractions dropped to 90¾, but recovered to 92½, at which they are a point lower on balance. Canadian securities held their ground with a good deal of strength, and Montreal shares rose 8 on a small demand. Shawinigan capital stock went up 3½, Canadian General Preference 1, though the Common is lower to the same extent. Victoria Falls Power Preference shares eased off to 15/16 upon an issue of new Second Debenture stock, the price of which is about 2½ discount. Kalgoorlie Preference at 8s. 9d. are 1/32 harder.

The Home Railway market gave way with Consols, and the weakness infected Metropolitans, Districts and Underground Electric Railways group. Central London Assented stocks are easier. The District dividend of 2½ per cent. on the Second Preference, against 2 per cent. a year ago, was fully equal to the market's expectations, and the company's Prior Lien stock rose two points. There are other rises to set against the falls, the principal being a jump of 5½ in Metropolitan Electric Trams 4½ per cent. Debenture stock, making 10 points in a fortnight. London Suburban Debenture is 3 higher, and the City and South London Senior Preferences improved a little, although the report of the last-named company is not cheerful literature. British Electric Tractions have moved irregularly.

The Telegraph market is generally firm, the rises being still much in advances of the declines. Anglo-American Telegraph Preferred has again improved, and American Telephone and Telegraph bonds have more than recovered their previous fall. The Eastern group is steady, with Eastern Ordinary 2 points higher. United River Plate Telephones lost ⅛, but Monte Video Telephones, both Ordinary and Preference, have strengthened. Marconis are a dull market, there being liberal sales on the approach of the settlement. Marines are amongst the firmest of the group at 35s.

Uniform strength characterises the list of Manufacturing stocks and shares. Edison & Swan "A" shares, after vegetating at nothing to ⅛ for some weeks, have risen to 3s. middle. General Electric Preference are better at 10 5/16, and India-Rubber shares regained the 10s. they shed last week—which, by the way, they were expected to do. Brush Prior Lien Debenture has attracted purchasers by reason of its good return, and British Aluminium Debentures are better. Aron Preference moved up to 16s. 3d. and Crompton Debenture to 83. The only decline in the shares quoted overleaf is one of 1/16 in Babcock & Wilcox Ordinary, this being a natural reaction after their sharp previous rise. Rubber shares developed renewed strength on a rise in the raw material to 2s. 7d. per lb. This brought about bear covering and a general improvement in the market for the shares.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 10th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	16 — 18	..	..
Do. Do. Deferred ..	100	..	..	7½ — 9½	+ ½	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	90 — 93	—3	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	3	..	57 — 60	..	5 0 0
Do. 5 % Perp. Deb. ..	100	5	5	93 — 96	..	5 4 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 83	+1	5 8 5
Central London Railway, Ord. ..	100	3	3	59 — 64	.	4 13 9
Do. Gtd. Assented	100	..	4	83 — 85	—1	4 14 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	82 — 84	—1	4 15 2
Do. 4 % Deb.	100	4	4	97 — 99		4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	+2	5 0 0
Do. Do. 1896	100	5	5	97 — 99	+1	5 1 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	93 — 95	..	5 5 0
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 8
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London and Suburban, Ord. ..	1	..	..	¼ — 5/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅝ — ¾	..	6 13 4
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	80 — 85	+3	5 6 0

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 10th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	65 — 68	..	5 17 8
Metropolitan Railway Consol. ..	100	1⅝	1⅝†	45½ — 45¾	— ⅛	3 11 0
Do. Surplus Lands	100	2⅜	2⅜†	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Pref.	100	3½	3½	84 — 86	+1	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	82 — 84	+1	4 4 4
Metropolitan District Ord. ..	100	Nil	..	32½ — 33	— ½	Nil
Do. 6 % Deb.	100	6	6	138 —141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	96 — 98	+2	4 1 8
Do. 4½ % First Pref.	100	4½	4½	89 — 91	—1	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	.	4 11 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	90 — 93	+ 5½	4 16 0
Do. 5 % Deb.	100	5	5	89 — 92	+1	5 8 8
Potteries, Ord.	1	3½	..	⅜ — ½	..	..
Do. 5 % Pref.	1	5	5	9/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	3½ — 3⅝	— ⅛	Nil
Do. "A"	1/-	..	..	7/16 — ½	— 1/16	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	116 —118	..	5 1 7
Do. 4½ % Bonds	100	4½	4½	100 —102	+1	4 8 0
Do. 6 % Income	100	6	6	95 — 96	— ½	6 5 0
Yorkshire (West Riding). Ord. ..	5	Nil	..	5/16 — 9/16	..	Nil
Do. 6 % Pref.	5	3	4	3¾ — 4¼	..	4 14 3
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends 1912.	Dividends 1913.	Closing Quotations Feb. 10th.	Rise + or Fall —	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅞ — 5⅛	..	5 7 5
Do. 2nd Pref.	5	5½	5½	4⅜ — 4⅝	..	5 19 0
Do. 4 % Deb.	100	4	4	93 — 95	+1½	4 4 3
Do. 4½ % Deb.	100	4½	4½	96½ — 99½	..	4 11 5
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 —106	..	4 14 3
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾ — 11¼	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	+ ½	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	91½ — 93½	—1	6 8 4
Brisbane Trams Invt., Ord. ..	5	8	8	7⅝ — 8⅛	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	120 —124	+1	6 9 2
Do. Pref. Ord.	100	6	6	107 —111	+1	5 8 1
Do. 5 % Pref.	100	5	5	102½ —105½	..	4 14 9
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	95 — 98	+1½	4 6 9
Calcutta Trams, Ord.	5	7½	5†	6 — 6½	..	5 15 5
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5†	5	5 7/16 — 5 11/16	..	4 0 0
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil

NAME.	Stock or Share.	Dividends 1912.	Dividends 1913.	Closing Quotations Feb. 10th.	Rise + or Fall —	Present Yield p.c.
La Plata Elec. Trams, Ord. ..	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4⅜d.	5	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1⅛ — 1⅜	..	4 7 8
Do. 6 % Pref.	1	6	6	1 1/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
„ Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½ —101½	+1	4 18 6
Mexico Trams Com	$100	7	7	74 — 77	—2	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	82 — 87	—3½	5 15 1
Do. 6 % Bonds	100	6	6	83 — 87	—2	6 18 0
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	5 — 5½	— ⅛	9 1 10
Do. 6 % Pref.	5	6	6	4½ — 5	+ ⅛	6 0 0
Do. 5 % 1st Deb.	100	5	5	93½ — 95½	..	5 4 6
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101 —103	+ ½	4 17 0
Do. 5 % Mort. Bonds	100	5	5	94½ — 96½	—1½	5 3 6
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	100 —103	..	4 17 0
Singapore Trams, 5 % Deb. ..	100	5	5	87 — 91	..	5 10 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	98 —100 xd	..	5 0 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ — 5⅛	+ ⅛	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	94 — 97	..	5 8 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends 1912.	Dividends 1913.	Closing Quotations Feb. 10th.	Rise + or Fall —	Present Yield p.c.
Bournemouth & Poole, Ord. ..	10	6	5†	9 — 10	..	6 0 0
Do. 4½ % Pref.	10	4½	4½	8⅝ — 9⅝	..	4 13 6
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord. ..	5	10	9†	9⅛ — 9⅝	..	5 4 0
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 9⅛	..	3 16 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅞	+ ⅛	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	4†	5 — 5½	..	4 11 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	6†	18¾ — 19¼	+ ¾	4 18 6
Do. 6 % Cum. Pref.	10	6	6	13 — 14	— ¼	4 5 9
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	99 — 102	..	4 8 1
County of London, Ord.	10	6	5†	12⅝ 13⅛	+ ⅜	4 11 5
Do. 6 % Pref.	10	6	6	11⅞ - 12⅜	+ ⅛	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	101½ —103½	..	4 7 0
Do. 4½ % Second Deb. ..	Stock	4½	4½	99 —102	..	4 8 1
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4⅛	..	7 5 5
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝ — 2	+ ⅛	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	+1	5 3 6
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	90 — 92	+1	4 17 10

NAME.	Stock or Share.	Dividends 1912.	Dividends 1913.	Closing Quotations Feb. 10th.	Rise + or Fall —	Present Yield p.c.
Hove	5	8	8†	8¾ — 9¼	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	8†	7¾ — 8¼	..	4 17 0
Do 4 % Deb.	Stock	4	4	89 — 91 xd	..	4 8 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	..	1⅜ — 1¾	..	4 5 0
Do. 6 % Pref.	5	6	6	5⅛ — 5½	..	5 9 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4	4†	3⅝ — 4⅛	..	4 17 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4¾	..	4 14 9
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort Deb.	Stock	3½	3½	82 — 85	+1	4 2 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford..	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord. ..	5	10	10†	9¾ - 10⅛	- ⅜	4 18 9
Do. 7 % Pref	5	7	7	6⅞ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5½	..	8¾ - [illegible]	+ ⅛	6 1 9
Do. 5 % First Mort. Deb. ..	100	5	5	98 101	..	4 19 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/32 — 1 7/32	..	5 14 9
Do. 4½ % First Deb. Stock ..	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	⅜ — ⅝	..	.
Do. 5 % Cum Pref.	5	3‡	..	2½ — 3	..	5 0 0
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86 — 89	..	5 1 3
Westminster, Ord...	5	10	10†	9 — 9½	..	5 5 3
Do. 4½ % Cum Pref.	5	4½	4½	5 1/16 — 5 3/16	..	4 4 8

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 8s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 10th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6†	5⅛ – 5⅝	..	5 11 7
Calcutta, Ord.	5	8⅓	5†	7⅝ – 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5 1/16 – 5 5/16	+1/16	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	89½ – 91½	.	5 8 8
Canadian Gen. El. Com.	$100	7	8	112 – 117	—1	6 16 7
Do. 7 % Pref.	$100	7	7	122 – 127	+1	5 10 1
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 – ⅞	..	7 13 0
Do. 5 % Deb.	100	5	5	90 – 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87½ – 89½	..	6 14 1
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 – 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	96 – 98	..	5 2 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 – 3/16	..	Nil
Do. 6 % Pref.	1	6	6†	⅜ – ½	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 – 104	..	4 16 2
Madras, Ord.	5	Nil	..	1½ – 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 – 104	..	4 16 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	65 – 70	—4½	7 2 10
Mexican Lt. & Power, Common	$100	4	4†	44 – 47	—7	..
Do. 7 % Cum. Pref.	$100	7	7	83 – 87	—3	8 1 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	79 – 83	—4½	6 0 6
Do. 5 % 2nd Mort. Bonds	100	5	5	64 – 68	—6	7 7 1

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 10th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	59 – 64	—5	..
Montreal, Lt., H. and Power	$100	9	10†	228 – 233	+8	4 5 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 – 20	..	..
River Plate, Ord.	Stock	10	..	207 – 217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	103 – 108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 – 103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	102 – 104	..	4 6 7
Shawinigan Water, Capital	$100	5½	6†	143 – 147	+8½	4 1 8
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ – 106½	.	4 14 9
Do. 4½ % Per. Deb.	Stock	4½	4½	98 – 101	+1	4 9 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 – 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	88 – 90	+1	5 11 1
Victoria Falls Power, Pref.	1	6	6	25/32 – 27/32	—1/32	7 2 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 – 105	..	5 14 8

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 10th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	11/16 – 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	¾ – ⅞	+1/16	6 17 2
Babcock & Wilcox	1	16	14†	3 1/16 – 3 3/16	—1/16	5 0 4
Do. Pref.	1	6	6	1 5/16 – 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 1/16 – 1 3/16	..	..
Do. 6 % Cum. Pref.	1	6	6	13/16 – 15/16	.	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	95 – 98	+1	5 2 0
Do. Deb. Stk.	100	5	5	87 – 90 xd	+2	5 11 1
B.I. & Helsby Cables	5	10	8†	8⅞ – 9⅜	..	5 6 8
Do. Pref.	5	6	6	5⅞ – 6⅜ xd	..	4 14 1
Do. Deb.	100	4½	4½	102 – 105	+2	4 5 9
British Thomson-Houston, Deb.	100	4½	4½	92 – 95	..	4 14 9
British Westinghouse, Pref.	2	Nil	..	1 5/16 – 1 7/16	..	Nil
Do. Deb.	100	4	4	68 – 71	..	5 12 8
Do. 6 % Prior Lien	100	6	6	102 – 105	..	5 14 6
Browett, Lindley, Ord.	1	..	..	2/- – 3/-	..	Nil
Do. Pref.	1	..	..	8/- – 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 – ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 – 85	+2	5 17 8
Do. 4½ % Deb.	100	4½	4½	39 – 43	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	23 – 27	..	16 13 4
Callender's Cable	5	15	5†	11½ – 12	..	6 5 0
Do. Pref.	5	5	5	4⅞ – 5⅛	..	4 17 9
Do. Deb.	100	4½	4½	97 – 100	..	4 10 0
Castner-Kellner	1	20	22½	2 1/16 – 2 3/16	..	..
Do. Deb.	100	4½	4½	103 – 106 xd	..	4 5 1

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 10th.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	82 – 84	+3	5 19 1
Dick, Kerr	1	Nil	..	5/16 – 9/16	..	..
Do. Pref.	1	6	6	23/32 – 27/32	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	5/32 – 7/32	+1/32	Nil
Do. fully paid	5	Nil	..	1 – 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 – 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 – 68	..	7 7 1
Electric Construction	1	5	..	9/16 – 11/16	.	7 5 6
Do. Pref.	1	7	7	15/16 – 1 1/16	+1/32	6 11 7
Greenwood & Batley, Pref.	10	7	7	6¾ – 7¼	..	9 13 2
Do. Deb.	100	5	5	92 – 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10⅛ – 10½	+ ¼	5 14 3
Do. Deb.	100	4	4	88 – [illegible]	..	4 6 0
Henley's, Ord.	5	15	10†	13½ – 14	..	5 7 1
Do. Pref.	5	4½	4½	4 13/16 – 5 1/16	..	4 9 0
Do. Deb.	100	4½	4½	100 – 102	..	4 8 3
India-Rubber, G. & T.	10	7½	7½	11 – 12	+ ½	6 5 0
Do. Pref.	10	5	5	9 – 9¾	..	5 2 7
Telegraph Construction	12	20	5†	38 – 40	..	6 0 1
Do. Deb.	100	4	4	97 – 99	+1	4 0 10
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 – 69	..	5 16 0
Do. B 4 % Cum. Pref.	100	..	..	51 – 56	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 10th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	6½ – 6¾	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	94 – 97	+1	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	120 – 127	.	6 6 0
Do. Collat. Trust	$1000	4	4	91 – 94	+2	4 5 0
Anglo-American Telegraph	Stock	3	3	65 – 68	..	4 8 3
Do. 6 % Pref.	Do.	6	6	108¾ – 109¾	+ ½	5 9 4
Do. Def.	Do.	30/-	..	24⅞ – 25⅜	..	5 18 3
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	103 – 105	..	4 15 2
Chili Telephone	5	8	..	7⅜ – 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	81 – 83	+ ½	4 16 5
Cuba Telegraph	10	6	6†	8¾ – 9¼	..	6 3 1
Do. 10 % Pref.	10	10	10	15¾ – 16¾	..	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3½ – 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	..	7½ – 8	+ ¼	6 5 0
Direct United States Cable	10	4	4†	6⅞ – 7⅜ xd	..	5 8 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 – 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	133 – 136	+2	5 3 0
Do. 3½ % Pref. Stock	Do.	3½	3½	78 – 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	95 – 97	..	4 2 4
Eastern Extension	10	7	7	12½ – 13		5 7 8
Do. 4 % Deb.	Stock	4	4	91 – 96	+1	4 3 4
Globe Telegraph and Trust	10	6	6†	11½ – 11¾		5 2 2
Do. 6 % Pref.	10	6	6	12½ – 13	+ ½	4 12 4
Great Northern Telegraph	10	20	5†	31½ – 33½	..	5 19 5
Indo European Telegraph	25	13	5†	58 – 60	+1	5 8 4
Mackay Companies Common	$100	5	5	83 – 87	..	5 15 0
Do. 4 % Cum. Pref.	$100	4	4	67 – 71	..	5 12 8

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 10th.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph	1	20	20	3 13/16 – 3 15/16	— ⅛	5 4 5
Do. 7 % Cum. Partic. Pref.	1	17	..	3¼ – 3½	— ⅛	5 0 9
Monte Video Telephone, Ord.	1	6	6	13/16 – 15/16	+1/16	6 8 0
Do. 5 % Pref.	1	5	5	¾ – ⅞	+ ⅛	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 – 101		4 9 0
Oriental Telep. and Elec.	1	10	10†	1⅞ – 2⅛	+1/16	4 14 0
Do. 6 % Cum. Pref.	1	6	6	1⅛ – 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87 – 89	..	4 10 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 – 100	..	4 0 0
Reuter's	10	10	10†	9 – 10	.	10 0 0
Submarine Cables Trust	Cert.	6	6	124 – 127	+1	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96 – 98	..	4 11 10
United River Plate Telephone	5	8	6†	6⅝ – 7⅛	— ⅛	5 12 5
Do. 5 % Cum. Pref.	5	5	5	5⅜ – 5⅝	..	4 9 0
West Coast of America	2½	2½		1 5/16 – 1 7/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 – 99	+1	4 0 10
West India and Panama Teleg.	10	1¼	1¼	2⅝ – 2⅞	..	4 8 6
Do. 6 % Cum. 1st Pref.	10	6	6	9¾ – 10¼	..	5 17 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9 – 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	97 – 99	..	5 1 0
Western Telegraph, Ltd.	10	7†	7	13⅛ – 13⅜	..	5 2 8
Do. 4 % Debs.	Stock	4	4	95 – 97	..	4 2 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 – 98	..	4 11 10

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Electro-Harmonic Society.—The next concert (Ladies' Night) will be held at the Holborn Restaurant (King's Hall) on Monday evening next, February 16th, at 8 o'clock. Mr. A. P. Trotter will be in the chair. The artistes are as follows:—Vocalists, Miss Annie Bartle (soprano), Miss Violet Oppenshaw (contralto), Mr. Joseph Cheetham (tenor), Mr. Constantine Morris (baritone); violinist, Senhor José Soler Gomez; Scottish comedian, Mr. Hector Gordon; humoresques, Miss Olive Twain and Mr. Cyril Weller; humour and music at the piano, Mr. Ernest Hastings; solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M.

Wireless Telegraphy and Explosions.—The following Reuter telegram from Paris, dated February 7th, is too utterly delicious to be missed:—The *Journal* this morning publishes an interesting statement by a French engineer, who declares that dangerous explosions are liable to occur at the meeting points of wireless electric waves. As an example, the engineer points out that the *Volturno* disaster took place just on the junction point of the Eiffel Tower and Glace Bay wireless lines. Again, the recent mining explosion near Cardiff was on the Clifden-Paris line, while Toulon, where the explosions on board the battleships *Jena* and *Liberté* occurred, is on the Paris-Bizerta line

GERMAN EXPORTS OF ELECTRICAL GOODS IN 1913.

The following figures showing the exports of electrical goods from Germany in 1913, are taken from the recently issued official trade statistics; figures for 1912 are added for purposes of comparison, and notes of any increases or decreases are given. The total exports of all kinds of electrical goods in 1913 were 133,855,100 kilogs. valued at 290,182,000 marks, as against 119,302,500 kilogs, valued at 239,699,000 marks, in 1912:—

	1912. Kilogs.	1913. Kilogs.	Inc. or Dec. Kilogs.
Dynamos, electric motors, transformers, &c., up to 25 kg. weight.—			
To Austria	116,000	121,000	+ 5,000
,, Russia	81,000	182,000	+ 98,000
,, France	50,000	59,000	+ 9,000
,, Great Britain ..	48,000	58,000	+ 10,000
,, Other countries ...	277,000	321,000	+ 44,000
Total ...	375,000	741,000	+ 166,000
Ditto, from 25 kg. to 100 kg.—			
To Austria	672,000	532,000	− 140,000
,, Russia	268,000	505,000	+ 237,000
,, Great Britain ...	212,000	268,000	+ 56,000
,, Belgium	193,000	197,000	+ 4,000
,, France	189,000	236,000	+ 47,000
,, Italy	193,000	146,000	− 47,000
,, Holland	197,000	238,000	+ 41,000
,, Spain	162,000	243,000	+ 81,000
,, Other countries ...	765,000	781,000	+ 16,000
Total ...	2,851,000	3,146,000	+ 295,000
Ditto, from 100 to 500 kg.—			
To Austria	895,000	616,000	− 279,000
,, Russia	622,000	809,000	+ 187,000
,, Belgium	577,000	641,000	+ 64,000
,, Great Britain ...	503,000	760,000	+ 257,000
,, Brazil	491,000	532,000	+ 41,000
,, Spain	433,000	574,000	+ 141,000
,, Italy	454,000	347,000	− 107,000
,, Argentina	330,000	491,000	+ 161,000
,, Other Countries ...	2,536,000	2,983,000	+ 447,000
Total ...	6,841,000	7,753,000	+ 912,000
Ditto, over 500 kg.—			
To Japan	2,960,000	2,419,000	− 541,000
,, Italy	2,550,000	1,613,000	− 937,000
,, Argentina	2,589,000	1,387,000	−1,202,000
,, Belgium	1,892,000	2,168,000	+ 276,000
,, Russia	1,421,000	2,171,000	+ 750,000
,, Spain	1,686,000	2,239,000	+ 553,000
,, British S. Africa ...	1,328,000	906,000	− 422,000
,, Brazil	1,078,000	1,144,000	+ 66,000
,, Other countries ...	8,559,000	11,592,000	+3,033,000
Total ...	24,063,000	25,639,000	+1,576,000
Cables.—			
To Belgium	4,382,000	5,305,000	+ 923,000
,, Holland	5,721,000	6,955,000	+1,234,000
,, Sweden	3,033,000	2,281,000	− 752,000
,, Japan	4,489,000	3,724,000	− 765,000
,, Argentina	3,514,000	6,835,000	+3,321,000
,, Norway	1,570,000	3,565,000	+1,995,000
,, Great Britain ...	1,220,000	1,073,000	− 147,000
,, Dutch E. Indies ...	967,000	3,616,000	+2,649,000
,, Other countries ...	13,074,000	14,237,000	+1,163,000
Total ...	37,970,000	47,591,000	+9,621,000
Electric Arc lamps.—			
To Russia	91,000	138,000	+ 17,000
,, Austria	66,000	40,000	− 26,000
,, Great Britain ...	71,000	74,000	+ 3,000
,, Argentina	66,000	105,000	+ 39,000
,, Other countries ...	263,000	238,000	− 25,000
Total	557,000	595,000	+ 38,000
Metal-filament lamps.—			
To Russia	370,000	325,000	− 45,000
,, Great Britain ...	260,000	148,000	− 112,000
,, Spain	136,000	104,000	− 32,000
,, Italy	152,000	155,000	+ 3,000
,, Austria	190,000	233,000	+ 43,000
,, France	113,000	100,000	− 13,000
,, Other countries ...	850,000	1,049,000	+ 199,000
Total ...	2,071,000	2,114,000	+ 43,000

	1912 Kilogs.	1913 Kilogs.	Inc. or Dec. Kilogs.
Galvanic batteries.—			
To Great Britain ...	[illegible]	[illegible]	+ 192,000
,, Holland	[illegible]	[illegible]	+ 9,000
,, Sweden	[illegible]	[illegible]	[illegible]
,, Switzerland ...	[illegible]	[illegible]	[illegible]
,, Other countries ...	516,000	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]
Electric apparatus for lighting, power, &c.—			
To Russia	1,790,000	2,921,000	+ 1,131,000
,, Austria	1,627,000	1,992,000	+ 365,000
,, Italy	1,263,000	1,205,000	− 58,000
,, Belgium	1,195,000	1,465,000	+ 270,000
,, Argentina	1,361,000	1,520,000	+ 159,000
,, Brazil	611,000	616,000	+ 5,000
,, Great Britain ..	815,000	1,441,000	+ 626,000
,, Japan	527,000	495,000	− 32,000
,, Other countries ...	6,128,000	9,895,000	+ 3,767,000
Total ...	15,317,000	21,553,000	+6,236,000
Electric meters &c.—			
To Austria	406,000	353,000	− 53,000
,, Russia	397,000	570,000	+ 173,000
,, Italy	361,000	375,000	+ 14,000
,, Argentina	163,000	279,000	+ 116,000
,, Japan	101,000	91,000	− 10,000
,, Spain	147,000	249,000	+ 102,000
,, Belgium	118,000	129,000	+ 11,000
,, Denmark	103,000	133,000	+ 30,000
,, Great Britain ...	122,000	275,000	+ 153,000
,, Other countries ...	639,000	867,000	+ 228,000
Total ...	2,557,000	3,321,000	+ 764,000
Insulating tubes.—			
To Belgium	306,000	358,000	+ 52,000
,, Switzerland	866,000	1,254,000	+ 388,000
,, Russia	354,000	329,000	− 25,000
,, Sweden	286,000	367,000	+ 81,000
,, Austria	274,000	406,000	+ 132,000
,, Italy	232,000	364,000	+ 132,000
,, Other countries ...	847,000	1,154,000	+ 307,000
Total ...	3,165,000	4,232,000	+1,067,000
Electric signalling apparatus, &c.—			
To Russia	140,000	169,000	+ 29,000
,, Great Britain ...	122,000	186,000	+ 64,000
,, Belgium	94,000	106,000	+ 12,000
,, Denmark	63,000	61,000	− 2,000
,, Holland	59,000	58,000	− 1,000
,, Other countries ...	408,000	468,000	+ 60,000
Total ...	886,000	1,048,000	+ 162,000
Telephones and telephone apparatus.—			
To Russia	134,000	130,000	− 4,000
,, Great Britain ...	89,000	131,000	+ 42,000
,, Italy	85,000	123,000	+ 38,000
,, Austria	53,000	68,000	+ 15,000
,, France	41,000	74,000	+ 33,000
,, Other countries ...	103,000	131,000	+ 28,000
Total ..	805,000	957,000	+ 152,000
Finished armatures and commutators.—			
To Austria	597,000	597,000	—
,, Italy	511,000	377,000	− 134,000
,, Belgium	429,000	246,000	− 183,000
,, France	202,000	223,000	+ 21,000
,, Great Britain ...	430,000	328,000	− 102,000
,, Russia	270,000	664,000	+ 394,000
,, Japan	246,000	328,000	+ 82,000
,, Argentina	191,000	185,000	− 6,000
,, British S. Africa ...	130,000	93,000	− 37,000
,, Other countries ...	1,030,000	1,562,000	+ 532,000
Total .	4,036,000	4,603,000	+ 567,000
Accumulators.			
To Denmark .	1,101,000	823,000	− 278,000
,, Sweden	1,953,000	878,000	−1,075,000
,, Holland ..	444,000	739,000	+ 295,000
,, Norway	290,000	632,000	+ 342,000
,, Japan	293,000	323,000	+ 30,000
,, Argentina	3,081,000	622,000	−2,459,000
,, Chile . .	699,000	531,000	− 168,000
,, Other countries .	1,209,000	1,491,000	+ 282,000
Total ...	9,070,000	6,039,000	−3,031,000

Kilog. = 2.204 lb.

THE ALL-ELECTRICAL OPERATION OF THE PANAMA CANAL.

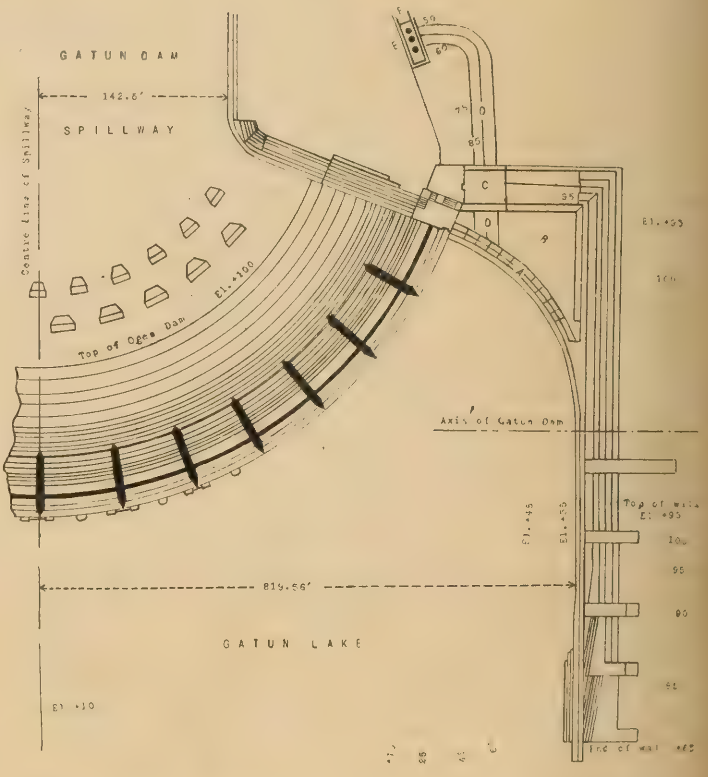
By JOHN GEO. LEIGH.

In two series of articles published in the Electrical Review* I have endeavoured to demonstrate the great assistance which electricity has rendered to the expeditious and economical completion of the Panama Canal. To-day there remains comparatively little to be done, beyond the deepening of the channel at the two terminals and the removal of material which has fallen into the Culebra Cut as the result of breaks and slides, to ensure the safe navigation of vessels over what was heretofore 47 miles of continent. Within, probably, a month after these words are in type, a vessel of draught and tonnage sufficient to command the respect of even the most captious of critics will have passed from the Caribbean Sea to the Bay of Panama, thus bringing very near to the imagination the day when America's splendid enterprise will be formally dedicated to the use of the commerce of the world.

I suggested during the course of the articles referred to that the success which had attended the use of electrical energy as an auxiliary to constructive work left little room for doubt that in the future the same power would reign supreme as the sole force relied upon to discharge the manifold duties connected with the operation of the Canal. I propose to show in the present contribution that this anticipation has been fully realised, and to indicate the means by which the energy will be applied to the various duties assigned to it. The triumph of electricity in this connection is the more remarkable, because of the exceptionally deteriorating effect of the Isthmian climate upon metals and delicate instruments. I have described in an earlier article—that of February 9th, 1912—the very exhaustive tests to which the Canal Commission, before considering any tender, subjected the sample motors submitted to it, and in subsequent pages frequent reference will be found to kindred precautionary measures adopted in the case of other equipment. To obviate, so far as practicable, the operating difficulties likely to be occasioned by the destructive influences of tropical humidity, great care has been taken to ensure that all electrical apparatus shall be of the best grade. Where it has been absolutely necessary to use iron, as in the framework for oil switches and switch-board panels, the pipe supports are heavily galvanised, or sherardised, and, after installation, have been well painted or varnished. In instruments, wherever practicable, either brass or copper has been substituted for iron and steel; and in cases where soft iron is essential to carry magnetic fluxes the iron cores have been specially impregnated. Local tests having demonstrated the peculiarly destructive effects of excessive humidity upon ordinary electrical insulation, exceptional care has been taken to ensure that the insulation of all transformer-room equipment shall be of quite superior character.

Climatic conditions have resulted also in the adoption of several precautionary improvements in the design and installation of telephone equipment. Generally speaking, all iron work, so far as possible, is galvanised; all interior woodwork and all cables have been treated with an impregnating compound and given two or three coats of shellac, and the tinned copper wiring of the switchboards is protected by enamelled insulation and wrappings, two of silk and one of cotton. The induction and receiver coils are boiled in a wax compound and then covered with coats of shellac, and transmitters are provided with a weatherproof granular button, also specially treated with a view to the exclusion of moisture. To the exposed surface of the magnet is given a coat of thin enamel, by which it is hoped to reduce very materially the formation of rust on the end of the magnet, and that consequent filling of the space between it and the diaphragm, which is one of the chief drawbacks to its use in the Isthmus.

As explained in earlier articles, the permanent source of energy to be employed in the operation of the Canal is a hydro-electric station situated a short distance below the concrete dam—in ogee form, with crest on the arc of a circle in place—which separates Gatun Lake from the concrete-lined spillway intersecting the east and west portions of Gatun Dam. As indicated in fig. 1, showing the main features of the development relative to the spillway channel, the dam is 808 ft. long on the crest line across the channel, 93 ft. wide from heel to toe, and rises 69 ft. above sea level. On it are built piers and regulating works, and between the former are installed 14 gates, built up of steel sheathing on a framework of girders, designed to give absolute control of the lake under all possible conditions. The power station is constructed of concrete and steel, is rectangular in shape, and contains one main operating floor, with a turbine pit and two galleries for electrical equipment. The dimensions of the building permit of the present installation of three 2,000-kw. units, provision being made for an extension, whenever required, of three additional similar units. The amount of structural steel used in the construction of the power house was about 320 tons. The forebay was built as an integral part of the curved portion of the spillway approach wall, which contains five



A, Fender wall; B, Forebay; C, Gate house; D, Penstocks; E, Power house; F, Possible extension.

Fig. 1.—Eastern Half of Gatun Dam Spillway, Showing Position of Power Station.

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* "Electricity and the Panama Canal," November 4th and 25th, 1910; "Electric Power for the Panama Canal," January 12th, 19th and 26th, and February 9th, 1912.

large apertures opening into it, and will serve as a fender wall to prevent floating *débris* from accumulating at the headgates.

It is calculated that from the storage in Gatun Lake there will be available always sufficient water to warrant the installation of 6,000 KW. in generating capacity, including reserve. The elevation of the lake will vary with the seasons from 79 ft. to 87 ft. above sea level, and the average head throughout the year will be approximately 75 ft., the elevation of the tail race being about + 8 ft. During the rainy season water in the lake will be plentiful, and must be wasted over the spillway, but in the dry months it will be necessary to draw upon the storage above elevation + 70. The maximum quantity of water diverted for hydro-electric purposes will be approximately 7 per cent. of the minimum supply, or the excess which is not required for lockages, evaporation and leakages.

The electrical load connected to the power station consists for the most part of power feeders, which will distribute energy to the machinery of the three series of locks, the Gatun and Miraflores spillways, the permanent machine shops, the coal and cargo-handling plants at Cristobal and Balboa, the dry dock at the latter port, the fortifications, and other smaller drives already in service or contemplated. In addition, there will be the lighting load of the locks and canal channel and of the Zone towns. Considerable load also will probably be obtained through a service for domestic purposes, electric cooking replacing the stove and its, on the Isthmus, expensive fuel. There is, moreover, a possibility in the near future of an electrification of the Panama Railroad. The circuits from the power house to the load centres are in duplicate, in order to ensure so far as possible an absolutely continuous service; and a high-voltage transmission line connects the Gatun power station to the station at Miraflores, which was in use during the construction period, and will be held in reserve as an auxiliary to, or temporary substitute for, Gatun.

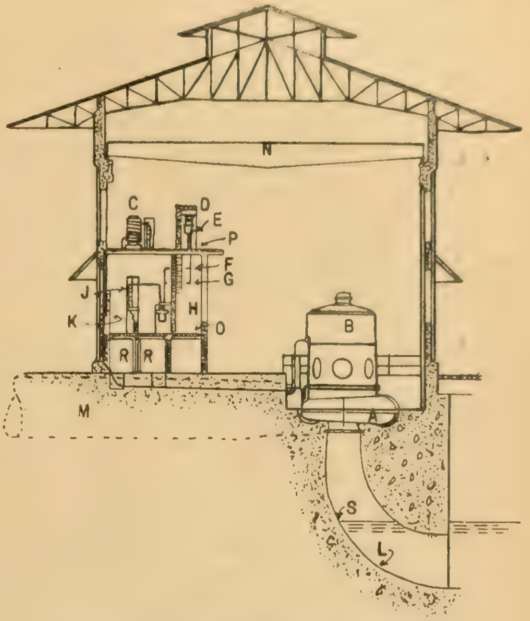
From the forebay the water will be carried to the turbines through three steel penstocks, each having an average length of 350 ft. The penstocks are constructed of $\frac{3}{8}$-in. plate riveted together, and have an inside diameter of 10 ft. 6 in. Their exteriors are surrounded by a concrete coating nowhere less than 12 in. thick, anchored to the steel by means of Z-bars, 3 in. × $\frac{3}{8}$ in., which are riveted to the plates. This coating will serve both as a protection against corrosion, and also as a means of protecting the penstocks against superimposed earth pressures. The steel and masonry, it may be added, are entirely covered with the fill of Gatun Dam. Near the lower end of the penstocks, at the power house wall, there is installed a testing link, for the purpose of measuring, by the velocity method, the quantity of water flowing in each tube.

The entrances to the penstocks are closed by cast-iron headgates and bar iron trash racks, the latter being intended to prevent sunken *débris* from entering the tubes, and possibly clogging or breaking the turbine runners. The headgates are raised and lowered by individual motors, geared to rising stems attached to the gate casting, control of each motor from the station switchboard being effected by means of reversing contactors, with interlocks, a limit switch and float switch, all operating automatically. The driving machinery and motors are placed in a small concrete gatehouse, erected upon the forebay wall directly over the gate recesses and trash racks, provision being made for a future addition of three headgates.

The turbo-generator units (see fig. 2) are of the vertical type, the entire weight of the rotating element being suspended from an overhung thrust bearing, supported from the top shield of the generator. The water enters the turbine through a tapering joint from the penstock, and discharges into an increasing elbow draught tube, made of $\frac{1}{4}$-in. steel plates, embedded in the concrete foundation. Each turbine is rated at 2,250 KW., at a speed of 250 R.P.M., and will pass approximately 500 ft./sec. of water at full load.

Superimposed upon the turbine casting, but separated by a distance ring, 6 ft. in height, is the generator, rated at 2,000 KW., and delivering three-phase 25-cycle current at 2,200 volts pressure. The governor is mounted upon one side of the distance ring, and is geared solidly to the main shaft.

From the lower part of the generator the leads to the outgoing feeders pass through a manhole at the base of the turbine into a duct line, which carries the cables to manholes in the cable vault. Thence the leads are taken up the building wall in tiled ducts to the generator reactances, which consist of air-insulated coils mounted upon concrete cores, and give protection to the generators in the event of severe and protected short-circuit outside the machines. A reactance coil is inserted in each of the three phases of each generator.



A, 2,250-KW. Water turbine; B, 2,000-KW. Generator; C, Reactance; D, Generator instrument transformers; E, Generator switches; F, Bus 1: G, Bus 2; H, Circuit switches; J, Circuit instrument transformers; L, Draft tube; M, Penstock; N, 80-ton crane; O, First gallery (el. + 40·85); P, Second gallery (el. + 55·35); R, Cable vault; S, Low water level (el. + 7).

FIG. 2.—SECTION THROUGH GATUN HYDRO-ELECTRIC POWER STATION.

Adjacent to the reactances is a concrete cabinet containing small series and shunt transformers for energising the instruments and protective devices on the main control switchboard. The generator leads next enter a concrete compartment in which are a pair of switches permitting a selection of connections to either of the duplicate bus-bars situated on the first gallery floor, directly underneath the generator oil switches. These bus-bars are to distribute the

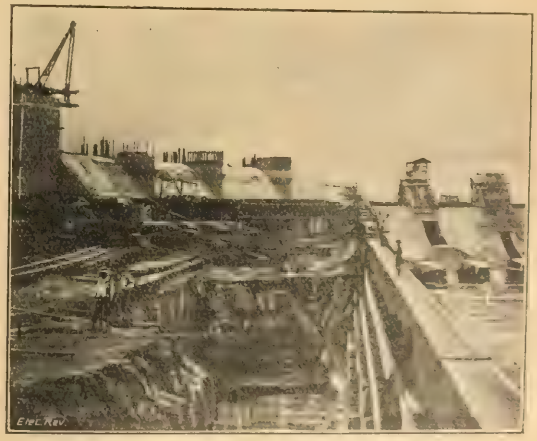


FIG. 3.—GATUN POWER STATION: TAIL-RACE PIT, LOOKING UP-STREAM.

energy among the several circuits, each of which is equipped with oil switches. The distributing circuit passes from the circuit switch to an instrument transformer compartment, similar in every respect to the generator instrument transformer compartment. From the instrument transformers, the circuit cables drop into vertical duct shelves in the cable vault, and thence emerge from the station through manholes at either end of the building into duct lines at the crest end of Gatun Dam.

An important feature in the design of a modern power house is the remote control of all auxiliary machinery and equipment, particularly of the dangerous switching operations on high voltages. The control and protecting devices at the Gatun station have been worked out carefully, and should permit of a quite flexible and reliable operation of the generators under any probable condition of loading. A main control switchboard, of the unit panel type, is erected upon the second gallery floor, from which the operator possesses a very good view of the entire station; and command of all operations—indicated by means of small pilot, or signal, lamps—is obtained through master control switches. The attendant at the switchboard remotely controls all switching operations, both on the high-tension and exciter bus-bars, and also the headgates, governors, rheostats and field circuit breakers.

In addition to the control switches, the main switchboard contains all indicating, integrating and recording instruments, essential for the methodical and economical operation of the station. Time-limit relays are mounted upon the relay panels to serve as a protection to circuits and generators in case of overload; and continuity of the operating circuit is obtained by the installation of a storage battery upon the first gallery floor, the switches being mounted upon one panel of the main control switchboard. A voltage regulator, automatically maintaining a uniform bus-bar pressure, is assembled upon a smaller station panel at one end of the main board.

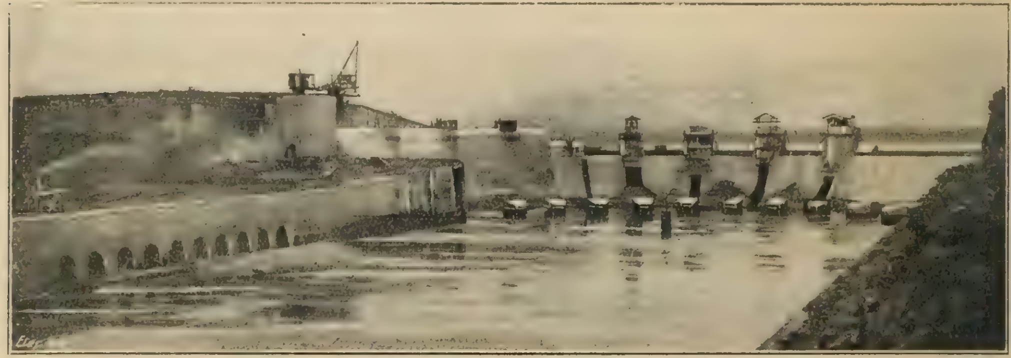


Fig. 1.—Spillway at Gatun Power Station: View Looking South from West Bank. Surface of Gatun Lake Rising in Distance.

A variation from standard practice is found in an attempt to secure maximum reliability in the excitation system without the installation of additional water turbine exciter sets. When the station is running smoothly, the direct-current supply is obtained most economically through motor-driven exciter sets, operated directly from the 2,200-volt bus-bars. Two such sets, each of 100 KW. capacity, are erected in the Gatun station. Difficulty, however, is encountered when the station is shut down, as no source of 2,200-volt supply is available to drive the exciter sets. The small water turbines usually installed for the purpose of driving the independent exciters are more complicated than motor-driven sets, since they require adjustment of governor and valves, and also additional penstocks and gates. At Gatun, each machine is equipped with a 50-KW. exciter mounted upon the vertical shaft in the 6-ft. space separating the turbine from the generator. When starting after complete shutdown, the direct-connected 50-KW. exciters will furnish the necessary excitation until such time as the motor-driven exciter may be connected to the system. It is believed that this selection of exciter equipment will result in a simple and easily operated system possessing ample capacity under all working conditions and exceptional reserve should one exciter be accidentally damaged.

(*To be continued.*)

ELECTRIC TRAIN-LIGHTING SYSTEMS.

By T. FERGUSON, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Birmingham, January 28th*, 1911.)

Much has been said and written with respect to the comparative danger and safety of gas and electricity as a means of train lighting, and it has even been denied that gas adds materially to the fire danger in case of collision; but the fact remains that in nearly every case of fire after a collision on steam railways, gas has been used for lighting the carriages.

It would appear that the reason why electricity at the present date has not entirely superseded gas is one of capital expenditure.

The cheapest system to use would be to install high-speed steam-driven generators on the locomotives and merely equip the carriages with lamps and wiring, providing suitable cable connections between the carriages. This system is used to a limited extent in America, where it is known as the "head end" system. It affords some inconvenience to traffic working, insomuch as the locomotives must remain attached to their trains for longer periods than are necessary with the gas-lighting system, and it does not lend itself to gradual conversion; hence the lines upon which electric lighting systems have been developed are practically confined to the "individual unit" system, where each carriage carries its own generator, driven from the axle, and also a storage battery to supply the lights when the train is standing.

An alternative course in the case of block trains is to light the complete train from one or more large axle-driven dynamos in the brake-van or vans, storage batteries and regulating gear of course being employed just as in the "individual unit" system.

The "individual unit" system is particularly well adapted to the requirements of the railways, as each coach so equipped is an independent unit, can be run anywhere on the railway, and has no storage tanks which require to be recharged at frequent intervals. The system can be introduced as gradually as required, the obvious way being to equip new coaches as they come out of the works and convert old gas-lighted rolling stock as opportunity arises.

The dynamo may be regulated to give either constant current or constant voltage at speeds above the normal. In either case, if the battery is to be charged during lighting duty, the dynamo voltage must be considerably higher than the lamp voltage, at least 25 per cent. if the battery is to be kept in good condition. The difficult problem to be solved lies not so much in regulating the dynamo so that it gives constant current or constant voltage, but in dealing in the lamp circuit with the extra voltage necessary to charge the battery. Much effort has been concentrated on the problem of introducing and withdrawing in the lamp circuit compensating resistances in such a manner as to prevent fluctuations in the light.

It was this and other difficulties that early in the history of train lighting led to the adoption of the double-battery system. This arrangement is practically confined to constant-current systems, and the arrangement is that No. 1 battery is on charge while No. 2 battery supplies current to the lamps. The batteries are, however, connected by means of a resistance, which permits the higher or charging voltage to send practically enough current through the resistance to supply the lamps, so that No. 2 battery should really float on the system. When the train is standing the two are connected in parallel, with the resistance short-circuited, so that the fully charged battery will partially discharge into the empty battery, with consequent double losses. The battery efficiency is therefore very low. A well-known firm of storage battery makers state that "with most double-battery systems the efficiency is probably not more than about 5 to 10 per cent. of the current generated." The arrangement, however, is very much used, as it enables a fairly steady light to be maintained with a comparatively poor dynamo regulation and with quite crude and simple automatic switchgear. A system which employs only one battery must be considerably cheaper to maintain, and may be cheaper in first cost.

The constant-current system has up to now proved the more practical system, and has been much more widely adopted than the constant-voltage system. With the constant-current system the current need not be adjusted to within 10 or 15 per cent., as a variation to this extent—or even to a greater extent—will not appreciably affect the battery-charging voltage, and all that will happen is that the battery will take a longer or shorter time to charge. In the case of a bad connection between the cells, or sulphated cells, the dynamo voltage will rise sufficiently to maintain the constant current, and the sulphates will become reduced and the battery charge maintained.

With most modern systems the efficiency at all speeds is practically constant; hence the draw-bar pull falls off as the speed increases. However, with belt-slipping systems the draw-bar pull will be constant.

Messrs. Stone & Co. are practically the pioneers of the "individual unit" system. Their dynamo is designed to work on the constant-current principle, and nearly all their equipments employ the double-battery system; whilst all the switches used for the automatic switch operation are controlled by means of a centrifugal governor contained under a dome cover fixed to the dynamo. The speed of the dynamo does not rise above full-load speed, however much higher is the speed at which the belt runs. As the dynamo does not possess any other regulating device, it becomes a very cheap and simple machine, but obviously must possess the disadvantage of depending for its regulation entirely on the coefficient of friction existing at any particular time between the belt and the pulley. Hence the output will vary as the condition of the belt changes. The waste of power at high speeds is also another serious drawback. Generally speaking, in making coal-consumption tests it is found that there is a greater difference in the amounts of coal burnt for any two similar journeys than for similar journeys made with and without the dynamos coupled. In fact, some journeys will show less coal burnt with dynamos running than without them. The total horse-power required for the dynamos will generally average something like 5 per cent. of the total power exerted by the locomotive, even with belt-slipping systems, and the total coal burnt may easily vary more than that percentage owing to differences in the direction and strength of the wind.

In spite of the disadvantages inherent to belt-slipping regulation, the system of Messrs. Stone & Co. has maintained its lead in face of severe competition from manufacturers of other systems, and this system undoubtedly operates satisfactorily. This is probably due to the fact that its action is quite obvious and easily understood; also that it is a constant-current system, and as such can be maintained by comparatively poor-class labour, since it does not require any particular nicety of adjustment.

The Leeds Forge Company's system is designed to avoid the disadvantages of belt-slipping regulation, (whilst preserving its simplicity, robustness, and directness of action. The author is particularly interested in this system, having designed and developed it.

The system belongs to the "constant-current" class, and accomplishes its regulation by means of the torque required to drive the armature. As the speed increases, the driving torque serves, by means of a cam, to thrust the armature bodily along its shaft in an axial direction from its normal position in the field, the thrust being resisted by a suitable spring. The spring is provided with an adjusting nut, so that the output can be varied by altering the initial compression of the spring, and an output scale is provided marked in amperes, so that the dynamo attendant can readily adjust the output to a definite figure.

The action is exactly the same in whichever direction the dynamo runs. The change in polarity is taken care of by fixing the brushes on a brush-rocker disc, which is mounted on bearings attached to the rotating part.

Regulation by withdrawal of the armature from the field enables a very wide range of speed variation to be obtained with a minimum of sparking. The lead of the brushes is automatically increased with the speed. The dynamo comes into action at about 450 r.p.m., and runs as a self-regulating machine up to 3,000 r.p.m. Hence a carriage can be used indiscriminately for slow or express trains without changing the pulleys and without waste of power. The system is adapted to be easily maintained by unskilled labour.

The automatic switchgear for switching the dynamo in and out of circuit and for introducing the voltage-compensation into the lamp circuit when the battery is charging while the lamps are burning, consists of two solenoid switches with resistances. A complete diagram of connections for the system, including the windings of the solenoids, is shown in Fig. 1.

The dynamo switch merely serves to connect and disconnect the dynamo from the battery and lamps when the dynamo voltage reaches or falls below the battery pressure. It is of the usual type with shunt and series windings; in its "down" position it short-circuits the series winding of the lamps solenoid. The lamps solenoid switch possesses several novel features with regard to regulating the pressure on the lamps. When the dynamo is stopped, the dynamo switch is open and the lamps receive current direct from the battery, the resistance 7—1 being bridged over. After the dynamo starts running, the dynamo switch closes at the right voltage and then the dynamo begins to take over the lamp current and relieves the battery. When its voltage has risen high enough to charge the battery, then and then only, is the bridge over the resistance removed in steps and the balancing connection 7—8 established *viâ* the main switch. The lamps are then connected across 10 cells receiving the charging voltage, so that the resistance 7—1 need not be altered when lamps are switched in or out. This saves a lot of complication of wiring and resistances when arranging the carriage lighting with individual lamps, each on its own switch. When the normal number of lamps is burning, the I R drop in the resistance balances the charging E.M.F. of 2 cells and no current flows in the balancing wire. If more lamps are switched on, the difference in current between the normal lamp current and the new lamp current will flow along the balancing wire. The net result is—so far as the lamps are concerned—that their voltage is practically unaffected by switching lamps in or out; and, as regards the battery, the two end cells will either receive a little more or a little less charging current than the remainder, depending on whether more or less lamps than the normal are switched on. In practice this arrangement works very well and the end cells do not appear to suffer any inconvenience even after several years' service.

It will be seen from Fig. 1 that the lamps solenoid is provided with series and shunt windings, the series winding being in the battery circuit only. A current which charges the battery flows through this coil to assist the shunt winding, while a discharge current from the battery to supply the lamps acts in opposition to the shunt. Therefore until the voltage of the dynamo is high enough to supply a charging current to the dynamo the solenoid switch remains down. When the dynamo, besides feeding the lamps, begins to supply current to charge the battery, the series coil acting in conjunction with the shunt, lifts the plunger until the stop comes in contact with the lower switch bar. The upper switch bar being lifted, the first step of resistance is inserted. When the charging current increases, the plunger will overcome the force of the spring, and owing to the position of the spring will tip up the switch bar across the left-hand bottom and the right-hand top contacts, thus inserting another resistance in series with the first. The leverage is now in favour of the spring, and the last step is therefore not made until the current has further increased. The switch bar is then tipped across the top contacts, inserting the last step of the resistance and establishing the balancing connector. With this novel arrangement of solenoid and spring the switching movements are effected by means of a single solenoid with a comparatively small travel. When the dynamo slows down below the minimum speed the charging current falls and the switch goes through its movements in the reverse order.

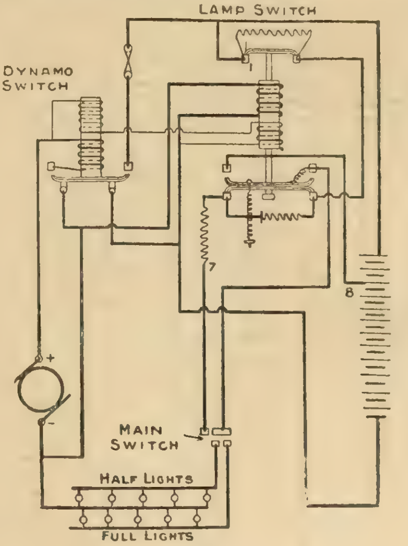


Fig. 1.

The best feature of any constant-current system is that it ensures the charging of the battery eventually to the "gassing" point, and thereby gets rid of any sulphates which may be formed on the surface of the plates. The objection is sometimes raised against it that it overcharges the battery. Admittedly it may under certain circumstances; moreover, a too long continuance of a gassing charge will tend to scrub the surface of the plates and boil away the acid. It is, however, easy to avoid this by using an over-charge preventer. Most over-charge preventers consist of a relay switch connected across the battery, which acts at a certain predetermined voltage and either cuts the dynamo out of action altogether or reduces its output.

The Leeds Forge Company use a small solenoid switch to break the dynamo field, thereby causing the machine to stop generating and the dynamo switch to drop out. The winding of this solenoid switch is connected across the battery *viâ* a small and simple switch which breaks contact when the dynamo stops. In this way a very reliable action of the solenoid is obtained, and the device does not depend on any delicate adjustment for releasing voltage when the battery voltage falls, as the solenoid plunger having been pulled "home" remains there until its circuit is severed by the dynamo stopping. Lost motion is provided between the solenoid plunger and the switch bar, so that the opening of the field is decisive. A similar arrangement of the plunger and spring to that employed on the lamps solenoid may be used to discharge the field on breaking.

Messrs. Mather & Platt also adopt what is practically a constant current system and use Dr. Rosenberg's patented generator. They usually prefer to employ the double-battery method. Dr. Rosenberg's dynamo is well known and has been frequently described in connection with train lighting.[*]

The main point in the dynamo as regards train lighting is that it does not require any pole-changing mechanism in order to retain the same polarity at its terminals when its direction of rotation is reversed. This system being a double-battery one takes care of the lamp voltage by means of the No. 2 or "floating" battery, in the manner referred to previously.

Another example of constant-current operation is the latest system adopted by Messrs. Vickers, Ltd.[†] This is the "D.L." system of the Consolidated Lighting and Heat Company, U.S.A. This system uses two separate regulators, one for controlling the dynamo and the other for controlling the lamp voltage.

The Tudor Accumulator Company's system is also a single-battery system on the constant-current principle. Regulation in this case, as in the Rosenberg dynamo, is accomplished by the windings of the dynamo itself. The dynamo is reverse-compounded in the ordinary way, so that a separate pole-changing device is necessary.

Both the Tudor Company and Messrs. Mather & Platt follow the same practice in varying the shunt-field excitation when the lamp-circuit hand switch is operated, in order to alter the dynamo output as lamps are switched on or off. The Tudor Company employs special hot iron-wire resistances permanently connected in series with the lamps to absorb the difference between the dynamo and lamp voltages.

These iron-wire resistances are enclosed in glass globes from which the air is excluded and in which hydrogen gas is introduced, and they are run at practically a dull-red heat. At this temperature iron wire increases in resistance very rapidly with an increase of current, so that a considerable increase in voltage will make but little difference in the current passing through the resistance; hence the resistances act as a protection to the lamps. They possess, however, the disadvantage that they absorb a considerable amount of energy.

The system of the India Rubber, Gutta Percha, and Telegraph Works Company, Limited,[‡] is an ordinary double-battery system more or less similar to the Stone system, except that regulation is not accomplished by the slipping of the belt, but by reverse-compounding coils, which carry the charging current to the battery.

The systems described up to this point have been examples of constant-current working; the majority of the existing systems operate on that principle. There are, however, several systems which use more or less the constant-voltage principle of operation, including besides those described, the Leitner.[§]

Messrs. Brown, Boveri & Co. adapt their well-known voltage regulator for use with their train-lighting system. The main point in their arrangement is that they provide compound windings on their regulator, so that the battery charging-voltage is not held constant, but gradually rises as the battery becomes charged. By this means the battery charging-current does not have the characteristic of the purely constant-voltage system, but more nearly approaches a constant-current curve. The dynamo is an ordinary shunt-wound machine, the field excitation of which is controlled by the regulator.

This system is obviously a step in the right direction, inasmuch as it raises the voltage on the battery as charging proceeds. It is unfortunate, however, that the arrangement for taking care of the varying lamp pressure should partially interfere with this good feature.

Some years ago Mr. Dalziel described a constant-voltage system, the D.C.V., invented by him.[‖] Unfortunately, in order to obtain the desired regulation he had to employ in addition to the dynamo a system of motor-generator and exciter gear which made the complete arrangement rather complicated, as there were too many small armatures and commutators, brushes, etc., to be readily maintained. Mr. Dalziel has now reduced the auxiliary motor-generator system to a single exciter geared direct to the dynamo shaft.

The diagram of connections and the arrangement of the dynamo and exciter are shown in Fig. 2. It will be seen that the magnetic circuit of the exciter is somewhat unusual. The main generator field is connected across the armature of the exciter, which revolves in a field that is the resultant of the fluxes on the two poles B B. These poles are so wound and connected across the dynamo terminals that the magnetomotive forces produced are in series. The one pole is of small section and becomes saturated at a very low terminal pressure. The other pole is of large section, possesses a fairly long air-gap, and is very far from saturation, in fact, possesses nearly a straight line characteristic.

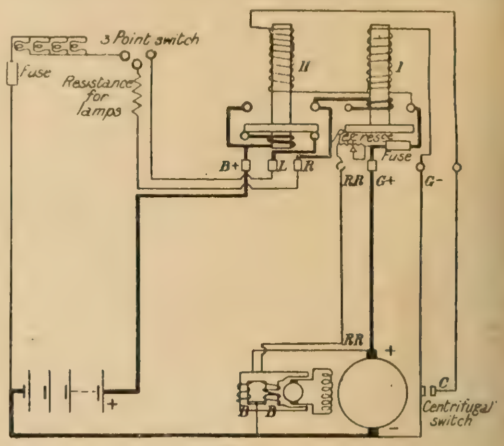


FIG. 2.

These two characteristics are shown in Fig. 3, where A is the curve for the saturated pole, and B the curve for the unsaturated pole with the air-gap. The difference between these two curves represents the flux passing through the exciter armature. Hence if D represents the difference in flux necessary to give the required excitation at the minimum normal or cut-in speed of the generator, the voltage cannot increase beyond the point represented by C, which is the point of "no flux" through the armature, corresponding to infinite speed; that is to say, the part E measured as a percentage of the part F is the percentage rise in the main voltage corresponding to a rise in speed from the cut-in point to infinite speed. By designing the exciter to give the necessary voltage with a sufficiently small flux, this percentage rise may be made as small as may be required. In order to keep the size of the exciter within reasonable limits, it is geared to run at a higher speed than the main generator.

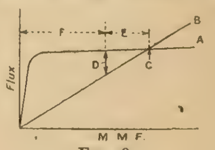


FIG. 3.

The difference between the dynamo voltage and the lamp voltage is, as usual, absorbed by means of the lamp resistance. Each lamp or bank of lamps controlled by a separate switch is provided with its own resistance, and these resistances are "cut in" in one step. The dynamo is switched in parallel with the battery at the correct voltage by means of the usual solenoid switch I, provided with series and shunt windings; but instead of switching it direct into circuit with the battery, it is switched in through the lamp resistance and the lamp switch. Assuming the latter to be closed, the path of the current is through G, switch I, terminal R, the lamp resistance, the lamp switch, and back to terminal L, through solenoid switch II, through the series holding coil of the same to the positive pole of the battery.

As the speed of the dynamo and its voltage increase, the dynamo takes over the lamp current, and the current in the series holding coil of solenoid II is reduced to zero, and this switch is free to act whenever its operating winding circuit is closed. Meanwhile this has been accomplished by means of the centrifugal switch C. The solenoid switch accordingly closes and so connects the dynamo direct to the battery, leaving the lamp resistance between the lamps and the dynamo. When the dynamo slows down, the reverse action takes place. This is where the necessity of the centrifugal switch C comes in, as it is impracticable to make solenoid II drop at the right moment without breaking its circuit by means of the centrifugal switch.

Described in the ELECTRICAL REVIEW [*] June 9th, 1905, page 923 [†] September 12th, 1913, page 406. [‡] December 1st, 1911, page 926 [§] March 17th, 1905, page 427; November 2nd, 1906, page 695. [‖] March 29th, 1907, page 511; April 5th, page 568.

This is a pure constant-voltage system, and the battery will be charged in accordance with such. In the author's opinion this is by no means the best way of treating the battery in practice, and it would be much better to insert a resistance between the positive terminal of the dynamo and terminal G and run the dynamo at a higher voltage in order to get the benefit of the diminishing drop in the resistance, with consequent building-up of the voltage as the battery becomes charged. The lamps would of course be subjected to this amount of voltage variation; but as the lamp resistance would be designed accordingly, the variation on either side of the correct voltage is by no means serious.

As this system employs a separate exciter, driven from the dynamo, it does not require any further pole-changing apparatus, as the polarity of the exciter reverses when the direction of motion is changed, thus altering the direction of excitation of the main generator; which is just what is required to maintain correct polarity.

The author would like to suggest to Mr. Dalziel that instead of using a compound magnetic circuit for his exciter he could merely use a standard exciter with two shunt windings connected across the main dynamo terminals. The two windings would act against each other, but in the circuit of one he could insert a hot iron-wire resistance. This would at once limit the excitation current in that winding. The working flux would be obtained from the difference between the two excitations, and the same effect is obtained as in his compound magnetic circuit, with possibly the advantage that it is not necessary to develop a fresh machine for the purpose. It would also be possible to use permanent magnets in place of the constant-excitation winding.

In the Grob system constant voltage is also used, but the dynamo runs at the same voltage as the lamps and the battery receives its charge through a booster. The dynamo is arranged with its field coils in series with a regulating battery; a second battery connected across the dynamo and booster in series is required for charging. The two batteries are arranged to be interchanged as suitable intervals so as to prevent the regulating battery running down.

In the opinion of the author single-battery systems will have to be much more universally adopted in the future if electric train lighting is to make the progress that is expected of it, as by reducing the number of cells the maintenance and depreciation costs of the equipment are certainly decreased by 25 to 30 per cent.

Discussion at Birmingham.

Mr. Taylor drew attention to the low efficiency of the batteries, especially when a double-battery system was employed.

Mr. Fennell said that some years ago a certain railway company tested the suitability of a battery for train-lighting purposes by its capacity for withstanding abnormal over-charges.

Dr. Coales thought that the total cost of a lighting installation might be considerably reduced by arranging batteries only on the individual coaches and a single generator in the guard's van.

Dr. Garrard expressed the opinion that modern train-lighting systems appeared to be unnecessarily complicated.

Mr. J. D. Morgan remarked that the development of the principal train-lighting systems appeared to be characterised by excessive accumulation of corrective accessories, and emphasised the necessity of the designer's reviewing the fundamental requirements of the problem and endeavouring to develop systems inherently satisfactory rather than attempting to gain perfection by complicating a system which was fundamentally defective. The lamp circuit demanded a constant voltage and variable current, but the requirements of the battery were incompatible with this condition. The designers of train-lighting systems had become so obsessed by the difficulties occasioned by the use of the battery that the problem was no longer how to light a train, but how to charge a battery, and it was for this reason that the constant-current system had become generally adopted. The unsuitability of the system was becoming recognised, and serious efforts were being made in a number of directions to realise an ideal constant-voltage system.

Mr. Gus. C. Lundberg, in a written communication, said that it was essential on main-line trains that passengers in individual compartments should be able to dim the light when wishing to rest. Various tumbler-switch controls had been devised for this purpose suitable for compartments lit by two, three, or four lamps. In each case there was only one tumbler switch (of ordinary size) per compartment, and this could only vary the light, by putting lamps in parallel or series, the supply to all the compartment switches being controlled by the guard.

Mr. C. A. Newton, referring to Mr. Ferguson's description of the D.C.V. system, and the treatment accorded to the battery by it, said that provision was already made for the use of the series resistance Mr. Ferguson mentioned, and it could be connected in such a manner that the regulation on the lamps was in no way affected. It had been found in practice that the battery treatment was all that could be desired without the use of this resistance; but in certain cases, where a very large storage capacity is required, compared with the actual lamp current, the resistance would be of use in enabling a smaller dynamo to be used, and as it would not be in circuit with the lamps when the battery discharged, its inclusion would affect the over-all efficiency to a very slight extent indeed.

A hot iron wire resistance and a plain magnetic circuit for the exciter was provisionally patented in this country some four years ago, but it did not appear to have been developed, and probably was not very practicable. With such a resistance the absolute certainty of building up with a constant polarity when driven in either direction of rotation (an important feature of the D.C.V. machine) would be very materially prejudiced, if, indeed, the machine could be depended upon to build up at all.

On one of the D.C.V. sets which had been in service for eight years, the original battery was still in use.

INSTITUTION OF ELECTRICAL ENGINEERS.

Annual Dinner.

The annual dinner and reunion of the Institution of Electrical Engineers took place on Thursday last week at the Hotel Cecil. Mr. W. Duddell, F.R.S., the president, occupied the chair, and there was a large and distinguished gathering of guests as well as a large number of members of the Institution, the company numbering in all nearly 400. Amongst those present were: Sir Charles Parsons, Sir Thomas Barlow, Sir G. Askwith, Sir J. Bradford, Sir H. F. Donaldson, Sir H. Trueman Wood, Sir A. Kempe, Sir J. Crichton-Browne, Sir W. G. Greene, Colonel Sir T. H. Holdrich, Major-General S. B. Von Donop, Rear-Admiral E. F. B. Charlton, Mr. H. A. Payne, Dr. A. Cooper, Mr. W. F. Marwood, Mr. R. A. S. Redmayne, Dr. F. G. Ogilvie, Mr. G. Roper, Lieut.-Colonel P. G. Von Donop, Colonel G. M. W. MacDonogh, Mr. G. W. Humphreys, Prof. A. W. Porter, Mr. E. Worthington, Dr. W. N. Shaw, and Mr. E. G. Dawber.

In the absence of Lord Moulton, Sir J. Crichton-Browne proposed the toast of "The Institution of Electrical Engineers," and said that medical men were greatly interested in the progress of electricity, with which they had been intimately associated from the days of Galvani. He mentioned many members of his profession who had played a prominent part in its development, and said that medical men had recognised the therapeutic value of electrical treatment and had made great use of it. The influence of electrical engineers extended far further than they suspected. Numerous examples of it were met with in lunatic asylums, and the commonest forms of insane delusions were connected with electricity. As a representative of the Royal Institution, he referred to its connection with electrical science, in particular through the work of Faraday, and concluded with highly complimentary allusions to the chairman. The toast was accorded musical honours.

In reply, Mr. Duddell said that he had of late been urging the Institution to seize upon every possible opportunity of development, and he hoped that the field of medical electricity would be energetically cultivated by the members. There was no society that valued more highly the work of the Royal Institution and the memory of Faraday, and their indebtedness to that Institution continued to the present day.

Dr. S. Z. de Ferranti proposed "The Guests," and in welcoming them pointed out the extraordinary variety of interests that they represented, into all of which the applications of electricity entered largely. Electricity was becoming an all-pervading influence, but there was still very much more that could and would be done electrically. It was right that every member of the public should possess some knowledge of electricity, and as an Institution it was their business to promote that end. There were many who, while not electrical engineers, had much to do with electricity, and they wanted them to join the Institution; the Associate class had been formed for that purpose, and he hoped that many of the guests would some day be their fellow-members.

In reply, Sir George Askwith referred to the youthful appearance of so many of the members, in view of the great advances that had been made in electrical science since the days when the electric light was regarded as a curiosity, and strange patent actions, in some of which he had been engaged, were going on. Yet they had but scratched the surface of the possibilities that lay before electricity. In spite of several serious strikes that were still in progress, there were fewer strikes and fewer men on strike in this country than there had been for many months past. There was electricity in the air, but he did not know that there was any great trouble to be anticipated in the near future.

The President then announced that a telegram had just been received from the Italian Society of Electrical Engineers conveying fraternal greetings, and afterwards the company adjourned to the Victoria Hall, where music was provided, and the members were at liberty to renew old acquaintanceships and make new ones, many remaining until a late hour.

British Association.—The Lord Mayor of Manchester recently presided over a meeting to consider the arrangements for the visit of the British Association to Manchester in September, 1915. A local Executive Committee was appointed.

PROJECTED ELECTRIC RAILWAYS FOR BERLIN.

Attention has recently been attracted in Berlin by a carefully worked out and co-ordinated scheme for intra-mural electric railways which has been published in the "Zentralblatt der Bauverwaltung" by Mr. Bousset, the constructional engineer responsible for the existing privately owned lines.

Whilst this scheme has no direct official support, it is regarded as having more than usual significance in that it is propounded by the engineer who is best acquainted with the local circumstances, and may be understood to indicate the proposals which the Berlin Elevated and Underground Railway Co. intend to bring forward. To a large extent also it consists of a summary of the lines already working, under construction, or officially approved.

The position may best be understood by reference to Fig. 1, but it should first be stated that these lines, both existing and proposed, constitute a system which is, and must remain, separate from the main railway system of the Prussian Government.

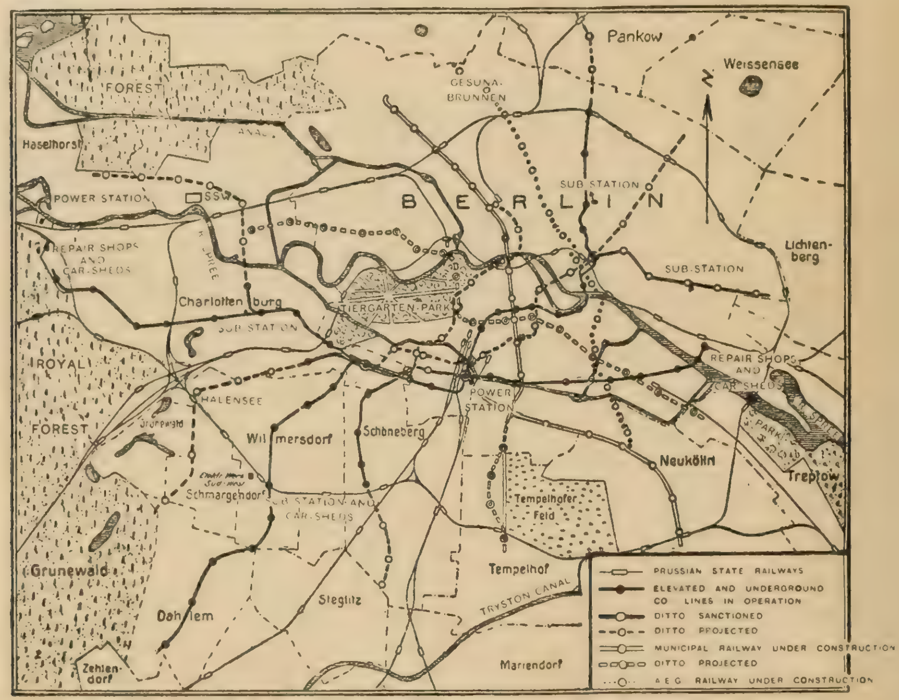


Fig. 1.—Projected Electric Railways for Berlin.

Through running is rendered practically impossible by a number of factors, not the least of which is the decision of the Government to electrify their suburban network on the single-phase system, whereas all the existing and approved intra-mural lines have adopted direct current at 700 volts with a third rail.

At the same time the State railway authorities are able to exert a powerful influence in regard to all proposals which are submitted for approval, and it is this influence which has led Mr. Bousset to omit from his plans a direct connection between the termini of the main northern and southern railways respectively. Such a connection is undoubtedly needed, and its omission from these plans has raised some comment, but Mr. Bousset regards the Government opposition as insurmountable.

On the map eight lines are shown:—

1.—The existing main line of the Berlin Elevated and Underground Railway Co., which is a Siemens and Halske concern. This runs from the north-east of the city, right through the centre, to the heart of Charlottenburg in the west, with a branch from Charlottenburg to the forest resorts in the extreme west and to the car sheds and new repair shops, which are also in these forests. This western extension is worked by a shuttle service, but of the trains coming from the north and centre a number do not run to Charlottenburg, but are diverted at Wittenbergplatz on to a recently constructed line, which leads to Wilmersdorf and Dahlem in the extreme south-west. This extension runs quite into the country, and the last few miles are in an open cutting and are worked by a shuttle service. Otherwise these railways are all shallow subways with the exception of a few overhead stretches. The latter construction has been practically abandoned for future schemes in favour of the subway system. It is probable that the Charlottenburg line will shortly be extended to the Siemens-Schuckert works at Nonnendamm, and eventually nearly to Spandau.

2.—A branch from the existing main line at Alexanderplatz, in the business centre of Berlin, to the extreme east at Frankfurter Allee. This is already approved, and the junction at Alexanderplatz was constructed when the present station was built.

3.—The existing overhead line from Gleisdreieck eastwards to Warschauerbrücke. This is being extended westwards across the main track (1.) which it will rejoin at Nollendorfplatz. The trains from Warschauerbrücke will not, however, run to Charlottenburg or Dahlem, but to another western branch. At present this branch runs only a short distance (to Uhlandstr.), but is about to be extended to Halensee, and Mr. Bousset proposes a further extension to Schmargendorf. The existing stretch from Wittenbergplatz is worked by a shuttle service.

4.—The important municipal subway line from Chausseestrasse, in the north, to Neukölln, in the south-east; this is already under construction, but Mr. Bousset suggests a branch to Tempelhof, in the south.

5.—The east-west line proposed by the Berlin Municipality. From the thickly populated district of Moabit, in the north-west, the line would pass through the heart of Berlin to Treptow, in the south-east, crossing or touching most of the other subways, and also joining the termini of the main lines from Hamburg and from Görlitz.

6.—The AEG railway from Gesundbrunnen, in the north, through the eastern end of the city to Neukölln, in the south-east. The construction of this line will be commenced very shortly.

7.—The Schöneberg Municipality has built an independent short line, from Nollendorfplatz into Schöneberg. It is worked by the Berlin Elevated and Underground Railway Co., but under a guarantee from the Municipality, and the latter incurs a heavy annual loss. Mr. Bousset proposes to extend the line southwards into the suburbs, and also northwards through the heart of Berlin to the Stettiner Bahnhof, the terminus of the main line trains from Stettin and other North Prussian towns.

8.—An entirely new suggestion is made by Mr. Bousset, which involves a subway from Wittenbergplatz, through the city, to the extreme north-east, with a large number of interchange stations affording connections to the other lines. The realisation of this scheme is probably remote.

In several respects the electric railways are remarkable. Great stress is laid upon ready access from the street to the platform; as the subway lines are immediately beneath the street surface there is only a short flight of steps, and in no case are there lifts or escalators.

The stations are all noticeably clean and bright in appearance, advertisements are neither intrusive nor ugly, and, in the case of the newer lines, the architecture attains a high artistic level. The station at Dahlem Dorf, on the recent south-western extension (Line I.), adjoins a well-preserved country village, and in order to harmonise with the old buildings the station has a thatched roof!

Safety devices are dear to the heart of every German railway engineer, but the intra-mural lines excel in this respect. Originally line 3 had a triangular physical junction with line 1 at Gleisdreieck, closely resembling the triangle on the S.E. Railway between London Bridge, Cannon Street, and Waterloo, but with two-track roads throughout. A serious collision at this point aroused public opinion, and the whole arrangement was reconstructed in the form of a T, without a physical junction, but with an interchange station. Most branches are worked by shuttle services, involving a change of trains, rather than by converging services merging with each other on the main lines (as on the Hampstead Tube). Where two services do converge, the peculiar lay-out shewn in Fig. 2 is adopted.

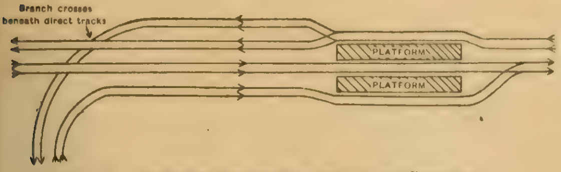


Fig. 2.—Junction on Berlin Shallow Subway.

From this diagram it will be seen that no two tracks cross each other on the same level, and that the two converging tracks join each other as they leave a station. Two trains could therefore only collide as they left the station. Not only would the speed then be very low, but it would be practically impossible for the drivers not to realize what was happening.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

NYASSALAND.—The export duty of 4d. per lb. leviable on all rubber, other than rubber collected from cultivated trees or plants, has been removed.

GRENADA.—The adhesion of Grenada to the terms of the Canada-West Indies treaty has been finally approved. Preferential treatment will now be accorded to certain British goods to the extent of one-fifth of the duty leviable on similar goods imported from foreign countries.

FIJI.—The Government have decided that no discount or deduction from the value of any goods chargeable with *ad valorem* duty shall be allowed in future, unless such discount or deduction is clearly shown to the satisfaction of the Collector of Customs on the original invoice in the same handwriting as that in which such invoice is made out.

AUSTRALIA.—Further applications have been made to the Inter-State Commerce Commission for revision of duties on electrical and similar goods in accordance with the arrangement previously referred to in the Electrical Review. Amongst these are applications for the granting of a preference to British goods under the following headings, for which there is now no preference. The existing rates of duty are given for purposes of reference :—

Regulating, starting and controlling apparatus for all electrical purposes, including distributing boards and switchboards, except telephone switchboards	20 % ad. val.
Electric fittings, consisting wholly or partly of metal, viz., switches, fuses, and lightning arresters	Free.
Electric fittings, not containing metal ...	According to material.
Telephones, telephone switchboards and appliances	Free.
Motive power machinery and appliances (other than high-speed reciprocating engines, steam turbines, superheaters, flue - heated economisers, mechanical stokers, and water purifiers)	20 % ad. val.

Further application has also been made for the increase of the preference now given to British goods under the following heading :—

Dynamo-electric machines up to the capacity of 200 H.P., static transformers and induction coils for all purposes, electric fans :—

Existing duty under preferential tariff on British goods	20 % ad. val.
Existing duty on foreign goods	25 % ,,

DENMARK. The Board of Trade have received from H.M Minister at Copenhagen, a translation of a Bill regarding the Commercial Rights of Aliens in Denmark, which was introduced in the Rigsdag by the Minister of Commerce on December 16th last, and has passed the first reading.

The Bill, which is of considerable importance to British firms trading with Denmark, embodies certain changes in the Regulations affecting British commercial travellers visiting Denmark, the chief being that it fixes the cost of a licence for a period of 30 days at 150 kroner, in place of the present yearly licence costing 160 kroner. After 30 days a new licence has to be obtained, but the old licence may be prolonged for a period of 15 days upon payment of 75 kroner.

If a commercial traveller represents more than one firm the Customs may issue a licence to him which shall contain the names of the firms for whom he is authorised to do business, provided the necessary evidence is produced in support of the lawful rights of these firms to do business in their own country. The Bill does not provide for any extra fee for such licences. [The existing regulations stipulate that if a traveller represents more than one firm he must pay a supplementary tax of 80 kroner for each additional firm.]

A deposit of 20 kroner has to be paid on each licence, which will be returned by the Customs provided the licence is given up to them by the traveller, at the latest, on the day after it has lapsed.

Whereas at present a commercial traveller is allowed to visit and take orders only from wholesale dealers and manufacturers, the Bill empowers him, under certain conditions, to offer or dispose of goods to persons having the right to do business, either wholesale or retail, and to manufacturers, artisans and other tradesmen; he is prohibited from selling to Danish merchants goods in which the latter have no lawful right to trade, and to manufacturers, artisans and other tradesmen he must only sell such goods as these people require for their business. He must not trade in goods purchased in Denmark. Sales must only be effected on time delivery and in no smaller amounts than is permitted in the case of wholesalers.

The new law is to come into force on October 1st, 1914, according to Sec. XI of the Bill. Yearly licences taken out before that date will be valid until they lapse in the ordinary way.

Kroner = 1s. 1¼d.

CANADA.—The Customs authorities have decided that street railway car bodies, without wheels or axles and without motors, are to be dutiable at the rate of 20 per cent. ad val. if of British origin, and at the rate of 30 per cent. ad val. if of other origin.

NEW PATENTS APPLIED FOR. 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

1,982. "Remote-Controlled Switches." G. W. Hart. January 26th. (Complete.)

1,984. "Means for, and Methods of, Changing the Frequency of Alternating Electric Currents." A. M. Taylor. January 26th.

1,996. "Lantern Construction for Electric Lighting and the Like." G. S. Strahan and F. J. Harris. January 26th.

2,023. "Transportable Military Telephone." E. Schuler and G. Schuler, trading as Erste Ungarische Stahlschreibfeder-Federhalter-und Indigo-Copierpapirfabrik, Josef Schuler. January 26th. (Complete.)

2,025. "Holders for the Filament of Electric Incandescent Lamps." January 26th. (Complete.)

2,032. "Engine-Room Telegraphs." J. Kidd. January 26th.

2,059. "Method of and Apparatus for Amplifying and Reproducing Sounds." L. de Forest. January 26th. (Convention date, June 24th, 1913, United States.) (Complete.)

2,063. "Miners' Electric Lamps or the Like, and Accumulators for Use therewith or for Like Purposes." F. J. Turquand. January 26th.

2,075. "Common Battery Telephone Systems." Western Electric Co., Ltd. January 26th. (F. T. Woodward, Belgium.) (Complete.)

2,089. "Electric Switches." British Thomson-Houston Co., Ltd. January 26th. (General Electric Co., United States.)

2,092. "Arrangements for Transmitting and Receiving Signals." Siemens Bros & Co., Ltd. January 26th. (Siemens & Halske Akt. Ges., Germany.) (Complete.)

2,100. "Telegraphy." E. C. R. Marks. January 26th. (International Quadruplex Co., United States.) (Complete.)

2,118. "Electric Griller or Toaster." G. Pate and A. R. Wood. January 27th. (Complete.)

2,149 "Incandescent Filament Lamps." J. R. R. Campbell. January 27th

2,173. "Electric Gas Lighter." H. Jenner and E. Pollard & Co., Ltd January 27th.

2.174. "Electric Distribution Systems." A. V. Gifkins and H. S. Watson January 27th.

2,197. "Loading-Coils for Use in Telephony." E. Wilson. January 27th.

2,198. "Electrical Heating Devices." British Thomson-Houston Co., Ltd January 27th. (General Electric Co., United States.)

2,206. "Cathodic Detectors." F. Holweck. January 27th. (Convention date, April 2nd, 1913, France.) (Complete.)

2,209. "Electrical Relay or Switch." P. L. R. Fraser and Tudor Accumulator Co., Ltd. January 27th.

2,211. "Arrangements for Telephone Systems." Siemens & Halske Akt. Ges. January 27th. Addition to 22,013, 10. Convention date, January 28th, 1913, Germany.) (Complete.)

2,214. "Spark-Gap Devices for Wireless Telegraphy." R. Goldschmidt. January 27th. (Convention date, January 27th, 1913, Belgium.) (Complete.)

2,215. "Telephone Desk Sets." Western Electric Co., Ltd. January 27th. (F. T. Woodward, Belgium.) (Complete.)

2,237. "Electrical Switches." H. W. Cox. January 28th.

2,242. "Dimming Switch." J. H. Colloe. January 28th.

2,249. "Electro-Magnetic Unlocking Apparatus for Miners' Lamps." O. Oldham. January 28th.

2,270. "Telephone Systems." Automatic Telephone Manufacturing Co., Ltd., and A. J. Ray. January 28th.

2,278. "Contrivance for the Electric Transmission of Messages through Land Lines and Submarine Cables." A. Orling and Orling's Telegraph Instruments Syndicate, Ltd. January 28th.

2,288. "Means for Use in Creating and Maintaining the Vacuum in Metal Vapour Arc Rectifiers and Similar Apparatus." E. Hartmann. January 28th. (Convention date, February 26th, 1913, Germany.) (Complete.)

2,290. "Electric massage apparatus" M. Jakowlew. January 28th. (Complete).

2,300. "Carbons for use in arc lamps." E. J. Day. January 28th.

2,301. "Electric safety fuses." H. H. Berry. January 28th.

2,311. "Selective signalling-devices." Western Electric Co., Ltd. January 28th. (F. T. Woodward, Belgium). (Complete).

2,323. "Electric lamps." E. A. Gimingham. January 28th.

2,325. "Electrical heating device." R. W. Gauntlett. January 28th.

2,327. "Dynamos." H. Leitner. January 28th.

2,333. "Electric fuse holders." Electric and Ordnance Accessories Co., Ltd. and N. G. Langrish. January 29th.

2,364. "Electric lighters." H. G. Davis. January 29th.

2,380. "Electro-magnetically-operated horns." H. Lucas and W.. H. Edwards. January 29th.

2,383. "Process for the manufacture of a substitute for ebonite." F. L. Schauermann. January 29th.

2,388. "Switches for use in connection with electric lamp sockets and the like." E. C. R. Marks. January 29th. (Benjamin Electric Manufacturing Co., United States). (Complete).

2,408. "Arrangements for loading electric induction frequency converters." Siemens Bros. Dynamo Works, Ltd. January 29th. (Siemens-Schuckertwerke G.m.b.H., Germany). (Complete).

2,409. "Electric alternating current commutator machines." Siemens-Schuckertwerke G.m.b.H. January 29th. (Convention date, January 30th, 1913, Germany). (Complete).

2,412. "Control of electric motors." H. O. Burge. January 29th.

2,413. "Recording apparatus for use with line or wireless telegraph systems." W. H. Shephard and A. E. McKechnie. January 29th.

2,418. "Type-printing telegraph apparatus." K. Fedossow, N. Kelch, and O. Klein. January 29th.

2,419. "Control of electric motors." H. O. Burge. January 29th.

2,424. "Loud-speaking telephones." Sterling Telephone and Electric Co., Ltd. January 29th. (Telephon-Fabrik. Akt. Ges. vorm. J. Berliner, Germany).

2,429. "Head-supports for telephone receivers or head-phones." P. M. Justice. January 29th. (C. Adams-Randall, United States).

2,432. "Electric signalling." H. O. Burge. January 29th.

2,437. "Controlling-devices for dynamo-electric machines." Soc. Anon. des Automobiles Delaunay-Bellville. January 29th. (Convention date, April 25th, 1913, France). (Complete).

2,469. "Tubular couplings, bends, tees, and the like for electrical conduits." S. B. Wainwright. January 30th.

2,475. "Electrical connectors." W. E. Gray and E. C. Daubeny. January 30th.

2,476. "Electric meter." R. S. Xenaky and F. Gilman. January 30th. (Complete).

2,486. "Electro-magneto propeller." D. Suchostawer. January 30th.

2,492. "Transformers for use in connection with electric measuring instruments." Siemens Bros. Dynamo Works, Ltd. January 30th. (Siemens-Schuckertwerke G.m.b.H., Germany). (Complete).

2,493. "Electric lock and alarm apparatus." O. Nitsch. January 30th. (Complete).

2,495. "Portable electric lamps." W. A. McKay and M. Claussen. January 30th. (Convention date, February 11th, 1913, United States). (Complete).

2,499. "Sparking-plugs for explosion engines." C. Spada. January 30th. (Convention date, April 1st, 1913, Italy). (Complete).

2,503. "Suspension and sectional strain insulator with interlinked suspension and cavities in the insulating body." W. Fellenberg. January 30th. (Convention date, November 28th, 1913, Germany). (Complete).

2,528. "Vehicular electric lighting systems." L. Renault. January 30th. (Convention date, February 15th, 1913, Germany). (Complete).

2,530. "Telephone exchange systems in which the connections are established through electro-mechanically controlled switches." F. Aldendorff. January 30th. (Complete).

2,543. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. January 30th. (Automatic Electric Co., United States). (Complete).

2,548. "Electric accumulators." Van Raden & Co., Ltd. and M. Metz. January 31st.

2,558. "Improvements in the glowing effect of electric fires." C. R. Belling. January 31st.

2,567. "Automatic electric signal indicator and train stop." C. H. Hicks and R. A. Stevenson. January 31st.

2,572. "Registration of telephone calls and call charges." S. D. Williams. January 31st.

2,586. "Electro-mechanical signal apparatus." J R Jardine January 31st.

2,604. "Electrical heating apparatus suitable for cooking, water-heating, and like purposes." A. F. Berry. January 31st.

2,605. "Means or apparatus for heating water and other liquids." A. F. Berry. January 31st.

2,612. "Manufacture of electric incandescent lamps." F. Simpson. January 31st.

2,624. "Microphones with carbon-powder fall for strong currents." Fratelli Marzi di *G.B.* January 31st. (Convention date, April 10th, 1913, Italy). (Complete).

2,628. "Spark-plugs." P. T. Campbell. January 31st. (Divided Application on 20,730/13. September 13th. Convention date, April 3rd, 1913, United States). (Complete).

2,629. "Method of rendering water or other liquid radio-active." J. Landin. January 30th. (Convention date, February 10th, 1913, Sweden). (Complete).

Brazil.—A company has lately been formed in Paris with a capital of £2,000 and the title La Compagnie des Cables Sud-Americains, to carry on telegraphic and telephonic business in South America.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

13,747. Apparatus for Electro Plating. G. P. M. Lee & W. A. Brame. June 12th. (January 13th, 1913.)

1913.

672. Connection of Motors of Electric Tramcars or Other Rail Carriages to Prevent Side Swing. I. Bulfin. January 9th. (Cognate Application, 14,243/13.)

745. Starting and Regulating Devices for Electric Motors. A. H. Ohnsted & L. Boothman. January 9th.

789. Combined Governor and Speed-Setting Device. J. S. Withers (Cox & Dicketts). January 10th.

1,069. Loud-Speaking Telephone for Closed Motor-Cars and Other Closed Carriages. R. Pecorini. January 14th.

1,218. Electric Vacuum Light Apparatus. Moore-Licht Akt. Ges. January 15th. (April 13th, 1912.)

1,337. Brush-Holders for Dynamo-Electric Machines. T. von Zweigbergk. January 16th.

1,343. Machines for Covering Conductors or Other Cores with Fibrous Material. G. Datta. January 16th. (July 3rd, 1912.)

*1,501. Magneto Electric Machines for Combined Ignition and Illuminating Purposes. F. R. Simms. January 18th.

1,935. Electrolytic Processes and Apparatus, Particularly Applicable to the Production of Alkali Compounds. C. White. January 23rd.

2,764. Lamp Holder for Electric Imitation Candles. E. Phillips. February 3rd.

3,934. Testing of the Sound Receivers of Submarine Signalling Apparatus. Signal Ges. February 15th. (March 9th, 1912.)

5,494. Anti-Vibration Holders for Incandescent Electric Lamps. A. Boon & H. T. Wilkinson. March 5th.

6,668. Process and Apparatus for the Electrical Treatment of Cellulose and Other Substances of which it Forms the Essential Part. A. L. C. Nodon. March 18th. (March 26th, 1912.)

6,964. Electric Arc Lighting. S. L. Pearce & A. Wilkinson. March 22nd.

7,146. Combined Dynamos and Governors. A. Churchward. March 25th.

7,151. Control of High Frequency Alternating Electric Currents. British Thomson-Houston Co. (General Electric Co.). March 25th.

7,983. Arrangements for Starting and Regulating Direct Current Electric Motors. F. Cumont. April 4th. (Addition to 8,108/12.)

8,288. Apparatus for Use in Drawing Wire. C. Gladitz. April 8th.

8,712. Vacuum Light Tubes. Moore-Licht Akt. Ges. April 14th. (April 15th, 1912.)

8,841. Telephone Transmitters. J. C. R. Palmer. April 15th. (April 15th, 1912.)

9,703. Selective Impulse Transmitters. Western Electric Co. (Western Electric Co.). April 24th.

9,818. Telephonic Indicating Apparatus. M. S. Conner & A. R. Kahl. April 26th.

10,369. Process for Fusing Tungsten Siemens Bros & Co. (Siemens & Halske and Akt. Ges.). May 2nd.

10,514. Reversing and Controlling Gear for Electric Motors Specially Applicable to Electric Motors for Operating Lifts. Etchells, Congdon, and Muir, Ltd., and F. Muir. May 5th.

11,219. Method and Apparatus for the Electrostatic Separation and Cleaning of Grits, Grain, or the Like. J. Kraus. May 13th. (April 29th, 1913.)

11,905. Means of Equalising or Balancing Electric Currents, Applicable to Rotary Converters. A. H. Railing & C. C. Garrard. May 22nd.

13,359. Electric Safety Devices Against Housebreaking, Burglary, and the Like. C. Pastore. June 9th.

13,447. Electric Elevator Systems. E. M. Fraser. June 10th. (July 29th, 1912.)

13,695. Incandescent Electric Lamp Filaments. C. W. Read. June 13th.

15,811. Base Plate for Electrical Measuring Instruments. Landis & Gyr (Firm of). July 9th. (July 12th, 1912.)

16,058. Electric Safety Lamps. F. Faerber. July 11th.

16,770. Electric Incandescent Lamps. C. W. Read. July 22nd.

16,807. Controlling Gear for or Connected with Electrically-Driven Hydraulic Pumps. J. A. Towler. July 22nd.

17,124. Arrangements for Transmitting and Receiving Signals. Siemens Bros. and Co. (Siemens and Halske Akt. Ges.). July 25th.

17,850. Trolley or Collector Wheels for Electricity. J. W. Anderson. August 5th.

20,929. Sparking Plugs for Electric Ingition Purposes. United Motor Industries, Ltd., & E. De Rodakowski. September 16th.

22,707. Portable Electric Lamps. J. Neu. October 8th.

24,459. Circuit Arrangements for Telephone Installations with Semi-Automatic Working. Siemens and Halske Akt. Ges. October 31st. (October 28th, 1912. Addition to 6,664/13.)

26,061. Method of and Apparatus for Electro-Osmotic Processes. Ges. fur Elektro Osmose. November 13th. (July 21st, 1913.)

Recovery of a Tube of Radium.—At the Liverpool Royal Infirmary recently a tube of radium, worth over £1,000, which had been applied to a patient's face, was missed, and as it was proved with the X-rays that the patient had not swallowed the tube, it was conjectured that it had been swept up from the floor. A cart full of sweepings was detained just as it was about to leave the infirmary, and Prof. Wilberforce, of Liverpool University, tested it with an electroscope, which indicated that the radium was in the cart. The rubbish was then placed in buckets, each of which was tested in the same way, and the tube was run to earth in the twelfth bucket

THE
ELECTRICAL REVIEW.

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LORD CLAUD HAMILTON AND RAILWAY MANAGEMENT.

THE appointment of an American manager to a great English railway would be likely, in any event, to be the subject of some comment, but the remarks of Lord Claud Hamilton at the meeting of the Great Eastern Railway Co., on Friday last, widen the scope of the comment considerably. Mr. Thornton, as manager of the Long Island Railway Co., has, according to Lord Claud, operated the chief suburban system in the United States. It was worked by electricity, and it was most desirable that the Great Eastern should have a general manager who thoroughly understood the principles of electricity and the working of railways by that method. As an indication of the intention of the Great Eastern Co. to utilise electrical methods and to acquire the benefit of the widest experience, this statement should be regarded as eminently satisfactory. The board expect criticism of their appointment, and Lord Claud replied by anticipation to some such criticisms. And here his mistake became apparent. Never was there a clearer example of the truth of the proverb "Qui s'excuse s'accuse." He had to look abroad because there was, he said, an acknowledged dearth of first-class men coming to the front in the railway world at home, not alone for those capable of acting as general manager, but for even the minor appointments. No word indicating that the head of a great undertaking appreciated the obligation, which is regarded as elementary in most enterprises, that there should be every encouragement for the most suitable men in the line of succession to all appointments! Lord Claud was on safer ground when he expressed the fear that there had grown up with us a tendency to sacrifice merit at the expense of seniority; but, surely, to break away from such a system it is not necessary to import the merit! From further remarks we must be led to question whether the chairman of an English railway knows whether any merit is available or not. The departments, he said, were kept so apart that there was little interchange of young men from one to another, thus removing any incentive to new ideas or methods. In the United States, on the other hand, the president and general manager knew every rising young man in their employ, because the young men were interchangeable from one department to another, and when this interchangement took effect the man at headquarters knew about it, "and their names were entered on his list." A re-arrangement in this direction, he thought, was required without delay. With such a sign of grace it may seem ungenerous to ask who arranged and continued the water-tight compartment system which stifles enterprise and suppresses merit. Was it the unfortunate victims of youthful age and comparatively subordinate position or their elders in the board room?

Now, the appointment of any officer of the Great Eastern Railway is a domestic matter. The directors have a responsibility, and upon the results they will be judged. The pity is that in making this announcement, the chairman should have taken the opportunity of uttering remarks which will unquestionably give rise to much misapprehension. We shall without doubt have a recrudescence of the depreciatory reflections from which we thought we were happily emerging. Our American cousins other than President Wilson, suffering traders, and unfortunate investors may run some risk of forming the conclusion that all their railway enterprises are perfection in management and financial returns. Let us at once bring the matter to a more accurate focus by remarking that one chairman must not be regarded as representative of Britain, or one manager as representative of America. We may also recall that not long since a prominent employer of labour in the United States deplored, just as does Lord Claud here, the dearth of talent for important posts there. He did not, however, include minor appointments, and his remarks were perhaps more general and less reflective on a particular class of workers.

Like all converts who have pondered over their new creed for so long as a fortnight, Lord Claud Hamilton is enthusiastic, and Mr. Thornton would lack a very necessary qualification for his appointment if his examination of the problem over a similar period did not inspire him with complete confidence. The problem is, of course, much deeper. A manager may contribute materially to the success of an undertaking under one set of circumstances with which he is familiar, and be less successful under changed conditions. It is possible, for example, that a manager in the United States may not have acquired a knowledge of the watertight-compartment system which differentiates the respective importance of the manager and chairman on an English railway. This was defined by Lord Claud Hamilton, and published by the Press Association in the evening of the day on which the new appointment was published in the morning. An announcement had been made that the railway companies had decided to accord recognition to the National Union of Railwaymen. This was denied by Lord Claud Hamilton in the following words:—"The question of recognition has never been discussed by the companies. The general managers have met and discussed the matter, but the general managers are not the companies, and the chairmen have never talked the subject over together. The statement, therefore, that recognition of the Union has been decided upon by the companies is perfectly untrue." If, by any chance, it should be customary in the United States to consider that subjects discussed by general managers have been discussed by the companies, the new general manager of the Great Eastern will have to learn a new code of etiquette. But such matters as these are internal, and easily acquired. There are others which are external, and not easily absorbed even by very capable men trained in other spheres. The general idea that administrative reforms are best carried out by new men is open to serious question, and this applies with especial force when the reformer is necessarily unacquainted with the ideas and aspirations (or lack of aspirations) of those for whom the reforms are initiated, and by whom they are to be carried out. This, however, is in the nature of a criticism of the appointment, which is less our intention than to enter a protest against the general tendency of Lord Claud Hamilton's remarks. A cordial welcome should be extended to any one who is expected to improve our facilities for travel, develop the discovery and encouragement of merit, or add even a fraction to dividends. And regret should also be expressed that the new manager's difficult task should be rendered the more difficult by the comments of his maladroit patron.

The Railway Electrification Problem.

Mr. Roger Smith's paper on railway conditions governing electrification, read before the I.E.E. on Thursday last week, introduces a topic of very great interest at a time when railway electrification is so much in evidence.

The British railway authorities have been both the hope and the despair of the electrical engineer in the past, partly because no obstacle has seemed too small to hinder the adoption of electric traction, and the most trifling improvement in steam traction, has served as a pretext for delay.

Generally speaking, the author appears to favour suburban electrification, although he says: "it is very doubtful if electrification is the only solution of the congested-traffic problem"; he evidently considers that the steam locomotive will continue to haul main-line trains for some time to come—for one reason, because a suitable electric locomotive has not yet been built—but he apparently believes that goods haulage is practicable and, if the North-Eastern experiment turns out successfully, a matter of the near future.

We value the paper because the author's inside knowledge of the working of a great railway is tempered by exceptional knowledge of the electric traction problem. His statement that many lines had been electrified before they had come to the end of their tether under steam traction can be taken as an admission of the superior possibilities of electric traction.

The author considers that the Brighton main-line electrification may be justified in view of the traffic conditions, but that this would not be so where passenger traffic was a small percentage of the total. Surely this is a somewhat paradoxical conclusion, in view of his evident belief that goods traffic could be dealt with electrically, for where passenger traffic is a small percentage of the total, goods traffic is presumably a large one and will bear its share of the cost of line equipment.

If we take the author's admissions in regard to electrification and couple them with the necessity, for financial reasons, of electrifying congested terminals in the near future and routes which are physically impossible of improvement by steam traction, we may almost assume that general electrification is not so far distant as is often believed. After all, what the railways urgently want is increased earning capacity, which electric traction can give them, and steam traction cannot give them, except on prohibitive terms.

We give place to none in our admiration for the sound engineering associated with British railway working, but railway electrification has, to a large extent, ceased to be an engineering question, and we may be permitted to doubt whether economics has had as much to do with its apparently slow progress in this country as tradition.

It is difficult to appreciate the railway point of view; Mr. Smith, for instance, says: "It is far easier to change things than to change the habits and inherited instincts of large bodies of men, and electrical engineers have not only to show railway managers that they can haul the railway traffic either better or more cheaply than is done to-day by steam, but that they can first of all haul traffic at least as well as it is hauled by steam and fulfil most if not all the functions of the steam locomotive in the manner to which those who work the traffic have been accustomed." It will be seen that the onus of proof is cast upon the electrical engineer; he must not only prove his case, but prove it along traditional steam lines. One might almost suppose that he was bolstering up an untried, unsound proposition, and that an indifferent railway management, with really nothing to gain by its adoption, was seeking the least troublesome way to avoid his unwelcome attentions.

We would suggest that the electrical engineer has shown his ability to better steam traffic conditions in very many instances, and that the real question is how to alter older methods of railway working, which present-day requirements are rendering more and more unremunerative, and adapt them to suit electric traction.

That this is a difficult matter under the present railway system will be granted, but it is nevertheless probable that existing conditions, which have led to the state of affairs outlined by Lord Claud Hamilton, in announcing the appointment of an American manager to the Great Eastern Railway, who has incidentally been in control of the largest suburban electric railway service in the United States, may have even greater influence on our railway electrification problem than those so ably outlined by Mr. Roger Smith last week.

The Lead Position.

The general position in the lead market remains pretty much as before, but there has been a decided abatement in the demand for early deliveries, which in conjunction with a more accommodating attitude on the part of the Convention brokers has resulted in an easing down of the stringency which has been an intermittent feature in the situation for so long. There has not been any sign of an increase in the quantities of metal coming to hand from abroad, and everything reaching here passes into consumption without difficulty, while immediate delivery lead is, as hitherto, held as a premium. On the whole, rather less general speculative interest has been shown in the market, the transactions recorded openly being decidedly smaller in volume than for some little while. There is still a fair oversold quantity for March and April shipment, and this may result in firmer prices when it becomes necessary to adjust the short account. One feature of rather special importance which has cropped up lately, has been the shipment of uncontrolled lead from New York to London. The business was entirely unexpected by the market at large, and it seems as if the controlling influences had decided in some measure to change their policy, following upon sales for export of uncontrolled material. In any event, since this particular lead arrived the price has never since been at a level at which outside producers could supply material to the European market, and it is quite possible that efforts will be made to prevent values rising to this pitch again except, possibly, for a short time only. Another point in the market is the recent sale of several hundred tons of lead for prompt shipment from Belgium to London, which is also an unusual feature; but, in spite of this, there has not been any excess of material available for delivery, and no evidence is to be obtained of any material alteration in the broad outlines of the position. While the home trade has been rather dull, there is still a lack of material in the hands of consumers, and Russian demands have been in evidence from time to time. The Continental buying, however, has been of a rather fitful nature, and dealers in London have on a good many occasions found themselves rather sharply undersold by leading Continental interests closely allied with the Convention. The reports from Mexico have lately been rather more reassuring so far as the resumption of industrial operations in the northern part of the country is concerned, but there is no assurance that any substantial progress has been made towards the restoration of normal conditions in respect to the production of lead available for export. Mail advices report that some of the lead furnaces have been put to work again, but railroad communications are very much hampered, and fresh destruction of permanent way material has been in progress. Indications as regards the market generally point to a continuance of moderately high prices until there is some radical change in the mutual relations between supply and demand. The January imports amounted to 15,540 tons, compared with 21,159 tons in January, 1913, and 14,095 tons in January, 1912, while the exports last month were 6,603 tons, compared with 5,584 tons a year ago and 3,572 tons in 1912.

Electrical Labour Disputes.

According to a report in a Manchester newspaper, the members of the Electrical Trades Union are refusing to accept an alteration in the District Rules relating to non-Union workers. They resent an attempt that is "being made to introduce into the electrical trades in Manchester the rule of the London Master Builders' Federation, which stipulates that Unionists shall work with non-Union men." Their attitude may be represented by the following statement :—"If the masters try that sort of thing . . . . there will be trouble." If this is still the policy of the electrical workers, they are certainly not paving the way for a settlement of disputes. Our own belief is that it is the battle-cry of the leaders rather than the opinion of the men themselves. As a matter of fact, however, the working rules of the Manchester, Salford and District Building Trades Federation, which have been accepted and observed for a number of years, have contained a rule that "Whilst agreeing not to place any obstacle in the way of men joining the Wiremen's Union, the masters do not agree to employ Union men only." The above version of the position is therefore nothing short of a gross misrepresentation. What the masters of Manchester desire to do is to substitute the following rule which is more generally adopted throughout the building trades :—

> No strike or lock-out to take place under any circumstances until the matter in dispute has first been referred to a joint committee of employers and operatives who shall meet within six days and endeavour to settle. Should they fail, the same shall be referred to an umpire to be mutually agreed upon by the said committee.

If the Manchester Unionist workers are serious in their suggestion that no non-Unionist shall follow his calling in their own choice company, they will require to be brought to their senses somehow. It practically amounts to saying that an employer is only to be permitted to engage an electrical workman if he is a member of the Union, and without any assurance as to fitness or efficiency! His non-Union workmen, if he employs both kinds, may only work on a job by themselves. How utterly unworkable, and, indeed, impossible of acceptance, such a proposition is, surely the most simple-minded man can see. We are more than ever convinced that it is sane leadership that the electrical workers require, leadership that will remind them of a few of the most elementary principles of business and common justice. It is not for the employers anywhere to force men into the Unions. It is for the Unions so to impress the workers with the benefits of membership, and so to inspire confidence and respect in their organisations, that they shall be induced to sacrifice their freedom. If they are unable to do that—and we believe that the Unions will lose rather than gain members in the long run if they continue the policy of intolerance—then they must be content for there to be two classes of workers, and must recognise that the unorganised worker is as much a man as themselves, and has equal rights to work and to protection in the course of his employment. All this is very elementary, we know, but elementary matters seem to be overlooked by the worker when listening to the wild propaganda talk of irresponsible agitators.

The German Electrical Industry in 1913.

The Association of Special Electrical Works, representing makers who are independent of the few large firms, reports that 1913 was in general favourable for the special works. During the first half of the year they experienced a further expansion in the turnover as compared with the corresponding period in 1912, but toward the end of the year a slackening was manifested, which is attributed to the general economic depression, the particularly unfortunate conditions in the building trades, and the reserve shown by local authorities in the extension of their supply works owing to the monetary stringency. On the other hand, a favourable influence on the degree of activity was exercised by the expansion of overland central stations free from monopolistic control, and by the further advance in the application of electricity to agriculture, trade, and domestic purposes. The centre of business gravity lay in the home market; the export trade also increased, although, to some extent, it can only be maintained by making sacrifices. By way of explanation of this statement it is mentioned that the export trade with Austria, Russia, France, Italy, and Switzerland is becoming more difficult day by day in consequence of the increasing development of the native industries of these countries under the protection of high import duties.

The report remarks further that the labour conditions in Germany in 1913 were satisfactory, and no strikes or lock-outs were recorded. The supply of skilled and unskilled workers was good, although there was a continued scarcity of really qualified mechanics for delicate work.

The rates of wages underwent a further increase over those of the preceding year. As far as the sale prices of electrical manufactures are concerned, the report states that they were mostly unsatisfactory in so far as the products were not controlled by trade syndicates; and it was no longer possible fully to maintain the additions which were made to prices in various branches at the beginning of 1912 for the purpose of compensating for the rise in the cost of raw materials, although the basis for the increases still existed in the prices of the materials.

A Mistake in a Contract.

The case of Commissioners of Works *v.* King, which was heard by Mr. Justice Sargant, on January 30th, affords an illustration of the ease with which a very serious mistake may creep into a contract. The contractors (Messrs. W. King & Co.) had undertaken the erection of a Post Office. They scheduled reinforced concrete at so much per "cubic yard," but when the schedules were sent to be typewritten the words were altered into "cubic foot." This mistake was not rectified in the two copies attached to the contract. Owing to this mistake the extras figured out at £23,000, although the tender had been but £20,000. In the circumstances the Commissioners applied for rectification; and the Court ordered the contract to be rectified, Mr. Justice Sargant saying that the conduct of the contractors was extravagant, as the slip was so obvious. Having regard to certain cases which appear in the law reports, it would seem that the Commissioners were somewhat lucky in escaping the consequences of the mistake; for it is to be borne in mind that they had an opportunity of correcting it at the time.

In the case of Seaton Brick Co. *v.* Mitchell (1900) 11 F. (5th ser.) 550, the defender offered to execute work for the pursuers for the lump sum of £859. His offer was accepted. He afterwards found that, owing to an error in calculation made by his son, the offer was £826 less than it should have been. In an action for damages for breach of contract, the defender having contended that this mistake released him from his contract, the Court held that he was not released—the mistake having arisen through no fault of the pursuers—and that the pursuers were entitled to damages. The episode brought to light before Mr. Justice Sargant recalls the case of the auditors who could not make out for a long time how the balance-sheet of a company was out to the extent of nearly £2,000. After prolonged investigation, it was found that by a typist's error the year of Our Lord had been added to the column of figures on the debit side!

VACUUM.

By "WHISTLEFIELD."

Most steam users are aware, in a vague kind of way, that a good vacuum means a better engine efficiency, out very few take the trouble to find out the real reason why this is so; the generally accepted idea is that the vacuum adds a few pounds to the effective pressure of the steam, that is, a vacuum of 26 in. corresponds to a pressure, roughly, of 13 lb. below atmosphere, therefore a boiler pressure of 200 lb. will yield an effective pressure in the engine worked at this vacuum of 213 lb. While this is correct, it does not go far enough, for the gain from half an inch of extra vacuum usually means far more than an increase of 1 lb. in the effective steam pressure. Users of steam turbines, for example, have it impressed on them by the makers that the half inch of vacuum between 28 and 28½ in. is most desirable, leading to a large increase in the efficiency, the expensive and often elaborate appliances provided for ensuring a high degree of vacuum in turbine condensers being a proof of their claim.

The principles involved can be readily understood by a consideration of what happens when steam expands.

Fig. 1 shows an entropy diagram, which represents by its area the quantity of heat stored up in a pound of steam which has been expanded from a pressure of 200 lb. absolute (381° F.), to a pressure of ½ lb. absolute, or a vacuum of 29 in. (80° F.); from this diagram we can derive a great deal of useful information regarding the value of a good vacuum.

Horizontal lines have been drawn at temperatures corresponding to various pressures to enable us to find out the amount of heat, and therefore of work which is obtainable from any degree of steam expansion.

On measuring the shaded areas A, B and C, we find that the amount of energy liberated by each of these expansions is approximately equal, for the heat areas are equal, that is to say, we get just as much work done when a pound of steam is expanded from a pressure of 200 lb. absolute to a pressure of 100 lb. absolute, as we get when the same weight of steam is expanded from a pressure of 100 lb. absolute, to a pressure of 50 lb. absolute, or from a pressure of 50 lb. absolute to a pressure of 25 lb. absolute.

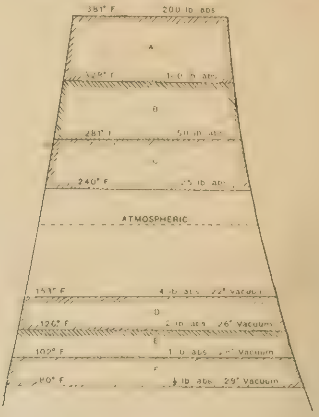


Fig. 1.—Entropy Diagram showing amount of work done during expansion of steam.

If we measure the shaded areas D, E and F at the lower end of the entropy diagram we find that these also are approximately equal, though there is a difference of vacuum of 4 in. enclosed in the area D, of 2 in. enclosed in the area E, and of only 1 in. enclosed in the area marked F; that is to say, an increase of 1 in. of vacuum from 28 in. to 29 in. is capable of yielding as much useful work as an increase of 4 in. of vacuum higher up in the pressure scale; not only so, but the area marked F is approximately equal to the area marked A, so that an increase of 1 in. of vacuum from 28 in. to 29 in. is capable of yielding as much useful work as a drop of 100 lb. of steam pressure between 200 and 100 lb. absolute.

TABLE I.—Showing the Quantity of Heat Liberated by the Expansion of Dry Steam at Various Pressures to Different Degrees of Vacuum.

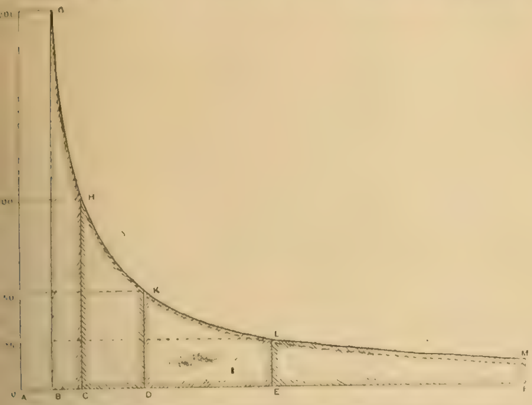
Initial absolute pressure.	The quantity of heat in British thermal units liberated by expansion of 1 lb. steam to—			
	14·7 lb. absolute.	26-in. vacuum.	27-in. vacuum.	28-in. vacuum.
200	189	302	316	336
175	180	294	308	328
150	169	284	298	318
125	156	272	287	308
100	140	258	273	294
75	119	239	254	275
50	89	211	227	248

Table I shows the amount of energy measured in British thermal units which is liberated by a pound of steam when it is expanded from various pressures to different degrees of vacuum, one British thermal unit being equal to 778 ft.-lb. of work.

It is not generally realised that the energy liberated by the expansion of a given weight of dry steam depends on the number of times that the original volume is increased, and not upon the initial pressure at which the expansion takes place.

If a pound of steam, say, at a pressure of 200 lb. abs. is expanded isothermally, that is, with its temperature kept constant, the expansion will take the form of the full curve shown in fig. 2. If A B represents the original volume of the steam at a pressure of 200 lb. abs., then when we expand it to twice the original volume, that is, to A C, the amount of energy liberated will be proportional to the area B G H C, and the pressure will have fallen from G at 200 lb. to H at 100 lb. abs.

If the quantity of steam A C at 100 lb. pressure be again expanded to double its volume, the pressure will again fall to one-half of the initial pressure according to the law governing the isothermal expansion of a gas, and the energy liberated will be proportional to the area C H K D. On measuring, it will be found that this area is equal to the area B G H C. If we still further expand the quantity of steam A D at 50 lb. to A E at 25 lb., and A E at 25 lb. to A F at 12½ lb., we will obtain the four shaded areas shown, each equal to the other. We thus see that the energy liberated when we halve the pressure of a given weight of steam is theoretically always equal, no matter whether the originally pressure was 200 lb. absolute or 1 lb. absolute (28 in. of vacuum).



Full line shows isothermal expansion; dotted line, adiabatic expansion.

Fig. 2.—Steam Expansion Diagram.

Actually the expansion of steam in an engine or turbine is not isothermal but adiabatic, *i.e.*, with a fall in temperature, so that the isothermal curve is not obtained, and the adiabatic curve, shown by a dotted line, represents more accurately, the condition of affairs.

Since the adiabatic curve falls below the isothermal curve, each shaded area will be slightly smaller than the previous one. An entropy diagram can be made to show the amount of energy liberated by both the isothermal and adiabatic expansion of steam, and will thus indicate the difference between them. If we take saturated steam at a pressure of 200 lb. absolute and expand it adiabatically, the temperature falls and the steam becomes wet, that is, a portion of it condenses and can no longer expand to do useful work. If, on the other hand, we expand it isothermally we must supply extra heat to maintain its temperature constant; this keeps the steam dry, no energy is lost through condensation, and the total energy available is shown by the full area in fig. 3.

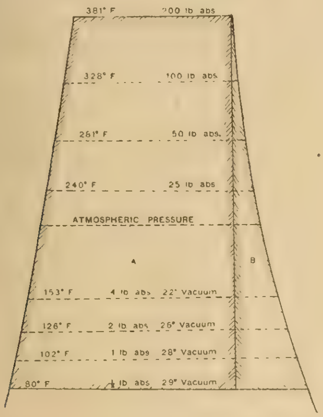


Fig. 3.—Entropy Diagram showing Difference in Work done by Steam Expanded Adiabatically (A) and Isothermally (A + B).

The portion marked A shows the amount of energy liberated by adiabatic expansion, and the area marked B shows the amount of energy lost through steam condensation. The diagram shows, therefore, that the difference between the amount of energy liberated by the isothermal and adiabatic expansion of steam increases the lower we go in the temperature scale, thus although theoretically the energy liberated in expanding steam from 28 to 29 in. of vacuum is equal to that obtained by expanding steam from a pressure of 200 lb. abs. to a pressure of 100 lb. abs., a greater amount of lost energy has to be deducted from that liberated between 28 and 29 in. of vacuum than from that liberated between a pressure of 200 lb. and 100 lb. abs.

Table II shows the volume of one pound of steam at different pressures ranging from 200 lb. abs. down to ½ lb. abs. or 29 in. of vacuum, and thus gives the actual ratio of the adiabatic expansion of steam. It is well known that as a rule, it does not pay to work reciprocating engines at a higher vacuum than 26 in. The above table shows one of the reasons. At the pressure corresponding to 26 in. of vacuum, 1 lb. of steam occupies 172 cb. ft., but at 28 in. of vacuum it occupies 335 cb. ft., and at 29 in. the volume has increased to 640 cb. ft. It is evident that a low pressure cylinder large enough to accommodate such a great volume of steam would present mechanical difficulties which would make the cost of construction prohibitive, and thus neutralise all the economy to be obtained by the increased vacuum; also from this table, as well as from fig. 1, we see that the temperature of the steam falls very rapidly with increasing vacuum, for whereas there is a drop of only 26° for the 4 in. of vacuum between 22 in. and 26 in., there is a drop of no less than 47° for the 3 in. of vacuum between 26 in. and 29 in.

Table II.—The Volume and Temperature of Steam at Various Pressures and Vacuums.

Vacuum.	Abs. pressure in lb. per sq. in.	Temperature in degrees F.	Volume of 1 lb. in cb. ft.
29	·5	80	640
28	1·0	102	335
26	2·0	127	172
22	4·0	153	89·6
14	8·0	183	47
0	14·7	212	26
—	25	240	16·1
—	50	281	8·4
—	100	327	4·4
—	150	358	3·0
—	200	381	2·3
—	225	391	2·0

In a reciprocating engine, where the whole expansion takes place in a few stages only, the final temperature in the low-pressure cylinder would be so low if the vacuum were high, that enormous initial condensation would take place when the steam from the intermediate cylinder was admitted.

With turbines neither of these objections exist. The steam flows through the turbine in a steady stream, so that smaller volumes have to be dealt with than in a reciprocating engine of the same power, and the diameter of the turbine rotor and the length of the blades at the low-pressure end can be increased for almost any degree of expansion without entailing any difficulties in design or construction.

The expansion of the steam takes place in so many stages that the drop in temperature in each stage is comparatively small, the condensation is consequently reduced, so that we can approach more nearly the theoretical gain in efficiency.

To summarise the above points regarding vacuum, we see :—

1. That the energy liberated by the expansion of steam is proportional to the number of times the volume has been increased, less a small loss due to natural condensation owing to the fall in steam temperature, and this condensation can be considerably reduced by superheating.

2. Taking the present practical working steam pressures as ranging from 225 lb. absolute to ½ lb. absolute (29 in. of vacuum), we find that from a pressure of 225 lb. absolute to

atmospheric pressure we have almost a fourfold expansion, but from atmospheric pressure to a vacuum of 29 in. we have a fivefold expansion, so that, theoretically, there is over 30 per cent. more energy to be obtained from the practical vacuum range than from the practical pressure range.

3. Reciprocating engines have been unable from their very design and method of working to employ usefully this wide range of vacuum, for even when working at a vacuum of 26 in., we see from fig. 4 that the compression reduces the amount of the available energy.

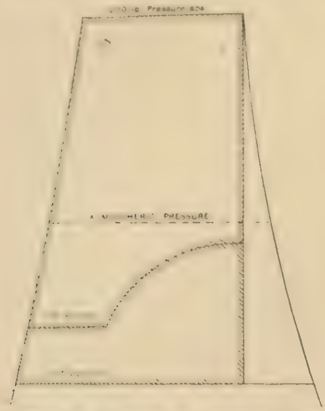


Fig. 4.—Showing Amount of Energy Utilised by Reciprocating Engine Expanding to 26-in. Vacuum and Amount Utilised by Turbine Expanding to 29-in. Vacuum.

4. Turbines, on the other hand, are adapted by their design and method of working to employ usefully all the vacuum which it is possible to produce, so that it is becoming increasingly common to combine exhaust steam or else mixed pressure turbines with existing installations of reciprocating engines to make full use of the energy liberated by high vacuum.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Insulated Aluminium Cables.

If not too late, the writer would be glad to tender a few remarks regarding the article under the above heading appearing in your issue of January 9th.

As one who has perused this article with interest, I think it somewhat of a pity that more complete information was not given. For instance, no unit prices for paper or lead are published, and as every cable designer will know, the cost of the latter metal will make all the difference between a saving in favour of aluminium and a loss.

The extent to which aluminium cables have been used in this country is, of course, limited, due to the hitherto high price of the metal: it is therefore interesting to note that the English price for aluminium wire is in the neighbourhood of 20c.

As regards the manufacturing cost, it seems somewhat strange that these should lie along straight lines, because one seldom expects that the large cables will cost as much per lb. as the small ones. Moreover, practice does not give reason to the conclusion that if an aluminium cable of 1·4 sq. in. section is 10 per cent. cheaper than the equivalent copper, an aluminium cable of half the section will show the same per cent. economy.

The article is of considerable interest as far as it goes, but I think the author would add to its value by giving a little more specific information in regard to manufacturing costs and unit prices, together with some particulars as to the manner in which the users of aluminium cables are solving the jointing problem.

Ernest V. Pannell.

New York, *January 30th*, 1914.

In answer to Mr. Pannell's letter, the curves given in the article in question are based on average prices for the cost of labour and all materials other than copper or aluminium, and will give the saving per mile by using aluminium with sufficient accuracy to determine whether or not the use of aluminium is justified. Any correction for other variables would make the comparison too troublesome for practical application. I agree that the price per pound of heavy cables will be less than that for smaller cables; but the curves given represent the cost per unit of length, not per unit of weight, and are actually very nearly straight lines. With regard to jointing, Mr. Pannell should apply to the British Aluminium Co., of 92, Queen Victoria Street, who have developed a most efficient type of clamp for all kinds of joints.

John B. Sparks.

London, N.W., *February 17th*, 1914.

The Design of Regulating Resistances.

With reference to Mr. L. Boothman's very interesting article on "Notes on Design of Regulating Resistances" in your current issue, it is stated therein that an empirical formula which has been found to give accurate results in practice for the "summation watt" capacity of a regulator is—

"Total rheostat ohms × maximum amperes × minimum amperes."

I have checked up the area of the lower curve in fig. 1 by Simpson's rule, as suggested, and it certainly agrees with the formula suggested by Mr. Boothman.

The formula must, however, be used with caution, as the following will illustrate. It may be written—

$$R \times I_{max.} \times V/(R + R_f),$$

where R = rheostat ohms and R_f = field coil ohms.

With R very large this becomes approximately equal to

$$I_{max.} \times V = \text{constant}.$$

That is to say, the formula indicates that increasing the resistance beyond a certain value does not appreciably increase the total watt capacity, which is obviously wrong.

After all, the "summation watt" capacity of a regulator is only required for purposes of comparison and for cost estimating purposes. I am inclined to think that the formula "square the mean of the maximum and minimum amperes and multiply by the resistance of the rheostat" is the better all-round one. It can be applied to potentiometer rheostats, to which Mr. Boothman's formula certainly cannot.

Charles C. Garrard.

Sutton Coldfield,
February 14th, 1914.

The 1/13-Watt Lamp.

It is interesting to see the electric arc lamp inviting the electric glow lamp to be honest. For years the 5-watt carbon lamp has called itself 3·5 or 4 watts, and for fewer years the 2·2-watt metal-filament lamp has called itself 1·5 watts. Latterly, the 1·5-watt metal-filament lamp has called itself 1·25 watts, and for a brief period it actually became "one-watt."

It is just possible that a real one-watt lamp has now arrived—it is to be hoped it is not the half-watt in disguise. Possibly someone as well acquainted with arc-lamp tests as the writer is with glow-lamp tests can offer the parallel.

Disinterested.

"Cables and Strategy."

Domestic trouble and ill-health prevent my dealing fully with the eminently "superior," though anonymous, person responsible for your leading article under the above title.

As, however, the writer uses the expression "he (meaning myself) asks us to believe," I hope you will allow me to invite your readers to read my *Quarterly Review* article for themselves, when they will, I think, be better able to judge of its actual scope and the views expressed therein.

I would further add that I am not particularly likely to be forgetful of "the arguments of those in favour of private ownership," especially in connection with the land telegraphs of the United Kingdom, if only in view of my father's and uncle's somewhat close association with the old "Electric," and still more the "Magnetic," Telegraph Co. Moreover, it was but the other day that I was reminded that the Government of the time had (as usual) refused to lend any aid to the promoters of the early telegraph companies when risking their time and money in the enterprise. But highly successful as these companies were when absorbed by the State, I am also mindful of the fact that, though the State "runs" our telegraph system at a loss, wires are now taken to many an outlying district such as the companies refused to afford telegraphic facilities for, except under quite favourable terms.

Again, in proof of the fact that I have not been neglectful of the advantages of private ownership as applied to ocean telegraphy, I would remind you that my article clearly suggests (page 142) that State ownership should be closely limited to certain inter-Imperial communicating links.

Your anonymous writer's method of expressing disagreement, is to speak of me as "falling into the error of supposing," &c. His remarks on the point he is referring to, I have not yet been fully able to follow; but, so far as I can see, he does not seriously contest my suggestion that the national control of a cable immediately preceding warfare, is often by way of being more important than when hostilities have actually broken out.

I will only remind you, in conclusion, that the subject dealt with in my article (covering some 13 pages) is one I have somewhat closely studied from all points of view, and without any interest at stake, for a good many years, rather more even than your anonymous writer, despite his somewhat "superior" and didactic tone.

Charles Bright.

Hastings, *February* 10*th*, 1914.

The P.M.G. and Users of Wireless Receivers.

Mr. F. Hope-Jones is to be congratulated on the successful result of his protest against the Gilbertian proposal of the Postmaster-General to levy a tax on users of wireless apparatus for receiving the international time signals, and I am sure he has earned the hearty thanks of all users of such apparatus.

If this success has whetted Mr. Hope-Jones's appetite for more, I would suggest that his next campaign should be against the regulation which requires that users of wireless receiving sets should be licensed. It is quite reasonable that transmitting sets should be inspected and licensed, as the uncontrolled use of such apparatus would lead to chaos in wireless communication, but why should it be necessary to inspect receiving sets which cannot in any possible way interfere with the working of other wireless apparatus? The Postmaster-General might as reasonably insist on the inspection and licensing of those who "have ears to hear."

In this connection it is interesting to note that the regulations recently issued in the United States respecting amateur licences do not require that users of receiving sets should be licensed. The words "receiving . . . . radiograms . . . . and of transmitting, &c.," which appeared in the old form of licence have been replaced by the words "transmitting private radiograms or signals, &c." It will be noted that the words "for receiving" have been omitted from the new licence forms.

Contractor.

Glasgow, *February* 16*th*, 1914.

The Great Eastern Railway.

I do not know if Lord Claud Hamilton has done well or ill in bringing in a general manager from America, but past experience of Americans in business here has not been happy owing, we fear, to the American habit of spread-eagleism, and their frequently crude manners and methods.

Lord Hamilton has avowed his own incapacity to find a man in Britain fit to manage a railway; the share list seems to us, by the gradual downward progress of Great Eastern stock under Lord Claud's rule, to show a certain incapacity for his Lordship in his post of chief of this unfortunate railway. And is this iron-jawed American, who we quite think can manage a railway, to be managed by Lord Claud and his colleagues at Liverpool Street? If there are no good men available in Britain, we have a third charge of incapacity to level against the whole tribe of titled railway magnates in our snob-ridden land. By what moral right does Lord this or the Lord that sit on a railway board? What experience has Lord Claud himself as a fireman or driver, a booking clerk, a traffic official or as anything practical in railway work? Our British brains may not elect to kow-tow to the titled men who usurp the places of better ones, and I sadly fear that really good men are not to be found in plenty on our lines. But is it not to such as Lord Claud that this paucity is due; to their policy of repression of good men that good men have left railways neglected? Mr. Thornton may succeed if he can keep his ability in face of a railway board, and can leave behind him that self-importance which has ruined so many Americans here. Any effort he can make to break the crusted methods of title-ridden railwaydom will be welcome to all of us. The Great Eastern Railway ought to be made to pay. Let Mr. Thornton do this by reducing charges for goods to a reasonable figure and he will be blessed all round. Can he find any good in Mr. Gattie's clearing-house scheme for London, and if he can, will he be able to link up with other lines in an effort to put all lines on a basis of sound working? But really, in condemning all our railway men, Lord Claud has condemned more his own co-directors. It is time that titles and social position stepped aside! A title does not fit a man for anything, yet men of title seem to think it does, for they seize positions and salaries to which they have no real claim of any sort. Influence has done much harm.

'Nuff Said.

A Query.

Can any reader suggest a method of coupling transformers to obtain single-phase current from three-phase supply, the load on the three phases to be balanced?

Ignoramus.

Leeds, *February* 13*th*, 1914.

Alterations to Dynamo.

Replying to your correspondent's proposal to increase the voltage of a 255-volt dynamo to render it suitable for charging accumulators, the alterations to the field windings he mentions may or may not give the requisite increase. This, of course, depends on the degree of saturation of the field magnets, and can easily be tried with the existing field coils. Presuming the dynamo has four poles, and that the shunt coils are connected in series with each other, these may be reconnected so that two of these coils in series are joined in parallel with the other two coils that are in series. Care should, of course, be taken in reconnecting that the polarity of the magnets is not altered. This rearrangement will about double the current passing through each field coil, or about quadruple the total shunt current.

The dynamo can then be run for a few minutes on light load to see what increase of voltage results. It can then be decided what alterations should be made to secure the necessary higher pressure.

R. Ainsworth.

Salford Rolling Mills, Manchester.
February 16*th*, 1914.

London Electric Supply Bill.—According to the *Financier*, certain of the West End companies—including the Westminster Co. and the St. James' and Pall Mall—are petitioning against the London Electric Supply Bill, 1914, which has been introduced on behalf of the London electric supply companies as a whole, having for its object the extension of the period of purchase. The petition is, however, not of a hostile nature, but merely to obtain a *locus standi* in order that, as the Bill proceeds, they may have the opportunity of introducing any clause which they may think necessary to cover any point affecting their company's individual interest.

THE TRADE OF ARGENTINA.

In a recent report on the trade of Argentina, the British Consul at Buenos Aires states that the demand for electricity, both for motive power and lighting purposes, increases every year. In the city of Buenos Aires electricity has hitherto been a German monopoly. The Italian financiers mentioned in a previous report have obtained a concession from the Government and have formed a company. Backed as this company appears to be by a powerful syndicate of European financiers, which has a capital at its disposal of £3,000,000, the German monopoly is threatened. The electrical installations of the new company are being pushed forward with all speed, and a central power station is in course of construction in the centre of the town. The cables, machinery, etc., came from Italy and Spain. The task of vanquishing German competition will not be an easy one. The Germans were the first in the field, and are naturally fairly established in the city. The German plant is one of the largest of its kind in the world, and is valued at £1,000,000. The company are at present actively extending their system to the suburbs, at an estimated cost of £400,000, and competition is likely to become keen. British capital is represented by an electricity company which holds concessions for the towns of La Plata, Ensenada, and Tucuman. The annual balance-sheets of the company show a steady and continuous growth of business in La Plata and Ensenada, but at Tucuman the company has to encounter the competition of a company which has recently started operations. In order to meet this competition the British company has amalgamated with another company. Should the extensive schemes for the electrification of the suburban railways materialise, a considerable demand for plant is likely to follow. An important contract was obtained by a London firm for the Central Argentine Railway some little time ago, in open competition with foreign firms, and the work undertaken will consist of supplying and laying underground cables, to be completed in 18 months. The output of the German company in 1912 was as follows:—

Light	57,153,400	kilowatts.
Power	22,830,300	,,
Traction	60,948,200	,,
Total	140,931,900	,,

The returns of the same company for 1911 showed a total of 128,829,100 kilowatts.

The British Consul at Bahia Blanca reports that great advantage has been derived from the economy and efficiency resulting from the extensive use of electricity in Bahia Blanca, and the Pacific Railway has been foremost in this enterprise. The company's newly constructed power house has a capacity of 5,000 kilowatts, but is designed for increased power when necessary. It also provides power for the Bahia Blanca tramways and the South American Light and Power Company, the holders of a concession for the street and private lighting of Bahia Blanca. The approximate annual output is as follows:—

South American Light & Power Co.	2,100,000	units.
Pacific Railway	1,175,000	,,
Tramways	900,000	,,
Total	4,175,000	,,
Total units generated and used in power house	5,950,000	

The Bahia Blanca tramways were opened to the public service in 1910, being then the property of the Buenos Aires and Pacific Railway Company. They are now the joint property of that railway and of the Great Southern Railway Company. The rolling stock consists of single-deck electric cars mounted on maximum traction bogies and equipped with 25-h.p. Westinghouse motors. The power is derived from overhead lines.

The British Vice-Consul at La Plata states that the tramway service of that town and suburbs is supplied by two companies, whose lines intersect the different streets and converge in the depôt of the Great Southern Railway. The branch lines furnish easy communication between La Plata and Tolesa, Los Hernos, Berisso and Ensenada. The frequent tramcar services of La Plata are maintained by two companies. The company called La Nacional was the outcome of an amalgamation of two old horse systems, of which one was originally under the direction of the municipality. The company is a purely local concern, with a capital placed at some £180,000. The second company is a British company known as the La Plata Electric Tramways Company. It has a capital of £550,000. The net revenue for 1912 gave a balance of £9,782, but the electrification of the system was not then complete. At the time of writing the whole of the company's lines, with the exception of small extensions, were electrified—a circumstance that should conduce to an increased revenue.

Dealing with the general trade position, the Consul at Buenos Aires calls attention again to the advantageous position of the United Kingdom due to the widely different economic conditions of the two countries, which places each in a position to supply what the other requires. British prosperity in Argentina remains unaltered. The prophecies that the United Kingdom will be overtaken by her foreign competitors in her commercial operations in Argentina do not find any support in the official trade statistics. While the imports from the United Kingdom show an increase of £2,006,300 in 1912 over 1911, those from Germany, our active rival in this country, have actually declined by £384,100. On the other hand, the United States is undoubtedly devoting greater attention to this market than in past years, and its efforts to increase its volume of trade have been bold and determined. Some prominent United States citizens have visited the country, the last of them to come being a deputation from the Boston Chamber of Commerce, and endeavours are being made to establish direct steamship communication. The advent of the United States capitalist unfortunately no longer symbolises a mere increase in trade competition that more often than not acts as a stimulant to rivals in the market of a young and prosperous country like Argentina. The method of the trust is too often a policy that crushes competitors by making them trade at a loss only to reap benefits out of the people as soon as the vanquished rival disappears from the scene. It may be said that our trading interests extend a long way beyond the mere figures of external commerce, as represented by the imports and exports. Argentina's magnificent system of railways alone accounts for £194,500,000 of British capital, to say nothing of the extensive dock works, tramways, water and irrigation works, meat-freezing, sugar, and other industries and the sea carrying trade. Enterprise in Argentina is as yet far from having attained its zenith, and British capital continues to flow into the country. The following table shows the total volume of the imports into Argentina from the United Kingdom, Germany, and the United States:—

From	1911. £	1912. £	Increase or Decrease. £
United Kingdom	21,727,500	23,733,800	+2,006,300
Germany	13,172,400	12,788,300	− 384,100
United States ...	10,470,700	11,825,900	+1,355,200

In 1912 the growing need for a British Chamber of Commerce was forcibly brought home to the British residents in Argentina by H.M. Minister at Buenos Aires, under whose auspices a renewed and successful attempt has been made to materialise the abandoned scheme. The opposing elements have at last yielded to the dogged perseverance of its organisers, and the United Kingdom will shortly derive in the fullest measure the advantages and assistance which an influential and active body of British merchants is likely to bestow upon the trade of their country. The Chamber is being rapidly organised, and there can be no reasonable doubt that the aims and objects that have called it into existence will be scrupulously carried out by its representative committee under the able leadership of its president, Mr. Hope Gibson, an old and highly esteemed resident in Buenos Aires. The objects of the Chamber are:—

(1) To assist members in any negotiations or difficulties with the Argentine authorities.
(2) To assist them in trade or labour disputes.
(3) To put them into touch with commercial firms.
(4) To look out for Government and other contracts and for trade openings generally.
(5) To make translations of laws and tariffs.
(6) To collect and tabulate statistics.
(7) To study Customs tariffs and take action on behalf of members in Customs disputes.
(8) To promote and organise British trade.
(9) To help members to assert their trade rights and protect them against unfair competition, falsification of trade marks, and so on.
(10) To take action with a view to improving postal and other communication with the United Kingdom.
(11) To assist members in finding employees.
(12) To provide a centre where local members can meet and discuss matters of mutual interest.

The address of the Chamber, where further enquiries should be made, is British Chamber of Commerce for the Argentine Republic, 643, Calle Sarmiento, Buenos Aires.

How to Save Wages.—A certain private power plant, including boilers, turbines and motor-driven machinery, some years ago was run with a staff per shift consisting of the following members:—Shift engineer, turbine driver, stoker and trimmer. There were in addition a leading stoker and a cleaner, both working on day shift.

The staff has been gradually reduced until it now consists of shift engineer, stoker and trimmer per shift, without any spare men, and from 6 p.m. on Saturday to 6 a.m. on Monday the trimmer is off duty, the trimmers working 12-hour shifts with week-ends off.

The next step taken by the employers has been to reduce wages by about 25 per cent. in the case of the shift engineers and cleaners, but not the stokers, who are now in receipt of the highest wages paid on the job. The shift engineers' duties are to supervise the running of the station, attend to the running of the turbines (and the condensing plant at week-ends), carry out any repairs and overhauling and other duties that the chief thinks fit to give them, for the salary of 30s. a week. No holidays are given, unless 12 hours' work is done to counterbalance the time off. The station pressure is 3,300 volts, and the plant has a total capacity of 2,500 KW. The facts speak for themselves, and we commend the case to the notice of the A.E S.E.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Osram Packing Boxes.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have now introduced special packing boxes for Osram drawn-wire tungsten lamps containing lots of 100, which they recommend to purchasers on account of the saving in carriage and smaller space required for storage.

The boxes are of superior appearance and finish, and are attractive from an advertising point of view.

G.E.C. Half-watt Lamps in Service.

We illustrate herewith one of Messrs. Harrod's showrooms, which has been equipped with 100-volt 1,000-c.p. half-watt Osram lamps, wired two in series.

These are each contained in a G.E.C. sphere fitting, and have replaced a similar number of arc lamps run in pairs. We understand that, as compared with the displaced arc lamps, the colour of the light is greatly improved, being much whiter, and better for coloured fabrics. The photograph was taken by the light of the lamps themselves.

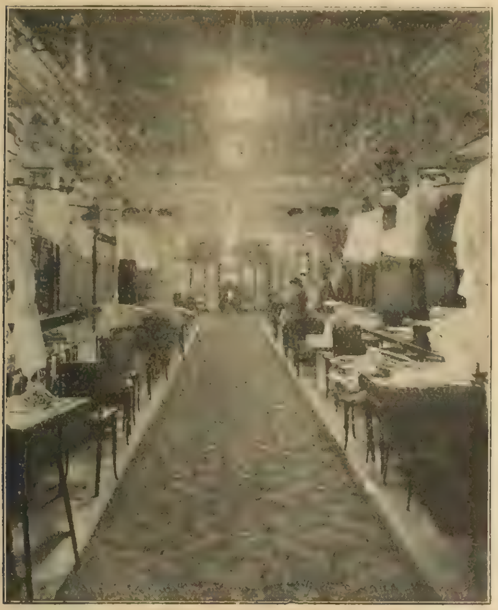


Fig. 1.—Half-Watt Lamps in Use.

A New Electrodynamic Frequency Meter.

Messrs. Hartmann & Braun have recently introduced a new frequency meter of the ordinary dial form in addition to their well-known vibrating reed type. The connections of this new instrument are shown in fig. 2. It consists of a set of four alternating magnet poles, which combine to set up two resultant fields F_1 and F_2 at an acute space angle ψ to one another, as shown in fig. 3. These fields act on a freely suspended coil, S, which, in order to ensure as regular a scale as possible, is given the shape shown in fig. 2. This coil is connected in series, with one pair of the field coils (f_1 f_2) by means of two fine bronze strips of negligible torsion. This circuit is connected in series with a condenser C across the mains whose frequency is to be measured. A second parallel circuit consists of the remaining two field coils f_3 f_4 and the choking coil D. The currents i_1 and i_2 in these circuits lead and lag respectively with regard to the supply volts.

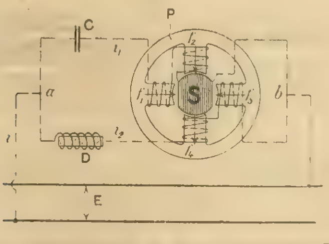


Fig. 2.—Connections of New Frequency Meter.

Since there is practically no control force on the suspended coil it will take up a definite position such that the opposed torques D_1 and D_2 due to the two resultant fields F_1 and F_2 are equal. For the sake of simplicity, the resultant fields F_1 and F_2 may be assumed to be in phase with the currents i_1 and i_2 respectively. The field F of the moving coil also is in phase with the current i_1. If y (fig. 4) is any given angle of space displacement between the fixed field F_2 and the moving coil field F, then

$$D_1 = c\,F\,F_1 \cos 0^\circ \sin (y - \psi)$$
$$\text{and } D_2 = c\,F\,F_2 \cos \phi \sin (360^\circ - y).$$

where c is a constant and ϕ is the angle of phase difference between the currents i_1 and i_2 (or between the fields F or F_1 and F_2) (fig. 5).

Equating these two torques and assuming that the fields F_1 F_2 are proportional to the currents i_1 i_2, and that the turns producing F_1 and F_2 are equal :—

$$i_1 \sin (y - \psi) = - i_2 \cos \phi \sin y.$$

$$\text{or } i_1 \sin y \cos \psi - i_1 \cos y \sin \psi = - i_2 \cos \phi \sin y.$$

Dividing both sides by $i_1 \sin y \sin \psi$

$$\text{cotan } \psi - \text{cotan } y = - i_2/i_1 \,.\, \cos \phi \sin \psi.$$

Now the saturation of the iron is so chosen, that within the working range of the instrument the space angle ψ is practically constant, so that this last equation may be written in the form

$$\text{cotan } y = a + b\, i_2/i_1 \,.\, \cos \phi.$$

where $a = \text{cotan } \psi$ and $b = 1/\sin \psi$, and both are constant.

Since both the ratio i_2/i_1 and the value of $\cos \phi$ fall with increasing frequency, any change of frequency produces a marked effect on the instrument deflection y. The actual variations in the various quantities are shown by the following measurements made on a finished instrument for 45 to 55 cycles, with an angle ψ of 32° —

Alternations per sec.	2 × 45	2 × 47	2 × 50	2 × 53	2 × 55
i_1	·0342	·0396	·0456	·0505	·0515
i_2	·074	·0705	·067	·058	·051
$i = \sqrt{i_1^2 + i_2^2}$ ...	·056	·054	·054	·056	·057
ϕ	133·5°	130·5°	126·5°	118·5°	113·5°
$\cos \phi$	—·688	—·649	—·595	—·477	—·399

Here, i_1 i_2 and i were measured by milliamperemeter, and the value of ϕ was then estimated graphically by drawing the current triangle. It will be seen that the ratio i_2/i_1 changes approximately as 2 : 1 within the range of the instrument, whilst $\cos \phi$ changes almost to the same degree. The open and regular nature of the scale attained is a valuable feature. The total current consumption of the instrument is about 60 milliamperes. Ordinary temperature variations have no effect on the readings, and voltage variations of ± 30 per cent. also have no effect. At the same time, the instrument is practically unaffected by variations of wave form, even when the variations from the sine wave are very considerable.

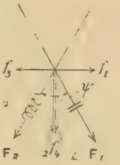


Fig. 3.

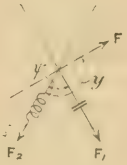


Fig. 4.

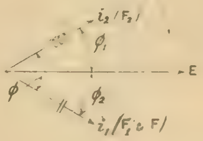


Fig. 5.

The instrument is made up in round form with maximum diameters of 9 in., 12 in. or 14½ in., and the scale is marked either in alternations or complete periods.—*E.T.Z.*

Pressure-Controlled Speed Regulator.

In fig. 6 we illustrate an "Igranic" patent pressure-controlled speed regulator, made by the Igranic Electric Co., Ltd., of 147, Queen Victoria Street, E.C., for use in connection with electric motors operating fans or blowers used in mechanical draught systems, the object being automatically to maintain a constant boiler pressure by varying the speed of the motor inversely in accordance with variations in the boiler pressure.

So long as the steam pressure is constant the speed of the motor is not changed, but any variation in pressure above or below the amount for which the controller is adjusted results in a decrease or increase of motor speed, the draught being thus automatically regulated so as to keep the boiler pressure practically constant.

The speed regulation may be obtained either by armature or shunt field control or by a combination of both.

The regulator consists of a slate panel mounted on the front of an angle-iron cage in which the necessary resistances are contained. The panel carries the contact segments over which a double-ended lever moves.

The lever is actuated by the piston of an hydraulic or compressed air cylinder, fitted with a pilot valve controlled by the movement of a diaphragm, one side of which is subjected to the boiler pressure.

The normal boiler pressure on the underside of the diaphragm is balanced by a weighted lever bearing upon the top of the diaphragm in such manner that this lever will rise or fall as the boiler pressure rises above or falls below the normal pressure for which the lever is counterbalanced. This up and down movement of the lever operates a pilot valve controlling the admission of water or air to the cylinder shown to the left of the slate panel, and, due to this pressure, the piston of the cylinder is moved back and forth, operating in turn the double-ended lever which rides over the contact segments mounted on the slate.

The operation of cutting the resistance in and out is not a continuous one, but proceeds step by step with a pause after each movement of the contact lever.

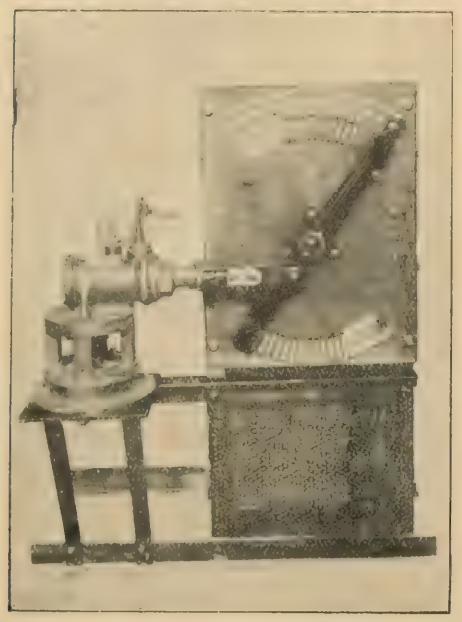


Fig. 6.—Pressure-Controlled Speed Regulator.

There are many other purposes to which this pressure-controlled speed regulator is applicable in a similar manner, as, for instance, boiler feed pumps, gas pressure blowers, &c., and the same system of control can be adapted for either direct-current or alternating-current motors.

Oil Drying and Testing Apparatus.

We have received from Mr. George Lister, of Dursley, particulars of the Hunt transformer oil-drying and oil-testing apparatus, for which he is sole European agent.

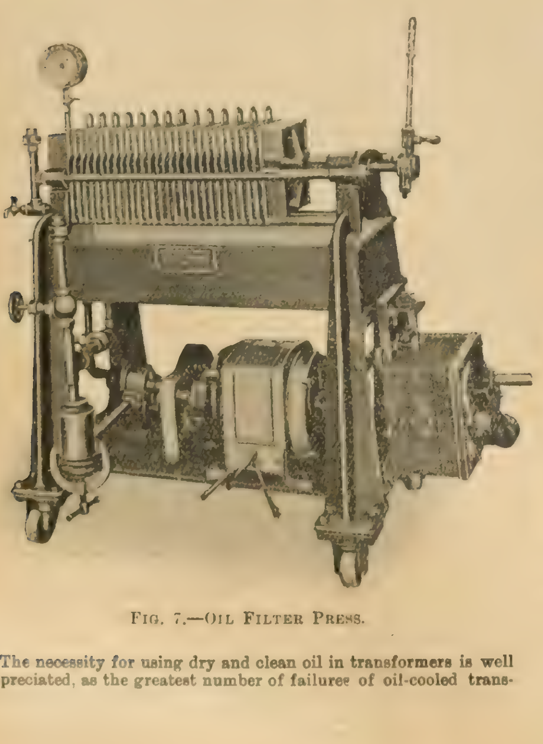


Fig. 7.—Oil Filter Press.

The necessity for using dry and clean oil in transformers is well appreciated, as the greatest number of failures of oil-cooled transformers is caused by deterioration of the oil from one cause or another. The apparatus here referred to consists of an electric drying oven, made in sheet-steel, which holds about five complete charges of filter paper, which is subjected to a temperature of 80° C. for from 24 to 48 hours. The oven contains four incandescent heating lamps.

The dried paper is placed in a filter press, fig. 7. About 200 sheets of 12¾ in. square filter paper constitute the full charge for a press, being placed five sheets together on each side of each of the 20 frames. Each frame forms an oil well, and the oil is forced by means of a motor-driven geared pressure pump, through the filter paper in each direction against the corrugated surface of the frame.

The machine illustrated is fitted with a constant speed induction motor and raw hide gearing; it has a capacity of six gallons of filtered oil per minute. A larger machine for 20 gallons per minute is fitted with a centrifugal-type pump.

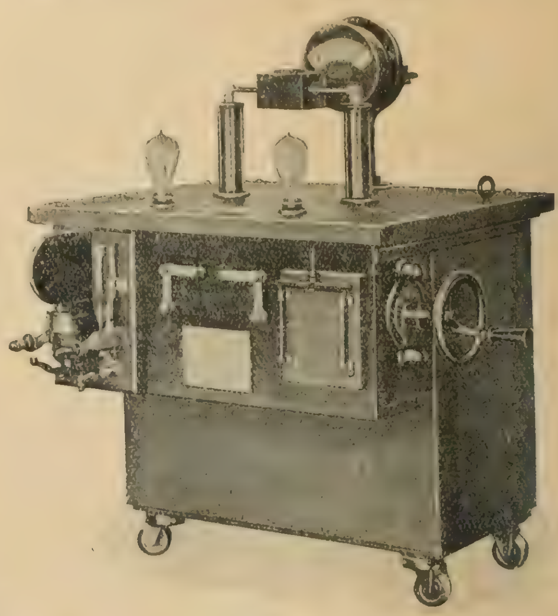


Fig. 8.—Oil-Testing Transformer.

Fig. 8 illustrates a 50,000-volt oil-testing transformer set, rated at 2 k.v.a., 60 cycles, 100-200/50,000 volts. It is fitted with a variable resistance, circuit breaker, oil-testing gap, pilot lamps, main switch and voltmeter for reading h.t. pressure direct.

The transformer is of the core type, oil insulated, and mounted on a sheet-metal case.

The variable resistance is of the compression type, adjusted by a hand wheel; the oil-testing gap is of small capacity, and about four tests can be made from the ordinary sample 4-oz. bottle of oil. The electrodes consist of two ½-in. diameter metal disks, which are adjustable, and usually set ·2 in. apart, and a steel gauge is provided for setting them.

The voltmeter is of the Weston dead-beat type, reading direct between zero and 50,000 volts.

Standard American Charging Plugs for Electric Vehicles.

In a recent issue of the *Electrical World* were shown the standard forms of charging plugs and receptacles recently adopted by the Electric Vehicle Association of America.

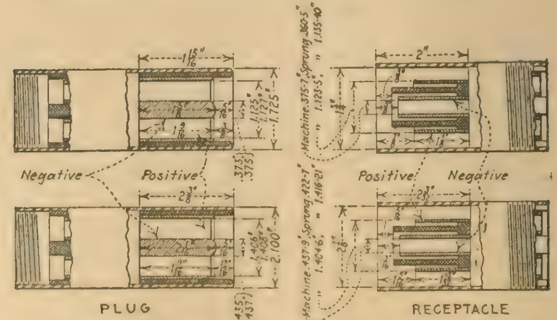


Fig. 9.—Standard Forms of 50-ampere and 150-ampere American charging Plugs and Receptacles for Electric Vehicles.

The outside contact, it will be noted, is of positive polarity while the inner contact is negative. Terminals should be marked with plus and minus signs to correspond with the polarity above given. The dimensions shown relate to plugs and receptacles for carrying 50 amperes and 150 amperes respectively, and the National Board of Fire Underwriters has approved plugs of these dimensions for overloads of 50 per cent. beyond the current ratings given. In constructing the plugs it is desirable that the contacts be accurately concentric to ensure interchangeability.

Explosion-Proof Gate-End Switch.

We have received from Messrs. Reyrolle & Co., Ltd., of Hebburn-on-Tyne, particulars of a gate-end switch which they manufacture in large quantities for underground work.

The switch consists of their three-phase, 500-volt, 50-ampere explosion-proof oil-break switch, combined with a dividing box. A gland for armoured cable is provided at one end, and at the other end there is fixed a watertight plug and socket, the plug being interlocked with the handle of the switch, so that the plug cannot be withdrawn or inserted while the switch is in the "on" position.

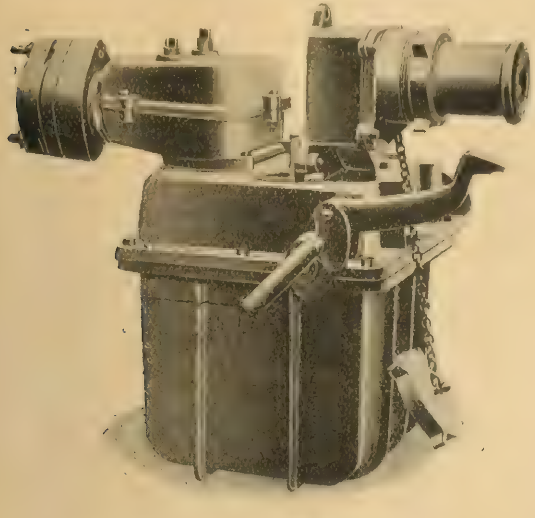


Fig. 10.—Explosion-Proof Gate-end Switch.

If necessary the switch could be used as a gate switch, and could be fitted with either a watertight plug at each end, or a dividing box at each end instead of one box and one plug as shown, also the dividing boxes can be of either vertical or horizontal type.

The whole arrangement is very compact and, at the same time, is sufficiently strong mechanically to withstand rough usage.

Messrs. Reyrolle are issuing a pamphlet, No. 193, dealing with this switch, copies of which can be obtained on application.

The "Pyrene" Fire Extinguisher.

On Thursday afternoon last week, through the courtesy of the Western Electric Co., Ltd., North Woolwich, we were present at a demonstration of the capabilities of their Pyrene Fire Extinguisher.

This device consists of a strongly built brass cylinder 14 in. × 3 in. dia., in which is incorporated a double-acting pump, by means of which the contained liquid—about one quart—can be projected in a continuous stream on to the fire. The apparatus weighs only some 5 lb, and will throw a jet 30 ft.

Of its effectiveness as a fire extinguisher, the dozen or so tests carried out during the afternoon, under the difficult conditions associated with a high wind and most inflammable materials, left not the slightest doubt.

Petrol, acetylene gas, celluloid, petrol saturated cotton waste, wood wool, wood, and bitumen were ignited in turn, and in some cases allowed to burn fiercely before being rapidly extinguished by the Pyrene apparatus.

Possibly the most striking test of the efficiency of these small extinguishers was a demonstration of the futility of trying to extinguish a burning stream of petrol with two well-known liquid extinguishers, each of about three gallons' capacity. Although these cylinders were exhausted in the unsuccessful attempt to put out the flames, yet with the small Pyrene apparatus there was no difficulty in smothering out the fire. The secret of its effectiveness is the contained liquid, which generates a large volume of heavy inert non-poisonous gas, especially where the temperature is above the normal, and this gas practically blankets the burning material, cutting off the supply of air necessary for combustion.

The liquid is harmless to fabrics, machinery, polished woodwork or foodstuff, and is, morever, a non-conductor of electricity.

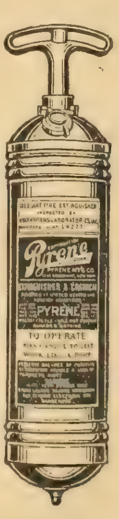


Fig. 11.—Pyrene Extinguisher.

To the electrical engineer the Pyrene extinguisher is valuable as its use, for instance, on a telephone switchboard in no way damages the latter, and, indeed, telephone equipment will operate almost as well when soaked in Pyrene liquid as when dry. The liquid can be pumped on to rotating electrical machinery without damage to the machine or danger to the operator. It will, moreover, extinguish an electric arc with considerable power behind it.

The harmless character of the liquid deserves emphasis, as that employed in some chemical extinguishers will do almost as much damage to objects in the vicinity of a fire as the fire itself.

The Pyrene apparatus costs about half as much as a chemical extinguisher, and costs less to refill; its small size enables it to be conveniently carried about (on a motor-car, for instance), and it appears to be ideal for domestic use.

LEGAL.

Day v. Willard and Others.

(*The Ruthenburg Electric Furnace.*)

On Friday, February 13th, Mr. Justice Pickford, in the King's Bench Division, delivered his reserved judgment in the action heard before him in January last, and reported fully in the Electrical Review, January 23rd, page 145.

Mr. Justice Pickford, in giving judgment, went into the matter in great detail, leading up to the following conclusion. It seemed to his Lordship that the question of the plaintiff's right entirely depended upon whether there was any general agreement approved between the parties to the effect that whatever shape the scheme eventually took and however the company was formed which should work the patents, they should share the profits that should be made out of the whole matter. It was quite clear to him (the Judge) that with regard to the Cornwall and Wales original scheme, the plaintiff and Mr. Willard were to share the profits equally, and in his opinion that agreement did not extend to the subsequent project and arrangements. It was an agreement made solely with regard to the Welsh scheme, it was made between the plaintiff and Mr. Willard only, and it did not include or concern Mr. Stalmann and Mr. Haviland, who were the other defendants, and when the Welsh scheme came to an end, his Lordship was of opinion that that agreement also ended. So that the only question that remained was—Was there an agreement between the parties, that, however the matter was carried out, they should all share in the profits; did an agreement exist by which these persons should work together for the purpose of putting the invention on the market, and forming a company and share the profits? This was the claim made in the third paragraph of the plaintiff's statement of claim, and the suggestion in brief was that in January, 1911, it was verbally agreed between the plaintiff and the defendants that they should become partners, and work together for the purpose of forming the company, and all the profits to be derived should be shared between them. In order to succeed in that action plaintiff had to establish an agreement of that nature. His Lordship was of opinion that there could be no doubt that the idea was, and the understanding was, if one might call it so, that they were all to share in that way; but, of course, one could not sue upon the strength of an understanding or an idea, and he (the Judge) had to find, if the agreement was proved to the effect and substance of that which he had referred to, and he was bound to say, with some measure of regret, that he did not think there was such an agreement. The plaintiff had given his evidence on the matter extremely fairly, but he could not find that the plaintiff's evidence came to anything approaching such an agreement as this. He said it was arranged that he and Mr. Willard were to divide the profits equally in the Cornish scheme, and then he said matters developed about the Newcastle project, but no agreement was made there about the profits, and his Lordship could not find in the plaintiff's examination in chief that he established any further agreement with regard to Newcastle until he came to the matter which was mentioned in the postcard of August 19th, and that, to his Lordship's mind, upon the face of it, and upon the evidence entirely, proceeded upon the basis of the option being given to the plaintiff. That was the only way the scheme could be carried out, if such an agreement as was contended for, was made. Plaintiff had also said in cross-examination that he took it for granted, that there was some arrangement as to profit, in connection with the Newcastle scheme, but nothing was really said about it. He (the Judge) was satisfied that upon all the evidence, he could not find any such agreement as was alleged, and which must be proved in order to sustain the action. Nor could his Lordship entirely disregard the evidence in contradiction of the plaintiff's testimony given by Mr. Willard and Mr. Haviland; the evidence of these gentlemen was in absolute contradiction of the somewhat loose and vague statements concerning the agreement made by the plaintiff. Nor could he disregard the evidence of Mr. Stalmann and Mr. Ruthenburg as to what took place at the interview at which they were all together in London, and at which Mr. Ruthenburg declined to renew the option to the plaintiff. He could not find any agreement involving a general sort of partnership, using the word in the ordinary sense, and no agreement to share profits however the matter was carried out, and if he could not find that, plaintiff could not succeed. He thought there was an idea and a scheme making such a provision, but that scheme fell through, and when the scheme fell through, the agreement fell through, and unless there was a general agreement to share profits to fall back upon, he did not think there was anything upon which the plaintiff could sue, and as there was no such general agreement, the plaintiff's case failed. He regretted this, because it did seem rather hard on the plaintiff. He was not going to say whether it was the failure to find capital, or whether he got into connection with persons of greater astuteness than himself; it was not necessary for his Lordship to express an opinion on this, but it did seem hard on plaintiff, considering that he had brought the matter to the notice of these gentlemen, and he regretted he was unable to find that plaintiff was entitled to anything in respect to the matter. However, he (the judge) could not find the agreement was proved. He thought the only answer plaintiff gave to go to anything like such an agreement was inconsistent with his other answers, and was inconsistent with the evidence of the others, and therefore he gave judgment for the defendants, with costs.

Mr. Patrick Hastings (counsel for the plaintiff) said that, with regard to the question of costs, he wished to point out that in view of the fact that the case for the plaintiff here was that the defendants went behind his back and did certain things surreptitiously, it was most important that they should have had proper "discovery," but this proper "discovery" was not in fact given, and he asked his Lordship to say that, under these circumstances, the plaintiff should not be entirely mulcted in the costs of the action.

Mr. Justice Pickford replied that he would like to accede to the application of Mr. Hastings, but he could not do so.

Player *v.* Crompton & Co., Ltd.

This case, which was a debenture-holder's action, was again mentioned to Mr. Justice Warrington in the Chancery Division on Friday, upon a motion for a Receiver.

Mr. Clauson, K.C., for the plaintiff, said Mr. Younger, K.C., was on the other side, but was engaged elsewhere, and subject to his Lordship's sanction, they had agreed that the motion should stand for another week. Counsel also mentioned that the motion raised a point of law.

His Lordship assented.

Buffalo Forge, &c., Co., Ltd., *v.* British Westinghouse Electric and Manufacturing Co., Ltd.

In the King's Bench Division, on Friday, February 13th, an application was made to Mr. Justice Pickford in this non-jury action.

Mr. Harold Morris, for the plaintiffs, applied that the case should be allowed to stand out till the 26th inst., keeping its place in the list in view of the fact that the parties were negotiating for a settlement.

Mr. Justice Pickford asked if counsel thought that the negotiations would prove effective, and counsel replied that he was instructed that an offer had been made and was being considered.

Mr. Justice Pickford: You really think it will come to something?

Counsel: Yes, I do.

His Lordship then assented to the application.

Stolz Electrophone Co. (1913), Ltd.

The petition of A. Hyman for a compulsory order to wind up Stolz Electrophone Co. (1913), Ltd., came before Mr. Justice Astbury in the Companies' Winding-Up Court on Tuesday, 17th inst.

Counsel for the petitioner said he was a debenture-holder for £171, and a shareholder for £31,000. A large number of persons present consented to the order. Mr. Ashton Cross said everybody desired a winding up, but the petitioner was not a creditor.

Counsel for the petitioner said in his affidavit he explained how he came to be a creditor and shareholder.

Mr. Manning and other counsel for creditors supported the petitioner, but desired another petitioner to be substituted for Mr. Hyman.

His Lordship said it was quite immaterial if he made an order.

Counsel for the company submitted to an order.

His Lordship ordered the company to be wound up compulsorily.

PARLIAMENTARY.

Petitions Against Private Bills.—Amongst the petitions which have been deposited in the Private Bill Office of the House of Commons in opposition to Private Bills, are the following:—

London Electric Supply.—St. Marylebone B.C.; Hammersmith B.C.; City Corporation; Charing Cross, West End and City Electricity Supply Co.; Brompton and Kensington Electric Supply Co.; South Metropolitan Electric Light and Power Co.; City of London Electric Co.; London County Council; and Woolwich B.C.

Metropolitan and Great Northern Railways Companies.—St. Marylebone B.C.; Port of London Authority; Hammersmith B.C.; City Corporation; Finsbury B.C.; London County Council; and a large number of private owners of property.

Central London Railway.—Hammersmith B.C.; Westminster City Council; Gas Light and Coke Co.; L.C.C.; Holborn B.C.; and others.

L.C.C. Tramways.—Port of London Authority; Westminster C.C.; City Corporation; London General Omnibus Owners' Federation; Metropolitan District Railway Co.; London United Tramways Co.; and a number of frontagers.

London Electric Railway.—Westminster C.C.; Holborn B.C.; and the L.C.C.; and others.

Deal and Walmer Gas and Electricity.—Sandwich Corporation; South-East Kent Electric Power Co.; East Kent Light Railway Co.; Deal Corporation, &c.

Leyland Gas and Electricity.—Leyland U.D.C.; and West Lancashire R.D.C.

London United Tramways.—Ealing Corporation; and the U.D.C.'s of Twickenham, Teddington, Hampton Wick, and Heston and Isleworth; Middlesex C.C.; Wimbledon Corporation, &c.

Lurgan Gas and Electricity.—Armagh and Down County Councils and the Lurgan U.D.C.

Oxford and District Tramways.—Oxford Corporation and Oxford Gas Co.

Norwich Electric Tramways.—The Dean and Chapter of Norwich Cathedral and others.

Alliance and Dublin Consumers' Gas (Electric Supply).—Dublin Corporation; U.D.C.'s of Kingstown, Blackrock and Dalkey; and the Dublin Southern District Electric Supply Co.

Sheffield Corporation.—Yorkshire Electric Power Co., and others.

South Suburban Gas.—West Kent Electric Co.

Street Accidents.—Replying to Mr. F. Kellaway, the Home Secretary states that in 1913 there were 608 street accidents in the Metropolitan area during 1913. Tramcars caused 58 and motor-'buses 180.

Second Readings.—In the House of Commons on Tuesday, according to the *Times*, the following Bills were read a second time:—Alliance and Dublin Consumers' Gas (Electric Supply) Bill, Central London Railway Bill, Deal and Walmer Gas and Electricity Bill, Leyland Gas and Electricity Bill, London Electric Railway Bill, and the London United Tramways Bill.

BUSINESS NOTES.

Catalogues and Lists.—Messrs. Crompton & Co., Ltd., Chelmsford.—Leaflet No. 506, just issuing, gives an illustrated description with tabulated prices of pedestal pattern moving coil and moving iron instruments for a.c. and c.c.

The British Thomson-Houston Co., Ltd., Rugby.—Four-page list No. 4,502, containing a full illustrated description of their compression chamber multi-gap lightning arrester for alternating currents, and its construction. Prices are tabulated and dimension drawings given.

Allgemeine Elektrizitats Gesellschaft, Berlin.—Leaflets illustrating medical apparatus, hair-drying blowers, and portable agricultural machines.

The A.E.G. Electric Co., Ltd., 133-135, Oxford Street, London, W.—Illustrated circular relating to their "Nitra" half-watt lamps which are now manufactured with a current consumption of 100, 200 and 400 watts.

Messrs. Alfred Herbert, Ltd., of Coventry, have again issued one of their very clearly printed calendars for the year, with monthly sheets.

Schiersteiner Metallwerk G.m.b.H., Swerinstr. 3, Berlin W. 57.—Leaflets relating to the "Veritas" relays for signalling purposes, for use in conjunction with electric clocks as time switches.

Messrs. Meldrum Bros., Ltd., Timperley, Manchester.—Thirty-two page catalogue containing a description of their coking and sprinkler type mechanical stokers, their design and construction, with illustrations of parts and pictures showing them applied to a number of plants. Tabulated results of tests are also given.

The Adnil Electric Co., Ltd., Artillery Lane, London, E.C.—List T 75 (8 pages) containing a fully-illustrated description of the Adnil mine shaft signalling system, which has been made to comply with the new Mining Regulations.

Messrs. W. McGowing & Co., 239, High Road, Leyton, London, E.—Price list of steel sheeting, metal flange covers, and non-conducting coverings.

British Westinghouse Electric and Manufacturing Co., Ltd., 14, Long Millgate, Manchester.—Pamphlet announcing reduced prices of Auriga wire-drawn lamps.

The Metallic Seamless Tube Co., Ltd., Meta House, Corporation Street, Birmingham.—Postal price-card relating to fuse and distributing boards.

Extension of the Pirelli Cable Works in Spain.—Messrs. Pirelli & Co., of Milan, have lately acquired a large area of land adjoining their Spanish branch electric cable works at Villanueva y Giltru. Two large new buildings, having a total floor space of 5,600 sq. metres, are being erected, one being intended for the production of rubber goods, and the other for the manufacture of telephone cables.

Rubber Exhibition.—We have received a copy of the official bulletin of the fourth International Rubber and Allied Industries Exhibition that is to be held in June next at the Agricultural Hall, London. It contains information concerning the rubber congress, and matters of general interest to exhibitors.

Book Notices.—*Phase Compensation* (Part I) is the title of a brochure which we have received from Mr. Val A. Fynn, consulting engineer to the Wagner Electric Manufacturing Co., of St. Louis, U.S.A., and which contains an amplified reprint of articles which he published in the *Electrical World* in July last year. The author reviews the nature of a phase difference, and its effects on the generating and consuming apparatus, indicates how it is produced, and shows how it can be controlled in A.C. motors. Part I especially deals with the control of the power factor of a single-phase motor; the author finds that the power factor in any A.C. motor can be controlled, within the widest limits, by changing the phase of the exciting flux relatively to the phase of the working E.M.F., and describes methods of carrying out the necessary compensation.

Automatic Telephony. By S. Turner. London: S. Rentell & Co., Ltd. Price 6d. net.—This is a reprint of articles which appeared in *Electricity* last year dealing with the system of the Automatic Electric Co., of Chicago, which is in use in some of the Post Office exchanges in this country. The system is described in detail, and the successive operations necessary to connect any two subscribers in a three-figure exchange are traced out, with the aid of numerous diagrams. The author's object is very successfully accomplished, and anyone who desires to become acquainted with the working of the system in question will find this little book a clear and inexpensive guide to the attainment of his ambition.

The Engineer's Year-Book of Formulæ, Rules, Tables, Data, &c., for 1914. By H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood & Son. Price 15s.—This year we have the pleasure of congratulating the Editor and publisher of "Kempe's Year-Book" upon the attainment of its majority; for this is the twenty-first year of publication. Fittingly to mark the occasion, the book has been revised and amplified with greater thoroughness than in any previous year, the new matter introduced occupying a space equivalent to more than 200 pages. Corrections and excisions have been made with a drastic pen, to maintain the reputation of the work as the standard of information on modern engineering practice. The total number of pages is now 1,800, but by systematic sectionising and sub-division—which has been reorganised and extended in this edition—the various subjects are made easy of reference. New sections deal with machine tools and power transmission; the sections on mining, rainfall and irrigation have been largely rewritten, and other new sections have been added on the cost of engineering works, link motions and valve gear, and the arrangement and construction of engineering workshops. The Editor has had the assistance of a large number of expert contributors, and enjoys special privileges conferred upon him by various public bodies which have enabled him to include much valuable information. To review such a work would not only be a gigantic task, but would also necessitate the collaboration of a small army of specialists; moreover, it is superfluous in the case of a tried and trusty friend of 21 years' standing. As we have said before, those who know the book will welcome the new edition; those who don't know it, ought to.

In addition to a number of other matters, the February *Journal* of the Tramways and Light Railways Association contains a list of members and their addresses.

"*Journal* of the Institution of Electrical Engineers." Vol. 52, No. 228. February 16th. London: E. & F. N. Spon, Ltd. Price 3s. 6d.—This issue contains papers on "Some Railway Conditions Governing Electrification," by R. T. Smith, and "Suggested Methods for Improving the Telephone Service," by W. Aitken.

"Applications of Electricity." By A. Ogilvie. London: T. C. and E. C. Jack. Price 6d. net.

"*Journal* of the Western Society of Engineers." Vol. XVIII, No. 10, December, 1913. Chicago: The Society. Price 50 cents.

"*Journal* of the Franklin Institute." Vol. CLXXVII, No. 2, February. Philadelphia: The Institute. Price 50 cents.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Vol. LVII, Part IV, February. Glasgow: The Institution.

"A Preliminary Report on Uranium, Radium and Vanadium." By R. B. Moore and K. L. Kithil; "Copper Wire Tables," and "Standard Specifications for Electric Lamps." Washington: Government Printing Office.

"The Physical Review," Vol. III, No. 1, January. Lancaster, Pa.: The American Physical Society.

"Handbuch der Elektrizität und des Magnetismus." By Prof. Dr. L. Graetz, 2 vols. Leipsic: J. A. Barth. Price 10 m each.

"*Bulletin* de la Société Internationale des Electriciens." Vol. IV. No. 31, January. Paris: Gauthier-Villars et Cie. Price 2 fr. 50.

"*Giornale* ed Atte della Associazione Elettrotecnica Italiana." Vol. I, No. 2, February 15th. Milan: The Association. Price L1.

Electric Welding.—A new company has just been formed in Antwerp with a capital of £6,000, and the title The Belgian-Swedish Electric Welding Co., to develop a new electric welding process.

Dissolutions and Liquidations.—[illegible] Liquid Fuel Appliances, Ltd.—The company is winding up voluntarily, with Mr. H. [illegible], of [illegible] Buildings, Merton Abbey, S.W., as liquidator.

The Kent Electric Power Syndicate, Ltd.—This company is winding up voluntarily, with Mr. F. A. H. Walker, of [illegible], Railway Street, Chatham, as liquidator. A meeting of creditors was held at 7, St. Helen's Place, E.C., on Saturday last.

Thompson & Co., electrical and mechanical engineers, [illegible] and 16, Garlick Hill, E.C.—Messrs. F. Thompson and H. [illegible] have dissolved partnership from December 31st last. Mr. H. [illegible] will attend to debts.

Brighten, Malcolm & King, Ltd.—This company is winding up voluntarily, with Mr. W. Lambert, of Dock House, Billiter Street, E.C., as liquidator.

Bankruptcy Proceedings.—W. R. W[illegible], electrical engineer, The Arcade, Northampton.—The adjourned public examination of this debtor took place at the County Hall, Northampton, last week, when it was reported that he was still employed at Bury, Lancashire, but there were possibilities that in the near future he would have more convenience for attending the Court. The case was therefore again adjourned.

J. G. M. Hilton, electrical engineer, Birmingham.—The first dividend of 3s. in the £ is payable on February 23rd, at the Official Receiver's office, Ruskin Chambers, 191, Corporation Street, Birmingham.

F. W. Suter, engineer and company director, 67, St. John's Park, N.—Application for debtor's discharge to be heard March 10th, at Bankruptcy Buildings, Carey Street, W.C.

For Sale.—Messrs. John Thomas, Jun., & Co. have for disposal the whole plant of the Newport Rolling Mills, Middlesbrough, including the electrical installation, particulars of which will be found in our advertisement pages.

Trade Announcements.—Messrs. J. Lomax-Kendal Co., Ltd., electrical engineers, of Manchester, are terminating their agency for Easton lifts in the Manchester district about the end of April.

Messrs. George Ellison, of Birmingham, have appointed Messrs. Nathan & Allen, of Queen Anne's Chambers, Westminster, as their London Agents.

Amalgamation.—According to reports in the Press, negotiations are on foot for the amalgamation of Stewarts and Lloyds, Ltd., and the Scottish Tube Co.

LIGHTING and POWER NOTES.

Aberdeen.—New Plant.—The Electricity Committee has decided to provide an additional 1,000-KW. motor-converter to transform the three-phase 6,000-volt supply for lighting and traction purposes, in place of the two sets which are going to Rubislaw and Broadford works; it was stated that a saving of £430 per annum would be effected. The Committee has also decided to augment the present water supply by obtaining a supply from the Dee.

Amersham.—Workhouse Lighting.—The B. of G. has asked the Chesham E.L. Co. to submit an estimate for the installation of E.L. at the workhouse.

Argentina.—An application has been made to the La Rioja Government for a concession for electric light and power in La Rioja.

The Ministry of the Interior has been authorised to expend $10,000 m/n. on the purchase of electric lighting and heating material for its new offices.—*Review of the River Plate.*

Australia.—The Brunswick (Vic.) Council has decided to borrow £7,000 for electric lighting purposes.—*Tenders.*

Ballachulish.—Electricity Works Fire.—According to the *Glasgow Daily Herald* the electricity works and gas engine house of the Ballachulish State Quarries were completely destroyed by fire on the morning of February 13th. Incendiarism is suspected.

Ballater.—E.L. Scheme.—Owing to the opposition of the Dee Fishery Board to the water power scheme the promoters have now decided to install a suction gas plant.

Barnes.—Cottage Lighting.—The D.C. has decided to charge 2d. per 30-watt lamp per week for E.L. in the cottages being erected in the Malthouse area, including the supply of lamps in the first instance, all other lamps being found by the tenants. The wiring and fitting is to be carried out by the electricity department.

Birmingham.—A new electric power plant has recently been installed at the works of the Austin Motor Co., Ltd., at Northfield, by the Anderston Foundry Co., of Glasgow. It consists of two vertical four-cylinder gas engines of 200 H.P. each, coupled direct to 175-KW. alternators by the Allmanna Svenska Electric Co., of Stockholm. The current generated is distributed to 16 20-H.P. motors located in various machine sections of the works, and also for lighting purposes.

Basingstoke.—Loan Sanction.—The L.G.B. has sanctioned loans for the E.L. scheme, and tenders are to be invited for [illegible] &c.

Bitterne.—E.L. Scheme.—A parish meeting has decided against the proposal of the Council to adopt the Lighting Act with a view to entering into an agreement with Southampton for public electric light—and a poll of the electors is to be taken on the subject.

Blackrock.—The petition which the U.D.C. has lodged against the Alliance and Dublin Gas Consumers' Electric Supply Bill states that the Council has itself an E.L. scheme under consideration in conjunction with neighbouring local authorities, and submits that the powers sought by the Bill are in breach of an agreement made between the Council and the company in July, 1913. The petition also objects to overhead wires.

Bo'ness.—The T.C. has decided to defer consideration of the taking over of the electricity works from the National Electric Construction Co. until the next break in the agreement, four years hence.

Canada.—Hydro-Electric Breakdown.—According to the *Electrical World*, the electric service of the Power Commission, extending from Niagara Falls to Toronto in the North, and to London and St. Thomas in the West, about 420 miles of H.T. and 20,000 miles of L.T. lines, was interrupted for 8 hours on January 31st, by a local hurricane, which snapped two of the ice-covered wires, which, falling across others, short-circuited the line. The delay was due to trouble in locating the break. Severe inconvenience was caused in Toronto, where the streets are exclusively lighted from the Hydro-Electric system; the civic tramways were also shut down, and other towns were more or less similarly affected. It is understood that a second line, to contain two circuits, has been surveyed between Dundas and Niagara Falls, and this will be of extra heavy construction, employing an aluminium conductor reinforced by steel.

Over 150 representatives of towns using the Hydro-Electric service have petitioned the Commission to develop a durable standard electric range of moderate cost, and to manufacture this for the various municipalities, who believe there is a great opening for such a stove, especially among the farmers.

Carlisle.—The T.C. has decided to supply E.L. to Scotby, which is from 2 to 3 miles from the centre of the city; the proposal was opposed by the Gas Committee.

Continental Notes.—Turkey.—La Société Anonyme d'Electricité Ganz, of Budapest, is installing a modern central station in Constantinople for lighting and power service. Hitherto, according to the *Electrical World*, only a few private plants in hotels, offices, &c., have been in use.

France.—We hear that the Paris, Lyons and Mediterranean Railway Co. is carrying out some tests of a number of different train electric lighting systems, including several of British design.

Crook.—Proposed E.L.—The U.D.C. has decided to consider the question of an E.L. scheme for the town.

Croydon.—The price of electricity supplied to the tramways department for traction purposes is to be fixed at ¾d. per unit for all beyond two million units per year. Electric light is to be installed in the depôts of the highways department in lieu of gas, at an estimated cost of £240. It is estimated that the current will cost £8 17s. 6d. a year, as against £16 14s. for gas. The General Purposes Committee is considering a new system of fire alarms.

Curragh Camp.—The War Office has undertaken to supply E.L. to the Camp, where extensive developments in business premises are taking place.

Dundee.—New Plant.—The Electricity Committee requires additional converting plant, boilers, and coal-handling plant for the Carolina Port generating station, and at a meeting the Convener suggested that the engineer and himself be empowered to negotiate privately for the necessary plant. The engineer expressed the opinion that, owing to the combination of the manufacturers of electrical generating plant, this would be the cheapest course. A member remarked that they had the same trouble in connection with the cables some years ago, and on that occasion they went to the Continent and got them cheaper. The Convener's suggestion was agreed to.

Ellon (Aberdeenshire).—E.L. Scheme.—The T.C. is practically assured of the requisite support for the E.L. scheme, and is now looking out for a site for a generating station.

Failsworth.—Street Lighting.—Sixteen electric lamps are to be installed in Oldham Road by the Manchester Corporation at an annual rental of £3 15s. per lamp.

Farnham.—The Slough and District E.S. Co. is arranging to supply electricity to Farnham in the autumn of the present year.

Flint.—Proposed E.L.—Mr. A. J. Leigh, of Northwich, is to make an inspection of the town, and report on the question of E.L. there.

Glasgow.—Hiring-out Proposals.—The Electricity Committe has appointed a sub-committee to report on the advisability of the electricity department hiring out cooking, heating and other appliances.

Glass Houghton.—Proposed E.L.—The P.C. has decided to communicate with the manager of the West Riding Tramways Co., with a view to the preparation of a scheme for the E.L. of the district.

Gravesend.—Loan Sanction, New Plant, &c.—The T.C. has received sanction from the L.G.B. to a loan of £800 for services.

The Council has decided to invite tenders for additional plant for the electricity works.

Great Yarmouth.—Loan Sanction.—The T.C. has received the sanction of the L.G.B. to a loan of £7,639 for electricity purposes.

Halifax.—New Plant Inaugurated.—At the starting-up of the new 3,500-kw. turbo-alternator, which has been installed at a cost of £11,310, Mr. A. Fawcett said that before very long they would have to look out for a site for the erection of new electricity works, using the present works as a sub-station. During the past two years the output from the works had increased by two million units, and if that rate of progress was maintained, further plant would be required.

Harrogate.—Loan Sanction.—The T.C. has received the sanction of the L.G.B. to loans, as follows:—Electricity works extensions, £5,239; H.T. mains, £1,000; and L.T. mains and transformers, £1,400.

Holywell.—Workhouse Lighting.—The B. of G. has reversed a decision of a Committee that gas shall be the illuminant for the workhouse and new infirmary, and has decided to use electricity

Huddersfield.—Annual Accounts.—The financial statement of the Corporation electricity undertaking for the year ended December 31st last, shows that the income was £49,886, compared with £45,078 for the previous year. The expenditure amounted to £31,671, and the surplus to £18,216, compared with £28,511 and £16,567 respectively for 1912. Interest absorbed £7,245, redemption of debt £5,640, and the amount repaid to the Public Works Board was £1,696; £1,585 has been transferred to the depreciation and contingencies account, which stands at £8,213, and £2,050 to the relief of rates.

Ipswich.—L.G.B. Inquiry.—An application by the T.C. to borrow £37,500 for electricity purposes was inquired into by Mr. H. R. Hooper last week. The loan was required for the following purposes:—Mains, £21,000; services, £3,000; motors, £4,000; works already carried out, £1,700; plant, £6,150; substations, £1,200. There was no opposition, but the Inspector questioned the wisdom of the expenditure on motors.

Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £4,000 for the purpose of erecting a substation to supply current to a district which will include the Orwell Works of Messrs. Ransomes, Sims & Jefferies, who have agreed to take 100 H.P. for seven years. It is proposed to install two 250-kw. converters and switchgear.

Keith.—Proposed E.L.—The T.C. has instructed the Lighting Committee to report upon the question of introducing an E.L. system into the town.

Kingstown (Co. Dublin).—Prov. Order.—The U.D.C. has resolved to apply to the B. of T. for the renewal of the prov. order granted to the Council in 1896, which was revoked in 1904 or, alternatively, to grant a prov. order to enable the Council to supply electricity within its area.

It was also decided to appoint a Committee, with powers to act, to consult with the law agent in reference to the E.L. Bills at present before Parliament.

Largs.—Proposed E.L. Scheme.—The T.C. has decided to obtain a report from an engineer on the cost of a power station, a lighting scheme for the promenades, and the price at which electricity might be supplied to consumers.

Leigh.—A proposal is being made that the gas and electricity departments of the Corporation should take a joint showroom to exhibit gas and electrical appliances.

Liverpool.—The Corporation is now sterilising by electricity the whole of the milk for infants supplied to the public from the various Corporation milk depôts in the city.

London.—The Fulham and Shoreditch B.Cs. have decided to oppose the London Electric Supply Bill, 1914.

Preston.—Street Lighting.—The authorities are reported to have made up their minds as to the superiority of gas, as compared with electricity, for street lighting. A few years ago a trial was given to electric light in Deepdale Road, and last winter Stanley Street was on alternate nights illuminated by high-pressure gas and electricity. Arrangements are now in progress to again test the high-pressure gas system.

Manchester.—On Saturday a new electrical street lighting scheme was inaugurated, similar to that adopted in Portland Street. In Stretford Road [illegible] 11 ampere flame arc lamps have been erected, and these will be automatically lighted and extinguished by a clock. A similar installation is to be adopted in Oxford Road and Peter Street, extending from Deansgate to Fallowfield Station. Altogether, there will be 11 miles of important thoroughfares lighted in this manner as the outcome of the test made some time ago between the merits of gas and electricity.

Plymouth.—Public Lighting.—The B.C. has instructed the Electricity Committee to prepare alternative estimates for the lighting of the Embankment by gas and electricity.

Reading.—The T.C. has decided to object to the application of the Reading E.S. Co. for a prov. order to supply electricity in bulk to the York Town and Blackwater Gas Co., on the ground that the Council's powers to purchase the E.S. Co.'s undertaking would be prejudiced.

Rhyl. — L.G.B. Inquiry. — Mr. T. C. Ekin held an inquiry on the 10th inst. into the application of the U.D.C. for permission to borrow £3,900 for extensions at the electricity works. The loan has, we understand, been sanctioned.

Romford.—The County of London E.S. Co. having undertaken not to seek in its Bill to interfere with the powers of the Council in regard to that portion of the undertaking authorised under the Romford and District E.L. Order, 1913, and situated in the area of the R.D.C., the Council has decided not to oppose the Bill.

Sandwich.—The T.C. has decided to oppose the Gas and Electricity Bill of the Deal and Walmer Gas Co.

Sligo.—Asylum Installation.—The Sligo and Leitrim Asylum Committee has approved of its engineer's report recommending that the institution be lighted by electricity, that a new power house be erected, and that two 20-B.H.P. gas engines with direct-coupled dynamos, as well as suitable suction gas plant in duplicate, be installed.

Southport.—Cottage Lighting.—Last week the T.C. adopted a revised scale of charges for electricity, including special terms for cottage property; the Corporation, through contractors, is to install lights at 7s. 6d. each with a minimum of three, the charge to be 1½d. per lamp per week if paid monthly in advance, and 2d., if paid weekly in advance.

Stirling.—Proposed E.L. Transfer.—The T.C. has decided that the offer of £32,000, made by Mr. George Balfour, for its electricity undertaking, would not compensate it for the "ultimate disadvantages consequent upon the transference of the undertaking from public to private control."

Swansea.—Rate Relief.—During the past two years the Corporation electricity department has contributed £2,200 to the relief of rates, and at last week's meeting of the Finance Committee the amount that could be allocated out of the current year's profits was discussed. The vice-chairman of the E.L. Committee opposed any allocation, and pointed out that the Committee was faced with a further outlay of £40,000 for extensions, which would be unremunerative for some time. They had increased working costs, the assessments had gone up, and the price of current had been reduced. The Swansea undertaking had only £8,000 in the reserve fund. The borough treasurer said some of the additional outlay would be at once remunerative, although at the same time he would not advise the Committee to transfer so much as in past years. He could not agree that placing 10 per cent. to reserve meant that it must be placed all at once, and if they reached 10 per cent. in 25 years, it would be doing more than a great many electrical concerns had done. It was decided to recommend the Council to allocate £700 towards the relief of the rates.

Swindon.—School Lighting.—The Education Committee is to consider the E.L. of the schools in the borough at present lighted by gas.

Swinton and Pendlebury.—A proposal has been made for utilising the steam generated at the Pendlebury refuse destructor in connection with the electric lighting of the adjacent main roads.

Taunton.—Street Lighting.—A new system of street lighting, which has proved very satisfactory, has just been completed. The lights are centrally-suspended, and tungsten lamps have been adopted, the arc lamps having been replaced by groups of five Osram lamps.

Trimdon.—The P.C. has decided to carry out a scheme of public E.L. at Trimdon Grange and Trimdon Colliery villages by means of overhead cables.

Truro.—E.L. Scheme.—At a meeting of the T.C. last week, the E.L. Committee reported that a letter had been received from the Cornwall Electric Power Co., setting out terms upon which it would be prepared to supply electricity in bulk to the town. Mr. L. A. Hurds, the manager of the company, and Dr. J. Purves attended the meeting. Mr. Hurds undertook to ascertain whether the company would be prepared to enter into a contract for 42 years instead of 21 years, with an option for the Council to determine the same at the expiration of the fifteenth or any subsequent seven years, to reduce the charge per KW., to obtain at its own expense the wayleaves from [illegible], and to agree to a penalty clause being inserted in the contract in the event of a defective supply of electricity. The report was adopted.

Turriff.—Proposed E.L.—The T.C. has appointed a committee to consider the question of E.L. for the town.

U.S.A.—A 125-Mile Transmission Scheme.—It is reported in the *Electrical World* that the Coachella (Cal.) Co. is to purchase energy from the Southern Sierras Power Co., a [illegible] transmission being built to connect to the latter company's lines; from Coachella a 150-mile line will be built to the [illegible] Power Co.'s system at El Centro. The total distance from the [illegible] Station of the Southern Sierras Co. to El Centro is 125 miles, representing the longest transmission in the world, which will work at 55,000 volts.

Warrington.—L.G.B. Inquiry.—An inquiry was held on the 12th inst. into the application of the Corporation to borrow £14,551 for extensions of the electricity works and plant.

Watford.—Prov. Order.—The R.D.C. has decided not to oppose the Colne Valley E.S. Co.'s application for a prov. order for electric light.

The U.D.C. has requested the local Member of Parliament to support the Bill of the I.M.E.A.

West Hartlepool.—Proposed Loan.—The T.C. is to apply to the L.G.B. for sanction to borrow £2,000 to cover the expenditure on the "waste heat" scheme in excess of the loan sanctioned, and £2,300 for additional cables.

The sub-committee in charge of the scheme has been instructed to report on the contract with Richardsons, Westgarth & Co. for the supply of plant to the new power station.

West Yorks.—E.L. Proposals.—The Huddersfield and Brighouse T.Cs., and the Horbury, Todmorden, Southowram and Holmfirth Councils, have decided to oppose the Yorkshire Electric Power Co.'s Bill, while the Otley, Lepton and Drighlington U.D.Cs., and the Barkisland R.D.C., have decided to support it.

Weymouth.—The T.C. has decided to request the local Member of Parliament to support the Bill of the Municipal Electrical Association.

Whitworth (near Rochdale).—E.L. Scheme.—An electricity scheme, estimated to cost from £11,000 to £12,000, is contemplated.

Willington (Co. Durham).—E.L. Scheme.—The U.D.C. has been informed by the contractors for public lighting by gas at Oakenshaw, that they are considering a scheme for supplying that part of the district with electricity in the near future.

Windsor.—Sewage Pumping.—The past year's experiment of using electricity for pumping at the sewage works has proved so satisfactory and economical that the T.C. proposes to purchase the plant from the Windsor Electrical Installation Co., which is to be asked at what price it will supply current in the event of the plant being bought by the Corporation.

Yeovil.—Prov. Order.—The T.C. has consented to the prov. order for the supply of electricity to the town which Messrs. Petters, Ltd., are applying for.

TRAMWAY and RAILWAY NOTES.

Bolton.—The Tramways Committee has approved of an estimate and design for the fitting up of an electric luggage car, and has given instructions for the work to be carried out.

Brighton Railway Electrification.—The report of the company for 1913 states that the major portion of the expenditure of £99,418 was incurred in the electrification of its suburban system. Good progress is being made with the first section put in hand, from Balham to Wallington, *via* West Croydon. A contract for the additional rolling stock has been made, and deliveries will commence during this year.

Cardiff.—The proposed tramway extension to Llandaff Field Gates has been deferred. The engineer has been asked to report on the cost of extending the system to Gabalfa. The estimated expenditure for the coming year is £151,1[illegible], and the revenue £163,555.

Continental Notes.—Germany.—Since the beginning of 1912 43 battery-driven coaches have been put in service on the Prussian-Hessian State Railways, 20 being able to run a distance of 80 miles and 23 112 miles on one charge.

Electric Cabs.—Out of 2,437 taxi-cabs in use in Berlin, 475 are of the electric type. In Hamburg the electric cabs outnumber the petrol variety, the figures being 184 and 128 respectively, while in Bremen they number 11 and one respectively.

Licences are being obtained in Berlin for a large fleet of accumulator omnibuses, and the movement is regarded favourably by the authorities. An independent company has been formed for this purpose. The Underground Railway Co. controls the existing petrol and horse buses; the former are few, and much inferior to the London vehicles.

Belgium. A tramcar collided with a wagon in Brussels on Monday; the conductor was killed, and 10 passengers were injured.

Spain.—Application has been made for a concession for the construction of electric tramways in the Seville district.

Switzerland-Italy.—According to the *Electrical World*, an electric 'bus service has been established across the Alps between Airolo, Switzerland, and Ulrichen, Italy; the route is *via* the Nufenen Pass, and the trip takes 1¾ hours, 22 passengers being carried.

Dundee. Proposed Tramway Extensions.—The tramway manager has under consideration several schemes of tramway extension, involving an expenditure of approximately £8,000.

Ealing.—The T.C. has decided to oppose the London United Tramways Bill.

Huddersfield.—Tramway Extensions.—The Tramways Committee has decided to double the track on the Outlane, Fartown, Longwood and Leeds Road sections, and then to carry out the Greetland and Marsden extensions. The Electricity Committee has been asked to supply the electricity required between the present terminus at Slaithwaite and the proposed terminus at Marsden, and all further extensions are to be dealt with in the same way.

The Newmill U D C. has asked the Corporation to extend the tramways and electricity supply to the district; the matter has been referred to the Electricity Committee.

Lanarkshire.—New Tramway Opened.—The extension of the Lanarkshire tramways from Uddingston Cross to Bellshill Cross was opened last week, following an inspection by Major Pringle.

London.—An accident, in which a driver was killed and several passengers were injured, occurred at Harringay on Tuesday evening. A car going down Manor House Hill apparently got out of control, and dashed into the one in front, both cars being severely damaged.

Electric Dust Cart.—The St. Marylebone B.C. has purchased a 5-ton F.R.A.M. electric vehicle for refuse collection; according to the *Financier*, the Southampton and Edinburgh T.C.'s are awaiting demonstrations of this vehicle before following suit.

Newcastle-on-Tyne.—Estimates for 1915.—The estimates for the Corporation tramway undertaking for the year ending March, 1915, show an income of £255,150, as compared with £233,645 receipts for the current year. The expenditure is estimated at £144,900, as against £133,500 for the past year. The estimated gross profit is £110,250, against £100,145, and the net profit £32,800. It is estimated that £34,256 will be spent out of the reserve and renewals fund, including alterations to cars, £6,000; new pipe line, valves, &c., at pumping station, £2,500; removing and renewing centre poles, £3,200; water softener, £400; additional turbine, £9,200; additional rotary converter, &c., £2,550. The expenditure on renewals will, therefore, exceed the net profits by about £2,000.

At a meeting of the City Council on the 4th inst., a report of the Finance Committee relative to the North-Eastern Railway Co.'s Bill, which proposes to run trolley vehicles across the high level bridge, was presented. The recommendation of the committee that the proposals be opposed, as likely to operate against the Council if it should ever desire to obtain control of the passenger traffic of the bridge, was carried. The proposal to promote a Bill in connection with the extension of the tramways to Longbenton and Weetslade was confirmed, Ald. Rodgers stating that the Council had come to an agreement with the Northumberland C.C., whose opposition had been overcome.

Plymouth.—The B. of T. has informed the Tramways Committee that, owing to the steep gradients and sharp curves on the system, it could not sanction the proposed introduction of double-deck cars.

The Municipal Tramways Association having informed the Council that it proposes to hold a meeting of the managers' section at Plymouth in the early summer, a sub-Committee has been appointed to make arrangements.

An estimate has been submitted showing that the proposed tramway extension to Lairn would cost, with single track, £6,000, and with double track, £8,300.

The estimates for next year show an anticipated income of £40,000, compared with £38,000 for the past year, and an expenditure of £38,531, compared with £36,626.

Poole.—Railless Traction.—The T.C. has decided to withdraw its opposition to the Poole, Sandbanks and Westbourne Railless Traction Bill.

Prestwich.—The B. of T. has sanctioned the doubling of a section of the tramway track in Bury Old Road.

Rochdale.—A tramcar proceeding down John Street, which has a gradient of 1 in 13, got out of control last Saturday, and dashed into a shop front. The car was wrecked and 18 persons were injured.

South Shields.—The T.C. has decided to double the tramway track in Frederick Street, the work to be carried out by the T.C. It also decided to obtain three motor-'buses to run in connection with the tramway system. The Corporation is asking the promoters of the Tyne tube railway to insert a clause ensuring that energy shall be purchased from either North or South Shields Corporation.

Stirling.—Proposed Tramways.—At their last meeting the T.C. discussed a report on the electrical and tramway schemes. It was estimated that a complete system of broad-gauge tramway could be constructed at a total cost of £74,000, with a reasonable certainty of success. It was agreed to have the report further supplemented for future consideration.

Swinton and Pendlebury.—In response to a request of the Farnworth and Kearsley D.C. and the Clifton P.C., the Tramways and Electricity Committee has decided, subject to a satisfactory service of Salford tramcars being maintained along Station Road, to offer no objection to a tramway to link up the Salford Corporation's and South Lancashire Co.'s systems at Newtown. This will provide another through tramway route between Manchester and Liverpool.

Tilbury Railway Electrification.—The Midland Railway authorities have decided to ask Parliament to extend the period from 1914 to 1916, for depositing a scheme for electrifying the Fenchurch Street—Southend route.

Twickenham.—The D.C. is to enter into a joint undertaking with the local authorities of Heston and Isleworth, Hampton, Hampton Wick and Teddington not to conclude any agreement with the London United Tramways relative to Clause 5 of the L.U.T. Bill, 1914, to which the marginal note is "agreements as to purchase of tramways by local authority," without first consulting and conferring with each other.

TELEGRAPH and TELEPHONE NOTES.

Australia.—Although only a couple of years have elapsed since the chief electrical engineer of the Postal department (Mr. J. Hesketh) made a tour abroad to acquaint himself with the latest developments in telegraphy and telephony, two more officials are being dispatched on a similar mission. They are Mr. G. H. Morgan, manager of the telephone exchange in Melbourne, and Mr. S. L. Monaghan, assistant manager of the Sydney exchange. They will visit Great Britain, the Continent and the United States, and are expected to be absent from the Commonwealth about six months.—*The Age.*

Ecuador.—The cable office and the British Consulate were burned during the recent fighting at Esmeraldas.

Fire at a Wireless Station.—On Sunday a fire broke out in the power station of the Post Office wireless station at St. Just (Cornwall) and did considerable damage before it was subdued by the staff. The roof fell in, and the apparatus was put out of operation through the fire. The station is a new one.

Long-distance Wireless Transmission.—On Thursday last week the new wireless station at Sayville, Long Island, U.S.A., was in communication with Nauen, near Berlin, a distance of over 4,000 miles. The system used was that of the Telefunken Co.

New Wireless Receiver.—Our correspondent in Sweden writes that a Belgian operator, named Brücq, has carried out successful experiments at Fredrikstad, with a simple receiving apparatus of his own invention, which is fixed at the top of a flagstaff, and connected with a telephone. With this apparatus Mr. Brücq has succeeded in receiving signals from the Eiffel Tower, Berlin, and Rundemanden—the station on the west coast of Norway, near Bergen. Between the last-named station and Fredrikstad there is a range of mountains having altitudes up to 2,500 m.

The Imperial Wireless Contract.—On Tuesday Lord Murray made a statement in the House of Lords regarding the purchases of shares in the American Marconi Co, for which he was responsible. He said that the facts were known, and there was nothing new to be revealed; he had never been interested in any other wireless shares. He expressed regret that he had not given more consideration to the matter at the time, but said that it was an error of judgment, not of intention.

A motion by Lord Ampthill that a Select Committee be appointed to inquire into the charges which had been made against Lord Murray was postponed until Thursday.

Switzerland.—The Federal Budget for 1914 prescribes an expenditure of 9,225,000 fr. for the establishment of new telegraph lines, interurban and international telephone lines, telegraph and telephone cables, &c.

Wireless in a Lifeboat.—The new Allan liner *Alsatian* has been provided with a motor-driven lifeboat equipped with an installation of wireless telegraphy, capable of communicating over a distance of 100 miles. One use to which the boat will be put is to scout ahead of the liner in foggy weather, and to report by wireless telegraphy the whereabouts of ice or other dangerous bodies. Two such lifeboats will be placed on board the *Alsatian*, and two on the *Calgarian*, and the Cunard liner *Aquitania* will have four of them.

Wireless Train Signals.—Experiments were made last year on the line from Nuremburg to Grafenberg with an electric system of communication, devised by Christoph Wirth. A vehicle of a train carries receiving antennæ, and the telegraph or telephone lines running alongside the railway serve as sending antennæ. It is possible so to order the arrangements that the working of the telephone or telegraph line is not disturbed. By these means a signal can be transmitted to the engine driver, or the Westinghouse brake can be set in operation.

Wireless Telegraphy in the German Army.—The use of wireless telegraphy in the German army has been making steady progress in recent times. Stations are now distinguished as permanent, movable, and airship stations. The permanent stations are established in fortresses; their range is 1,000 km. All fortresses situated on the remotest frontiers are able to communicate with Nauen *via* Berlin and to receive news from distantly located airships.

The movable or field stations are controlled by the officials of commandos, and are either "heavy" or "light" stations. The range of the heavy stations is 200 km., and of the light 60 to 70 km. Heavy stations are posted at the larger headquarters, with army chief commandos and with cavalry divisions.

Light stations are allotted to the cavalry divisions and apportioned to the reconnoitring squadrons, who have charge of the news-gathering arrangements. In this way all news from the officers of patrols, which streams into the reconnoitring squadron, is quickly passed on through the staff of the Cavalry Division to the heads of the chief commandos and thence to the commander-in-chief.

Dirigible airships are equipped with airship stations, which can, however, only transmit messages. They are not fitted with receivers. Their range is about 300 km. Airships can thus communicate with fortresses and cavalry divisions.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—February 28th. U.D.C. Transformer, high and low-tension switchgear and instruments. Supply of cables and feeder pillars.

March 2nd. U.D.C. Service cable; D.C. and A.C. meters; joint boxes, &c. See "Official Notices" February 13th.

Aberaman.—March 12th. Electrical goods for a year for the Powell Duffryn Steam Coal Co., Ltd. Stores Manager.

Ardee.—March 2nd. Public lighting by electricity for three years, for the Town Commissioners, from September 1st. Particulars from Mr. T. Malone, Town Clerk.

Australia.—SYDNEY (NEW SOUTH WALES).—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" February 6th.

MELBOURNE.—March 5th. 20,000-volt and 1,500-volt underground cables and accessories, for Agent-General for Victoria. See "Official Notices" February 6th.

April 7th. P.M.G. Accumulator batteries (Tudor) for radio-telegraph stations. Relays, non-polarised. Stores Schedule 996. See "Official Notices" to-day.

April 21st. P.M.G. Telephone switchboards. Schedule No. 1,005. See "Official Notices" to-day.

HOBART.—March 2nd. For the Postmaster-General. Telephones, common battery, wall pattern, and table pattern, Schedule T 104. See "Official Notices" January 16th.

PERTH.—March 7th. High-tension cables, telephone cable and accessories for the West Australian Government. See "Official Notices" February 13th.

N.S.W.—April 29th. Electrically-controlled clocks for the Post Office, Newcastle, N.S.W. Specification, &c., at office of High Commissioner, 72, Victoria Street, S.W.

Aylesbury. — March 7th. U.D.C. Contract 2. Two 100-KW. Diesel oil engine D.C. generating sets, with static balancers, battery boosters and accessories. See "Official Notices" February 13th.

Barnes.—March 9th. U.D.C. Distributor cables. See "Official Notices" to-day.

Barrow-in-Furness.—Corporation. Converting steam-driven plant at the pumping station to electrical drive. Particulars from Borough Engineer.

Bosnia.—Establishment of an electric lighting service. Particulars of the Stadtgemeinde Gorazda, Bosnia.

Bedford.—March 7th. Corporation. Electrically driven centrifugal pumping plant (four single-phase [illegible] motors, &c.). Specifications, &c., from Major Tulloch & Haworth, 25, Victoria Street, S.W.

Bedwas.—March 5th. Electrical goods for a year for the Bedwas Navigation Colliery Co., Ltd. The Secretary.

Belfast.—February 23rd. Corporation. Twelve months' supply of stores for Tramways and Electricity Committee. See "Official Notices" January 30th.

Belgium.—March 3rd. The municipal authorities of Ghent are inviting tenders for a number of transformers and electrically operated pumps.

March 17th. La Société Nationale des Chemins de fer Vicinaux of Brussels (14, Rue de la Science) is inviting tenders for the contract for the overhead electrical equipment of the new local electric railway between Ghent and Loochristy.

Bexley.—February 25th. U.D.C. 500-KW. turbo-alternator, with exciter, condensing plant and pipe-work, water-tube boiler and superheater, with mechanical stoker. See "Official Notices" February 13th.

Birkenhead.—February 24th. Corporation. Continuous-current electricity meters (ordinary and pre-payment). House service fuseboxes. See "Official Notices" February 6th.

Bolton.—February 23rd. Corporation. Twelve months' supply of tramway stores. See "Official Notices" February 6th.

February 26th. Corporation. Twelve months' supply of stores for Electricity Committee. See "Official Notices" February 13th.

Burton-upon-Trent.—March 14th. Corporation. One 1,250-KW. three-phase turbine-alternator and condenser, pipe-work, valves and accessories. Extensions to high-tension switchboard. See "Official Notices" February 13th.

Cape Colony.—March 16th. Water-power plant for Municipality of Paarl, Cape Province (see ELECTRICAL REVIEW, page 183, January 30th). Time extended to March 16th. Specifications can be seen in London (C.I. Department, Board of Trade).

Copenhagen.—February 21st. Municipality. Three 300-KW. motor generators or converters for sub-stations; also switchgear. See "Official Notices" February 6th.

Crete.—March 13th. Tenders for the concession for electric tramways and water supply. See this column in last issue.

Dublin.—March 2nd. Corporation. One 210-B.H.P. three-phase E.H.T. motor. See "Official Notices" to-day.

Edinburgh.—February 28th. Corporation. Electric lighting installation at the South Gray's Close and Fountainbridge Wash-houses. Specifications from Engineer's Office. Town Clerk.

March 9th. Corporation. Maintaining house telephone and electric bell installations. Forms of tender from Superintendent of Works, City Road.

March 9th. Corporation. Twelve months' supply of electrical and insulating material. Specification from the Resident Electrical Engineer, Dewar Place.

February 20th. School Board. Electric lighting at Castle Hill School. Specifications from Messrs. Crawford & Cumming, consulting engineers, 51, George Street.

Edmonton.—February 25th. Electrical lamps for the B. of G. Mr. F. Shelton, Clerk, The Grange, White Hart Lane, Tottenham.

Eritrea.—April 15th. The Governor of the Italian Colony of Eritrea, at Asmara, is inviting tenders for the electric lighting of the towns of Asmara and Massua.

Gateshead. — February 22nd. Complete wiring of cottage homes, Shotley Bridge (number of lights, about 400). See this column in last issue.

Gillingham.—March 6th. Corporation. Twelve months' supply of meters, cables and other stores. See "Official Notices" to-day.

Gorton (Manchester).—March 3rd. Great Central Railway Co. Six months' supply of stores. See this column in last issue.

Heston and Isleworth.—March 7th. U.D.C. Twelve months' supply of stores, including cables, meters, &c., for the electricity works. See "Official Notices" to-day.

Hornsey.—February 24th. Corporation. Electricity meters, cables, cable stores, &c. See "Official Notices" Jan. 30th.

Ilford.—February 24th. Corporation. Twelve months' supply of stores for electricity works. See Official Notices February 13th.

Leeds.—February 21st. Corporation. Twelve months' supply [illegible] and other stores, including a number of electrical items. See "Official Notices" January 23rd.

London.—Islington.—February 25th. Natural draught cooling tower and pipework for Electric Lighting Committee. See "Official Notices" January 30th.

February 27th. Electrical fittings and sundries for a year for the B.C. Mr. E. Davey, Clerk, St John's Road, Upper Holloway, N.

L.C.C. Asylums Committee. March 2nd. Twelve months' supply of electrical sundries; forms of tender from the office of the Asylums Committee; 6, Waterloo Place, Pall Mall, S.W.

St. Pancras. March 2nd. Corporation. Supply of arc lamp carbons. See "Official Notices" February 6th.

Shoreditch.—March 3rd. Corporation. Extra-high-tension and low tension switchgear. See "Official Notices" February 6th.

H.M. Office of Works.—February 27th. Three years' supply electric conduit and fittings. See "Official Notices" Feb. 13th.

March 12th. Bellhangers' work to building in the London district during three years. See "Official Notices" to-day.

Battersea.—March 3rd. Corporation. Twelve months' supply of stores for electricity department. See "Official Notices" February 13th.

Macclesfield.—March 11th. Electrical goods for one year for the Cheshire County Asylum, Parkside, Macclesfield. Forms from Mr. W. Tingay, Clerk of Asylum.

Madeira.—March 31st. General Council of Administration of the District of Funchal, on the Island of Madeira. See this column in last issue.

Newport (Mon.)—March 3rd. E.L. fittings for the B.C. Mr. A. H. Rees, Clerk, Queen's Hill.

New Zealand.—March 26th. The Dominion Portland Cement Co. Ltd. Hydro-electric plant, Wairua Falls. See "Official Notices" February 13th.

Auckland.—April 21st. The Harbour Board. 1-ton and 2-ton truck cranes. Specifications from London agents, Messrs. W. and A. McArthur & Co., 18, Silk Street, Cripplegate, London, E.C.

Nuneaton.—February 21st. Corporation. One 600-kw. high-pressure, geared, direct-current turbo-generator, surface-condensing plant, pipework, &c. See "Official Notices" February 6th.

Plymouth.—March 19th. Corporation. Registering punches for use on the Corporation tramways system. Particulars from Town Clerk.

Ratasek.—February 28th. Construction of an electric lighting installation. Particulars of the Gemeindeamt, Ratasek, Comitat Tolna.

Redditch.—February 24th. Urban District Council. 6,000 tons coal. Stores for the Electricity Department. Main traction switchboard. See "Official Notices" February 6th.

Rotherham.—March 12th. Corporation. One 2,000-kw. high pressure turbo-alternator with condensing plant, switchgear, steam and exhaust piping and accessories; one 1,000-kw. rotary converter, transformer and switchgear; one 20-ton overhead crane. See "Official Notices" to-day.

Shipley.—February 24th. U.D.C. Steel girder tram-rails and fishplates for the tramway department.

Spain.—March 27th. The Harbour Works authorities at Gijon-Musel are inviting tenders for four electrically-operated cranes and supply mains therefor.

Swindon.—March 7th. Corporation. Twelve months' supply of stores for electricity and tramways departments, fuse and service boxes, &c., meters, oils, &c. See "Official Notices" Feb. 18th.

February 25th. Three years' supply of tramway tickets and ticket punches, Specifications from Mr. T. Medcalf, Tramway Manager

Tottenham.—Electrical installation at the central library. Specifications from Mr. W. H. Prescott, engineer to the Council, Council Buildings, The Green.

Trimdon Grange.—February 21st. Parish Council. Installation of electric light at Trimdon Grange and Trimdon Colliery villages. Specifications from T. W. Wilkinson, Clerk to the Council, 1, Church View.

Walthamstow.—February 25th. Corporation. Stores for electricity supply works and tramways. See "Official Notices" February 6th.

West Ham.—March 5th. Guardians. Six months' supply of electrical fittings. Specifications from Mr. T. Smith, Clerk to Guardians, Board Room, Union Road, Leytonstone, N.E.

Weymouth.—February 21st. Corporation. 12 months' supply of coal for the electricity works. Specifications from Mr. J. H Bolam, Borough Electrical Engineer, Stavordale Road.

Wimbledon. — March 6th. Corporation. Twelve months' supply of stores for electricity department. See "Official Notices" to-day.

Wolverhampton.—February 25th. 40,000 tons of partly washed fine and partly unwashed nutty slack coal for the electricity department. Specifications and forms of tender (£1 1s.) obtainable from Mr. S. T. Allen, Borough Electrical Engineer.

Worle (Somerset).—March 19th. Street lighting for the Parish Council. Mr. Robert K. Clay, Clerk, Virginia Villa, Worle.

Wrexham.—February 28th. Meters, carbon-filament lamps, oils, coal and boiler solution, for the Corporation electricity department. Borough Electrical Engineer, Willow Road.

CLOSED.

Australia.—N.S.W.—Postmaster-General's Department.

Oil engine and generator at Albury Post Office, £190; switchboard, £110; 336 "Varta" accumulator cells and six Tudor cells, £291.—Falkiner-Boll Electric Co.
250 magneto bells, £112.—James Paton & Co.
200 magneto bells, £260.—Western Electric Co. (Aus.), Ltd.
Telephone material.—Lawrence & Hanson Electric Co., Ltd.—*Tenders.*

Barnsley.—The Electricity Committee has accepted the tender of the British Thomson-Houston Co., Ltd., for three electrical motors for the electricity works for £79.

Basingstoke.—Messrs. Johnson & Phillips, Ltd., have received an order from the borough authorities for providing, laying and jointing-up complete, a low-tension, three-wire system of mains, paper-insulated lead-covered and steel tape armoured, complete with all feeder pillars, &c.

Batley.—The Corporation has accepted tenders as follow:—

Brush Electrical Engineering Co.—One 1,200-kw. turbo-generator.
British Westinghouse Co.—One 500-kw. and one 250-kw. rotary converters.

Belgium. — The municipal authorities of Farciennes (Province of Hainaut) last week opened tenders for the electric lighting of the town. For the establishment and equipment of the central station, as a separate contract, the lowest tender was that of the Société des Ateliers de Constructions Electriques, of Charleroi, and for the laying of the necessary network of mains, that of the Société de Gaz et Electricité du Hainaut. As a combined contract, for both the generating station and the mains, the best offer was that of the Société A.E.G. Union Electrique, of Brussels.

Burnham (Somerset).—For installing the E.L. in the Town Hall, the U.D.C. received the following tenders:—

Burnham Electric Light Co.	(accepted)	£40
King & Co.		38
Bellringer & Watts		38
Muncey & Pine		42

Cleckheaton.—The U.D.C. has accepted the tender of Green's, Ltd., for an economiser for the electricity works.

Glasgow.—The T.C.'s Committee on Tramways, Works and Stores recommends the acceptance of the following tenders:—

Cast-iron pipes.—R. M'Laren & Co., Ltd.
Air filter for Pinkston power station.—Heenan & Froude, Ltd.
Ashphalt buckets.—P. & W. MacLellan, Ltd.
Lead-covered cable.—W. T. Henley's Telegraph Works Co., Ltd.

Messrs. Johnston, Park & Co.'s offer for the supply of fittings for the electrician's workshop at the new slaughter house has been accepted.

The Corporation Tramways Department has placed an order with the J. G. Brill Co., for one of their patented radial axle trucks.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

Admiralty Contract Department.

Electric bells, bell fittings, gongs, &c.—Player & Mitchell, Ltd.; Reid Bros. (Engineers), Ltd.; Chadburns (Ship) Telegraph Co., Ltd.; Sterling Telephone, &c., Co., Ltd.; Spagnoletti, Ltd.; W. McGeoch and Co., Ltd.; Hawkers, Ltd.; D. H. Bonnella & Son, Ltd.

Admiralty Works Department.

Electric generating station, loco. shed, &c., at Crombie.—R. Bruce & Son,

War Office.

350-kw. generator.—J. Howden & Co., Ltd.
Internal wiring for electric lighting Cambridge Hospital, Aldershot.—V. G. Middleton.
Laying cable to and erection of converter at army aircraft factory, Farnborough.—Bruce Peebles, Ltd.

Crown Agents for the Colonies.

Electrical fittings, &c.—J. Stone & Co., Ltd.
Materials for wireless station.—Marconi's Wireless Telegraph Co., Ltd.

H.M. Office of Works.

Electric cable and wire, Board of Agriculture.—Armorduct Manufacturing Co., Ltd.
Renewal of electric mains, Houses of Parliament.—W. T. Henley's Telegraph Works, Ltd.
Electric wiring, Stationery Office.—Tyler & Freeman.

Post Office.

Protective apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; International Electric Co., Ltd.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; Gent & Co., Ltd.; London Electric Wire Co. & Smiths Ltd., Western Electric Co., Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.
Battery boxes.—Standard Woodwork Co., Ltd.
Packing boxes.—C. H. Glover & Co., Ltd.
Telephonic cable.—Callender's Cable Co., Ltd.; W. T. Henley's Co., Ltd.; Johnson & Phillips, Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Desiccators.—Lacy, Hulbert & Co., Ltd.
Stoneware ducts.—Doulton & Co., Ltd.
Ironwork.—Bayliss, Jones & Bayliss, Ltd.; Bullers, Ltd.; F. W. Cotterill, Ltd.; T. W. Louch, Ltd.; J. Sidaway & Co.; Walls, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; B.I. and H. Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (inc. in London Electric Wire Co. and Smiths, Ltd.).
Copper wire.—B.I. and Helsby Cables, Ltd.
Laying lines of multiple-way ducts, Leeds Bradford (Section 2).—H. E. Buckley. Manchester, Bury, Burnley. (Section 2).—W. H. Worthington, Ltd. Manchester, Rochdale.—W. Irwin & Co., Ltd.
Laying lines of pipes, multiple-way ducts and "U"-shaped earthenware troughing, Darlington.—M. B. Anderson.
Laying lines of "U"-shaped earthenware troughing and pipes, Reigate.—W. Griffiths & Co., Ltd.
Manufacturing, supplying, drawing-in and jointing lead-covered cable.—Cardiff-Newport (Mon.).—W. T. Henley's Co., Ltd.
Cardiff-Swansea.—W. T. Henley's Co., Ltd.
Liverpool-St. Helens.—B.I. and Helsby Cables, Ltd.
Manchester-Bolton, Manchester-Burnley, Manchester-Rochdale and Newcastle-North Shields.—Siemens Bros. & Co., Ltd.
Telephone exchange equipment, Weybridge.—Peel-Conner Telephone Works, Ltd.

Huddersfield.—The Tramways Committee has accepted the following tenders for 10 new cars:—

Dick, Kerr & Co., Ltd.—Electrical equipments.
United Electric Car Co.—Car bodies and trucks, differential gearing to be applied to the cars.

Italy.—The Italian State Railway authorities in Rome have lately placed a contract with the Italian branch at Saronno of the Esslingen Maschinenfabrik for the supply of six 84-ton and 12 60-ton electric locomotives, intended to work at a pressure of 3,000-3,300 volts. The contract for the electric equipment of the locomotives has been sublet to the Oerlikon Maschinenfabrik.

Keighley.—The Keighley and Bingley Joint Hospital Board has accepted the tender of the Smith Electrical Co., Ltd., for electrical work for the ensuing year.

London.—L.C.C.—The Highways Committee recommends the acceptance of the offer of the Brush Electrical Engineering Co., Ltd., for the supply and erection of a traverser at the Abbey Wood car-shed extension, at £437, and of the offer of the British Westinghouse Co., Ltd., for the supply and erection of the electrical equipment for the traverser, at £184. The Committee recommends the acceptance of the tender of Messrs. W. H. Smith and Son for obtaining advertisements on the Council's electric cars, for a period of nine years, on the following basis:—10 per cent. commission on existing orders, and 20 per cent. commission on new contracts, and on the renewal of existing contracts with a guaranteed annual minimum income to the Council, after deducting the firm's commission of 5 per cent. increase on the average revenue, advertisements for the three years ending March 31st, 1914, the firm being allowed to deduct from the amount guaranteed the present cost to the Council of obtaining orders. The net receipts from advertising on cars in 1912-13 were £24,281.

The Highways Committee reports the receipt of the undermentioned tenders for the supply of (I) 500 tons special section rolled-steel bar for type 25A magnets; and (II) 84 tons special section rolled-steel bars for type 26A magnets, required in connection with the maintenance of magnetic brake equipments for the 12 months ending April or May, 1915:—

	Price per ton. (I)	Price per ton. (II)
Lilleshall Co., Ltd. (recommended)	£6 10 0	£6 10 0
Andrew Brown & Co. (agent for Société Anonyme des Acieries d'Angleur, Belgium)	7 1 6	7 1 6
Frodingham Iron and Steel Co., Ltd.	6 14 9	6 14 9
John Batt & Co. (London), Ltd.	7 0 0	7 0 0
Cargo Fleet Iron Co., Ltd.	6 16 6	6 16 6
Geo. Schultz & Co., Ltd.	7 2 6	7 2 6
Earl of Dudley Round Oak Works, Ltd.	7 2 6	7 15 0
P. & W. McLellan, Ltd.	7 2 6	7 15 0
Henry Bessemer & Co., Ltd.	8 0 0	8 0 0
W. Bain & Co., Ltd.	9 0 0	9 10 0
Robt. Murdoch & Co.	9 5 0	9 5 0
D. Colville & Sons, Ltd.	9 5 0	9 5 0
Brown & Tawse	9 12 6	9 12 6
" " (alternative)	8 7 6	8 7 6

The Main Drainage Committee reports the receipt of the following tenders for wiring and fitting for the electric lighting of the new building in connection with the enlargement of Crossness pumping station:—

A. Hawkins & Son (recommended)	£559
Foote & Milne, Ltd.	574
R. H. & J. Pearson, Ltd.	575
H. J. Cash & Co., Ltd.	648
Tredegar & Co.	716

Stepney.—The Electricity [illegible] ance of the offer of the [illegible] about 140 tons of [illegible] in York [illegible] purposes.

Kensington.—The Guardians [illegible] tenders for a supply of electric lamps and [illegible]:

Pryke & Palmer	[illegible]
Brompton and Kensington Electricity Supply Co., Ltd. (irregular)	[illegible]
British Economical Lamp Co., Ltd. [illegible]	[illegible]
"Z" Electric Lamp Mfg. Co., Ltd. [illegible]	[illegible]
Maxim Lamp Works, Ltd. (four items only)	[illegible]
Cryselco, Ltd. (four items only)	[illegible]
London Electric Warehouse Co. (four items only)	[illegible]
Cooper & Roberts (five items only)	[illegible]
Brimsdown Lamp Works, Ltd. (five items only)	[illegible]
General Electric Co., Ltd. (11 items only)	[illegible]
Siemens Bros. Dynamo Works, Ltd. (10 items only)	[illegible]
Edison & Swan Co. (10 items only)	[illegible]
British Westinghouse Co. (seven items only)	[illegible]
Baxter & Caunter, Ltd. (eight items only)	[illegible]
Atlas Electrical Co., Ltd. (10 items only)	[illegible]
Pope's Electric Lamp Co., Ltd. (six items only)	[illegible]
Kanson & Co., Ltd. (six items only)	[illegible]

Luton.—The T.C. has accepted the tender of the [illegible] Engineering Co., Ltd., at £168, for a lathe for the electricity works.

Nelson.—A syndicate responsible for the scheme of erecting arcades and shops at Nelson has accepted a tender from Messrs. Carter & Sons, for electric lighting installations.

Newport (Mon.).—In view of the very favourable condition of the copper market, the borough electrical engineer has purchased, through Messrs. Callender's Co., 15 tons of copper for making into cables, at £65 per ton.

New Zealand.—The Gisborne Hospital Board has accepted the tender of Messrs. Holford & Co., at £1,398, for electric lighting and power plant for the new hospital.—*New Zealand Shipping and Commerce.*

Stalybridge.—The T.C. has accepted the tender of Mr. H. Gordon, Ashton, for an electric light installation in connection with the extensions of the milk sterilisation depôt.

Weymouth.—The T.C. has accepted the tender of Mr. J. H. Rankin, for electrical wiring work at 4, Portland Buildings.

Whitstable.—The contract for the whole of the plant and mains for public electric lighting supply has been placed with Messrs. J. B. Saunders & Co., Ltd., of Westminster, the work being carried out under the supervision and to the specification of Mr. H. R. J. Burstall, of Messrs. Burstall & Monkhouse.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week:—

Monday, February 23rd.—"A" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Tuesday, February 24th.—"B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Wednesday, February 25th.—Recruits only. Infantry drill, 7 to 8 p.m. Technical instruction, 8 to 10 p.m. Rating examination for all Companies, 7 to 10 p.m.
Thursday, February 26th.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range instruction, 7 to 9 p.m.
Friday, February 27th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range instruction, 7 to 9 p.m.
Saturday, February 28th.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

Bijur Motor-car Lighting and Starting Equipment Tests.—We have received from Messrs. Duncan Watson and Co., of Berners Street, W., some interesting test figures relating to the Bijur car lighting and starting equipment, for which they hold the sole selling and manufacturing rights in this country. The tests were carried out by the Automobile Club of America, under severe conditions, and show with a [illegible] engine, that, at 20 miles per hour, the cost would [illegible] per year for lighting and cranking, and at [illegible] miles per hour [illegible] $6.38 per year, measured in petrol consumed. The tests were made with all the lights on all the time, and the figures are based on 10,000 miles of service within the year. The generator was giving out between 17 and 18 amperes [illegible], and, in the opinion of the Packard Motor-car Co., which has accepted this apparatus in the States, the test conditions were from five to ten times as severe as ordinary working conditions; the cost for the latter would therefore average between 71 c. and $1.12 per year or per 10,000 miles of driving, which represents a negligible item, in view of the fact that some more costly form of lighting would have to be installed if electric lighting were not used. In one official test the engine was run from the battery for [illegible] minutes at a speed of 135 R.P.M.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, February 20th. At 8 p.m. At Storey's Gate, S.W. Paper on "Some Modern Methods of Welding," by Mr. T. T. Heaton.

Electrical Engineers' Ball.—Friday, February 20th. At Hotel Cecil.

Greenock Electrical Society.—Friday, February 20th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Paper on "Power Station Design," by Mr. J. Punch.

Manchester Electro-Harmonic Society.—Friday, February 20th. At Albion Hotel. Concert.

Wolverhampton and District Engineering Society.—Friday, February 20th. At 7.45. At Technical School. Presidential address: "Electricity and Gas" by Mr. C. E. C. Shawfield; "The Cooking Problem—Why Electricity is Winning," by Mr. F. S. Grogan.

Royal Institution of Great Britain.—Saturday, February 21st. At 8 p.m. At Albemarle Street, W. Lecture (II) on "The Electric Emissivity of Matter," by Dr. J. A. Harker.

University College, Nottingham.—Saturday, February 21st. At 3 p.m. Educational and Scientific Exhibition to be opened by Lady Henry Bentinck.

Institution of Civil Engineers.—Tuesday, February 24th. At 8 p.m. At Great George Street, S.W. Papers on "Rail-Steels for Electric Railways," by Mr. W. Willox, and "Rail-Corrugation and its Causes," by Mr. S. P. W. D'A. Sellon.

Nottingham Society of Engineers.—Wednesday, February 25th. At "Welbeck" Hotel, Milton Street. Paper on "Ventilating and Heating," by Mr. W. Townsend.

Royal Society of Arts.—Wednesday, February 25th. At 8 p.m. At John Street, Adelphi. Ordinary Meeting.

Institution of Electrical Engineers.—Thursday, February 26th. At 8 p.m. At Victoria Embankment. Paper on "Motor and Control Equipments for Electric Locomotives," by Mr. F. Lydall.

(**Newcastle Local Section**).—Friday, February 20th. At 7 p.m. At Hugh Bell School, Middlesbrough. Discussion on "Coal and its use in Steam Raising," introduced by Mr. P. S. Thompson.

Monday, February 23rd. At 7.30 p.m. At Armstrong College of Science. Paper on "Some Railway Conditions Governing Electrification," by Mr. R. T. Smith.

(**Yorkshire Local Section**).—Friday, February 20th. At 6.30. At Hotel Metropole, King Street, Leeds. Annual Dinner.

(**Manchester Local Section**).—Tuesday, February 24th. At 7.30 p.m. At University (Physical Laboratory). Paper on "Some Railway Conditions Governing Electrification," by Mr. R. T. Smith.

Institute of Marine Engineers.—Thursday, February 26th. At 7 p.m. At Liverpool Street Hotel. Annual meeting.

Junior Institution of Engineers.—Friday, February 27th. At 8 p.m. At 39, Victoria Street. Paper on "Operation and Upkeep of Electric Motors," by Mr E. F. Butler. Saturday, February 28th. At 6.30 p.m. At Holborn Restaurant. Annual dinner.

Saturday, February 21st. At 8 p.m. At Cutlers' Hall, Sheffield. Inauguration of Local Section.

Northampton Engineering College Engineering Society.—Friday, February 27th. At St. John Street, E.C. Paper on "The Forth Bridge," by Mr. H. J. Nichols.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, February 27th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

Physical Society.—Friday, February 27th. At 8.30 p.m. At Imperial College of Science, South Kensington. Guthrie Lecture, by Prof. R. W. Wood, on "Radiation of Gas Molecules Excited by Light."

Royal Institution of Great Britain.—Friday, February 27th. At 9 p.m. At Albemarle Street, W. Paper on "Surface Combustion," by Prof. W. A. Bone, F.R.S.

Manchester Association of Engineers.—Saturday, February 28th. At Grand Hotel, Aytoun Street. Paper on "Mechanical Filtration," by Mr. A. J. Clark.

Batti-Wallahs' Society.—Saturday, February 28th. Annual Dinner.

NOTES.

Annual Dinners.—The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd. (the Silvertown company), held their thirty-first annual dinner and social evening on Saturday last, at the Liverpool Street Hotel, E.C. A record number of 152 was present, and a most enjoyable evening was spent. Mr. A. P. Crouch (secretary) was in the chair, and Mr. F. C. Crawford (submarine department) in the vice-chair. The toast, "Success to the Company, its Agents, and the Annual Dinner," was proposed by Mr. Crouch in a very interesting speech, and responded to on behalf of the company's agents by Mr. W. J. Head, of the Newcastle branch. Mr. S. A. Russell (works manager) proposed "The Chairman," and Mr. C. H. Hills (general stores department), "The Vice-Chairman." The musical programme was in the able hands of Mr. T. W. Reeds, who engaged the following artistes:—Miss Elizabeth Hyde, Miss Hope Jackson, Miss Doris Lee, Miss Nellie Perryer, Mr. Alfred C. Steed, Mr. Owen Way, Mr. Harry Knight, Mr. Jock MacCallum, and Mr. Eustace Wallace (accompanist). The following acted as Committee:—Messrs. W. Best (chairman), W. Blair, A. Cheetham, C. H. Hills, T. Lockwood, F. Matthews and T. W. Reeds.

The employés of the Blackpool, St. Anne's and Lytham Tramways, to the number of nearly 100, assembled at Collinson's Café, South Shore, Blackpool, on Wednesday evening, February 11th, on the occasion of the annual dinner. Mr. Laing, the manager, presided.

Electrical Congress in Russia.—Arrangements are in hand for the holding during the coming summer of an All-Russian Electrotechnical Congress at Kharkov during the coming summer, with the view of developing the use of electrical installations in connection with the mining undertakings in the Donetz district.

"F" Rays.—It is reported from Florence that the Italian Government has carried out experiments with the system devised by Signor Ulivi for exploding submerged torpedoes, and has secured the right to use it.

International Electrotechnical Commission.—The report on "International Symbols" has just been issued by the I.E.C. (publication No. 27; to be obtained from the general secretary, Mr. C. le Maistre, 28, Victoria Street, S.W., price 2s. 1d. post free); it was unanimously adopted at the Berlin meeting of the Commission, and consists of certain rules of principle, together with a list of 36 symbols that have been officially adopted. A number of signs for the names of units and a few mathematical rules and symbols commonly employed by electricians are included. The International Electrical Congress at San Francisco next year will be asked to adopt the term "Siemens" for the unit of conductance. It is hoped that the symbols recommended by the I.E.C. will be widely adopted by lecturers, authors and others concerned with the study of electrotechnics. To a considerable extent the symbols correspond with those in current use. Fundamental requirements are that they must be distinguishable from one another when written on paper or on a blackboard, and that it must be possible to spell them out whilst writing them; the distinction between roman letters and italics, therefore, is abandoned, and small roundhand letters, as well as Gothic type, cannot be used. Suggestions are made in the report as to the course to be followed where the symbols habitually used by physicists and mechanical engineers occur in conjunction with the electrical symbols. The symbols recommended differ from those to which English readers are accustomed in very few cases. There are, however, some curious features in the lists. For instance, work and energy are allotted separate symbols; after numerical values capital letters, the initials of the names of the respective electrical units, are employed, but where these are combined with other letters, small type is used, so that, for instance, we get kWh for kilowatt-hour. The symbol ω for ohms is abolished, as well as Ω for megohms, but substitutes have not yet been definitely adopted; O or Ω is provisionally recommended for ohms. The use of the comma or the full stop for separating decimals from whole numbers is left to follow the custom of the country, and an attempt is made to avoid confusion by substituting a space for either of them in writing whole numbers of four or more digits—thus, one million is 1 000 000. As the report is copyright, readers who desire to make themselves acquainted with its details must obtain copies of it from headquarters.

Fatalities.—A correspondent states that George Gray, Stirling, was electrically killed while working in Polmaise Colliery on the night of February 10th. He had just finished his shift, and while in the act of putting his lamp away, touched a "live" wire, and was killed instantaneously.

An inquiry was held on 10th inst. into a fatality which occurred on 4th inst. at Littleburn Colliery, Co. Durham. The victim was Joseph Edward Blackburn, 49, a fitter's assistant. It was stated in evidence that on 4th inst. Blackburn was engaged in opening a steam valve 14 ft. from the ground. He was seen standing on some metal pipes against the side of the engine house, but later was found on the ground unconscious. A witness named Owers said that there were some wires which passed from three insulators at an angle of 45° across the pipes, and Blackburn would have to stoop down to get to the steam pipes. Another fitter named Jones expressed the opinion that Blackburn, having finished his work, in straightening himself up had come into contact with the wires, which were unprotected. The pressure was 445 volts, alternating current. Dr. Hare gave it as his opinion that death was due to concussion or shock; most probably the man had been electrically shocked. A verdict that death was due to the deceased having come into contact with the wires was returned.

An inquest was held at Manchester, on 9th inst., into the cause of death of a man named Clarke, aged 50. A tramcar collided with a horse and lorry in Queen's Road on 4th inst. There were in all 16 witnesses, and the evidence was very conflicting. The car driver said that he applied his electric brake about 10 yards away. The deceased man was riding on the lorry when the car came up from behind. The jury returned a verdict of "Accidental death," adding that they thought the tramcar driver did not show sufficient care.

The Birthday of the Bioscope.—Exactly 18 years ago to-day Mr. R. W. Paul exhibited for the first time his "Theatrograph," at a conversazione of the students of the City and Guilds of London Technical College, Finsbury. A short description of the apparatus, with an illustration, appeared in our issue of February 21st, 1896. In its original form it was designed for operation in conjunction with a projection lantern, using the films of the kinetoscope, which Mr. Paul had been manufacturing during the previous two years, and of which it was the logical outcome. The machine was driven by hand, but the cycle of operations followed was essentially the same as that employed in the modern kinematograph. Moving pictures of the sea and of the interior of a workshop were shown, and a few weeks later hand-coloured films were exhibited. The extraordinary development which has ensued is familiar to all town-dwellers. Not only is the "Electric Theatre" one of the most popular places of entertainment, and a source of revenue not to be despised by the supply authorities, but also the moving picture has been applied to educational purposes with the greatest success, and its influence in various directions is far-reaching.

Football.—A football match was recently played between the representatives of the Newcastle-on-Tyne branch of the General Electric Co., Ltd., and Messrs. Robson & Coleman, contractors, of the same city, with the following result:—General Electric Co., 2 goals; Robson & Coleman, 1 goal.

Institution and Lecture Notes. THE CONCRETE INSTITUTE.—On February 12th a discussion took place on a paper on "Factory Construction" by Mr. Percival H. Fraser, A.R.I.B.A. The next meeting of the Institute will take place on February 26th, 1914 when Mr W. Cyril Cocking will read a paper entitled "Calculations and Details for Steel Frame Buildings from the Draughtsman's Standpoint."

THE PHYSICAL SOCIETY.—At the annual meeting of the Physical Society on Friday last, Prof. Sir J. J. Thomson was elected president. It was announced that owing to the improved financial condition of the Society its activity was to be increased. It had been decided to issue from to time reports on subjects of general interest. The Council had also decided to arrange for the delivery of an annual or occasional lecture by some eminent physicist, and the first of the lectures would be delivered by Prof. R. W. Wood (see "Forthcoming Events").

INSTITUTION OF ELECTRICAL ENGINEERS.—At the meeting of the BIRMINGHAM LOCAL SECTION on Wednesday last, Mr. Roger T. Smith read his paper on "Some Railway Conditions Governing Electrification." The discussion was closed.

ROYAL INSTITUTION.—In the course of his first lecture on "The Electric Emissivity of Matter," Dr. J. A Harker said that he had been able to bring about the emission of electrons by heating substances in a cooled cylinder of carbon without the use of an electric current.

INSTITUTE OF METALS.—This Institute holds its annual meeting on March 17th and 18th, at the Institution of Mechanical Engineers, in London. A programme of papers and other arrangements has been issued.

Getting Rope over Top of Stack.—Several times within his experience the writer has had to place a rope over the top of a self-supporting stack. Sometimes it has been desirable to paint the outside of the smokestack, and the rope running through the pulley at the top has broken or fallen. Frequently in isolated plants inconvenience is occasioned by this trivial accident.

There are several simple methods for getting a wire or a rope over the top of the stack. One method is to use an ordinary skyrocket with a cord attached, on the inside of the stack. By shooting the rocket up the stack the stick will fall on the outside, and pull a fine cord with it, which will in turn pull a larger one up until a rope of any size desired can be drawn up. It is an easy matter then for anyone to scale a stack with a rope that is extended up the inside, and down to the ground on the outside.

Sometimes in isolated places a skyrocket is hard to obtain at some seasons of the year, and then a much simpler method can be employed. It consists of erecting a cross-bow inside the stack and then shooting an arrow, or any other projectile, up the inside and letting it fall on the outside, pulling a fine cord with it. In some of the larger cities, where steeple-jacks can be secured, this work can be delegated to them, but it will save much expense if the engineer in charge knows this little trick of getting the rope over the top of the stack.—LETSON BALLIET in *Power*.

Legal.—We have received the following letter from the solicitors to the plaintiffs in the case reported on page 278 of our last issue:—

"In your issue of Friday last, the 13th inst., you reported the hearing of an action brought by our clients, the Morgan Crucible Co., Ltd., against the Electrical Engineering and Equipment Co., Ltd., heard as a short cause in default of appearance before Mr. Justice Eve on Wednesday, the 10th inst., and that his Lordship had granted an injunction restraining the defendants from infringing our clients' letters patent.

"Owing to a technical irregularity in the proceedings, we are applying to the Court to rescind this order, and the action will therefore be continued and heard in due course.

"We shall feel obliged if you will kindly insert this correction in the next issue of your paper.

"JOHNSON, WEATHERALL & STURT.

"7, King's Bench Walk, E.C., *February 18th*."

Copper.—After the large increase during December, visible supplies are inclined to diminish again. Messrs. Merton's statistical circular for mid-February shows that, during the fortnight completed on the 14th, English stocks lost 321 tons, while the French acquired 161 tons. European visible supplies only lessened by 122 tons, to 25,822 tons.

Supplies from America are above average. From Spain and Portugal the quantity is low to England and France, though up to the average elsewhere. Chile shipments are over the average, and Australian considerably so (supposing the figure to be doubled for the month). Total deliveries implies a normal figure, if the same rate be maintained.

American stocks at the end of January showed a falling-off of 1,850 tons, after their large rise in December. The world's visible supply stood, on January 31st, at 64,915 tons, a higher figure than has been given since last May, with the exception of that for December.

Magnetic Miracles.—A "miracle-worker" in France has been prosecuted by the local medical society for the illegal practice of medicine. His method was to make mystic passes over empty bottles brought by his clients; he then said the bottles were "magnetised," and instructed the patients to fill them with water and drink a glass before each meal. Marvellous results are said to have followed the treatment. The amusing part of the incident lies in the fact that the wizard was acquitted by the court on the ground that magnetism is not yet a recognised science.

Improved Efficiency of Tungsten Lamps.—During the last few months the specific consumption of tungsten lamps has been considerably reduced, this increase in efficiency having been brought about by gradual refinement of the methods of construction and the materials which enter into the manufacture of the lamps. Perhaps the most noteworthy of these improvements is that for the 110-volt lamps in sizes larger than 100 watts. The specific consumption of these units has been reduced to [illegible] watt per candle, directly increasing the candle-power over 11 per cent. The 20-watt 110-volt lamp has been similarly improved from [illegible] watts to 1·17 watts per candle, while the new 40-watt lamp has a specific consumption of 1·10 watts per candle. Half-watt street series lamps, having an actual specific consumption of [illegible] watt per candle, are now regularly available in 80, [illegible] and 1,000-watt sizes for both 6·6-amp and 7·5-amp circuits. For 110-volt multiple operation there are offered both a [illegible]-watt lamp of the above efficiency and a 1,000-watt lamp which operates at 0·65 watt per candle.—*Electrical World*.

The Conductivity of Locomotive Funnel Gases. In a note communicated to the Société Internationale des Electriciens, Mr. Parodi recently referred to the difficulty of maintaining the insulation of high-pressure lines in tunnels traversed by steam locomotives, which could not be explained by the deposit of carbon on the insulators, for this was found to have little effect on their efficiency. He attributed the loss of insulation to the ionisation of the gases and vapours emitted by the funnels according to the Armstrong phenomenon; he had verified the fact by experiment, and had also observed the vibrations of the smoke in the neighbourhood of wires at high pressure. It seemed possible that ionisation of the atmosphere might also be the cause of the difficulties met with in insulating high-pressure lines in tunnels not traversed by steam locomotives, but ill-ventilated, and that the damp surroundings alone did not afford an adequate explanation.

The Electro-Harmonic Society.—The concert held on Monday last at the King's Hall, Holborn Restaurant, was a Ladies' Night in more senses than one, for the lady artistes triumphantly carried off the honours of the evening. Miss Violet Oppenshaw and Miss Annie Bartle delighted the audience with their charming rendering of charming songs, and Miss Olive Twain's amusing "Humoresques" with Cyril were appreciated. Mr. Ernest Hastings, an old friend, plaintively lamented the flying years, and Senhor Gomez performed delightful selections on the violin; but the ladies made the concert a success. The Hall was full, as usual.

Our Railway Directors.—A morning paper has analysed the constitution of the boards of 28 leading railways in the British Isles, and it finds that the following are among the directors:—2 Dukes, 4 Marquises, 6 Earls, 8 Viscounts, 26 Lords (including courtesy titles), 27 Baronets, 19 Knights, 13 Honourables, 8 Colonels, 3 K.C.'s, 1 Admiral, 1 Judge, 1 Major. It may be that in some degree this may be regarded as an interesting commentary on Lord Claud Hamilton's statement as chairman of the Great Eastern.

Electrically Sterilised Milk.—The Liverpool Corporation, says the *Manchester Courier*, is now sterilising by electricity the whole of the infants' milk supplied to the public from the various Corporation milk depôts in that city. All tubercular and manurial contamination is said to be completely annihilated, and any danger from zymotic disease infection thereby prevented. The taste and constitution of the milk remain unaltered by this form of sterilisation.

Mr. John Burns at Diesel Engine Works.—Before speaking at Stockport on Saturday evening last, the Right Hon. John Burns, M.P., President of the Board of Trade, visited the Diesel oil engine works of Messrs. Mirrlees, Bickerton & Day. Among those present at luncheon provided by the firm were Mr. Spencer Leigh Hughes, M.P., Messrs. Colin, Charles, and H. T. Day, Mr. H. N. Bickerton, Mr. H. S. Russell, Mr. C. E. Windeler, and Mr. R. Onions.

"The Electric House" at Southend.—At the Exhibition of Industries which is being held at the Kursaal, Southend-on-Sea, from February 11th to 25th, the Electric Supply Publicity Committee has its "Electric House" exhibit. A special booklet has been issued for distribution in connection with the occasion, as in the case of the Olympia and Birmingham displays.

Radium in Demand.—At a meeting in Manchester on Friday last, it was decided to establish a central fund for the whole of the hospitals, for the purchase of radium. Ashton and Sheffield are also raising funds for this purpose.

Appointments Vacant.—Supernumerary switchboard attendant (36s. 2d.) and electrical tester ([illegible]), for H.M. Dockyard, Devonport; electrician attendant, for County Asylum, Rainhill, near Liverpool; chief assistant in the Physics and Electrotechnics Department, Borough Polytechnic Institute ([illegible]); traffic superintendent for Darlington Corporation Tramways Department ([illegible]). Particulars are given in our advertisement pages.

The A.E.S.E.—The head office of the Association of Electrical Station Engineers is to-day being transferred from Stratford, E., to [illegible], Warren Road, Leyton, London, N.E.

Employers and the Trade Disputes Act.—At a meeting of the Employers' Parliamentary Council, held at 25, Victoria Street, Westminster, on February 4th, to consider the grave industrial situation due to the Trade Disputes Act and to the [illegible] conspiracy of labour Unionism against private freedom and public welfare, arrangements were made to hold a mass meeting of representatives of the Associations of Employers connected with the various industries in the United Kingdom to urge upon the Government the need for an inquiry into the working and the effects of the Act, to determine whether the present unlimited area in which picketing in unlimited numbers may be carried on should not be restricted and the number of pickets regulated by Statute, whether combinations for disorganising trading and social conditions should not be made unlawful, and whether it is not of national interest that all Unions should be subjected to the ordinary law of the land, and made responsible, like all other classes, for their actions.

Educational Note.—Imperial College of Science, City and Guilds (Engineering) College, South Kensington, S.W.—A course of instruction in Electro-Magnetic Machinery, including The Design, Manufacture and Testing of Transformers, will be given by Mr. F. E. Berry, commencing March 5th. Particulars are given in our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Ipswich T.C. has granted a bonus of £100 for the year ending March 31st, 1914, and a similar bonus for the following year, to Mr. F. Ayton, engineer and manager of the electricity works and tramways. The last increase of Mr. Ayton's salary was confirmed in May, 1910, he undertaking to remain in the Council's service for five years from that date.

The Stepney B.C. is recommended to make the following increases in salaries of its employés on the clerical staff of the electricity department:—Mr. A. J. Squire, chief clerk, on his appointment as deputy commercial manager, from £270 to £300 per annum, and subsequently by annual increments of £25 to £350. Class I. Mr. E. F. Dorking and Mr. E. E. Pepper, from £180 to £190 per annum, rising by annual increments of £10 to £200. Class H. Mr. E. W. Simmons, from £150 to £160 per annum, and by annual increments of £10 to £180; Mr. A. M. Apps, from £130 to £150 per annum, and by annual increments of £10 to £180. All the above increases to date from April 1st, 1913. Class F. Mr. C. Taylor, from £70 to £100 per annum, and by annual increments of £10 to £130, to date from April 1st, 1914.

At the Sheffield City Council meeting last week there was a discussion on the recommendation of the Electric Supply Committee that the salary of Mr. S. E. Fedden, general manager of the electric supply undertaking, be advanced from £800 to £900, and then by annual increments of £25 to £1,000. Mr. Harold Jackson moved that the question be deferred until the special committee appointed to inquire into the commercial management of the undertaking had reported. After an hour's discussion, the amendment was defeated by 33 votes to 21. The advance of £100 was agreed to, the matter of the further increments being deferred until the report referred to was considered. Alderman Hobson, the chairman of the special committee, explained how the committee had been delayed in its work by litigation and by the Corporation Bill of 1912. It was perfectly clear that the committee could not deal with the question of the separation of the position of commercial manager and engineer until they had arrived at a conclusion as to what the scope of the commerce was to be in the future. He could only promise he would push on with that question as rapidly as he could, and would report at the earliest possible moment.

After several divisions, the Electricity Committee of Glasgow T.C. recommends the following minima and maxima salaries for higher officials in the department:—Chief engineer, £1,000 and £1,250 respectively; chief assistant, £500 and £700; chief clerk and accountant, £300 and £500; superintendent of mains, £300 and £500; constructional engineer, £250 and £400; treasurer's chief assistant, £200 and £300; chief book-keeper, £200 and £300; two chief surveyors, £200 and £300.

Mr. E. Fenton, who has left the Warrington electricity works for Yorkshire, was recently presented by Mr. F. V. L. Mathias (borough electrical engineer) with a rose-bowl. Mr. Mathias expressed regret at losing a capable assistant.

Mr. A. E. Collings, has been appointed sub-station assistant to the Stoke Newington undertaking at 30s. a week, in place of Mr. R. F. Rampe, resigned.

At the electricity works, Worksop, on 11th inst., Mr. Harold Hall, the station superintendent, who has obtained an appointment at the Dewsbury Electricity Works, was the recipient of a [illegible] and a pair of military hair brushes, subscribed for by the staff of the electrical department. The presentation was made by Mr. J. Percival Crowther, manager and engineer.

Mr. C. N. Hefford, manager of the Leeds Corporation electricity department, has been presented by power consumers with a large silver candelabrum in appreciation of his efforts in maintaining an efficient service during the recent strike of municipal workers.

The Salaries Committee of Newport (Mon.) Corporation has decided to make the undermentioned increases in the salaries of the following officials employed in the electricity and tramway departments:—Mr. A. B. Adams, assistant mains superintendent, £119 12s. to £125 12s.; Mr. A. H. Felton, station superintendent, £143 to £156; Mr. W. J. Willis, deputy ditto, £143 to £150; Mr. H. C. Sanders, senior engineer-in-charge, £130 to £143; Mr. W. H. Clark, ditto, £114 8s. to £119 12s., and by annual increments of £6 to £130; Mr. F. Debley, junior ditto, £91 to £104; Mr. G. Ingham, ditto, £78 to £91.

Tramway Officials.—Mr. H. Holliday, engineer and manager to the Torquay Tramways Co., has accepted the position of engineer and manager to the Rhondda Tramways Co., of Porth (Glam.), and will leave Torquay early in May.

General.—The annual general meeting of the Optical Society was announced to be held on February 12th, but as a mark of respect to the memory of the late Sir David Gill, K.C.B., F.R.S., who was president of the Society at the time of his death, the proceedings were adjourned after a suitable resolution had been passed putting on record the appreciation of his very great services to the Society and to science generally; and to express the deep sympathy of the Society with Lady Gill.

At the annual dinner of the Aberdeen P.O. Electric Golf Club, the Postmaster presented prizes to the following successful members:—Messrs. D. Dawson, A. C. Duthie, C. Eaton, J. Gordon, S. I. Rae, J. Reid, J. Ross, A. Smart, J. M. Smith, R. Thomson, D. F. Webster, P. Wood and W. G. Wright.

The appointment has been confirmed of Mr. D. J. Barnes as district telephone manager at Blackburn. Mr. Barnes, who has been in the service 27 years, has held positions at Manchester, Rochdale, Plymouth, Birmingham, Brighton and Bradford.

Mr. T. Rowland Wollaston has resigned the position that he has held during the last seven years as North-Western representative of the Power-Gas Corporation, Ltd., of Stockton-on-Tees. He will continue his consulting practice at Lord's Chambers, 26, Corporation Street, Manchester.

Mr. W. M. Selvey, Wh.Sc., M.I.E.E., who for the past 10 years has been associated with Messrs. Merz & McLellan, and the power companies of Tyneside, and latterly with the Wallsend laboratories, has now set up in business on his own account as a consulting engineer. His address is Independent Buildings, Sheffield.

Mr. S. M. Hills has resigned his position as a representative for Messrs. Ferranti, Ltd., to take up an appointment as assistant sales manager in London to the Record Electrical Co., Ltd., Caxton House, Westminster, S.W.

Mr. Bernard Dees, a member of the staff at the works of Messrs. Crompton & Co., Chelmsford, is leaving for Cuba, and has been presented with a case of pipes as a farewell gift.

Mr. Harry A. Blackburn, only son of Mr. A. A. Blackburn, chief engineer, Belfast city tramways, who has just completed his apprenticeship with Messrs. Workman, Clark, Ltd., Belfast, has now joined the British Westinghouse Electric and Manufacturing Co., Ltd., of Trafford Park.

It is announced in the *Times* that Dr. E. E. Fournier d'Albe, Assistant Lecturer in Physics at the University of Birmingham, has been appointed Special Lecturer in Physics at the University of the Punjab, Lahore.

NEW COMPANIES REGISTERED.

Universal Economisers, Ltd. (133,836).—This company was registered on February 7th, with a capital of £[illegible] in 1s. shares, to acquire inventions relating to heating, lighting, fuel economisers, heat regulators, &c. The subscribers (with one share each) are:—F. G. H. Hull, 16, Hermitage Road, Finsbury Park, N., clerk; R. W. Pollard, 26, Tasman Road, Stockwell, S.W., clerk. Private company. The number of directors is not to be less than two or more than five: the first are P. Hennessy, Paris; N. G. Gwynne, Red House, Broxbourne, Herts.; and C. F. Mendl, Paris. Registered office, 17, Farringdon Street, E.C.

Gresham Export Co., Ltd. (133,728). This company was registered on February 3rd, with a capital of £500 in £1 shares, to carry on the business of electrical, mechanical or chemical engineers, electricians, manufacturers, exporters and importers of electric lamps, generators and accumulators, &c. The subscribers (with one share each) are:—T. Durrant, 34 6, Gresham Street, E.C., merchant; A. Wright, 34 6, Gresham Street, E.C., accountant; W. F. Mohr, 1, Guildhall Chambers, E.C., merchant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Ashurst Morris Crisp & Co., 17, Throgmorton Avenue, E.C.

South Wales Transport Co., Ltd. (133,884).—Registered February 10th, by S. Morse, 1, Kingsway, W.C., capital, £50,000 in £1 shares. Objects: To carry on in the United Kingdom, Europe and elsewhere the business of tramway, railway, light railway, pier, motor-car, steamboat, motor-boat, omnibus, van, waggon, cab and carriage proprietors, store and garage keepers, carriers of passengers and goods, manufacturers of and dealers in motors, motor-cars, omnibuses and vehicles of all kinds, electrical and mechanical engineers, electricians, &c. The signatories (with one share each) are:—H. A. Stagg, 137, Boundaries Road, S.W., secretary; C. G. Tegetmeier, 1, Kingsway, W.C., director; W. L. Madgen, 1, Kingsway, W.C., electrical engineer; G. J. Somerville, 23, South Hill Park, Hampstead, N.W., electrical engineer; J. N. Gray, 45, Kent Road, Gravesend, secretary; T. J. Clements, 11, Danecroft Road, Herne Hill, S.E., secretary; T. Bower, 48, Victoria Road, Alexandra Park, N., secretary. Minimum cash subscription, seven shares. The first directors (to number not less than two or more than six) are C. G. Tegetmeier, W. L. Madgen and G. J. Somerville; qualification (except first directors) 250 shares; remuneration, £50 each per annum (chairman, £100).

Magneto and Taximeter Co., Ltd (133 954).—This company was registered on February 13th, with a capital of £2,000 in £1 shares, to take over the business carried on by G. Kress at 16, Goldhawk Road, Shepherd's Bush, W., as the "Magneto and Taximeter Co.," and as "Kress and Co." The subscribers (with one share each) are: H. W. A. Hislop, Ingleside, Billericay, Essex, chartered accountant; S. H. Clinch, 15, Cumberland Park, Acton, W., chartered accountant; J. Schneider, 186, Euston Road, N.W., cane chair manufacturer. Private company. The number of directors is not to be less than three or more than seven; the first are G. Kress, W. Reinecke and J. Schneider. Office, 56, Goldhawk Road, Shepherd's Bush, W.

Elbon Metallising Co., Ltd. (133 896). This company was registered on February 11th, with a capital of £1 000 in £1 shares, to take over the business carried on by L. G. Lewis and W. B. Tubbs, at 12, Berners Street, W., as the "Elbron Metallising Co." to carry on the electrolytic deposit of metals on non-metallic substances, &c. The subscribers (with one share each) are:—A. C. Crowl, 15, Harringay Gardens, Green Lanes, N., clerk; B. K. B. Barber, Linden Lodge, Trewsbury Road, Sydenham, S.E., articled clerk. Private company. The number of directors is not to be less than two or more than five: the first are W. B. Tubbs, chairman, and L. G. Lewis, managing director (permanent), M. Dodds, and C. Tubbs. Solicitors, Carter Harrison & Armstrong, 39, Great James Street, Bedford Row, W.C.

Irish Telephone (New System) Co., Ltd. (8 980).—This company was registered in Edinburgh on February 10th, with a capital of £2 500, in £1 shares, to carry on the business of making and fitting up private telephones, telegraphs, &c. The subscribers (with one share each) are: J. Levy, 36, West Princes Street, Glasgow, piano dealer; J. McMahon, Shawfield Park House, Rutherglen, provision merchant. Private company. The number of directors is not to be less than three or more than seven; the first are G. Cochran, F. T. Jackson, J. Levy and J. McMahon; qualification, 50 shares. Registered office, 55, West Regent Street, Glasgow.

Sceando Lamp Co., Ltd. (133,906).—This company was registered on February 11th, with a capital of £100 in £1 shares, to carry on the business of manufacturers of, and dealers in, all kinds of electric lamps, &c. The subscribers (with one share each) are:- O. W. Porritt, Tor Side, Helmshore, woollen manufacturer; H. J. Osborn, Fern Bank, Gravel Lane, Wilmslow, engineer. Private company. Table "A" mainly applies. Registered office, 7, Blackfriars Street, Salford, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Harvey Electro-Chemical Co., Ltd. Two charges on company's uncalled capital and other assets, dated January 15th, 1914, to secure £140 and £100 respectively. Holders: Major H. de L. Walters, Warren Farm House, Guildford; and J. D. Jones, 250, Westminster Bridge Road, S.E.

Yale Electric Power Co., Ltd.—Particulars of £3,000 debs., created December 23rd, 1913, and secured by trust deed dated January 19th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including certain leasehold lands and water rights in and near Festiniog, Merioneth. Trustees: Liverpool Mortgage Insurance Co., Ltd., 6, Castle Street, Liverpool.

James Keith & Blackman Co., Ltd.—Issue on February 9th, 1914, of £200 debentures, part of a series of which particulars have already been filed.

Foster Engineering Co., Ltd.—Mortgage dated January 30th, 1914, to secure £2,100 and further advances up to £3 000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: M. V. Ely, 26, Hill Road, Wimbledon, and E. Dobson, Chalgrove Lodge, Sutton, Surrey.

Rhondda Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £700, on February 5th, 1914, of charges dated March 24th, 1911, and November 13th, 1912, securing £240,000, has been filed.

Musselburgh and District Electric Light and Traction Co., Ltd.—A memorandum of satisfaction to the extent of £100 on January 15th, 1914, of charges dated November 13th, 1905, and May 11th, 1909, securing £90,000, has been filed.

Trowbridge Electric Supply Co., Ltd.—A memorandum of satisfaction in full, on January 26th, 1914, of mortgage dated September 21st, 1911, securing £250, has been filed.

Coast Development Corporation, Ltd.—Charge on freehold land at Reyden, Suffolk, dated February 4th, 1914 (supplemental to charge dated April 18th, 1907, securing not more than £20,000). Holders: F. P. Matthews, Hearn Street, Curtain Road, E.C.; and E. J. Bellord, 8, Waterloo Place, S.W.

CITY NOTES.

South Metropolitan Electric Light and Power Co., Ltd.

THE directors report that for the year ended December 31st, 1913, the revenue account shows a credit balance of £41,570, which, with £5,470 brought forward, made a total of £47,039. After deducting £13,461 for interest on debenture stock paid and accrued, and for other interest, and £6,504 for interim dividends paid on the preference shares, there remains a balance of £27,075. Out of this the directors recommend a final dividend upon the 7 per cent. cumulative first preference shares, absorbing £5,004; a final dividend to December 31st, 1913, upon the 6 per cent. cumulative second preference shares, £1,500; to depreciation account, £5,000; to reserve account, £10,000; and that £5,571 be carried forward.

The following comparative figures show the progress of the business:—

Year.	Lamps (35-watt). Connected at end of year.	Lamps (35-watt). Increase.	Consumers.	Gross revenue.	Expenditure.	Net revenue.
1910.. ..	208,046	16,714	4,305	£44,687	£17,678	£27,009
1911.. ..	230,191	22,145	4,697	51,614	20,541	31,072
1912.. ..	258,872	28,681	5,263	56,604	22,670	33,933
1913.. ..	289,705	30,833	5,888	65,635	24,065	41,570

The new consumers and the lamps connected exceeded th added during 1912 when the number of connections was great than in any previous year, and the net revenue shows a large increase for 1913 than in any year since the formation of th company. The surplus profits, after placing £5,000 to depreciation account, represent a dividend of [illegible] per cent. on the ordinary share but the company is precluded by the provisions of the debenture trust deed from paying any dividend on the ordinary shares until has set aside to a special reserve fund a sum [illegible] which during the past year amounted to [illegible]. The West Kent undertaking is being actively developed in portions of the statutory area with satisfactory results. The company having been formed in [illegible] the articles of association, as altered by special resolutions, are [illegible] inconvenient for reference and out of date having regard to late legislation, and the directors propose the adoption of new articles to consolidate the existing regulations and make them accord wit modern practice. For this purpose an extraordinary meeting convened. By the new articles the number of directors is fixed not more than five or less than three; provision is made fo alternate directors; an article is inserted expressly authori arrangements with the West Kent Electric Co., Ltd., and any oth similar subsidiary company which may be controlled by the sam board of directors.

The meeting is called for February 25th.

Yorkshire Electric Power Co.

AT the annual meeting held on February 17th, MR. A. G. LUPTO the chairman, said that the capital expenditure had been curtail as far as possible, amounting in 1913 to £26,291, as against £53,0 in 1912, but the demand for current must be met, and the reven was growing in a satisfactory proportion. The revenue for 19 added 25 per cent. to the receipts for 1911, and that for 19 amounted to over £61,000, as against £46,000 for 1912, a furth growth of over 30 per cent. This left a profit of £15,401, and aft paying the 6 per cent. dividend on the preference shares, £9,1 remained to be dealt with. They recommended that £5,000 this be put aside as the beginning of a reserve fund, and t balance, £4,188, carried forward. It would be possible to pay small dividend on the ordinary shares, but in view of the rap growth of the company, and of the need to deal with the seco mortgages on the undertaking, the directors considered that th would be unwise, although they hoped that the patience of t shareholders would not be much longer tried before a divide would be reached on the ordinary shares. The cost of coal continu high, and there did not seem to be any immediate hope of relief this. The 2,000-KW. turbine in the waste heat station at Barugh h been running satisfactorily on load since October, and owing the great increase of demand for current, it had been alrea necessary to order a second turbine of 3,000 KW., which wou bring the plant in that station up to 5,000 KW. This would so be completed, and the capital required for it would be provided the issue of further first mortgage debenture stock of the Wa Heat Co., bearing interest at 5½ per cent., secured by the lease the station to the Power Co. Applications for the 6 per ce preference shares, and the 5½ per cent. Waste Heat debenture sto had been continuous throughout last year, and several had be received since the issue of the report for 1913. In July, 19 when capital was needed to develop the company, it was decid to issue £45,000 second mortgages, carrying 6 per cent. intere and repayable with a bonus of 5 per cent. The time to repay th had now come, and with that object the directors recommend that a further issue of £50,000 6 per cent. preference shares authorised and offered to the holders of the second mortgages exchange, the small balance being issued in the ordinary way, dividend on this issue being at the same rate as the interest th has been paid upon the second mortgages. Holders of over £15,0 of the second mortgages had already signified their intention make this exchange, and there was no doubt that when proposal was approved by the shareholders, and the formal of made, the bulk of the second mortgage holders would desire secure this good return rather than have their capital repaid them. Any mortgages which were not exchanged would be paid in September, and this would clear the way when an issue of debent stock became necessary, and would enable the company to the borrowing powers for £45,000 to secure further capital at lo rates of interest than had been possible in the past. The object their Bill, for an amending Act was partly financial, partly increase the supply powers and generally to facilitate the devel ment of the company. The financial clauses would enable company to exercise its borrowing powers when shares were par instead of fully paid as at present, to issue redeemable debent stock instead of iredeemable only, and there were other clau which were mostly of domestic interest, but one clause seemed have excited considerable interest, and that was Clause 3, wh enabled the current supplied by the company to be used for lig ing in those places where no other supply was possible. In original Act of 1901 the company was empowered, subject certain restrictions in particular areas, to supply electric curr for power purposes, and for lighting purposes on premises wh power was used, but not for lighting alone. In the more popul places the company was supplying in bulk to local authorities to companies who distributed for lighting, and their current available to a very considerable population, but it had beco apparent that the cost of these distributing orders was too gr to make them practicable in the scattered and more ru districts, so that in many parts of the company's area inhabitants were cut off from the use of electricity for lighting p poses, even though their mains might be passing their do ere was no difference whatever between the electric current ich would drive a factory or a motor, heat a flat-iron, cook the ner in an electric oven, or warm a sitting room by a radiator, these uses were all included in the powers of their Act, whilst use of the same current for light was forbidden to the ordinary s-holder. It was as if in the area of a water company, the ter might be sold for trade purposes, for washing and sanita- n, but must on no account be drunk unless mixed with tea, oa, or whisky. Clause 3 had therefore been inserted in the npany's Bill in response to many inquiries from residents in h districts who saw the company's mains close to them, but re unable to take advantage of the supply, because they only uired it for lighting purposes and not for power, and the company re also receiving a large amount of support from the local horities in such districts. The local authority of the district uld not be in any way prejudiced if this power were granted. they wished, they would be able at any time to take out an ctric lighting order, but in the meantime their inhabitants uld be able to obtain from the company what had now become nost a necessity of modern life. For some reason, a number of larger local authorities, most of whom were in no way affected the Bill, owing to the special protections they enjoyed, were itioning against the Bill on this particular clause. It was the ne blind policy which they pursued in 1901, when they opposed l tried to destroy the original Act, but he could hardly think t Parliament would approve their action or prevent the abitants of the rest of the West Riding from obtaining the antages which they asked the company to give them. e Horbury Council had resolved to oppose the Bill after ch talk about the company obtaining a monopoly. If the ectors had read the Bill, they would see that there was an olute misunderstanding on their part. The only change asked was that their ratepayers might be able, if they so desired, to the current supplied by the company for light as well as for ver, and, like any other local authority, they might apply for a visional order if they desired to do so. Bearing this in mind, vas difficult to understand the reason for the Council coming to s decision. In 1904 the Council obtained an Electric Lighting ler, and although this company offered to give them a bulk ply, and the Distribution Co. offered to take over their order, hing was done, and the Board of Trade eventually revoked ir powers. If, instead of opposing the company, these mani- al authorities would realise what it would mean to them and to ir citizens to clear away the floating cloud of smoke which fted backwards and forwards over the whole West Riding nufacturing area, and to let in sunshine, and health and cleanli- s, and how the whole possibilities of life in their towns would altered, they would give up this short-sighted opposition, and all in their power to encourage and help the company; but it uld seem that this was quite beyond the imagination of these ncillors or that of their legal advisers.

Farnham Gas and Electricity Co.

E annual meeting was held on Monday evening, Mr. B. J. Nash siding. The directors, in their report, recommended a dividend he rate of £7 7s. per cent., less income-tax, for the whole year, being the dividend permissible under the sliding scale clause he Farnham Gas and Electricity Act. This, after deduct- the interim dividend already paid, would absorb £923, and ve a balance of £753 to be carried forward. A most satisfactory rease in sales had been obtained from both branches of the com- y's business. The electricity department sold 67,927 units, as inst 10,212 last year.

Ir. Ernest Crundwell, a director, pointed out that the gas ital was now practically £40,000, and the electricity capital),000. The effect of that upon the electricity portion of the lertaking was that, under their Act of Parliament they were nd to distribute the expenses common to the whole undertaking portionate to the amount of capital of each portion of the under- ing. The electricity portion of the undertaking showed a loss of rly £400, but that was arrived at after deducting the proportion of -third of all the common expenses, whereas in the ordinary way, it been a separate undertaking, a very small proportion of se expenses would have been attributable to it. Therefore, one hed to show that to that extent the gas portion of the under- ing was benefited and the electricity portion hampered and dicapped. With regard to the progress of the electricity portion the undertaking, Mr. Crundwell remarked that they were now nping the town sewage, and, he believed, perfectly satisfac- ly, so much so that the company had been approached with a w to the extension of electric power to a new pumping station ich it was proposed to erect. There was also every prospect t in the near future the whole or a greater portion of the town's er supply would be pumped by means of electric power.

he report was adopted.

Electrical and Industrial Investment Co., Ltd.

directors' report states that during the year £85,237 4½ per t. debenture stock and £12,955 5¼ per cent. deben- stock were issued at par, making the debenture and share ital issued at December 31st, 1913, £480,000. The directors ommend that the ordinary shares be divided into equal amounts preferred ordinary shares of £1 each and deferred ordinary res of £1 each, the preferred ordinary shares to be entitled out he profits of each year to a preferential dividend at the rate of r cent. per annum as from the passing of the necessary special olution, and in a distribution of assets to priority of capital over the deferred ordinary shares; the deferred ordinary shares to be entitled to all surplus profits and assets. The directors have continued to act on the principle of adding to reserve the profits made on sales of investments and of charging losses on realisation against the reserve. The balance at the credit of reserve account at December 31st, 1913, was £24,224. The revenue account shows a profit, after payment of all management expenses and interest on debenture stocks, of £13,059, plus £3,314 brought forward, making £16,373. The directors have written off £3,091, the expenses of the debenture stock issue, and they recommend a dividend for the year on the 6 per cent. cumulative preference shares, carrying forward £7,282. At December 31st the company held 208 investments of the total book value of £588,430. On the basis of the middle market prices of the quoted securities (£365,197, equal to 62 per cent. of the total) at December 31st, and of the cost of the unquoted securities (£223,233, equal to 38 per cent. of the total), the assets after deducting the reserve, less the liabilities, are deficient by £4,868 to provide for the whole of the capital. This deficiency is equal to a depreciation of the quoted securities of 1·33 per cent., and has been more than neutralised by the rise in values since December 31st. Mr. Kingsford has resigned his seat on the board, and Mr. Charles H. Dade has been elected to fill the vacancy. Mr. J. A. Christie, owing to impaired health, does not seek re-election to the board, and the directors propose that Mr. Wm. Parker be elected a director.

Cleveland and Durham Electric Power, Ltd.—In the Chancery Division, Mr. Justice Astbury has sanctioned a scheme of arrangement of the Cleveland and Durham Electric Power, Ltd. Counsel said the scheme affected nobody, and, in reply to his Lordship, explained how the arrears of the preferential dividend amounted to £58,000. Up to 1910, he said, the dividend was cumulative, but, by special resolution passed at that time, the cumulative dividend was made non-cumulative. It was in respect of that large arrear that the company issued stock.

Mather & Platt, Ltd.—The report for 1913 states, according to the *Financial Times*, that the net profits for the year, after charging depreciation and directors' remuneration and expenses, are £164,524, plus the balance brought forward £35,506. The directors recommend a dividend for the year at the rate of 10 per cent. per annum on the ordinary shares (less interim dividend paid September), also a bonus of 5 per cent. on the ordinary shares, transferring to reserve account (bringing up the amount to £270,000), £50,000, and carrying forward £40,030.

Companies Struck off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

Auto-Controllers.
Electrical Instrument Manufacturers.
Electro-Medical Institute.
Improved Electric Traction.
Mica Boiler Covering Co.
Midget Steam Trap Syndicate.
Phosphor Bronze Co., Ltd. (Registered 1874).
Solium Electrical Co.
Wimshurst Hollick & Co.

London Electric Wire Co. and Smiths, Ltd.—The directors, according to the *Financial Times*, recommend a dividend of 7½ per cent., less income-tax, on the ordinary shares for the half-year, making 10 per cent. for the year, placing £500 to depreciation reserve, making £2,500, £50,000 to extinguish goodwill, and carrying £22,673 forward.

Chas. Clifford & Son, Ltd.—The directors report a profit of £10,123 for 1913 after deducting debenture interest, depreciation, &c. After paying the preference dividend of 6 per cent. for the year, and 10 per cent. on the ordinary shares, £2,500 is transferred to reserve and £2,500 to debenture redemption reserve, carrying forward £5,014.

Official Notices re Companies.—The following companies will be struck off the Register, at the expiration of three months, unless cause is shown to the contrary:—

Bombay Hydro-Electric Syndicate.
Imeson Finch & Co.
Pearson Fire Alarm.

Bruce Peebles & Co., Ltd.—For 1913 the directors report more satisfactory results than in previous years. The net profit is £2,821. The company has obtained a fair share of orders at slightly improved prices.

Newcastle and District Electric Lighting Co., Ltd.—The directors recommend a final dividend at the rate of 5 per cent. per annum, making 4 per cent. for the year.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—The directors announce a final dividend of 3 per cent., making 5½ per cent. for the year, on the ordinary shares. For 1912 the total was 5 per cent.

Prospectuses.—*Tramways (M.E.T.) Omnibus Co., Ltd.*—The Electric and General Investment Trust Co., Ltd., have this week been offering for sale £100,000—4½ per cent. guaranteed debenture stock in this company, at 92 per cent. The list was to close of Wednesday.

Constantinople Telephone Co.—The list is to close to-morrow in an offer of £200,000 6 per cent. obligation bonds at 97 per cent., the money being required for extensions consequent upon the large number of applications for service.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

THE directors' report for the year 1913 states that the renewal and reserve fund account now stands at £122,139, being an increase of £6,777. After providing for the amount placed to renewal and reserve fund account ["By provision for renewal and maintenance of buildings, plant, mains, &c., £15,974, less repairs and maintenance, £7,013 = £8,961"] and after paying the dividends on the 6 per cent. first preference shares to 30th June, 1913, on the 5 per cent. second preference shares to 30th September, 1913, and an interim dividend at the rate of 8 per cent. per annum on the ordinary shares for the first half of the year, the balance standing to the credit of the net revenue account for the year 1913 is £9,933. Of the above sum £1,500 has been appropriated to the payment of the first preference dividend to the end of the year, and £625 has to be set aside to meet the portion of the dividend on the second preference shares accrued to the same date. It is proposed to pay out of the balance of £7,808 a further dividend on the ordinary shares at the rate of 10 per cent. per annum, for the past half-year, making with the interim dividend paid on August 14th, 9 per cent. for the year. This will leave £2,558 to be carried forward. The directors announce the death of Mr. R. S. Erskine who held the position of secretary to the company since its formation, and they put on record their extremely high appreciation of the sterling qualities of their late Secretary, to whose unremitting efforts the high standing of the company is very largely due. They have filled the vacancy caused by his death by appointing Mr. G. S. Britton who for a number of years has acted as assistant secretary to the company.

The meeting will be held on February 25th.

London Electric Railway Co.

THE directors' report to December, 1913, states that the gross receipts of the railway were £715,319 and the expenditure was £332,856, leaving £382,463 plus miscellaneous receipts (net) from rents, interest, &c., £59,001, making the total net income £441,464, plus £3,107 brought forward. There have to be deducted interest, rentals and other fixed charges £215,259, appropriation to reserve £8,000, and dividend on preference stock £126,947, leaving a balance available for dividend on ordinary shares of £94,365. The interim dividend at the rate of £1 per cent. per annum, which was paid on the £10 ordinary shares for first half of the year ended 31st December, 1913, absorbed £46,639, leaving £47,726, which will admit of the payment of a dividend at the rate of £1 per cent. per annum for the second half of the year ended December 31st, 1913, making £1 per cent. for the year, carrying forward a balance of £1,086 after setting aside £8,000 for reserves. The dividends paid on the £10 ordinary shares for the year 1912 were at the rate of £1 per cent. per annum with a balance of £3,107 carried forward after setting aside £15,000 for reserve. The capital expenditure during the year amounted to £638,074. The extension of the railway from Edgware Road to Paddington was opened on December 1st, 1913, and the traffic is developing satisfactorily. Good progress is being made with the construction of the extension from Charing Cross to the Embankment, and it is hoped this will be opened for public traffic at an early date. The work on the Queen's Park extension and Oxford Circus escalators is also well advanced. Three bills were submitted for approval at yesterday's meeting. Lord George Hamilton, the late Chairman, having retired from the Board, the directors have elected Lord Farrer as chairman in his place, and Viscount Knollys has been elected to fill the vacancy on the Board created by Lord George Hamilton's resignation.

London Electric Supply Corporation, Ltd.

THE directors' report for the year ended December 31st, 1913, states that the profit on working was £71,753, against £68,670 last year. Adding the amount brought forward, £4,706, and interest on deposit £75, there is a total of £76,534. From this there has been paid interest on debenture stock, 1913, £19,494, sinking fund for redemption of debenture stock in 1931, £12,000, leaving a balance to be appropriated of £45,040. It is now proposed to pay a dividend of 6 per cent. on the preference shares (of which an interim dividend of 3 per cent. was paid on September 1st, 1913), viz., £26,952, a dividend of 3 per cent. on the ordinary shares £9,990, to put to contingencies account £3,000, and to carry forward £5 098. The sinking fund of £12,000 a year, cumulative, for the redemption of debenture stock in 1931, now amounts to £24,756, in addition to the fund shown at the bottom of the capital account. The supply has been efficiently maintained during the year. The number of units sold amounted to 35,336,223, as against 28,409,755 last year; the total costs per unit sold being ·62d., as against ·66d. last year. The power supplied for traction purposes shows 13 per cent. increase, while the power supply for tramways and industrial purposes shows 60 per cent. over last year. The plant and machinery have been maintained out of revenue, and are in efficient condition. The directors record the death of their esteemed colleague, Sir William Preece, who had been a director of the Corporation since 1899. Mr. Oliver Bury has been elected to the board. The meeting is to be held on February 26th.

Westminster Electric Supply Corporation, Ltd.

THE directors' report for the year 1913 states that the total power of the lamps, motors and apparatus connected to the company's mains, which on 31st December, 1912, was the equivalent of about 37,710 k.w., had increased on 31st December, 1913, to the equivalent of about 39,646 k.w. The length of roadway in which [illegible] have been laid now exceeds 95 miles, making about [illegible] miles of ways, into which upwards of [illegible] miles of copper (strip and cable) have been drawn. In addition 6 miles of trunk mains (35 miles of ways) are laid in the [illegible] area to connect the stations with the Central Electric Supply Co.'s station at St. John's Wood. An interim dividend, at the rate of 10 per cent. per annum on the ordinary shares and the dividend on the 4½ per cent. preference shares, for the half-year ending 30th June, 1913, have been distributed. After allowing for depreciation, sinking fund and other charges, the net balance is £43,625, from which must be deducted the second half-year's dividend on the preference shares, which absorbed £11,653, leaving £31,972. Out of this the board recommend the payment of a dividend at the rate of 10 per cent. per annum, less Income tax, for the past half-year, making 10 per cent. for the year, carrying forward £6,078. The directors greatly regret the loss of the valuable services on the board of Mr. R. W. Wallace, K.C., who has ceased to be a director. Mr. E. A. Goulding, M.P., has been elected to fill the vacancy.

The meeting is called for February 25th, at Eccleston Place.

Units sold (including A.C. suppl. of 1,500,360) ...	21,906,196
Used on works	466,977
Total	22,373,173
KW. on circuit, December 31st, 1913	39,646

Charing Cross, West End and City Electricity Supply Co., Ltd.

THE directors' report for the year ended December 31st, 1913, says that the result of working has been satisfactory.

West End Undertakings.—The gross earnings of these undertakings from sales of current, rents, &c., were £151,240, as compared with £146,676 for 1912, and the expenses, excluding depreciation, were £66,866, as compared with £66,686 for 1912. The net earnings were £84,374, as against £79,990. After bringing in from the previous year the balance of £18,000, profits from the revenue account for 1913 £84,374, and interest accrued in 1913 £2,238, making together £104,612, and providing for interest on debenture stock £17,829, and setting aside for depreciation £22,000, there is a balance of net revenue of £64,782. Out of this have been paid the dividend on preference shares for the year £18,000, and an interim dividend for the first half of 1913 at the rate of 5 per cent. per annum on the ordinary shares, amounting to £10,000, leaving a balance to be dealt with of £36,782. The directors recommend that a final dividend be paid on the ordinary shares for the second half-year at the rate of 7 per cent. per annum, making 6 per cent. for the whole year, absorbing £14,000; that there be transferred to general reserve (income) account £4,782; and that there be carried forward £18,000. The company has now connected to its West-End mains a total equivalent of 703,693 (30-watt) lamps. The total is made up as follows:—454,037 in lighting, 31,845 in heating, and 217,811 (8,759 H.P.) in motive power.

City Undertaking.—The gross earnings of this undertaking from sales of current, rents, &c., were £149,819 for 1913, as compared with £148,513 for 1912; the expenses were £80,639, as against £84,959; and the net earnings were £69,180, as against £63,554. After bringing in the balance of £18,000 from 1912, and paying interest on the debenture stock, loans and advances (£30,853), there is a balance on net revenue account of £56,327, out of which has been paid the dividend on the preference shares amounting to £18,000, leaving £38,327, as compared with £18,000. The directors recommend that £20,327 be transferred to general reserve (income) account, and £18,000 carried forward. The company has now connected to its city mains the total equivalent of 688,421 (30-watt) lamps. The total includes 318,527 in lighting, 53,285 in heating, and 316,609 (12,732 H.P.) in motive power.

The chief engineer certifies that the plant and machinery at the several stations of the company have been maintained in a high state of efficiency.

By the London Electricity Supply Bill, 1914, the County of London Co. is seeking Parliamentary powers to enable it and other London supply companies to enter into agreements with the London County Council. The directors have considered the provisions of this Bill, and are taking the steps they deem necessary for the protection of the company's interests by lodging a petition to be heard before a Parliamentary Committee.

Mr. John D. Laurie, of the firm of Messrs. Laurie, Millank & Co., of 31, Threadneedle Street, E.C., has been appointed a director of the company in place of the late Mr. Henry Campbell Pulley.

	West End undertakings.	City undertaking.
Units generated	9,910,661	28,596,509
Units bought	7,777,444	263,430
Quantity sold—Public lamps . .	558,827	22,602,693
Other sales	12,711,246	—
Total B. of T. units sold	13,270,073	—
Used on works, and transmission and distribution losses..	4,418,032	6,257,246
Total accounted for	17,688,105	28,859,939
Number of public lamps ..	303	—
Total maximum supply demanded in KW.	6,716	13,633

The meeting is called for February 26th

Central London Railway Co.

The directors' report to December 31st, 1913, shows that the gross receipts of the railway, &c. for the year were £254,837, and the expenditure was £147,781, leaving £107,056, plus miscellaneous receipts (net, from rents, interest, &c., £36,502, making the total net income £143,558, plus £27,218 brought forward. There have to be deducted interest, rentals and other fixed charges £38,298, and dividends on 4½ per cent. preference stock £21,600, leaving a balance available for dividend on ordinary, preferred ordinary and deferred ordinary stocks, £110,878. The interim dividend at the rate of £3 per cent. per annum which was paid on the ordinary stock and at the rate of £4 per cent. per annum on the preferred ordinary stock for the first half of the year ended 31st December, 1913, absorbed £38,499, leaving £72,379, which will admit of the payment of a dividend at the rate of £3 per cent. per annum on the ordinary stock, at the rate of £4 per cent. per annum on the preferred ordinary stock for the second half of the year ended 31st December, 1913, and at the rate of £2 per cent. on the deferred ordinary stock for the whole year, making £6 per cent. on the ordinary stock and £4 per cent. on the preferred ordinary stock for the year, carrying forward a balance of £20,878. The dividends paid for the year 1912 were at the same rates, with a balance of £27,218 carried forward. The capital expenditure during the year amounted to £67,749. The Bill to empower the company to enlarge a portion of its railway tunnels; to construct new subways and works; and for other purposes was submitted for approval at yesterday's meeting, as was also the London Electric Railway Co.'s Bill to construct new subways. In accordance with the arrangements referred to in the last report regarding the proposals of the Underground Electric Railways Co. of London, Ltd., the following directors have resigned, viz.:—Dr. H. F. Parshall, Mr. Robert Fleming, the Rt. Hon. Viscount Knollys, the Rt. Hon. Lord Rathmore, and in their places have been appointed the Rt. Hon. Lord George Hamilton, Mr. Albert H. Stanley, the Rt. Hon. Viscount Knutsford and Colonel Sir Herbert Jekyll.

Consolidated Diesel Engine Manufacturers, Ltd.

At an extraordinary general meeting of this company, that is to be held to-day, Friday, at Salisbury House, London Wall, E.C., shareholders will have before them a number of resolutions submitted by the majority of the Shareholders' Committee, and by certain individual members thereof. Those put forward by the majority read as follows:—

(A) That this meeting hereby approves and accepts the report of the majority of the shareholders' committee dated 7th February, 1914.

(B) That the provisional Agreement dated the 28th day of January, 1914, and made between Messrs. Alphonse, Georges, Gaston and Charles Carels, and Usines Carels Frères, Ltd., of the one part, and Mr. J. C. Inglis on behalf of the shareholders' committee of the other part, be and the same is hereby ratified, and that the directors be hereby authorised to carry the same into effect.

(C) That it is desirable to reconstruct the company, and accordingly that the company be wound up voluntarily and that Reginald Norton Dawson, F.C.I.S., of 356/9, Winchester House, Old Broad Street, in the City of London, be and he is hereby appointed liquidator for the purposes of such winding up.

(D) That the said liquidator be and he is hereby authorised to consent to the registration of a new company to be called British Diesel Oil Engines, Ltd., or some other suitable title, with a Memorandum and Articles of Association in a form to be approved by the directors of that company.

(E) That the draft Agreement submitted to this meeting and expressed to be made between this company and its liquidator of the one part and such new company of the other part be and the same is hereby approved, and that the said liquidator be and he is hereby authorised pursuant to Section 192 of the Companies (Consolidation) Act, 1908, to enter into an Agreement with such new company when incorporated in the terms of the said draft, and to carry the same into effect with such (if any) modifications as he may think expedient.

Mr. E. A. Richardson proposes as an amendment that the above resolutions be not adopted, but that a provisional agreement dated January 28th, 1914, made between Messrs. Alphonse, Georges, Gaston and Charles Carels, and Usines Carels, Ltd., of the one part, and J. C. Inglis on behalf of the shareholders' committee of the other part, be adopted; also that the Consolidated Diesel Engine Manufacturers, Ltd., be wound up voluntarily. Mr. J. M. Fells announces a resolution that he will move in the event of Mr. Richardson's resolution becoming the substantive motion; and the majority of the committee also have a recommendation that the expenses of the committee, &c., not exceeding £600, be paid.

The following are extracts from the "Majority" report:—

The committee see no reason to doubt the honesty and integrity of the directors, but the management of the affairs of the company has been characterised by an absence of business capacity. They further consider that in view of the difficulties which occurred, the directors should have consulted the shareholders at a much earlier period than they did. The unfortunate financial position of the company is not due to the general state of the industry itself. On the contrary, the leading Diesel engine manufacturers in this country have as much work as they can do for the next two or three years, and in the circumstances the company ought not to be in its present condition. After careful consideration your committee strongly recommend that the arrangement hitherto existing with Messrs. Usines Carels Frères should be determined. The committee found that there are outstanding obligations and loans to the extent of about £215,000 on the Ghent works. The obligations constitute a first charge on the Ghent property. In view of this and taking into consideration the fact that further large sums would have to be found for the development of Messrs. Carels' business—of which this company would be expected to find half—it is essential that the company's interest in Messrs. Carels should be disposed of. The committee have, therefore, concluded a provisional agreement with Messrs. Carels, subject to the sanction of the shareholders, for the purchase by Messrs. Carels, as individuals, of the 10,001 shares held by this company in their firm for £150,000, to be satisfied by the payment of £50,000 in cash or its equivalent and the surrender of the 100,000 fully paid £1 shares held by them in this company. Under this arrangement the shareholders will become sole owners of their property in England. The committee have given the most serious attention to the question whether legal proceedings should be instituted against the directors and others, but they have come to the conclusion that any such proceedings would be of doubtful advantage to the company, owing to the delay and great expense involved, and to the consequent depreciation of the assets and goodwill during the continuation of such proceedings. Moreover, the committee desire to point out that the full benefit of the agreement with Messrs. Carels can only be realized by a constructive policy, and that to complete the various large existing contracts new financial arrangements are urgently required. The chief consideration, however, is the very advanced state of the works at Ipswich. Members of the committee have personally inspected these works and are very much impressed with the design, equipment and condition of the property. With a further expenditure of £20,000 on heavy tools, the Diesel engines now being purchased from Messrs. Carels could be economically manufactured at Ipswich. This fact your committee think should weigh with the shareholders in deciding upon their future action. With the approval of the committee the unnecessarily large staff in the London office was considerably reduced in the month of December. The committee have considered various reconstruction schemes. That submitted by the directors to the meeting held on the 2nd December they have found to be open to two objections. (1) That the capital to be provided would be quite inadequate for carrying on the Ghent and Ipswich works combined; (2) that the commissions, underwriting and other expenses were excessive. To carry on the Ipswich works alone will require at least £100,000 fresh capital. In view of the very difficult situation that has arisen as well as of the great diversity of opinion which appears to prevail among the shareholders as to the best course to pursue, your committee have decided to ask them for a straight vote on the three alternatives open to them. *First.*—Reconstruction of the existing combination of Consolidated Diesel and Carels Companies. *Second.*—Sale of the Carels' shares and reconstruction on the basis of the Ipswich works alone, which the committee recommend. *Third.*—Voluntary liquidation. In the event of a sufficient majority being obtained for the second scheme the committee suggest that a new company be formed for the purpose of taking over the assets and liabilities of the existing company, the new company to have a capital of £500,000 divided into 1,000,000 shares of 10s. each, of which 750,000 will be issued. In the opinion of the committee the cash to be provided by scheme No. 2, detailed above, should be adequate to meet the future requirements of the company.

Metropolitan Railway Co.

Lord Aberconway, P.C., presided on February 12th, at the offices, Baker Street, over the annual general meeting of the company. The large hall was crowded with shareholders.

The Chairman, in moving the adoption of the report (see Electrical Review, p. 281), referred to the fact that for the first time the directors met the proprietors on their own premises. The new building would accommodate the whole of the departments, and would enable them to effect economies in various directions. The report and accounts were in the new form prescribed by the Railway Companies (Accounts and Returns) Act, 1911. The accounts covered the whole of the year 1913. The information given was very complete. As this was the first time the accounts had been prepared in this form and on an annual basis it was not possible to give comparative figures for the preceding year, but for their own purposes they had had a comparison made in the case of the more important items. In the cost of maintaining the motors and locomotives there was an increase of about £1,000, due partly to the increase in the mileage through the introduction of the new East London service, and partly to the higher prices of nearly all materials. The running expenses were £12,800 more, due partly to increased train services, but mainly to the higher price of coal. The price of fuel was very high all through 1913, but there were indications of better conditions in this respect during the current year, and they were already working at materially lower prices. The traffic expenses showed an increase of £6,600, due to the necessary increase in staff to work the East London service and to the enhanced wages paid to the men under the settlements come to with them at the end of 1912. To balance the increased expenses caused by the running of the East London service they had received £15,000 more than in 1912 for work done on behalf of other companies, which included the running of the service on the East London Line between Whitechapel Junction and New Cross. The passenger train traffic decreased by £15,700. The falling off was confined exclusively to the short distance traffic and was caused by the increased motor bus competition. The season ticket traffic, however, increased by £1,500, and the longer distance traffic was steadily increasing, the proportion due to this company of the net earnings of the line north of Harrow being, for the year, £21,000, an increase of £5,500 over 1912. The goods, mineral and coal traffic continued to show a satisfactory development, being better by £6,500. The residential places served by the line north of Willesden were all showing signs of further development, and the prospects for a continued increase in the daily business traffic, which of course was one of their principal assets, were very good. Their rents were again a very satisfactory feature of the revenue account, as they showed an increase from new tenancies created of £4,500 over 1912. During the coming twelve months they would see a further substantial increase from this source. As to the working of the Great Northern and City line, they did not really take over the active management until 1st September. In the four months from September to December they had saved £1,600 in the working expenses of the line as compared with the previous year, which was at the rate of nearly £5,000 a year, in addition to which they had saved £1,260 for the half-year in the interest on debenture stock. The saving in expenses was in excess of the estimate given by the general manager to the shareholders' committee when they considered the scheme twelve months ago. The further saving in the cost of current would, of course, not be effected until the new sub-station was completed in the course of a few months. The traffic on the line showed a slight falling off for the half-year, but the revisions in fares made since 1st January were improving the earnings at the present time. During the year they had had many difficulties to contend with, and there had been many circumstances operating against them, and it had only been by the exercise of the greatest economy in working and by taking every opportunity of opening up new sources of revenue that they had been able to keep the net receipts up to practically the same level as 1912. They had reason to believe that in the current year the working costs would be more favourable in many directions, and that the traffic prospects were decidedly better. In regard to the item Appropriation to Reserve in the accounts, in 1912 they put £15,000 out of revenue to the electrical renewal and depreciation fund, which stood now at £65,900, after having borne during the last few years £47,000 in connection with the renewal of the generating plant at Neasden, which was now completed. They considered, having practically a new plant to-day that it was not necessary this year to make any addition to the electrical depreciation fund, but they proposed instead of doing so to commence a fund for general renewal purposes. They proposed to start this fund with £12,500, £7,500 of which was taken direct from last year's revenue, and £5,000 from a suspense account, which would otherwise have been credited to last year's figures. After making reference to the surplus lands stock, the Chairman said that the reconstruction of the whole of the company's generating plant at Neasden had been completed during the past year, and the economies that they expected by the change were being fully realised. They had also installed new grates for the boilers, which enabled them to burn a much lower grade of fuel than hitherto. They now had at Neasden a generating station which they considered was second to none, and their cost per unit generated was lower than it had ever been, and compared very favourably with the cost at other large power stations. They were now erecting a sub-station at Drayton Park for the purpose of distributing current from Neasden for working the Great Northern and City section. The necessary transforming machinery was being constructed at the Westinghouse Co.'s works at Manchester. They expected to have the new sub-station in operation by about the end of the half-year, and this would enable them to effect a very substantial economy in the working of that part of the line, and at the same time to reduce the cost of current at Neasden. By arrangement with the companies who were lessees of the East London line, they were providing the rolling stock and doing the whole of the working of that system, and he was glad to say that the traffic was showing a steady development month by month. They were also making improvements on the Hammersmith and City line, which was jointly owned by this company and the Great Western. Amongst other things they were building two new stations where the line crossed the Uxbridge Road and the Goldhawk Road respectively. They were also at the present time making final arrangements with the L. and S. Western Co. for exercising with electric traction their running powers to Richmond. This would enable them to run a through service from the City to Richmond *via* the Hammersmith line, and would incidentally improve the service between the stations on that line and the City. Their widening works on the Northern Extension line had made rapid progress, and they had brought certain sections of them into use. They would not be able to open the whole of the widening from Finchley Road to Wembley Park until the extension of the viaduct at Kilburn was completed some months hence, but meanwhile they would have the use of the additional lines both north and south of the [illegible] and they would have the advantage of the automatic signalling all the way to Harrow. These facilities would enable them to improve their service to Pinner and beyond, and they were arranging to [illegible]. They were promoting another Bill in the coming Session of Parliament, mainly with reference to the Great Northern and City line. The Chairman later dealt at some length with a circular (which he described as an extraordinary one) which had been issued by Mr. Pownall to the shareholders of the company. The result, however, of that circular, contrary no doubt to the intention of the author, had been the receipt of an unprecedented number of proxies in support of the Board and their policy.

Mr. Paul Speek seconded the motion.

Mr. Pownall addressed the meeting at great length with reference to the points he had set out in his circular to the proprietors and as to the reply issued by the Board in which they stated that his circular was full of untruths and [illegible] statements. He maintained that the statements he had made were cold hard facts, every one of which could be verified. He quoted from letters by his solicitor to prove that his assertions as to certain share transactions by the Chairman and his wife and son were true, and also as to the financial stake which Sir Clarendon Hyde had in the company when he was elected a director. He reviewed the whole of the circumstances attending the acquisition of the Great Northern and City Railway, and suggested that there had already been a loss of £10,000 on it. The Metropolitan Co. had paid twice as much for the Tube as it was worth, but the Great Northern Co. could afford to lose considerably in order to gain additional conveniences for their long-distance travellers. He protested strongly against the proposal to raise £500,000 additional capital and asked for the support of the shareholders at the Warncliffe meeting to be held. The direction in which the railway should develop was to the west, and not out to New Cross. In conclusion, he proposed a vote of "no confidence" in the Chairman and his son, the Hon. Francis McLaren, M.P.

Mr. J. Hedges seconded the vote of "no confidence." He suggested that they wanted practical workers and not figure heads.

After further discussion, the Chairman said he believed Mr. Pownall was sincere in his views, but the shareholders had gone against him and he would ask him to fall into line with the majority. As to the accusations made that he and his family had been speculating in the funds of the company, there was no foundation for the charge. From the time he joined the Board he had never speculated in the shares of either that or any other railway company. The Chairman gave the details of his share transactions over a series of years, and said that he and his wife and son held between them nearly £52,000 of ordinary stock in the company.

The resolution of "no confidence" was put to the meeting, and, as the result of a show of hands, the Chairman said the voting was near but he thought the motion was defeated.

Mr. Pownall demanded a poll, which it was agreed should be taken at the close of the meeting.

The report was adopted, and Lieut.-Col. Probyn and Mr. P. Speek were re-elected directors. When the motion for the re-election of Sir Clarendon Hyde came on the motion was defeated on a show of hands, and the Chairman demanded a poll.

A motion to empower the Board to raise £750,000 of fresh capital as authorised by the Act of 1913 was also defeated, and the Chairman accordingly demanded a poll on this.

The meeting stood adjourned to enable the polls to be carried.

The poll resulted in the defeat of the "no confidence" in the Chairman and the Hon. F. McLaren resolution by 274,504 votes to 38,174. The motions for the re-election of Sir C. Hyde and for the motion to create new capital were carried by similar figures.

Metropolitan District Railway Co.

The report of the directors shows that for the year ended December, 1913, the gross receipts of the railway were £789,662, and the expenditure was £383,132, leaving £406,530 plus miscellaneous receipts £116,542, making the total net income £523,072, plus £8,529 brought forward. There were to be deducted interest, rentals and other fixed charges £337,262, appropriation to reserve £20,000, and dividends on 4 per cent. guaranteed stock and 4½ per cent. first preference stock £124,930, leaving a balance available for dividend on the second preference stock of £49,409. The interim dividend at the rate of £2 10s. per cent. per annum which was paid on the second preference stock for the first half of the year ended 31st December, 1913, absorbed £18,375, leaving £31,034, which will admit of the payment of a dividend at the rate of £2 10s. per cent per annum for the second half of the year ended 31st December, 1913, thus making a dividend of £2 10s. per cent. for the year, carrying forward £12,659 after setting aside £20,000 for reserve. The dividends paid on the second preference stock for the year 1912 were at the rate of £2 per cent. per annum with a balance of £8,529 carried forward, after setting aside £20,000 for reserve. The capital expenditure during the year amounted to £100,621. The electrification of the East London Railway has been completed and electric trains commenced running thereon on the 31st March, 1913. The work of constructing flying junctions at Earls Court has been completed, and the new line brought into use. The works in progress at Charing Cross Station which are being carried out in conjunction with the London Electric Railway Co. will be shortly completed. A satisfactory means of interchange will be established at this point between the Metropolitan District Railway and the Bakerloo and Hampstead lines of the London Electric Railway Co., and the station thus reconstructed must become a large exchange centre for passenger traffic between the three above-mentioned railways. The following Bills were submitted for consideration at a special general meeting held immediately after the ordinary meeting yesterday :—

"A Bill to empower the Central London Railway Co. to enlarge a portion of their railway tunnels, to construct new subways and works; and for other purposes."

"A Bill to empower the London Electric Railway Co. to construct new subways, and for other purposes."

"A Bill to confer additional powers upon the Midland Railway Co. and the Cheshire Lines Committee for the construction of works and upon that Company and Committee and the Midland and Great Northern Railways Joint Committee for the acquisition of lands, and for other purposes."

The company have sold, during the past year, £14,586 of prior lien debenture stock, the proceeds of which have been applied for the general capital purposes of the company. The directors have elected Capt. Wilfrid C. Dumble to fill a vacancy on the board.

St. James' and Pall Mall Electric Light Co., Ltd.

Mr. Walter Leaf presided on Tuesday at the offices, Carnaby Street, over the annual meeting.

In moving the adoption of the report (See Elec. Rev. p. 283) the Chairman first referred to the serious illness which Mr. Walker, the managing director, had passed through, and congratulated him and the Co. on the fact that he was now, they believed, permanently re-established in health. The steady and normal increase in their sales had produced a total revenue of £146,000, as against £138,000 last year; an increase of £8,000. For this purpose they had purchased and generated about 800,000 units more than last year, at an additional cost of about £6,000, giving them apparently an additional profit from all sources of something over £2,000. These were, however, only part of the facts. They had to consider not only the figures of their own Co., but those of the Central Electric Supply Co., in which they were the partners with the Westminster Co. They were becoming each year more dependent on the bulk supply which was furnished by the Central Co., and this year their purchases of current amounted to £52,233, as against only £41,483 in 1912. The Grove Road works, as they knew, were admirably suited for the generation of electricity. They had adopted the most modern descriptions of turbine and boiler plant, and extensions were continually made to meet the requirements of the two purchasing companies. At present the directors had in hand large additions to the main generating plant, involving a capital expenditure of about £60,000, and from the experience which they had acquired, they were confident that this expenditure would be justified by a further reduction of the low working costs which had placed this fine power station in the forefront of such undertakings. As they were aware, their concessions expired in 1931, and as that date drew in sight, the question of raising additional capital repayable at the end of the term became a serious problem. If they were to go to the public to seek to raise fresh capital by a new debenture issue, the necessary sinking fund needed to repay the whole in less than seventeen years would form a serious burden on the undertaking, and one which would rapidly grow more onerous every year. It was therefore of the first importance that they should finance themselves during the remainder of their term out of their own resources. For this purpose the joint engineers had drawn up a careful and detailed estimate of the capital requirements of the Co. for the next ten years. That was as far as, at the moment, they need look forward. After full consideration, the board had adopted a scheme, due to the ability of the joint managers, by which the Central Co. could finance itself for this period by adding yearly a sum of something over £4,000 to the depreciation fund invested in the business. Their practice in the Central Co., by agreement with the supplying companies, had been to set aside annually a sum, increasing from year to year, and in 1912 amounting to £13,500, of which two-thirds had been invested in the names of the trustees of the Co. jointly, to form a sinking fund for the redemption of the debentures, while the other one-third had been invested in the business. After setting aside this sum and paying each of the companies a dividend of 5 per cent. on their holdings, the price of the current charged had been fixed at the lowest figure per unit which would balance the revenue account. Thus the additional sum which the Board had decided to set aside for the depreciation account was provided by an increase in the price per unit charged to the purchasing companies, and if they referred to the accounts of the Central Co., they would find that instead of £13,500 as in 1912, they had in 1913 charged £18,574 to the depreciation account, of which £10,000 had been placed to the sinking fund, and the balance of £8,571, or £1,000 more than last year, had been invested in the business as depreciation fund. By maintaining that allocation they would not only make provision for all new capital expenditure so far as they could forsee it, but still offer additional security both to the debenture holders and the shareholders for the due repayment of capital in 1931. And this additional security had been obtained by charging these companies about £2,000 more for current than they would otherwise have had to pay. In other words, about £2,000 of their profits had been put away to reserve in the Central Co. He was anxious to make that point quite clear before he said anything about the dividend. Taking the accounts of the St. James' Co. by themselves, it would appear that they were proposing to increase the dividend on the ordinary shares by £4,000, when they had really only made £2,000 more profit, and that they had provided the additional £2,000 by reducing the sum passed to credit of the contingency fund. He hoped he had made it clear that this was not so, and that they had in fact, after providing practically the same amount as in 1912 for their own depreciation, a little over £16,000, again set aside £4,500 as in past years for contingencies, only instead of adding the whole to their own contingency fund, they had taken £2,000 for a similar purpose in the Central Co., and of course the Westminster Co. had done the same. It was not for him to prophesy as to the maintenance of the dividend of 12 per cent which they now proposed. He could only tell them that they were placing to reserve, in one form or another, a sum which after consultation with the auditors, they held to be such as prudent men should set aside having regard to the experience they had had in the past, and the most careful estimate they could make of the future. They might, of course, be affected again by some such difficulty as that caused by the advent of the metallic filament lamp, but they did not at the moment see the quarter from which such an event was likely to come upon them. They were still engaged, and doubtless would always be engaged, on scrapping plant which had grown out of date. One such considerable undertaking, of which they had told them in past years, had now been nearly carried through, and had been financed out of the provision they had made for it from revenue. Others would follow on it, and they proposed to provide for them in the same way. And before they asked the shareholders to vote for the increase, he would like to say he was sure they had made as ample provision for all contingencies as any electric supply company in London. Few, if he might say so without invidious comparison, had done nearly so much. He must refer to another matter which many of them had doubtless seen in the Press and upon which they might wish him to say a few words. A bill had been promoted in the name of the County of London Co. called the "London Electric Supply Bill," with the object, apparently, of attempting to secure a revision of the existing conditions and an extension of tenure for the whole of the London electric supply companies. They had no part in the inception or drafting of that bill, and heard of it first only through the public advertisement. They were therefore free to express their views impartially. They would, of course, be glad to have an extension of their life beyond the forty-two years given in their order, but it was essential that they should have a voice in the terms on which that extension was to be obtained. Of those the bill itself contained no hint. And when they found that it proposed to override the Act of 1908, which by regulating their position towards the County Council, gave them rights which they deemed to be of the utmost importance to them, and they could not accept it in a blank. They must at least be in a position to discuss on an equal footing the terms, possibly very onerous, on which the County Council might be willing to grant an extension of their Order, and they had therefore in the interests of the Co. joined with other companies in presenting a petition against the Bill. They had doubtless heard that they had been approached by a financial group which desired to effect, under the form of a large holding Co., an amalgamation of all the electric supply companies of London. Of that scheme he could not say much at the moment; it was still under consideration by a conference, and he had no right to anticipate their decision. He could only say that they were not as yet satisfied that the scheme would effect the economies and secure the profits which it promised, and they were awaiting further information. But with regard to their own Co. in particular, he must add that the proposal in its present form was unacceptable as it failed to recognise the exceptionally strong position which that Co. had, with a few others, attained by prudent and conservative management in the past. He must ask them to rely on the board to protect their interests in that respect. As soon as any scheme was presented to them which was satisfactory on that as on other points, they would lose no time in calling the shareholders together and laying it before them. In the meantime he would ask them not to pay too much attention to irresponsible statements appearing in the Press from possibly interested sources, but to continue to the board the confidence on which it had always been their privilege to reckon in the past.

Mr. Pryor seconded the motion, and it was carried without discussion.

Notting Hill Electric Lighting Co., Ltd.

The directors in their report state that during the year ended December 31st, 1913, the expenditure on capital account at the date of the last balance-sheet stood at £219,608. It now stands at £247,992. During the past year £3,916 has been realised by the sale of surplus lands. The expenditure on capital account exceeds the receipts by £38,640. The cost of the joint station at Wood Lane to date has amounted to £221,163, and joint debenture stock amounting to £231,500 has been issued. The redemption of this stock is secured by cumulative sinking funds, which now amount to £59,079 invested in trustee securities. The following table shows the progress of the company :—

			Profit.
1910	Equivalent of 8-c.p. lamps connected.	189,885	£22,002
1911	" "	199,156	23,557
1912	" "	211,838	24,136
1913	" "	222 360	24,165

The number of consumers is now 4,027, and with the exception of 27, they are supplied at 200 volts. The gross revenue for the year was £46,118, showing an increase of £1,338. From the available net profit of £25,562 have to be deducted the following sums :—Depreciation, renewal and reserve fund, £3,000 ; debenture interest, £2,411 ; Kensington and Notting Hill joint debenture stock—debenture interest, £2,581 ; sinking funds, £1,586 ; interest on loans, £376 ; amount to be distributed to staff under co-partnership scheme, £265 ; leaving a balance available for dividend of £15,343. Both classes of 6 per cent. preference shares have already received their full dividend, which absorbs £8,136, and leaves a balance of £7,207 available for dividend on the ordinary shares. The directors therefore recommend the payment of a dividend of 5s. per share, less tax, on the ordinary shares, absorbing £6,368, carrying forward £839. The scheme of co-partnership with the company's staff. brought into operation during 1912, is working satisfactorily, Under this scheme there will be distributed among the staff an addition to their wages of 8 per cent. The directors regret to have to report that Mr. Geo. Schultz, who has been the engineer and manager to the company since its formation, has been compelled to withdraw from active work for reasons of health. In view of his long service and intimate knowledge of the undertaking, the directors have appointed him consulting engineer to the board. Mr. R. G. Rawkins, who has held the position of secretary since the opening of the works, has been entrusted with the duties of manager, and Mr. A. P. McDouall, who has been for some years assistant engineer under Mr. Schultz, has been appointed chief engineer.

The meeting will be held on February 25th, at Winchester House, E.C.

Units generated and purchased..	3,469,624
Units sold—Public lamps..	102,523
Private consumers by meter	2,478,707
Total sold	2,581,230
Units used on works	15,843
Total units accounted for..	2,597,073
Units expended in distribution	872,551
Number of public lamps	53
Total max. supply demanded in KW.	1,740

Cambridge Electric Supply Co., Ltd.—The directors' report shows during the year ended December, 1913, there were connected 235 additional consumers, and the number of units supplied was 930,554, an increase of 119,851 units. The profit was £11,302, plus £984 brought forward. After deducting debenture and other interest £1,832, placing £4,000 to depreciation fund account, there remains a balance of £6,454. An interim dividend of 2½ per cent., absorbing £2,170, has already been paid, and the directors recommend the payment of a further dividend of 3½ per cent., making 6 per cent. for the year. This will absorb £3,084, leaving £1,200 to carry forward. Of the 577 shares which were offered to the shareholders, 369 were taken up at a premium of £2 per share, which premium will be transferred at a later date to the depreciation fund account or to reserve, as may be thought best. There remain a further 208 shares which are again offered to the shareholders at the same premium. Mr. J. B. Simpson has decided not to seek re-election as a director. He has been a director of the company since its formation, and his services have been of very great value. The meeting takes place at Cambridge on February 25th.

City of London Electric Lighting Co., Ltd.—Subject to the completion of the audit, the directors are placing £50,000 to reserve and recommending the following dividends :—Preference shares, 12s. per share (6 per cent. per annum). Ordinary shares, 20s. per share, being at the rate of 10 per cent. per annum. On account of these dividends 6s. per preference share and 6s. per ordinary share was paid in September, 1913. After transferring the balance of the dividend equalisation fund to profit and loss and providing for other appropriations, there remains about £27,000 to be carried forward. For 1912 the ordinary dividend was 9 per cent.

W. T. Henley's Telegraph Works Co., Ltd.—Subject to audit, the directors have decided to recommend a dividend on the ordinary shares of 15 per cent., free of income-tax, including the interim dividend of 5 per cent. paid August 31st last, and also, consequent on the success of the company's "Why Not" golf balls, a bonus of 5s. per share on the ordinary shares, free of income-tax. The transfer books will be closed from February 28th to March 5th, both days inclusive. For 1912 the total distribution on the ordinary shares was 15 per cent.

Northampton Electric Light and Power Co., Lt—For the year 1913 the directors state that they are again able report a steady expansion of the company's operations. Lam and motors have been added: [illegible] watt lamps, [illegible] making total equal to 13[illegible] lamps. The increase in H.P. of motors 316, making a total of [illegible] H.P. The mains added were yards, making a total of 30 miles 1,1[illegible] yards. In addition to th new feeder ducts have been laid in various directions the increa amounting to 1,301 yards. The output of electricity has bee 3,468,981 units, compared with 3,0[illegible] in the previous year. Th maximum load on plant was 2,111 kw. Substantial additions the buildings and generating plant have been made. In view o future requirements it has been found advisable to acquire furth property in Angel Lane and Fetter Lane. The general depreciatio account has been increased by £5,200, out of which certain speci items have been written down; also £[illegible] has been written o motors, and £1,500 added to reserve. The sum of £[illegible] will required for the dividend on the 5 per cent. preference shares, an the directors propose that 7 per cent. per annum should be paid o the ordinary shares for the half-year (making 6 per cent. for th year) £2,450, leaving £2,408 to be carried forward. It is no necessary to increase the capital of the company, and, to this en a resolution will be submitted to the shareholders

The meeting takes place at Northampton on February 26th.

Electrical Distribution of Yorkshire, Ltd.—Th directors report that the net profit for the three years endir December 31st is as follows :—1911, £1,347 ; 1912, £1,903 ; 191 £2,569. The balance brought forward from 1912, after paymen of directors' remuneration, was £485, and adding the profit fo 1913, there is a disposable balance of £3,054. The directo recommend that this balance should be dealt with as follows :— dividend for 1913 at the rate of 6 per cent. per annum on th ordinary shares, £1,418, adding to the reserve fund £1,000, ar carrying forward, subject to any remuneration voted to th directors, £636. During the year the company has acquired b transfer the electric lighting provisional orders promoted by th Urban District Councils of Birstall and Greetland. The numbe of consumers of the company's supply is steadily increasing. A the date of the last report to the shareholders 4,865 shares of £ each had not been applied for. These shares have now bee allotted and fully paid. At extraordinary meetings of shareholde held on February 25th and March 18th, 1913, a resolution wa passed and confirmed increasing the nominal capital of the con pany from £25,000 to £50,000. In order to develop the unde takings of the company further capital will shortly be require The issue will be offered to the shareholders in proportion to the holdings. The meeting takes place at Leeds on February 24th.

Crossley Bros., Ltd.—The directors' report for th year ended December 31st, 1913, shows that the amount to th credit of revenue account is £78,670, out of which a dividend ha been paid on the preference shares at the rate of 5 per cent. pe annum for the first half of the year, amounting to £10,085. It proposed to pay a further dividend for the second half of the yea at the rate of 5 per cent. per annum on the preference share amounting to £10,085, to place £20,000 to the reserve fund, and t carry forward the balance of £38,501 to next account. Mr. Joh Dempster, having left Manchester, has resigned his seat on th board. The meeting will be held at Manchester, February 25th.

STOCKS AND SHARES.

Tuesday Evening.

The halt in the pace of the rise, to which attention was draw here last week, has lengthened into a pause. A few days ago, day to-day money showed signs of getting a little stiffer, which had damping effect upon gilt-edged securities, and through them upo Home Railway and many other investment stocks. Political event at home and abroad combined with other matters, the majorit being of small consequence, to emphasise the sagging of prices tha started when it became obvious that the public had ceased to bu in large amounts. The House all round was infected with th spirit of dulness, and the next developments are awaited wit some vivid interest. Markets took a turn for the better on Tuesda afternoon.

The Electric Lighting companies give an excellent account o themselves in their dividend declarations in respect of the pas half-year. Several have raised their dividends, the St. James' City of London, Charing Cross, and Kensington being amongs them, while two or three are expected to follow in the same direction. Charing Cross shares responded to the announcement, bu the rest of the market is quiet, tending a little to the dull side, muc of the recent steam having evaporated from its energy. If the Stoc Exchange as a whole were to wake up into renewed strength electric lighting shares would, doubtless, participate in the movement ; but until such a lead is afforded, it may be surmised with safety that this department will not strike out a line of its own.

City Lights are ¼ easier at 18½, those who bought in advance o the dividend increase not having been supplemented by furthe purchasers. At 18½ *cum* 14s. dividend, the yield on the shares i £5 12s. 6d. per cent. Speculation interests itself in the probabilities of the County of London's Bill being passed in the curren session of Parliament, although it is thought that the matter will not come up for debate until later on. Metropolitan and Urban Preference are firmer, while London Electric and County Preference lost ½. Debenture stocks are still exceedingly scarce, with the demand for them as keen as ever. The public are taking little interest in the market generally, and those who have been responsible for the recent advances are resting upon their oars, feeling that the lack of business in stocks and shares supplies a reason for the comparative lassitude of prices.

In the Electric Railway section there rests a fair amount of firmness. Metropolitans and Districts are ¼ to ½ lower unchanged. District 4 per cent. Debenture stock is 1 higher, and Central London 4½ per cent. Preference rose 3 to 104. Underground Electric Railway shares eased off to 8s. 9d., and the 6 per cent. Income bonds hardened upon the company's financial statement, given here last week; later, there was a slight reaction. The Home Railway market is none too pleased with Lord Claud Hamilton's statement that his company—the Great Eastern—had to go to the United States in order to get the general manager most suitable for the line; and the view prevails that such a step, with its public proclamation at the company's meeting, is a blow to ambition and initiative on the part of the British Railway staffs, especially those employed in the most responsible kind of work. East Londons gained a little, the old rumour being circulated that the Port of London Authority wanted to buy the line. The Midland Railway, by the way, is asking for powers to extend for a couple of years the time fixed by Parliament for the commencement of the electrification work on its Southend Railway.

Lancashire United Debenture rose 2 points, and Hastings Debenture is also higher. London United Tramways Debenture eased off to 65, but Metropolitan Electric Tramways Debenture stocks have both improved, after their previous good rises. North Metropolitan 6 per cent. Preference stock has been rising, on steady demand from investors and the price is now quoted at 109½ middle. The Electric and General Investment Company has been offering £100,000 Guaranteed 4½ per cent. Debenture stock, at 92, of the Tramways (M E.T.) Omnibus Company, Limited.

Mexican bonds and stocks are mainly lower. Recent news from the country has been largely composed of items telling of small attacks upon railway and other joint stock property—none of them particularly serious, but interpreted as an indication of the temper towards the foreign undertakings on the part of the revolutionaries. In consequences of this, Mexican Light and Power Common followed up its last week's drop of 7 points with a small further decline. Mexican Electric Light bonds are 1 down, Mexico trams have given way more sharply, and Monterey Debenture reverted to 58½. It takes so little business, either of buying or selling, to move these Mexican quotations considerably that, as we have pointed out before, too much importance should not be laid upon movements that in other securities would be regarded as substantial.

The Canadians are generally firm. Shawinigan Capital stock hardened to 146, British Columbia Electric Railway stocks are better, and Canadian Generals hold their prices; while, of the bonds Shawinigan Firsts are 1½ higher. Victoria Falls Preference went back to 15s. 7½d. upon the underwriters getting left with the greater part of the new issue of Second Debenture stock recently made by the company; the price has declined to 4 discount.

The Anglo-Argentine Tramways new Debenture stock keeps at ¼ premium for delivery at the end of the month. Evidently there are stags about who have not yet disposed of their allotments: and as the rush for new issues has given place to a much more sober demand, scrip stocks are less popular. The 4 per cent. Debenture stock is a little lower at 93½, City of Buenos Ayres Trams reacted to 5½, and Para Electric Railways shares have lost another ⅛.

The Telegraph market is steady. Great Northerns rose to 33½, and in the Eastern group Eastern Extension Ordinary is better, though "Chinas" lost ⅛. Commercial Cable Debenture stock rose to 82½. Anglo-American Telegraphs are irregular, the Preferred stock being unchanged, while the Deferred fell ½ to 24⅝. Submarine Cables Trust certificates have been wanted, New York supplying buyers. West India and Panama shares reacted to $2\frac{11}{16}$, as speculative markets in other parts gave way. There has been a little selling of Marconi shares. The impression is that if the miserable affair has to be gone over again, in the House of Lords, with Lord Murray as the principal character, its effect will be to stifle interest in the shares, from the Stock Exchange point of view, although it may titillate the appetite of those who are not already tired of the unsavoury business. The rest of the group is affected by the dulness in the parent shares.

The Manufacturing division shows a fair number of rises. Telegraph Constructions improved to 40 upon the declaration of the usual dividend and bonus, making 20 per cent. for the year. Henleys jumped up 7s. 6d. to 14½, thanks to the declaration of a bonus of 5s. per share in addition to the usual 15 per cent. dividend, the former due to the success of the company's golf ball "Why Not." Those who play with it may be tempted to apply the same question to the consideration that, as the price of rubber has fallen so much, that of golf balls might be lowered in proportion. One can well understand, however, the non-golfing shareholder of Henley's feeling extremely satisfied at the success which the company has achieved in the "Why Not" direction. Callenders are better at 11⅜, and there are small improvements in Babcock and Wilcox, Castner-Kellner, and Edison £2 paid shares. British Aluminium Debenture stocks are strong, the Seconds jumping to 92½, three points higher than they were a week ago. Rubber shares are an erratic market, for, after being exceedingly buoyant at the end of last week, they fell upon reaction directly afterwards, although the decline was marked by steady buying of most of the investment shares as the prices gave way here and there.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, February 18th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	8d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£22 10	..
a Lead, Nitrate	„	£30 10	..
a „ White Sugar	„	£28	..
a „ Peroxide	„	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	8½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	82/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£6	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	8⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	8d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£86	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£112	..
b „ Sheet, in ton lots ..	„	£112	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c „ Tube (brazed)	„	9⅝d.	..
c „ „ (solid drawn) ..	„	8¼d.	..
c „ Wire, basis	„	7⅝d.	..
c Copper Tubes (brazed)	„	10¼d.	..
c „ „ (solid drawn) ..	„	10½d.	..
g „ Bars (best selected) ..	per ton	£83	..
g „ Sheet	„	£83	..
g „ Rod	„	£83	..
d „ (Electrolytic) Bars ..	„	£68 10	..
d „ „ Sheets ..	„	£86 10	..
d „ „ Rods ..	„	£74	..
d „ „ H.C. Wire	per lb.	8¾d.	..
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/-	..
h India-rubber, Para fine	„	3/1	½d. dec.
l Iron Pig (Cleveland warrants) ..	per ton	51/9	4d. inc.
„ Wire, galv. No. 8, P.O. qual.	„	£14	
g Lead, English Pig	„	£19 17 6	12s. 6d. dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small ..	per lb.	6d. to 3s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10⅝d.	..
r Steel, Magnet, in bars	per ton	£65	..
g Tin, Block (English)	„	£179 10 to £180 10	£8 10 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Manila Electric Railroad and Lighting Corporation.—According to the financial Press, the directors have resolved to create a British Advisory Board, consisting of three members, and Sir William Garstin, Mr. Leonard Govett, together with Mr. A. N. Connett, have been appointed to serve in this capacity. It is stated that the appointment of an English Board should enable the large number of English investors associated with the undertaking to secure through their newly appointed representatives a greater participation in the councils of the undertaking than they have hitherto enjoyed.

North Metropolitan Electric Power Supply Co.—A meeting is called for March 2nd to authorise the company to raise £100,000, a further portion of the additional capital authorised by the Act of 1909.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 17th.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 6 % Pref.	1	5	6	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	16½ — 18½	+ ½	..
Do. Do. Deferred	100	..	..	7½ — 9½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	90 — 93	..	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	3	..	57 — 60	..	5 0 0
Do. 5 % Perp. Deb.	100	5	5	93 — 96	..	5 4 0
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 83	..	5 8 5
Central London Railway, Ord.	100	3	3	59 — 64	..	4 13 9
Do. Gtd. Assented	100	..	4	83 — 85	..	4 14 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 2
Do. 4 % Deb.	100	4	4	97 — 99	.	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	97 — 99	—1	5 1 0
Do. Do. 1896	100	5	5	97 — 99	..	5 1 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	93 — 95	..	5 5 0
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	67 — 72	+1	6 5 0
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2¼	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 8
Lancashire United, 5 % Deb.	100	5	5	83 — 85	+2	5 17 8
London and Suburban, Ord.	1	..	..	¼ — 5/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅜ — ¾	..	6 13 4
Do. Do. 4½ % 1st Deb.	100	4½	4½	80 — 85	..	5 6 0
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	64 — 67	— 1½	6 1 5
Metropolitan Railway Consol.	100	1⅝	1⅝‡	41½ — 42½	— ½	3 11 10
Do. Surplus Lands	100	2¾	2¾‡	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Pref.	100	3½	3½	84 — 86	..	4 3 1
Do. 3½ % Con. Pref.	100	3½	3½	82 — 84	..	4 4 4
Metropolitan District Ord.	100	Nil	..	32½ — 32¾	— ½	Nil
Do. 6 % Deb.	100	6	6	138 — 141	..	4 6 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	+1	4 6 10
Do. 4½ % First Pref.	100	4½	4½	89 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	92 — 95	+ 2	4 14 9
Do. 5 % Deb.	100	5	5	90 — 93	+1	5 7 6
Potteries, Ord.	1	3½	..	⅜ — ½	..	..
Do. 5 % Pref.	1	5	5	½ — ⅔ xd	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	3½ — 3¾	..	Nil
Do. "A"	1/-	..	..	15/32 — 17/32	— 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	116 — 118	..	5 1 7
Do. 4½ % Bonds	100	4½	4½	100 — 102	..	4 8 0
Do. 6 % Income	100	6	6	95 — 96	..	6 5 0
Yorkshire (West Riding), Ord.	5	Nil	..	5/16 — 9/16	..	Nil
Do. 6 % Pref.	5	3	4	3¾ — 4¼	..	4 14 3
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅞ — 5⅛	..	5 7 5
Do. 2nd Pref.	5	5½	5½	4⅜ — 4⅝	..	5 19 0
Do. 4 % Deb.	100	4	4	92½ — 94½	— ½	4 4 8
Do. 4½ % Deb.	100	4½	4½	96½ — 99½	..	4 11 5
Do 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	103 — 106	..	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 — 100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	91 — 93	— ½	6 9 0
Brisbane Trams Invt., Ord.	5	8	8	7⅝ — 8⅛	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	.	4 13 0
Do. 4½ % Deb.	100	4½	4½	99 — 102	+2	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8†	121 — 125	+1	6 8 4
Do. Pref. Ord.	100	6	6	107 — 111	..	5 8 1
Do. 5 % Pref.	100	5	5	103½ — 106½	+1	4 13 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4¼	4¼	95 — 98	..	4 6 9
Calcutta Trams, Ord.	5	7½	5†	6 — 6½	..	5 15 5
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5†	5	5⅜ — 5⅝	— 1/16	4 9 0
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4⅜d.	6	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1⅛ — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	5 — 5⅜	+ ⅛	5 11 7
" Elec. Tr. (1904), Deb.	100	5	5	101 — 103	..	4 17 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 — 100 xd	+1	5 0 0
Mexico Trams Com	$100	7	7	70 — 74	—3½	..
Do. Gen. Con. 5 % Bonds	..	5	5	78 — 83	—4	6 0 6
Do. 6 % Bonds	100	6	6	83 — 87	..	6 18 0
Para Elec. Rlys. & Lt., Ord.	5	10	10†	4⅞ — 5⅜	— ⅛	9 6 0
Do. 6 % Pref.	5	6	6	4½ — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	93 — 95	— ½	5 5 3
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101 — 103	..	4 17 0
Do. 5 % Mort. Bonds	100	5	5	94 — 96	— ½	5 4 2
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	100 — 103	..	4 17 0
Singapore Trams, 5 % Deb.	100	5	5	87 — 91	..	5 10 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	97 — 99	—1	5 1 0
Un. Elec. Trams Monte Video	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5½	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	94 — 97	..	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	5†	9 — 10	..	6 0 0
Do. 4½ % Pref.	10	4½	4½	8¼ — 9½	— ⅛	4 14 9
Do. Second 6 % Pref.	10	6	6	9¾ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord.	5	10	9†	9⅛ — 9⅝	..	5 4 0
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 9⅛	..	3 16 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	6†	4¾ — 5¼	+ ½	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅞ xd	+ ⅛	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94	+1½	4 5 1
Chelsea, Ord.	5	5	4†	4⅞ — 5⅜	— ⅛	4 13 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10†	18 — 19	— ¼	5 5 3
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	99 — 102	..	4 8 1
County of London, Ord.	10	6	5†	12⅝ — 13⅛	..	4 11 5
Do. 6 % Pref.	10	6	6	11¾ — 12¼	— ⅛	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	101½ — 103½	..	4 7 0
Do. 4½ % Second Deb.	Stock	4½	4½	99 — 102	..	4 8 1
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4⅛	..	7 5 5
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	91 — 93	+1	4 16 9
Hove	5	8	8†	8¾ — 9¼	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	9†	7¾ — 8¼	..	5 9 1
Do 4 % Deb.	Stock	4	4	89 — 91	..	4 8 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	..	1⅜ — 1¾	..	4 5 0
Do. 6 % Pref.	5	6	6	5 — 5⅜	— ⅛	5 11 7
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4	4†	3⅝ — 4⅛	..	4 17 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	+ ¼	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort Deb.	Stock	3½	3½	82 — 85	..	4 2 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford	5	7	6†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord.	5	10	12†	9⅝ — 10⅛	..	5 18 5
Do. 7 % Pref	5	7	7	6⅝ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5½	..	3¼ — 3½	..	6 1 9
Do. 5 % First Mort. Deb.	100	5	5	98 — 101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/32 — 1 7/32	..	5 14 9
Do. 4½ % First Deb. Stock	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	⅜ — ⅝	..	
Do. 5 % Cum Pref.	5	3‡	..	2⅝ — 3⅛	— ⅛	4 18 0
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 3
Westminster, Ord.	5	10	10	9 — 9½	..	5 5 3
Do. 4½ % Cum Pref.	5	4½	4½	5 1/16 — 5 3/16	..	4 4 8

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 8s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 17th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Adelaide, 6 % Pref.	5	6	6†	5¼ — 5½	..	5 11 7
Calcutta, Ord.	5	8½	5†	7⅞ — 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5$\frac{1}{16}$ — 5$\frac{5}{16}$	..	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	89 — 91	— ½	5 10 0
Canadian Gen. El. Com.	$100	7	8	118 — 117	..	6 16 7
Do. 7 % Pref.	$100	7	7	123 — 128	+1	5 9 5
Cordoba Lt., Power and T., Ord.	1	5	..	$\frac{7}{16}$ — ⅝	..	7 13 0
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87½ — 89½	..	6 14 1
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	96 — 98	..	5 2 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	$\frac{1}{32}$ — $\frac{3}{32}$	..	Nil
Do. 6 % Pref.	1	6	6†	⅜ — ½	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 — 104	..	4 16 2
Madras, Ord.	5	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	108 — 103	+2	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	64 — 69	—1	7 5 0
Mexican Lt. & Power, Common	$100	4	4†	43 — 46	—1	..
Do. 7 % Cum. Pref.	$100	7	7	83 — 87	..	8 1 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	79 — 83	..	6 0 6
Do. 5 % 2nd Mort. Bonds	100	5	5	64 — 68	..	7 7 1
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	56 — 61	—3	..
Montreal, Lt., H. and Power	$100	9	10†	228 — 233	..	4 5 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	[illegible]	..	207 — 217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	103 — 108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 — 103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	102 — 104	..	4 6 7
Shawinigan Water, Capital	$100	6½	6†	144 — 148	+1	4 1 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 — 108	+1½	4 12 7
Do. 4½ % Per. Deb.	Stock	4½	4½	98 — 101	..	4 9 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Victoria Falls Power, Pref.	1	6	6	¾ — $\frac{13}{16}$	—$\frac{1}{32}$	7 7 8
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 8

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 17th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	$\frac{11}{16}$ — $\frac{13}{16}$	..	8 12 4
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	6 17 2
Babcock & Wilcox	1	16	14†	3⅛ — 3¼	+ $\frac{1}{16}$	5 18 6
Do. Pref.	1	6	6	1$\frac{5}{16}$ — 1$\frac{7}{16}$	..	4 8 6
British Aluminium, Ord.	1	..	..	1$\frac{1}{16}$ — 1$\frac{3}{16}$	..	..
Do. 6 % Cum. Pref.	1	6	6	$\frac{27}{32}$ — $\frac{15}{16}$	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	96 — 99	+1	5 1 0
Do. Deb. Stk.	100	5	5	90 — 95	+4	5 5 3
B.I. & Helsby Cables	5	10	8†	8⅞ — 9⅜	..	5 6 8
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	102 — 105	..	4 5 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	2	Nil	..	1$\frac{5}{16}$ — 1$\frac{7}{16}$	..	Nil
Do. Deb.	100	4	4	68 — 71	..	5 12 8
Do. 6 % Prior Lien	100	6	6	102 — 105	..	5 14 6
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	8/- — 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	39 — 43	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	11¾ — 12¼	+ ½	6 2 4
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 9
Do. Deb.	100	4½	4½	97 — 100	..	4 10 0
Castner-Kellner	1	20	22½	2¾ — 2⅞	+ $\frac{1}{16}$	..
Do. Deb.	100	4½	4½	103 — 106	..	4 5 1
Crompton & Co., Deb.	100	5	5	83 — 85	+1	5 17 8
Dick, Kerr	1	Nil	..	$\frac{5}{16}$ — $\frac{9}{16}$	..	..
Do. Pref.	1	6	6	$\frac{23}{32}$ — $\frac{27}{32}$	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	⅛ — ¼	+ $\frac{1}{32}$	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	$\frac{9}{16}$ — $\frac{11}{16}$	..	7 5 6
Do. Pref.	1	7	7	$\frac{15}{16}$ — 1$\frac{1}{16}$	..	6 11 7
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10⅛ — 10½	..	5 14 8
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	20†	14 — 15	+ ⅞	6 13 4
Do. Pref.	5	4½	4½	4⅞ — 5⅛	+ $\frac{1}{16}$	4 7 10
Do. Deb.	100	4½	4½	101 — 103	+1	4 7 5
India-Rubber, G. & T.	10	7½	7½	11 — 12	..	6 5 0
Do. Pref.	10	5	5	9 — 9¾	..	5 2 7
Telegraph Construction	12	20	20	39 — 41	+1	5 17 0
Do. Deb.	100	4	4	98 — 100	+1	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref.	100	..	..	51 — 56	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 17th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	6½ — 6¾	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 — 126	—1	6 7 0
Do. Collat. Trust	$1000	4	4	92 — 95	+1	4 4 8
Anglo-American Telegraph	Stock	3	3	65 — 68	..	4 8 3
Do. 6 % Pref.	Do.	6	6	108½ — 109½	..	5 9 4
Do. Def.	Do.	80/-	..	24⅜ — 24⅞	— ½	6 0 7
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	103 — 105	..	4 15 2
Chili Telephone	5	8	..	7⅜ — 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	81½ — 83½	+ ½	4 16 0
Cuba Telegraph	10	6	6†	8¾ — 9¾	..	6 3 1
Do. 10 % Pref.	10	10	10	15¾ — 16¾	..	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	..	7½ — 8	..	6 5 0
Direct United States Cable	10	4	4†	6⅞ — 7⅜	..	5 8 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	134 — 137	+1	5 3 0
Do. 3½ % Pref. Stock	Do.	3½	3½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	..	4 2 4
Eastern Extension	10	7	7	12⅜ — 12⅞	— ⅛	5 8 9
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust	10	6	6†	11⅝ — 11⅞	+ ⅛	5 1 1
Do. 6 % Pref.	10	6	6	12½ — 13	..	4 12 4
Great Northern Telegraph	10	20	5†	32½ — 34½	+1	5 16 0
Indo-European Telegraph	25	13	5†	58 — 60	..	5 8 4
Mackay Companies Common	$100	5	5	83 — 87	..	5 15 0
Do. 4 % Cum. Pref.	$100	4	4	67 — 71	..	5 12 3
Marconi's Wireless Telegraph	1	20	20	3¾ — 3⅞	—$\frac{1}{16}$	5 3 1
Do. 7 % Cum. Partic. Pref.	1	17	..	3⅛ — 3⅜	..	5 0 9
Monte Video Telephone, Ord.	1	6	6	$\frac{13}{16}$ — $\frac{15}{16}$	..	6 8 0
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 14 8
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 — 101	..	4 9 0
Oriental Telep. and Elec.	1	10	10†	1⅞ — 2⅛	..	4 14 0
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	+ ½	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	4 0 0
Reuter's	10	10	10†	9 — 10	..	10 0 0
Submarine Cables Trust	Cert.	6	6	126 — 129	+2	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½ — 98½	+ ½	4 11 5
United River Plate Telephone	5	8	6†	6⅜ — 6⅞	— ½	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 9 0
West Coast of America	2½	2½	..	1$\frac{3}{16}$ — 1$\frac{7}{16}$	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	1¼	2$\frac{3}{16}$ — 2$\frac{5}{16}$	—$\frac{1}{16}$	4 8 6
Do. 6 % Cum. 1st Pref.	10	6	6	9¾ — 10¼	..	5 17 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	10	7†	7	13⅛ — 13⅝	..	5 2 8
Do. 4 % Debs.	Stock	4	4	95 — 97	..	4 2 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 — 98	..	4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

The Metric System.—The Decimal Association has sent us a copy of its report for the year 1913, together with a price list of its publications, and a verbatim report of an address by Mr. Alexander Siemens to the Bradford Textile Society on November 17th last year. The report for the year refers to the adoption of the metric carat by Order in Council, the steps taken to forward the movement in Australia and India, the adoption of the metric system by Siam and in Tripoli, the favourable attitude of the Japanese Government, and the inquiry in progress by order of the Chinese Government into the question of introducing the system into China. Captain H. Riall Sankey and Mr. Hugo Hirst have been elected to the Executive Committee, and Sir Charles Parsons has joined the Association. The populations of the countries which have adopted the metric weights and measures as their sole standards now amount to 476 millions, including Siam.

Mr. Siemens's address was given on the invitation of the Bradford Textile Society; it covered briefly the history of the system and the arguments in favour of its adoption by this country. A discussion followed, in which almost all of the speakers favoured the metric system, and a resolution was carried, with only four dissentients, to the effect that the meeting viewed with favour the compulsory adoption of the metric weights and measures in this country, and urged the Bradford Textile Society and other trade organisations to work for the reform. Only two members of the Textile Society voted against the proposal, which is often said to be hopeless of adoption in the textile industries.

NOTES ON THE STARTING OF SQUIRREL-CAGE MOTORS.

By E. JACKSON.

The reliability and simplicity of the squirrel cage motor render its adoption particularly desirable in many cases where these factors are of vital importance and where the nature of the load is such that no speed variation is required.

Having such an extremely simple piece of apparatus as the squirrel-cage motor, it is very advisable to give due consideration to the starting arrangement, which should be equally reliable, if properly selected, as the motor it controls. Generally speaking, starting may be performed in five ways, viz.:—

1.—By using a plain triple-pole switch, either single or double throw, arranged to throw the motor direct across the lines.

2.—Employing an auto-starter enabling a definite percentage of line volts to be first applied—full voltage being thrown on when the motor has started.

3.—Star-Delta starting—the motor having its winding connected in star at starting, and the alteration to delta being made when the motor is more or less up to speed.

4.—By inserting resistance in series with the stator windings during starting, this resistance being entirely cut out in the full speed and running position.

5.—Where a group of motors, all driven by one generator, are required to start up together, all the motors may be connected to the generator, and the latter gradually run up to speed—the speed of the motors gradually increasing with the speed of the generator.

At the outset it must be clearly understood that all the above methods, with the exception of (1), have one object, viz., to reduce the voltage applied to the motor windings at starting, thus reducing the rush of current, torque, and disturbance to the system which would result from the motor being thrown across the lines.

The curves shown in Fig. 1 will be found of use, whatever system is employed, graphically showing the relation between the percentage starting voltage applied and the resultant torque and current. They have been calculated for a well-known make of motor, and although individual makes of machines may vary somewhat more or less, they will be found to be sufficiently representative for most practical purposes.

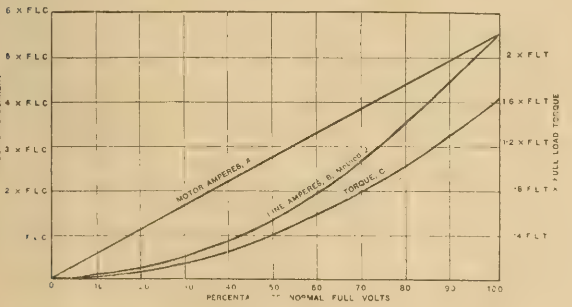


FIG. 1.

1. *Direct Starting.*—It is at once obvious from the curve that this method must be limited to comparatively small machines, since the momentary rush of current at starting may reach 5½ times normal full load. It will be found, therefore, that 15 H.P. represents the usual limit, although for individual cases where the starting is light and the momentary heavy rush of current no disadvantage, motors of large horse-power may be successfully started in this way. The L.E.P. Co state that motors up to 15 H.P. may be switched straight on to the mains, provided they are started up absolutely light; if they are started up under load, 7½ H.P. is the limit which may be switched straight on.

It is advisable that the starting switch be of the double-throw type, and so arranged that ammeter, fuses, and other protective devices are cut out at starting, otherwise the instrument may be damaged by the heavy rush of current, while if the fuses are not to blow they must be rated so high as to be of little use. Of course, a time-limit device on the circuit breaker is an alternative to the above. Owing to the heavy momentary currents it is advisable that all contacts on the starting switches be readily and cheaply renewable. Either oil immersed or non-oil immersed switches are permissible, the type largely depending on the situation in which the starter is used. In either case it is advisable to select a switch designed with the object of starting motors by this method rather than a cheap, flimsy article which is merely a three-pole switch but nothing more.

2. *Auto-Transformer Starting.*—The auto-transformer starter is perhaps the most widely used, and is a piece of apparatus standardized from the lowest horse-power up to 500 or 600 H.P. This type of starter may either have a single starting position, or, alternatively, may gradually increase the applied voltage by several steps. Generally speaking, the first-mentioned type is the more usual and meets most requirements.

The change-over, or switch, portion of the starter generally is either of the knife switch or drum type, the fixed contacts being connected to a, preferably, self-contained auto-transformer. The auto-transformer may either have two or three windings, the first arrangement having the coils connected in V and resulting in a slightly simplified starter. On moving the handle to the starting position, the auto-transformer coils are connected directly across the lines, while the windings of the motor are connected across a definite percentage of the total turns in the coils, thus applying a definite voltage to the motor, say, only 60 per cent. of normal.

The starting voltage should be the lowest at which the necessary torque to start the motor can be obtained, and to secure this an auto-starter should have provision for readily adjusting the starting voltage on site. It is advisable to specify that starting voltages of, say, 25, 40, 50, 60, or 75 per cent. of line voltage may be obtained. The curve in Fig. 1 is of use in settling which is likely to be the nearest voltage for any particular job where the starting torque is roughly known beforehand. It must be clearly understood that the current given (curve A) is *motor* current, and that therefore the *line* current will be proportionately less dependent on the particular tapping employed (see Curve B). For instance, with a 50 per cent. tapping the line current will only

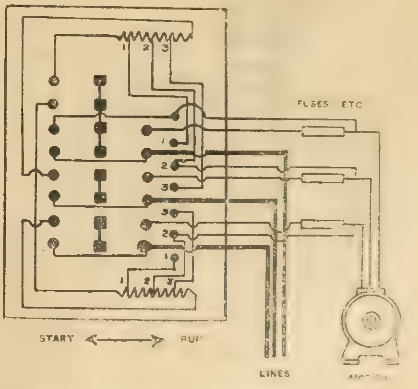


FIG. 2.—CONNECTIONS OF AUTO-STARTERS.

be about half the motor current, and so on. Here again it may be advisable to cut out fuses, etc., at starting, and Fig. 2 shows the diagram of connections to give this feature, the starter being one of the change-over knife switch type.

Some trouble has been experienced on this type of starter by reason of the fact that it is often possible to leave the starting handle in the "start" position. With a careless attendant, it will be seen that there is a chance of burning out the auto-transformer coils, since naturally these are only rated to carry current for a minute or two without damage. Something in the nature of a spring return is therefore highly desirable, and it will be found that it is now possible to obtain starters of the drum type embodying this feature, although there will always be numerous cases where the simple type, without spring return, may be safely installed. A feature which should be insisted upon is the provision of means to render it necessary for the operator to move the handle into the starting position before it is possible to move it over into the running position, and further that the actual change over be quickly made.

One interlock, using a trigger on the handle engaging on the inner and outer surfaces of a cam on the case, is defective in that although it ensures the operator first moving to the "start," yet in the event of his moving back to the "off," and leaving the handle there, it is now possible on the next attempt to start to move straight over into the running position. Although not recommended, it will be seen that the use of this method of starting permits of torques higher than full load being obtained, provided that a suitable tapping is used.

3. *Star-Delta Starting.*—This is one of the simplest and best methods provided the starting torque does not exceed half normal load. It will be seen that this method is really equivalent to using an auto-starter having a 58 per cent. tapping, since the voltage at starting is 1/1.73 = .58 of that when running.

It should be noted from the curve B that the current taken is approximately 2 F.L.C. from the line, which is not excessive, and hence quite large motors may safely be started by this method under suitable conditions.

The motor has generally to be wound somewhat specially, but this usually presents no difficulty on motors for circuits not exceeding a medium pressure. The main advantage of this method lies in the simplicity of the starting gear, the auto-transformer coils used in method (2) being eliminated, together with their possibility of breakdown.

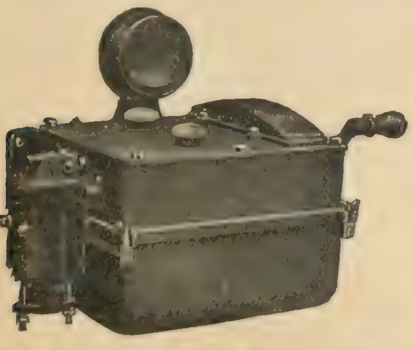


Fig. 3.—Star-Delta Starter, with Ammeter and Trifurcating Box.

Starters of the star-delta type should be provided with some device to prevent the operator going straight over from the "off" to the "delta" position, and preferably should ensure a definite pause being made in the "star" or starting position, while it is a further advantage to arrange so that the starter will not remain in the starting position, if the starter handle be released. Figures 3 and 4 show a typical star-delta starter embodying the above points.

4. *Resistance Starting.*—The method of introducing resistance into the stator circuit at starting is chiefly employed on small machines starting light and where the current increments at starting are to be strictly limited. The usual starting arrangement is of a very similar construction to the ordinary rotor starter, but has the three arms of the starter insulated, one from the other. An alternative arrangement which may be of use in an emergency is shown in Fig. 5, and allows the use of an ordinary type of starter, or even a liquid starter, assuming the pressure does not exceed the limits of medium pressure.

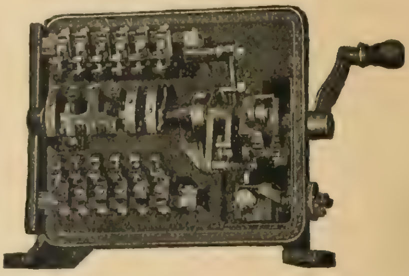


Fig. 4.—Underneath View of Starter, with Oil Tank Removed.

It will be noted that a separate triple-pole switch is necessary to isolate the motor and starter.

Either of these methods of connection may be used, say, for motors up to about 15 h.p., starting under not more than half full-load torque with about twice full-load current.

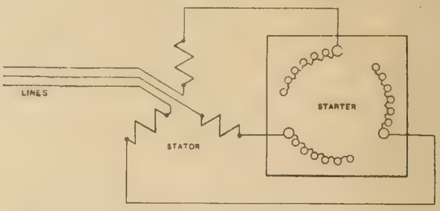


Fig. 5.—Connections of Rheostatic Starter.

5. *Starting with Generator.*—This method obviously can only be used in certain cases, and even then it is usually necessary to provide each motor with a separate starting switch, for use in the event of any one motor being shut down, the others being left running. Provided the individual motors are fairly small, this starting device may well take the form of the double-throw switch dealt with under (1), as this may then also be used to isolate the motor for inspection and repair.

The notes above merely deal with standard three-phase squirrel-cage motors, although they apply almost equally to two-phase, three- or four-wire machines.

The star-delta starter method has its counterpart in the series-parallel scheme of connection for two-phase machines, the stator windings being divided into two parts connected in series for starting and in parallel for running.

In conclusion, it is important to see that all current-carrying and circuit-breaking surfaces are of ample area, because of the fact that the currents dealt with are usually much in excess of those required for D.C. or even slip-ring machines.

At the same time, as is well-known, the interrupting of the A.C. circuit, particularly under oil, can be more easily and satisfactorily accomplished than that of a corresponding D.C. circuit.

N CATALOGUES.

By H. R. TAUNTON.

Catalogues are issued by manufacturers and middlemen with two objects. The first, and most obvious one, is to induce you to place orders with them. The second is only to be guessed at after long and bitter experience: it is to wreak a subtle vengeance on you if perchance you withhold your orders.

As thus. Six mornings in the week you find a score of catalogues in the post. The majority are emaciated, flabby-backed things; others display the mis-shapen eccentricities of a Cubist enthusiast. One perhaps is normal in size and shape, and can stand on its own; none probably is of the least potential value to you. But weakly, as is your custom, you slam the lot with the others on the office mantelpiece, and there they lie, forgotten and useless; until in the fulness of time (and the mantelpiece) they slide off at the ends, and are borne away by the charlady.

No single order has resulted from their fleeting existence in your office. And yet they have not lived in vain! Every time you have had occasion to look up an item in some oft-used price list, these others, intent on vengeance, have clogged your search; hung limply round your fingers, or banged heavily upon them; disguised themselves as your objective, and being taken out, jibbed at being put back again; tumbled over each other, slid under each other, crushed and crumpled each other in their malicious eagerness to get in your way. When at length you find the list you are in quest of—either swallowed, like Joseph's kine, by some bulkier catalogue, or itself engulfing half-a-dozen smaller invertebrates—the whole mass leans ponderously upon your hands. You attempt, impatiently, to push them into unstable equilibrium for the moment necessary to enable you to withdraw the one precious volume you covet—and they incontinently topple over in the opposite direction, led by one bulky brute in the middle. "When father says turn, we all turn." Your ewe lamb is lost in the general débâcle; and you start all over again.

Two years of catalogue hoarding will reduce the strongest man to a nervous wreck; three years at the utmost, and he vanishes from friendly ken, and his relatives g[illegible]chy at the mention of his name. The various "sys[illegible]" of keeping catalogues do but add fuel to the fire of madness. There are some who seek to classify their catalogues, dividing them into compartments in which they obstinately refuse to stay. Little wonder: the discomfort of a slim, paper-backed quarto, sandwiched between a podgy, "vest-pocket" list and a bulky octavo, bound at the short edge, is surely sufficient excuse for restlessness.

Others get over this difficulty by arranging their catalogues according to size, like a regiment of Boy Scouts. This is pretty, but unscientific. Others, again, would have their lists arranged alphabetically, or geographically, or ethnologically; or according to a colour scheme. On Monday they are all on parade, each in its place, standing at attention. On Tuesday they are scattered in skirmishing order, the weaker units crippled by the casualties of the preceding day. For the rest of the week they are all *hors-de-combat*.

Then [illegible] the "Modern Methods" man. He puts quaint [illegible]d labels on his library, and keeps a junior clerk and a typist constantly employed on an elaborate card index, guaranteed to mask the identity of a "general" catalogue in four volumes. Such a super-system was the rock on which one catalogue-haunted contractor of my acquaintance was catastrophically wrecked. Three policemen and a taxicab with difficulty prevented him proclaiming to Piccadilly at tea-time his sudden conversion to the Simple Life. This was immediately after discovering, on a pale blue card written by his favourite and most-trusted typist, a list of "Current-saving Devices" indexed under "Cooking Apparatus."

It is with some diffidence, therefore, that I put forward yet another system of keeping catalogues. It is not, perhaps, novel in all its details, but it has the merit of being as simple as it is effective. The idea is, briefly, to fix three shelves in any convenient recess, the space between the two bottom shelves being sufficient to accommodate quarto volumes, and that between the two top shelves to accommodate octavo volumes. On the inner sides of the top and bottom shelves, and both sides of the middle shelf, are a number of broad, shallow saw-cuts, at regular intervals of, say, an inch. These saw-cuts take pieces of painted sheet-iron, fitting between each pair of shelves. These pieces should be stout enough to be rigid, but an easy fit, and need not extend back for more than half the depth of the shelf. By their means the shelves can be divided up into any convenient number of compartments of any convenient size, readily altered when necessary.

The catalogues are then sorted according to subject. The electrical contractor, for instance, will have a compartment for "fittings" catalogues, one for "cables," another for "switchgear," and so on. A minute sub-division is unnecessary: a dozen different classes will probably be quite sufficient. It is easy to pick out any desired catalogue when it is one among not more than, say, thirty. It will be seen that there will be two compartments for each class, one for octavo, and the other for quarto. This is unavoidable; there are so many octavo catalogues issued that provision must be made for them, and it is hopeless to attempt to keep them with the quarto volumes.

Having sorted the catalogues into their several compartments, the next point is to ensure that they shall not stray from the fold, as is their wont, but shall retain their original classification, which is the point where all the usual systems break down. Each compartment, of course, is labelled. Take all the catalogues in compartment number one and stack them so that their backs lie flush, and then paint a band of white across the lot, half an inch wide, along the bottom edge. Treat the catalogues in compartment number two in the same way, except that the band of white paint is half-an-inch from the bottom. For the third compartment it is an inch from the bottom, and so on for each successive compartment. This half-inch band of paint is the key to the whole system. Its position on the back of the volume is a rough visual guide to the person replacing it as to the particular compartment it belongs to, without his having to reclassify it mentally; so that he will, without conscious effort, replace it correctly. If, by any chance, he does not, the mistake is seen at a glance: any volume with its distinguishing band at a different level to all the others in the same compartment is an obvious intruder.

I suggest white as it is practically the only colour not used for the binding of catalogues, and will therefore show up best. If there are a large number of different classes the bands may have to be made narrower, especially for the octavos; or they may be kept the same width—half-inch—and have their relative positions varied by shorter intervals.

We are still left with the problem of the leaflets, and pamphlets, and anæmic catalogues that cannot stand up by themselves. The best place for the majority of these is the waste-paper basket; but some of them must be kept. As most of the firms who issue them have not the common decency to supply a binder for them, the only thing to be done is to provide binders oneself. It is these wretched weaklings that are the cause of all the untidy confusion characteristic of the average collection of catalogues, and it is absolutely essential to the success of any system that they be segregated. An octavo and a quarto binder, large size, will be required for each class, and in these the leaflets must be bound as they come in. If they are numbered, and an alphabetical index is provided in each folder, any required price-list can be readily found.

And what of the lanky folios, and podgy duodecimos, and the other crank-sided, double-jointed abominations beloved of printers? The upper side of the top shelf may afford a resting place for a favoured few, but the best rule to adopt is to destroy incontinently every catalogue that will not comfortably fit either the quarto or the octavo shelf. Most people save far too many catalogues; the whole problem would be immensely simplified if only those catalogues were kept that were in the least likely to be referred to within their currency. And the first ones to be weeded out should be those of abnormal size and shape; losing no opportunity of acquainting the senders with the fact, and the reason. If such a plan were consistently followed by all users of catalogues, the natural law of evolution would reduce all catalogues to the one size and type—a stiff-backed quarto—by the gradual conversion or ultimate elimination of all those short-sighted firms who seek to call attention to their wares by catalogues so very different to other people's as to require a special bookcase to themselves. What a waste of money, for instance, is the issuing of "vest-pocket" catalogues. Has anybody ever seen a sane business man carrying one about with him? Do the firms that issue them really think that a healthy-minded civilised being is going to leave his watch and chain, his fountain pen, his card-case and his cigar-holder, all at home in order to have four vest pockets free for the accommodation of catalogues? And if he has *one* pocket to spare, are there firms so blinded in their egotism as to think theirs is the one catalogue out of a hundred others he will select to serve him for mental pabulum? And if not, what is the good of issuing them? A "vest-pocket" catalogue is futility outside a vest pocket.

There is only one way of dealing with these and similar freaks, and that is the way of a certain Dublin contractor with catalogues in general. "The best way to keep catalogues, me bhoy, is not to keep them at all!"

ANTENNÆ FOR COASTAL STATIONS.

The calculation of the inductance and capacity of an aerial from its dimensions is comparatively easily carried out, but the relative practical merits of various arrangements can be determined by practical experience alone. Formerly the chief concern of designers was to increase the effective radius of transmission of very heavily damped oscillations. This was accomplished by the use of narrow vertical "harp" or "screen" aerials, the capacity of which was very high. Such aerials proved satisfactory, and are still used in coastal stations working with low spark frequency and tight coupling. It does not follow, however, that this form of aerial is the best when higher frequencies, looser coupling and lower instantaneous pressures are employed.

Whereas new coastal stations have a sending equipment rated at over 5 K.W., the receiving requirements are becoming more and more stringent in all cases, and increasing attention must be paid to the characteristics of the aerial as a receiver. The vertical trellis aerial is a good sender, but reception is often as powerful and less distorted when a single aerial wire of the length of the main wave is employed. A horizontal aerial is very suitable for receiving purposes, hence, suggests a writer in "T.S.F.," the best form of aerial for coast stations consists of a vertical grid of wires connected to horizontal wires stretched between two masts—in other words, the bridge and tee-shaped aerials as used on board ship. The tee-formed aerial is specially suitable for wave lengths of about 300 metres and the bridge-form for wave lengths of 600 metres or so. These wave lengths are at present prescribed for public service stations. The possibility of changing from one to the other improves reception, assuming the antenna energy is not reduced by the use of supplementary self-induction and capacity. Bearing these facts in mind, provision is made for two independent aerials (one for 300 M. and one for 600 M. wave length) in each station. The London Convention made provision for yet another wave length (1,800 metres), but this is seldom employed in practice. The connection of additional self-induction in the 600-metre aerial adapts the latter for use with any longer wave length likely to be required.

The aerial equipment for a long-range station (using 10 K.W. primary power) would comprise masts 250 ft. in height, carrying:—(1) For 600-metre waves a network of five horizontal wires (190 to 200 ft. in length and 2½ ft. apart) at a height of 250 ft., connected at each end to five vertical down-going wires. (2) For 300-metre waves a tee-shaped aerial having three 100-ft. horizontal wires (2½ ft. apart and suspended at a height of 160 ft.), connected centrally to three vertical wires forming the second downtake to the station.

A 5-K.W. station, having masts 45 ft. in height, might well have, side by side or one under the other, a four-wire aerial for 600-metre waves and a two-wire tee-aerial for 300-metre waves. These arrangements are said to have proved satisfactory in actual working, in materially increasing the loudness of reception over given distances, and thus in lightening the duty of operators while increasing the public value of the stations concerned.

THE ALL-ELECTRICAL OPERATION OF THE PANAMA CANAL.

By JOHN GEO. LEIGH.

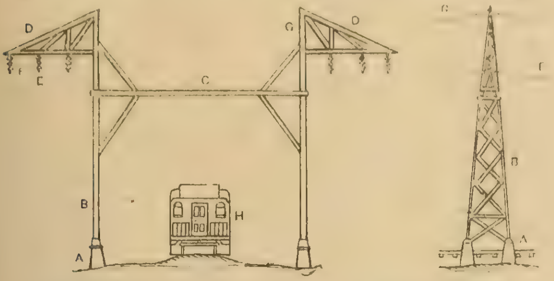
(*Continued from page* 290.)

From the generating station the energy will be carried along the east wing of Gatun Dam by heavy cables in duplicate underground duct-lines, and through tunnels under the locks, into a transformer station, situated on the east side of the locks. The duct-lines are duplicated, so as to ensure against damage in the event of a burn-out of a cable in one or other of them, and are laid approximately 600 ft. apart. At the Gatun sub-station the energy will be transformed from 2,200 volts to 44,000 volts by means of three 2,000-KW. step-up transformers, other equipment being the necessary lightning arresters, oil switches, bus-bars, control board and auxiliary apparatus. From the sub-station will emerge two high-tension lines, running into duplicate transmission lines.

The transmission line crosses the isthmus from Cristobal to Balboa, permitting distribution of energy both ways from Gatun. Its erection has been not a little facilitated by the fact that the line parallels the Panama Railroad, by means of which material has been brought within a few yards of the point of its erection. At Cristobal and Balboa terminal sub-stations will receive the energy at 44,000 volts, less the voltage drop in the line, and convert the pressure, by step-down transformers, to 2,200 volts, which will be the distributing voltage for all circuits. At Miraflores there will be a sub-station for supplying energy for the motors and lamps of Pedro Miguel and Miraflores locks. If electricity is required along the line, the transmission lines will be tapped by an outdoor type of transformer sub-station. For example, at Caimito energy will be supplied to the high-power radio station, and at Monte Lirio to the bascule bridge.

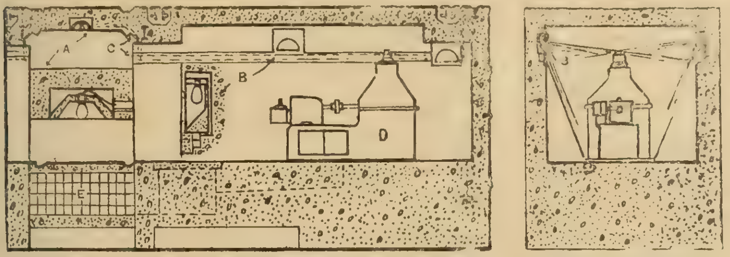
The present generating station at Gatun, which has been in operation during the construction period, may be abandoned in a year or so if conditions warrant complete reliance upon the water power. Temporarily, however, it will be included in the system, and until the transmission system is fully installed will be used to supply energy to Gatun locks.

In the following sketch, fig. 5, is illustrated the type of transmission line. Each of the three-phase conductor lines is carried from suspension insulators attached to a side bracket. The conductors, No. 00 in size, are 5 ft. apart. The insulators are made of vitreous porcelain, in three units, and ample to sustain the impressed potential of 44,000 volts, while the fittings are of monel metal to resist climatic corrosion. A copper-clad $\frac{5}{16}$-in. ground wire is carried at the top of each side frame for protection against lightning. The steel bridges, of which 917 will be required, are spaced on 300-ft. centres. The span between side frames is 36 ft., and the bridges, in addition to supporting the duplicate transmission lines, admit of the suspension of a catenary trolley construction, for use in the event of the electrification of the railway.



A, Concrete pedestals; B, Side frame; C, Cross bridge; D, Brackets; E, Three-phase transmission line; F, Suspension insulators; G, Ground wire; H, Panama Railroad car.

Fig. 5.—Rail-span Bridge, Cristobal-Balboa Transmission Line; Front and Side Elevations.



A, Reflector for ceiling lamps; B, Reflector for wall lamps; C, Chase for wiring; D, Cylindrical valve machine; E, Ducts for power and lighting cables.

Fig. 6.—Interior Lighting at the Locks.
(1) Operating tunnel in lock walls; (2) Detail of tunnel reflectors.

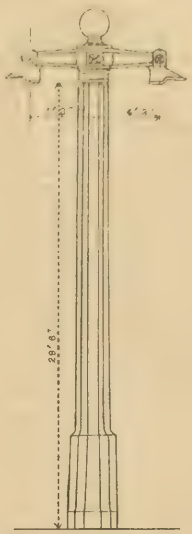


Fig. 7.—Lamp Standard for Exterior Lighting.

Some features of the construction appear worthy of note. The side-bracket suspension of the conductors separates the duplicate lines so that a burn-out in one will in no measure affect the other, while the conductors, being outside the rails, will be comparatively free from deterioration caused by smoke from the locomotives. The conductors are seven-strand pure copper cables, the individual strands being manufactured without either a soldered or welded joint; splices are made with soft copper sleeves. As the conductors are suspended at the insulators from monel metal fittings, which are bushed with copper sleeves, there will be no point in the entire length of line where the copper strands are in intimate contact with a second metal. Thus there will be prevented the introduction of an electric couple and consequent electrolytic deterioration. At each span bridge the ground wire is clamped to the tower, and a positive T-connection is made to ground plates buried in the earth, the idea being thereby to reduce to a minimum line trouble and sub-station burn-outs caused by lightning. The insulators supporting the conductors are of two types, suspension and strain, each assembled of three porcelain disks, 10 in. in diameter, joined by monel metal fittings. This metal has been used on account of its unusual strength and ability to resist corrosion, the galvanised fittings customarily employed being practically worthless in the Isthmian humidity. The strain insulators, which hold the conductors more rigidly to a line, are used on sharp curves, two being required per bridge, and also for anchoring at intervals, the other type being reserved for use on tangents and light curves. The copper conductors along the line will aggregate in length about 2,000,000 ft.—1,500,000 ft. of No. 00 and 500,000 ft. of $\frac{5}{16}$ in.—and weigh approximately 530 tons; of strain insulators there will be 2,500 and of suspension insulators 4,000.

Among the permanent loads to be placed on the transmission system may be mentioned the following:—

Cristobal.—Docks, lighting and power, bakery, laundry, cold storage, ice plant, &c.

Mount Hope.—Coal-handling plant, Colon waterworks.

Gatun.—Lock machinery and lighting, Agua Clara pumping plant.

Monte Lirio.—Bascule bridge.

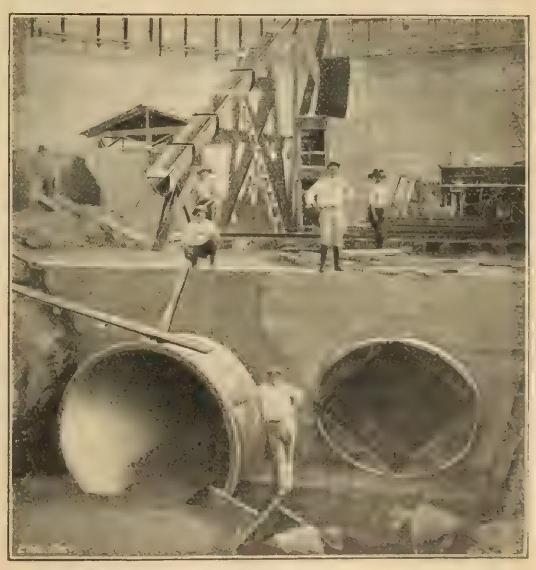


Fig. 8.—Electrical Conduit and Floor Culvert, Miraflores Lower Locks.

Caimito.—Wireless station.

Pedro Miguel.—Lock machinery and lighting.

Miraflores.—Lock machinery and lighting, water pumping plant.

Balboa.—Dry docks, permanent shops.

The lighting of all towns in the Canal Zone and of various aids to Canal navigation.

Also following the route of the Panama Railroad, there is being laid a four-way vitrified clay duct-line from Colon to Balboa, to contain the signal and telephone-telegraph cables. One duct is to be available for lease or rental, and the fourth will be left for future requirements. The ducts are laid on a base of concrete, 5 in. thick, and encased with 3 in. of the same material on the top and sides. There will be about 265,000 ft. of signal cable and 257,730 ft. of telephone-telegraph line. The duct-line is being laid at the rate of 1,500 ft. per day.

For the illumination of the locks there have been exhaustive studies, with a view to securing a distribution of light best suited to the varying conditions. In the end, there has been designed a distribution which, it is believed, will produce a correct and pleasing illumination, and an intrinsic brilliancy, causing the least possible inconvenience to the eye. The lighting required has been divided into three distinct classes—exterior, interior and machinery room—and for each of these a different system and different lamp unit are used.

The exterior lamp installation has called for particular attention. As ships will traverse the Canal at night, it is necessary, first, that a high intensity should be maintained on the coping and in the water chamber; and, secondly, that brilliant sources of illumination should be shaded from the eyes of an approaching pilot, thereby permitting an unrestricted vision of range and signal lights. The type of lamp finally selected is a large-power tungsten bulb (400-watt) set in a concrete hood (fig. 7). The area to be illuminated extends 300 ft. back from the lock chamber, Single-bracket standards will be used on the centre wall, where the lamps are staggered so as to illuminate both lock chambers; but on the side walls, for the purpose of throwing the light for a considerable distance at the back of the lock chamber, standards with double brackets are being placed. The reflector is of cast concrete, provided with shading skirts which prevent the glare of the lamp filaments from penetrating into distance along the axis of the Canal. The illumination on the lock coping will vary from 0·7 to 0·1 ft.-candle, and on the open water surface of the chamber from 0·25 to 0·1 ft.-candle. The entire reflector, with lamp and socket, is, of course, waterproof and designed to resist the effects of tropical deterioration.

All exterior lamp units are set 30 ft. above the coping, bracketed from an ornamental concrete standard of massive proportions conforming to the heavy masonry construction. These standards, of which there will be 511—211 at Gatun, 131 at Pedro Miguel and 169 at Miraflores—are being spaced on centres from 50 to 60 ft. Each double-arm bracket weighs, with reflectors, approximately 1,610 lb., and the solid ball finial, weighing 730 lb., will be employed to counterbalance the weight of the single-arm brackets used on the centre wall. Electrically, the lamps are connected alternately upon separate circuits, there being thus a duplication of wiring, as well as a means of economical operation whenever only half illumination may be required. Arrangement is made in the wiring so that all the circuits are controlled from the watch-tower centre from which all lock machinery and indicating apparatus are operated. This remote control is accomplished through solenoid-operated circuit-breakers, the main contacts of which connect the lamp circuit to the lighting bus-bar of each transformer room, the solenoid being connected to the control wires running from the transformer rooms to the control house.

Provision is made in the pedestal of each lamp standard for a special outlet box made of bronze, which permits the insertion of plugs to connect up portable lamp and telephone circuits. A portable lamp may be required at any moment in the operation of the locks to provide light upon a towing locomotive or the deck of a passing vessel, while the portable telephone is intended to enable a supervisor of lockages to communicate with the central control house from any position on the lock walls.

The tunnel which connects the various machine rooms and operating centres is 7 ft. in height, its floor being 8 ft. below the lock-wall coping (fig. 6). This will be lighted normally during daylight hours through deck-lights spaced longitudinally on 15-ft. centres, but for use at night or on dark days the illumination will be by 16-c.p. carbon-filament lamps, or 25-watt tungstens, set in recesses in the ceiling alternately with the deck-lights. For these lamps there has been cast a special concrete reflector (fig. 6). Of these reflectors there will be required at Gatun Locks 952, at Pedro Miguel 412, and at Miraflores 677. The lamps and reflectors used in the machine rooms differ only in the shape of the reflectors and in their setting, which is in recesses in the side walls, 6 ft. above the floor. Provision has been made at Gatun for the installation of 4,751 machine-room reflectors, at Pedro Miguel for 1,126, and at Miraflores for 1,524.

Both the tunnel and machine-room lamps are fed from panel boards, 66 in number, distributed throughout the lock walls. They are of the fused, branch-circuit type, with both main switch and branch switches. Among the machine rooms are also distributed 800 additional circuit switches, breaking the circuits from the panel boards into smaller groups, and 700 receptacles for portable lamps.

All the lighting is upon a 110-220-volt, 25-cycle, alternating current, three-wire Edison system. The copper wires possess large cross-sectional area to produce a minimum drop and consequently excellent regulation. To secure unusually good insulation, joints are avoided, the wires being looped into the lamp and receptacle terminals wherever practicable. The wires for lighting circuits run in longitudinal T-shaped chases, which are cast into the upper corners of the operating tunnel, and were covered with concrete after the installation of the wires. Branch chases also connect to all recesses and machine-room lamps.

Recent experiments and trials have demonstrated the advantages of the interior lighting arrangements described above. The proposed use of concrete reflectors was due primarily to the consideration that metal corrodes rapidly in the tropical humidity. Later, however, it was suggested that steel fixtures specially enamelled should be manufactured in the United States, and tenders therefor were duly invited. These proving unsatisfactory, as regards both price and anticipated illumination, the Commission engineers were encouraged to work up new designs of concrete reflectors likely to be suited to local requirements. The reflector adopted for the tunnels is of comparatively simple design, consisting of inclined surfaces at the four sides to throw the light in proper directions. In the top of that used in the machine room is set a lamp socket, and in front of the lamp is placed a concrete shade with a semi-circular opening at the bottom, this shade being adjusted in a vertical plane so as to cut off from the eye the direct glare of the filament, and permit the light to penetrate through the opening and flood the machine.

The same experiments went far to demonstrate the superiority for the purposes required of the tungsten-filament lamp. Two adjacent rooms in the centre lock-wall were fitted up with four concrete reflectors; in one were used 16-c.p. carbon-filament lamps, and in the other 40-watt tungsten lamps. The illumination with the latter was pronounced greatly superior, the yellow light emitted by the carbon lamps being inferior to the white light produced by the tungstens. Forty-watt lamps were used because of temporary inability to procure sufficient 25-watt lamps. It was considered that the tungsten illumination, represented by 100 watts per room, was much superior to that of the carbon-filament lamps, represented by 220 watts.

In the past some fear had been entertained concerning the life of tungsten lamps when subjected to possible vibration caused by passing locomotives and the operation of machinery. It appears, however, to be now evident that the stability of the lock walls and decking will render this vibration of small moment.

(*To be continued.*)

Fire.—By a fire at the Ballachulish State Quarries, the gas engines, electricity plant and engine house were completely destroyed.

A PETROL-ELECTRIC ROAD TRAIN.

[BY OUR BERLIN CORRESPONDENT.]

A remarkable petrol-electric road train has recently been constructed by Messrs. W. A. Th. Muller, Ltd., of Berlin-Steglitz, consisting of a power car and ten trailers, each of 5 tons capacity.

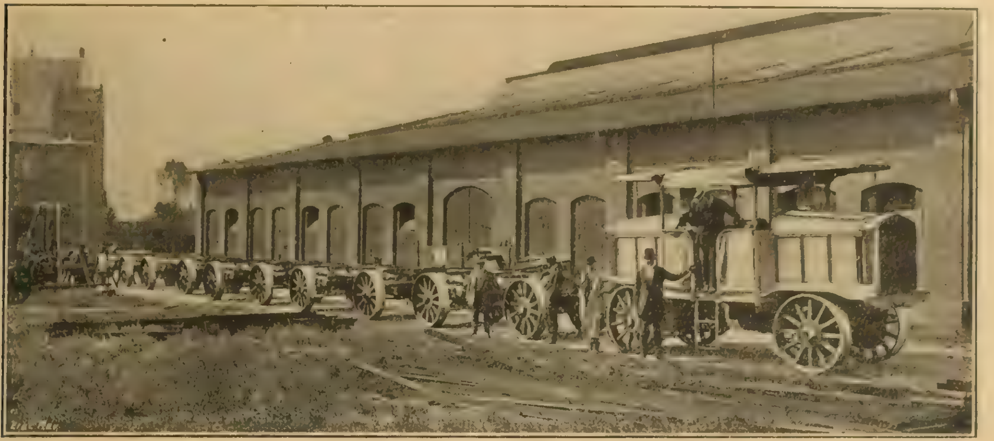


Fig. 1.—View of Complete Power Car and Train.

The power car carries the generating set, viz., two Daimler motors, each of 125 h.p., driving a dynamo installed in the centre. The current is transmitted to electromotors driving each of the wheels of the power car and trailers. The armatures of these motors are arranged in parallel, and the fields in series; the former derive their current from the main dynamo, whereas the latter are fed from an exciter machine which, at the same time, serves to excite the main dynamo. The field regulator of the main dynamo controls the voltage of the armature and, accordingly, the speed of the train. A loop circuit allows a perfect uniformity of pressure to be ensured in all motor armatures. The motor fields are controlled by a special " traction regulator," inserted into the exciter circuit, and the direction of travelling is controlled by reversing the excitation of the motor fields. This arrangement presents the advantage of eliminating from the trailers all controlling apparatus necessitating any superintendence. The electric apparatus and instruments are arranged on the power car, above the dynamo, so as to be readily accessible.

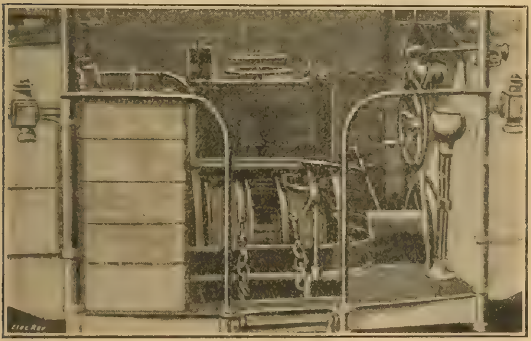


Fig. 2.—Interior of Power Car, showing Twin Dynamo.

The steel rims of the wheels are 1·2 m. in diameter and 250 mm. in width. Thanks to the identical construction of all the trucks, the number of spare parts is reduced to a minimum. Chain transmission has been used to connect the trucks with one another, and the inside brakes formerly used have been replaced by outside brake shoes acting directly on the circumference of the wheels, thus greatly facilitating the superintendence of the brakes.

The net weight of the power car in full working order is 9 tons, and that of the 10 trailers, 3 tons each. The ratio between the carrying capacity and the net weight thus works out at 50 : 39 = 1·3, which is 30 per cent. more favourable than in the case of heavy vans. The mean travelling speed is 12 km., and the maximum speed 16 km. per hour.

Since all the wheels of the train are driving wheels, its total weight is utilised for adhesion. The steel rims are cylindrical, slightly slanting towards the edges. The surface of the road is thus exposed only to a stress of 80 kg. per centimetre width of the wheels.

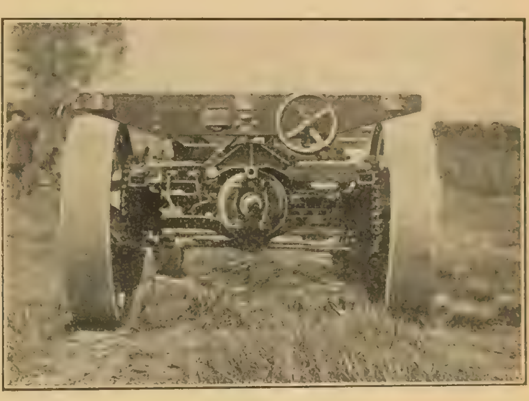


Fig. 3.—End View of Truck, showing Motor.

The train is controlled from the driver's cabin.

SOME RAILWAY CONDITIONS GOVERNING ELECTRIFICATION.

By ROGER T. SMITH, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *February 12th*, 1914.)

It seems reasonable that if any change from steam to electricity is proposed by electrical engineers, they should first endeavour to provide something which will at least do what steam will do, next try to give electrically what steam cannot give, and, finally, do this in such a way as will result in improved financial prosperity to the railway. It is far easier to change things than to change the habits and inherited instincts of large bodies of men. Any proposal, otherwise economically correct, that will suddenly alter the way in which large bodies of men have been used to handle traffic in the past is not sound engineering or sound business, unless the resulting gain is very considerable.

It is convenient to divide railway services into three groups, which correspond to entirely different conditions as far as traction is concerned:—

1. Urban and suburban passenger services.
2. Fast passenger services.
3. Fast or slow goods and mineral service.

1. Urban and Suburban Passenger Service.

Urban electric service differs only in degree from suburban service. Steam traction for underground services is out of the question in the 20th century.

A suburban passenger service exists to enable a working and business population to live outside the town in which it works. In this country suburban transport has mostly grown haphazard with the population, and its extent is governed by the time which people consent to spend in the train between their homes and their business occupation. Excluding outer suburban service, the limit may be taken to be about 45 minutes each way. The greater the distance covered in that time, that is to say the higher the schedule speed (average speed including stops) of the train, the more chance has the railway of creating new traffic.

If a railway possessing a suburban system equipped with permanent way, platform accommodation, and locomotives designed for a certain time-table finds this equipment outgrown by the traffic, it is obvious that it must increase the number of coaches run in a given time. To do this several courses are open.

First, it may double or treble the number of tracks and increase both the number and length of its platforms, thus increasing the number of passengers carried without necessarily increasing the journey schedule time. This has been done on several of the London railways with suburban services, the cost of widening the line and rebuilding the stations having been enormous.

Secondly, the railway may retain its permanent way and stations and with them the maximum length of its trains, but increase their schedule speed by using the biggest type of steam locomotive permitted by the load gauge for running comparatively light suburban trains.

Thirdly, the railway may electrify, which solution is commending itself to many of the railways in this country with congested suburban services. With electrification a maximum of 48 trains an hour can, if required, be run each way during the rush hours while employing existing stations and tracks. That it is possible to run trains so close to each other is chiefly due to signalling by track circuits, but full advantage of the possibilities of running up to 40 or more trains per hour by the use of track-circuit signalling can only be taken by trains having rapid acceleration and very rapid deceleration. With tracks and stations (and hence also the train length) remaining as before, the number of passengers carried per hour has in many cases been doubled by increasing the scheduled speed 50 per cent., while improved signalling has at the same time made it possible to increase by 50 per cent. the maximum number of trains per hour.

The characteristics of urban and suburban services for which electric traction is suitable are a dense or fairly dense service of not less than, say, 5 trains per hour each way, up to 40 and more per hour each way, with station stops varying from less than half a mile apart up to 1½ miles apart. With services less dense than the minimum, and with stops further apart on the average than the maximum here given, the advantages of electric traction, if they exist, are special and not characteristic.

The essential element which gives to electric traction its advantage over steam under these conditions is the motor-coach train. The train is made up either entirely of motor coaches (as in the western suburban system of the French State Railways), or of motor coaches and trailers. The number of motor coaches must be such that the weight on the driving wheels available for adhesion is not less than 25 per cent. of the total train weight. It is more often 33 per cent., and may be 100 per cent. The making up and driving of such trains has been rendered possible by multiple-unit control.

With the motor-coach train it is quite easy to have such an adhesive weight as will permit of a tractive effort, over and above that required to haul the train against resistances, sufficient to accelerate it during the notching period at rates up to 1½ miles per hour per second (2·2 ft. per second per second), while the rate of deceleration is usually increased up to 2 miles per hour per second. Such a rate of acceleration is not often justified, and a more characteristic example may be taken from one of the London suburban services where trains weighing 175 tons are accelerated during the notching period at 1·7 ft. per second per second to give with 20-second stops a schedule speed of 17 miles per hour, the station stops averaging half a mile apart. The adhesive weight is 46 per cent. of the train weight, and the energy input while accelerating is 1,300 H.P. Within the load gauge of this railway no steam locomotive could be built of such a power. The cost in energy is shown by fig. 1, representing actual tests of 20 such trains, including the moving and controlling of the train only.

Other advantages of the multiple-unit-controlled motor-coach train are, first, the doubling of terminal accommodation by halving the number of signal and locomotive movements; and, secondly, the ability to make and break up the motor-car and trailer units of which the maximum train is composed to suit the traffic.

No piece of apparatus is more fitted to accelerate a train rapidly than an electric motor with a series characteristic. The series-parallel-connection of the continuous-current motor can give without opening the circuit two running speeds for each definite load after acceleration is complete, while in the single-phase motor, voltage regulation can give as many running speeds as are desired.

For any suburban service requiring 20 trains per hour to bring morning passengers in and take evening passengers out of a city, tracks and terminal accommodation must be set apart exclusively for the purpose.

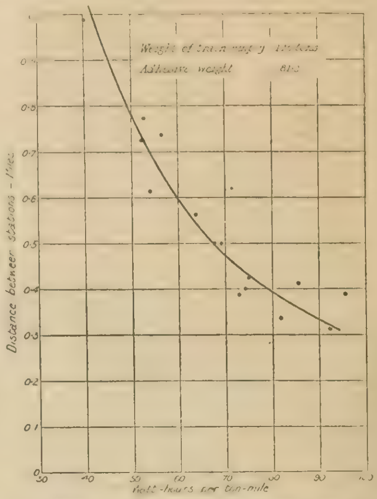


FIG. 1.—Curve of Energy Consumption for London Suburban Motor-Coach Train.

In general it is safe to say that until it is necessary to devote terminal facilities, station accommodation, and at least two tracks entirely to a suburban service, it is very doubtful if electrification is the only solution of the congested traffic problem, although it may prove to be the best solution. Such a service can be electrified on any system which best suits its conditions, and the method may be quite different from any other method which may subsequently be desired for main-line electrification.

The results of suburban electrification all the world over show that there are really no fresh engineering problems to be solved. When the traffic department asks for any reasonable schedule, the engineer is not only able to design his equipment to work to it, but can say within very close limits what it will cost in power and maintenance.

The question of the electrification of a suburban system has become for a railway company purely one of finance. Essentially it resolves itself into a question as to whether the fares charged for the service, even with the additional traffic obtained, can give a reasonable return, or any return at all, upon the new and old capital, after the cost of working has been provided for.

Even when the management cannot make the development of its suburban traffic pay directly, it may still pay the railway as a whole considered only as a feeder to the main line, or urban and suburban traffic as a whole may pay if the latter goes far enough out into the country. The latter type of suburban service is best illustrated by the Liverpool-Southport electrified system on the Lancashire and Yorkshire Railway.

From Liverpool to Hall Road, 7½ miles away, the average distance between stops is ⅞ mile and the schedule speed is about 25 miles per hour. This is probably the most rapid suburban service in existence. From Liverpool to Southport is 18½ miles, with an average distance between stops of 1¼ miles, but beyond Hall Road this average is only a little under 2 miles. The schedule speed of stopping trains is 30 miles per hour. The maximum instantaneous input to the train is nearly 2,000 H.P., and the power consumption for the stopping trains to Hall Road is about three times the power averaged over the whole service of stopping and express trains and idle mileage. This is an excellent example of how a service if extended far enough out and combining express with stopping trains reduces the energy used over the whole system to a reasonable figure. The long-distance fares have to make up for the far greater cost of the short-distance stopping service.

Not only have electrical engineers completely solved the engineering problem of frequent service with short distances between stops, but the cheap and simple measurements of electrical quantities have taught railway companies for the first time how costly the constant stopping and starting of a train must be as compared with running at high speeds with infrequent stops, whatever form of power is used for traction.

At the present moment it is safe to say that everybody in London and its suburbs is being carried at too low a fare to give proper remuneration to any form of traction which, in addition to rates and taxes and Government duty on some fares, pays for its road and the right to use it.

If the suburban systems of the main-line railways running into London are left out of account there has on the whole been no increase during the last three years in the number of passengers carried by the underground railways of London, all of which are electric.

The total number remains stationary at about 136,000,000 passengers per annum. The purely London traffic of the main-line railways—inclusive of their suburban traffic—is estimated for 1912 as 250,000,000, which is a decrease of 1¼ per cent. on the traffic of the previous year.

Greater London traffic as a whole increased by 125,000,000 passengers in 1912, which is 20 per cent. less than the omnibus increase, every other form of traffic having declined except that on the underground railways, which remained stationary.

Like most other industrial working costs, that of running a suburban service depends on certain standing charges which, taken as a whole, do not vary, or hardly vary, with the service given (upkeep of permanent-way equipment, management, rent, rates and taxes, and station traffic expenses), and a charge varying with the service catered for (rolling stock, repairs and wages, running wages and electricity). In a particular case the ratio of standing to variable charges for running a small suburban service for a year was as follows:—Standing charges unaffected by the number of trains, 60 per cent.; variable charges, 40 per cent.; and of this 40 per cent. electricity formed three-fourths.

If the cost of electricity can be reduced by 50 per cent., the total working costs may be reduced by one-quarter, which shows the importance of cheap electricity. This is a particular case where the cost of electricity was high, and as a rule its percentage effect is not so great.

Fig. 1 shows how, for a given average schedule speed, the distance between stops affects the amount of electricity used, and supposing it were possible to have a differential tariff for railway passengers based on the actual cost of the service, the short-distance passenger ought to pay much more per mile than the long-distance passenger, since he costs more to carry; but on nearly all suburban services competition has cut down the fares of the short-distance passenger to a non-profitable point.

What is wanted to make urban traffic on electrical lines pay is either an increase in the fares, which is achieved abroad by zone fares, or the ability to purchase electrical energy delivered to the conductors at, say, ½d. per KW.-hour. Competition may prevent the former. Is there any chance of obtaining cheaper electricity?

The generation of electrical energy and its supply is a business in itself. In general, the addition of a load which, in the case of a heavy suburban service, may continue during 18 or 20 hours out of the 24, with an annual maximum demand load factor of from 45 to 55 per cent., should enable a supply authority with a light and power load to offer a railway company such a price as would leave no question as to its acceptance. However, the purchase of electrical energy has not been the policy of the majority of the railway companies. Some of them have had no chance of buying, but those like the North-Eastern and London, Brighton and South Coast Railways, who have purchased electrical energy, have no reason to regret it.

The cost of electric working is important, but the cost of money may be still more important, and the raising of fresh capital for anything that is not certain to swell the dividend is a very serious matter indeed at the present time when the credit of British railways stands so low.

2.—Fast Passenger Service.

When the condition of frequent stops and short distances between them is left, and the question of main-line passenger services as run by steam locomotives is considered from the point of view of electric traction, the problem alters completely.

A seven-coach train hauled by a steam locomotive at an average schedule speed, including stops, of 40 miles per hour, the stops being 23½ miles apart, and the same train, run at an average schedule speed of 27 miles per hour, and stopping on the average every 5½ miles, required practically the same average draw-bar horse-power. The time taken to do the same distance is in the ratio of 1 to 1½, so that the energy used for the stopping service for the same distance is 50 per cent. greater than for the fast service.

A good deal of experimental and pioneer work has been done on the Continent and in the United States in electric locomotive design, but the engineering problems which have to be solved in this country before fast passenger electric services can compete with existing services have hardly been considered.

The chief difficulty in the way of electrification for fast passenger services is the existence of the steam locomotive. Fig. 2 gives curves kindly supplied to me by Mr. G. J. Churchward, of draw-bar pull plotted against the speed for two types of steam locomotives, one for passenger service (the 4-6-0 type*) and one for goods service (the 2-8-0 type). The curves represent the average results for saturated steam of many experiments with each type of locomotive hauling actual trains, the draw-bar pull being measured by the dynamometer car. The two types of locomotives may be taken as representative, one for hauling fast passenger trains and the other for hauling fast goods trains with nearly the maximum loading on the coupled axles permissible for British permanent way and structures. They also represent approximately the maximum powers which can be developed by steam locomotives built within British load gauges, which are not the same for all our railways. Constant-output draw-bar horse-power curves are added for guidance. Curves of an American and of a French steam locomotive of the 4 6 2 or Pacific type are added for comparison.

The steam locomotive is so designed that with earlier and earlier cut-off as the speed increases, practically constant outputs are obtained for the same load. The timetables of British railways imply maximum speeds of between 70 and 80 miles per hour. The resistances to train movement increase in proportion to the speed raised to the [illegible] power, so that for trains running with infrequent stops a locomotive with constant output has sufficient reserve of power at low speeds, over and above that required to overcome resistances, to give a moderate acceleration (up to the limit imposed by the adhesion of the coupled wheels) and to maintain the train at any speed (determined by the regulator and the cut-off) up to the maximum speed with that load.

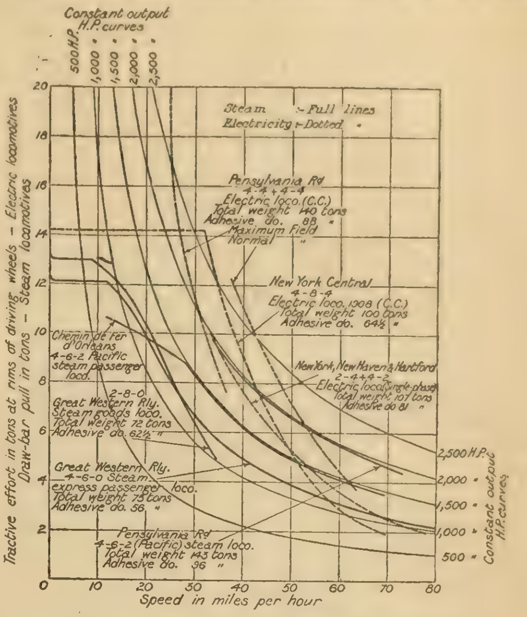


Fig. 2.—Curves of Maximum Continuous Draw-Bar Pull (Steam Locomotive) and Maximum Tractive Effort at Driving-Wheel Rims (Electric Locomotive) Plotted against Speed.

As compared with the electric locomotive the steam locomotive is handicapped by the distribution of weight due to the length of the boiler. In the former, from the shape and size of the motors it is possible to get a greater ratio of adhesive to total weight than in the latter, especially if every axle is driven. In general for fast passenger service the acceleration of the steam locomotive is limited not only by the boiler capacity but by the maximum adhesive weight on the coupled driving wheels.

For the 4-6-0 type locomotive, the adhesive weight being absolutely limited by structures to 60 tons, and by usual practice to 56 tons, the starting draw-bar effort is limited to about 16 tons. From the start until the driving wheels are moving at about 50 R.P.M.—say, about 12 miles per hour for the engine under discussion—the maximum draw-bar pull is 12 tons, determined by the adhesion.

Such a passenger engine can haul a train of 450 tons on the level at the highest speeds called for in this country and, unassisted, a train of 300 tons up a gradient of 1 in 50. To haul such a train, a constant-output locomotive is satisfactory, and the control of the output and speed by the regulator and cut-off is so complete that the steam locomotive can run at any speed below its upper limit for the load hauled.

With the exception of certain three-phase locomotives in Italy and America, all the electric locomotives built have been equipped with motors having series characteristics. At any given voltage the series motor has one speed for each definite load. Series-parallel control with continuous-current motors gives two speeds, and with certain numbers of motors three speeds for continuous working can be obtained.

Since the series motor can be overloaded momentarily 75 per cent above its hourly rated capacity, while for adhesion purposes if necessary every axle can be made a driving axle, even greater starting torques than those shown in fig. 2 are possible, but on British railways they would be not only useless but actually harmful, exceeding the draw-gear strength. Unlike the case of the multiple-unit train, the adhesive weight may be only 12 or 14 per cent. of the total train weight, and the strength of the draw-gear limits the draw-bar pull after starting to 12 tons. But with an increase in speed the torque of the series motor falls off so rapidly that above 60 miles per hour (where difficulties begin with steam locomotive design) no electric locomotive yet built for hauling only such maximum loads as obtain on our railways could give anything like 1,100 H.P. at 70 miles per hour, as given by the 4-6-0 steam locomotive shown in fig 2.

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* There is no uniformity in different countries in the symbols used for types of locomotives. This paper follows American and British steam practice, thus 4-6-0 indicating a leading four-wheeled bogie, six coupled driving wheels and no trailing pony or bogie. 2-8-0 indicates a two-wheeled leading pony, eight coupled driving wheels and no trailing pony or bogie; 4 — 4 + 4 — 4 indicates an articulated locomotive with leading and trailing bogies and four driving wheels in each half

Fig. 2 shows tractive effort curves of a very fairly modern American electric locomotives, the loads representing not draw-bar pull but tractive effort at the rims of the driving wheels, so that the hauling of the locomotive itself is included. They are added to show how very quickly the tractive effort at the rims of the wheels falls off at high speeds. Such locomotives are only of academic interest to us, as their starting effort is quite beyond the strength of draw-gear on British railway passenger stock.

One object of the series winding is to saturate the field of the electric motor at starting, and provided the field is saturated, no extra current through the winding is of any use. The field can equally well be saturated by separate excitation, which opens the possibility of a shunt characteristic with variable speed for the continuous-current motor, voltage variation already providing several running speeds with the single-phase motor.

The very interesting experimental line equipped by the Lancashire and Yorkshire Railway for 3,500-volt continuous-current electrical working between Bury and Holcombe Brook has two motors on its motor coaches permanently in series and a motor-generator for providing current at 100 volts for the auxiliary service of control, brake pump, lighting and heating. The same principle could be used for exciting the field, and it is suggested that such a method of obtaining the series characteristic at starting and the shunt characteristic for higher speeds is worthy of consideration.

Up to the present time no electric locomotive has been made suited to our maximum loads which can replace the fast passenger steam locomotive in this country.

Turning from the engineering to the economic side, and assuming a suitable electric locomotive has been built, a very rough estimate may be made of the cost of working.

The annual cost of a steam passenger locomotive, averaged over all the different types in use on a railway carrying passengers, goods, and minerals over not less than 2,000 miles of route, and hauling its own locomotive coal, may be taken to be £825 for such items as do not vary with the mileage run or only vary to an extent which will not affect this first approximation. The annual cost of coal at about 9s. per ton per 10,000 B TH.U. averaged over the whole working together with the cost of water may be taken to be £350, giving a total for the year of £1,175, inclusive of capital charges. This is a mean for all locomotive types working an average passenger mileage of 10,000,000 train-miles per 1,000 miles of route. During the year a passenger engine may be expected to run between 25,000 and 30,000, or, say, 27,000 passenger train-miles, so that the mean cost for locomotive expenses (including locomotive capital charges) per train-mile will be 10½d.

Of the above sum of 10½d. per train-mile, 3d. per train-mile will represent the cost of coal and water. Cheap coal in this country is one of the factors making against railway electrification. The cost of coal burnt in a large modern generating station producing electricity for hauling trains by an electric locomotive is less than half the cost of coal for doing the same work in a steam locomotive. In America coal costs about the same as in England, but in France the 3d. per train-mile for coal and water would be at least 6d., and in Switzerland and Italy 9d. or more. The influence of the cost of steam locomotive coal in non-coal-producing countries, more especially where water power is available for generating electricity, becomes obvious.

Mr. Hobart works out the efficiency of a Pacific type 4-6-2 steam locomotive between the heat value in the coal in the tender and the work done at the draw-bar at 3¼ per cent. He also quotes the actual efficiencies obtained between the heat value in the coal in the bunkers of a large modern electric generating station using similar coal and the work done at the draw-bar of an electric locomotive for similar work, and finds it to be 6 per cent., after his constants have been altered to suit English conditions in both cases. Working from these efficiencies the result is obtained that the cost of electricity per passenger train-mile is about the same as the cost of coal and water per passenger train-mile hauled by the steam locomotive, provided that electricity can be bought at ⅓d. per KW.-hour.

Weight for weight the electric locomotive costs about twice as much as the steam locomotive, but for the same adhesive weight the electric locomotive weighs some 30 to 40 per cent. less than the steam locomotive. Electric repairs and renewals cost less, and the net result is that the annual cost of the electric locomotive will be in the neighbourhood of £1,250 per annum, assuming the same rate for capital charges.

But while the passenger steam locomotive only runs on the average 27,000 train-miles in the year, spending 75 per cent. of the time out of active service, the electric locomotive, which need only be in the shops for one month out of the 12, will not spend more than 50 per cent. of its time out of active service. The electric locomotive can run at least 40,000 passenger train-miles per annum. Multiple-unit motor-cars runs 45,000 to 50,000 miles per annum.

If these figures are accepted, the cost per train-mile with the electric locomotive (including locomotive capital charges) will be 7½d., always assuming that electrical energy can be bought at ⅓d. per KW.-hour.

If a saving of 3d. per train-mile was secured by electrification, representing the charges on a capital of £2,100 per mile of route, this sum would certainly not cover the corresponding electrical equipment of the line on an overhead system, inclusive of contact wire and structures, distributing cables, bonding, and sub-stations.

The only items for which a reduction in costs may be expected are the cost of electricity and the capital cost of electric locomotives. No great reduction in the cost of the former can be expected so long as railways generate their own electrical energy, as there must be a diversity of load and generation on a scale far beyond railway requirements to secure an appreciable reduction in price. If electrical energy could be bought at ¼d. per KW.-hour, and the electric locomotive could be made for £50 per ton, the cost per train-mile in the above estimate would be reduced to about 6d.

The problems in front of the electrical engineer who would compete with the passenger steam locomotive are therefore first to design an electric locomotive that will do what the steam locomotive does at high speeds; secondly, to reduce the cost of the electric locomotive (which will come about when there is sufficient demand for it); and thirdly, to be in a position to buy electrical energy at something approaching the ⅛d. per KW.-hour which forms Dr. Ferranti's ideal.

3.—FAST OR SLOW GOODS AND MINERAL SERVICE.

For goods and mineral service the outlook is different. The same comparative ratio of cost between coal and electricity per train-mile would hold with electricity at ½d. per KW.-hour—the price at which it can in some cases be obtained to-day—in place of the ⅓d. per KW.-hour assumed for passenger service.

Considering English conditions, the chief difference between goods service and passenger service is the reduction in the annual train mileage run by the steam locomotive. Whereas for steam passenger service it was taken to average 27,000, for goods and mineral service it drops to 10,000 train-miles per locomotive. In addition to this, the coal per train-mile is nearly doubled. Each goods engine in steam may not work more than 40 to 50 train-miles per day averaged throughout the year, which gives some idea of the length of time the locomotive is standing in steam and using coal, but earning nothing, while nearly one-third of the engines are away under repairs.

It is in this direction that the electric locomotive appears to have its best chance. In America it has been found to be possible at least to double the daily mileage run by a steam locomotive, owing to the ability of the electric locomotive to haul heavy loads at an increased speed, while it wastes no energy while standing idle. Not more than 10 per cent. of the electric locomotive year need be spent in the repair shops.

In America the strength of the draw-gear is such that draw-bar pulls of more than 30 tons are permissible, and trains of 3,500 and 4,000 tons weight can be hauled if fitted with continuous brakes. In British goods and mineral service the limiting factor is the strength of the draw-gear, which is tested to 50 tons, and with a factor of safety of 4 is supposed to be worked at a maximum load of 12 tons. At the present time there are some 700,000 wagons owned by traders liable to be run on British railways.

On lines with no adverse gradients it is possible at times to haul trains of 100 wagons weighing 1,600 tons, but that is the exception in this country. Goods trains of 56 wagons weighing 900 tons can be taken by a 2—8—0 engine up gradients of 1 in 150, and of 24 wagons weighing 380 tons up gradients of 1 in 50, without endangering the draw-gear, and as a general rule longer trains than 60 wagons are not conveniently dealt with in the usual lay-by sidings, although trains of 100 wagons can be handled in suitable places. We are not, therefore, really limited in our train weights by the maximum size of steam locomotive which can be built within the restricted British load gauges, but by the strength of draw-gear and the lay-out of sidings. The draw-bar pulls of the American electric locomotive shown in fig. 2 if used on a British goods or mineral train would merely break the couplings.

One class of traffic in this country is happily free from this drawback, and that is the mineral traffic of the North-Eastern Railway on the north-east coast. The railway owns the coal and ore wagons, or the greater proportion of them, and not being handicapped by traders' wagons, can maintain the draw-gear at the required standard. They are fortunately situated for the bulk of their heavy mineral traffic in a district served by the North-East Coast Electric Power Companies, and can buy electricity cheaply.

The mineral line between Shildon and Newport (Middlesbrough), a distance of 18 miles, is now in process of being electrified, the length of single track and sidings amounting to 50 miles. Two sub-stations on the route will supply continuous current at 1,500 volts, for the most part through overhead conductors and through a protected conductor rail in places where an overhead conductor is inconvenient.

The locomotives will be able to start and haul mineral trains weighing 1,400 tons at a speed of 25 miles per hour on the level, and start an 800-ton train on a grade of 1 in 100.

Apart from suburban electrification this is the most interesting railway electrification which has been contemplated in this country, and if successful it will undoubtedly be the real beginning of goods electrification. Its working this year will be a matter of great interest to electrical and railway men.

While the cost of everything in the industrial world has been going up, increasing the expense of many things that a railway has to buy, including labour, the railways have not hitherto been able to increase the price at which they sell transport.

However much expenses may increase, practically no corresponding increase in the revenue from passengers can follow; and it is largely for this reason that the substitution of the electric locomotive for the steam locomotive can only be considered if the result is going to reduce the ratio of expenses to gross receipts by such an amount as will increase dividends.

The methods of electrification available for the consideration of the engineer are varied, but for goods working involving the equipment of sidings some form of overhead equipment seems imperative.

The electrification of goods and mineral lines is likely to begin only in favourable districts, especially with steep grades where the overload capacity of the electric motor and its accelerating ability will enable traffic, which is now very slow, to be speeded up. This will increase the earning capacity of the existing permanent way without costly re-grading.

The electric shunting engine is a very good example of what has to be done in the matter of suitable design. A shunting engine may be called upon for hours to push heavy trains of wagons at 2 or 3 miles per hour and then to clear away a train of empties at 25 miles per hour. It is frequently called upon to push or pull a heavy loaded train over a weighbridge with a pause long enough for the weight to be recorded while each wagon is on the bridge. This the steam locomotive can do, but the continuous-current series-motor locomotive with continuously rated resistances seems hardly an engineering competitor of the steam locomotive for such work as this. There is far more hope for the single-phase locomotive.

To sum up the position as it appears to the author, the inherent advantages of the electric locomotive for goods and mineral haulage are, first, its ability to haul up to the maximum strength of the draw-gear at more than double the speed possible with the most powerful steam locomotive which can be built within British load gauges; secondly, the ability, if necessary, to have all axles driven, so that the whole weight of the locomotive is available for adhesion, while the weight per axle is sensibly reduced; thirdly, the advantage that any driver can work any locomotive, which is not the practice in this country with steam locomotives; fourthly, the ability to run annually at least twice as many train-miles as the steam locomotive, partly due to increased speed, and partly due to less time spent in the repair shops and for cleaning; fifthly, the saving of all coal wasted by the steam locomotive when getting up steam, standing in steam, and left in the firebox at the journey's end, with the result that with electrical energy at ½d. per KW.-hour the bill for current per mile is about the same as the bill for coal and water per mile; sixthly, the possibility, when the strength of the draw-gear permits, of loads being hauled quite beyond the capacity of any steam locomotive that can be built within our load gauges. The electric locomotive takes its power from a generating station, and not from a moving boiler; it can therefore be designed to give its maximum draw-bar pull at any desired speed. It is for the electrical engineer to make the most of such advantages.

Discussion.

Mr. H. W. Firth, in opening the discussion, said the author emphasised the greatest drawback in connection with expenditure on electrification, *i.e.*, the small return from passenger traffic. The companies could not help themselves in this, although they were expected to give improved services. Electrification might pay if it were possible to secure 100 per cent. load factor, but rush hour or peak load traffic involved capital lying idle. Electric traction had shown its ability to increase passenger traffic, but the published figures must be taken with caution, as the character of the district and previous service had to be taken into account. The limiting factors were financial and traffic ones, and 48 trains an hour each way could not be accommodated on most lines, even with separate electrical tracks, as conflict with other services was bound to occur. It was not always possible to restrict certain rolling stock to a definite service, and this point required attention in the design of locomotives and motor coaches. As a case in point, he mentioned that the Brighton Railway used their suburban stock for seaside excursion traffic in the summer, and some method must be devised to give a flexible speed characteristic to the motor. They could not double the number of trains in a terminus by electric traction; in fact, terminal and flat junction working would control the result obtained. He thought with the author that under the present conditions as to cost of energy, money, &c., there was little chance of superseding steam working to any great extent. It was no good providing electric locomotives capable of working 50,000 miles per annum unless traffic conditions called for it; the theoretical locomotive mileage was not always obtainable in goods working. As regarded the latter, the north-east coast was a special case and, on the whole, the chances for fast and goods traffic being worked electrically were not very great.

Mr. J. B. Sparks criticised the suggestion to use two different systems of electrification on the same railway. The remarks as to cost of energy were important, as railways would not be able to purchase at much less than ·4d. per unit, as was shown by the huge contracts made by the Chicago railways. He calculated that for main-line working, with a train every 40 minutes, electric working would just pay. The author gave approximately 50 per cent. more train-miles for the electric locomotive, but Kahler gave twice as many miles for the electric locomotive, and it seemed certain that 75 such locomotives would do the work of 100 steam locomotives. American figures gave averages of 28-30,000 miles for electric locomotives per annum, but some of the locomotives on the Pennsylvania line did 54,000 miles per annum.

Dr. S. P. Smith wished the author had given reasons why certain people had adopted electric working; they were certainly not always economic ones. The attraction was not profits, but prevention of losses in some cases. Terminal electrification was not mentioned by the author, although it was bound to come in the same way as suburban electrification. He understood the author to suggest that an electric locomotive to develop 1,100 H.P. at 70 M.P.H. had not been built, and referred him to the Lötschberg locomotives, with two 1,250-H.P. motors. He had gone carefully into the design of this locomotive, substituting two 500-H.P. motors, increasing the size of the driving wheels and the gear ratio, and found no difficulty in obtaining a locomotive to meet the conditions laid down by the author. Some analysis diagrams of steam and electric locomotives by Prof. Dalby showed that only 4 per cent. of the energy of the coal was available for traction purposes in either case, but if the electrical method were employed the coal cost could be halved and a great saving made.

Mr. W. M. Mordey thought the author was rather hard on the electrical engineer, as he wanted cheaper locomotives and cheaper energy, but the speaker doubted whether he was right in attaching so much importance to this. It might be possible to make better use of the energy, as it appeared that the efficiency was only some 18 per cent. Fig. 1 was a strong condemnation of present methods of working railways with frequent stops, and the showing was poor by comparison with the Central London line, for instance, where the reduction of energy losses had been specially studied. Advantage must be taken of inductive effects for starting and regenerative effects must replace brake losses.

Mr. H. M. Sayers said he was glad to see that the author admitted that goods traffic could be dealt with electrically and was in agreement with other railway authorities in this. As to fast traffic, the speaker could not agree that the position was as hopeless as the author suggested; nearly the whole of the weight of the motor could be utilised for adhesion, and this was a great advance on steam locomotive practice. He believed that electric locomotives to fill the conditions outlined by the author could easily be made if required. The author dealt with present—not future—conditions, a failing common to British railways; much capital expenditure on roads and widenings in the past could have been avoided by electrification. Electrical working induced traffic, and he thought that this would apply even to main-line traffic.

The **Author**, in replying, said he understood that 48 trains per hour each way would shortly be run on the Metropolitan District line. It was evident that a shunt characteristic was desirable for locomotive working, and that not too much importance should be attached to the additional mileage obtainable from an electric locomotive. He thought it was quite feasible to use two electric traction systems on one railway system for dealing with separate traffics. The figures as to train-miles and cost of steam locomotive working for fast passenger services represented the conditions on the Great Western Railway; the London-Brighton line was a typical case where dense traffic favoured electrical working. It was different where the passenger traffic represented a small percentage of the total. He had not said that an electric locomotive could not be built to meet the conditions outlined; some American locomotives did meet the speed requirements, but the draw-bar pull at starting was so great that it would pull a British train to pieces.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

AUSTRALIA.—The Commonwealth Customs authorities have decided that railless electric trolley cars are to be dutiable at the rate of 35 per cent. ad val. if of British origin, and at the rate of 40 per cent. ad val. if of foreign origin.

SUDAN.—An Ordinance recently passed, which establishes a Customs tariff for the Sudan, provides that goods not specially mentioned in the tariff (no electrical goods are mentioned) are to be dutiable at the rate of 8 per cent. ad val. Subject to certain regulations goods imported into the Sudan from Egypt are free of duty. The Director of Customs is empowered to fix the values on which duties shall be paid at the above rate, and to consult the principal merchants engaged in the trade for that purpose. The valuations fixed will be published for the information of traders, and no tariff of valuation will remain in force for more than 12 months from the date of its official publication.

NEW ZEALAND.—The Board of Trade have received a copy of a Bill regarding the valuation of goods for import duty purposes, which is to come into force on April 1st next. It provides, among other things, that when any duty is imposed on any goods according to value, such value shall be the fair market value of such goods when sold for cash in the ordinary course of business for home consumption in the principal markets of the country from which exported at the time when they were so exported, with 10 per cent. added to such fair market value. No deduction of any kind will be allowed from this value for any special or sample discount, or because of any special arrangement or on account of any other consideration by which a special reduction in price has been, or might be, obtained. If any import duty, or excise duty, has been actually paid, or is payable, on the goods in the country of export, the amount of that duty may be deducted from the fair market value as above determined. For the purpose of determining this value, the importer or his agent shall, on the first entry thereof (other than an entry for removal) produce to the collector or other proper officer the invoice for those goods, and make a declaration in the prescribed form verifying that invoice, and setting out the true value of the goods for the purposes of duty, and such other particulars as may be prescribed. If a failure to produce the invoice is accounted for to the satisfaction of the collector or other proper officer, proof of its contents by a copy, or otherwise, may be received in lieu of its production.

The "invoice" referred to is defined as follows:—

(*a*) In the case of goods imported on the sale thereof the original invoice prepared and issued by or on behalf of the seller showing the true description of the goods and the actual money price paid, or to be paid, for the goods by the purchaser; or

(c) In the case of goods consigned for sale in New Zealand, or otherwise than on the sale thereof, the original invoice prepared and issued by the consignor showing the true description of the goods and the fair market value thereof in the principal markets of the country whence they were exported at the date of exportation thereof.

With regard to the valuation of goods by the collector, it is prescribed that the amount of the invoice, after deducting therefrom all reasonable and lawful deductions in respect of discount, freight, insurance and other charges, may be accepted by the collector as sufficient proof of the fair market value of the goods for purposes of duty, and he may value the goods and assess the duty accordingly. If the importer satisfies the collector that the fair market value of the goods for purposes of duty is less than the value as shown by the said invoice after making such deductions as aforesaid, the collector shall value the goods at such lesser sum accordingly, and shall assess the duty on that value. If the collector has reason to believe or suspect that the fair market value of the goods for purposes of duty is greater than the amount of the said invoice after making such deductions as aforesaid, he may value the goods at such higher sum as he thinks proper, and assess the duty on that value accordingly.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

2,672. "Electric wiring system." A. H. Morse and C. S. Persichetti. February 2nd.

2,679. "Methods of controlling distant apparatus by Hertzian waves." J. H. Hammond, Jun. February 2nd. (Addition 13,310/13). (Complete).

2,684. "Telephone writing-attachments." W. W. Lower. February 2nd.

2,691. "Apparatus for controlling motors from a distance." A. Mond. February 2nd. (Maschinenfabrik Oerlikon, Switzerland). (Complete).

2,693. "Automatic switches." Western Electric Co., Ltd. February 2nd. (F. T. Woodward, Belgium). (Complete).

2,713. "Globe holders for electric, gas, and other lamps." J. A. Shaw. February 2nd. (Complete).

2,737. "Arc lamps." C. C. Hughes. February 2nd. (Complete).

2,738. "Transmission of wireless signals." R. C. Galletti. February 2nd.

2,739. "Electric dischargers." R. C. Galletti and R. Manzetti. February 2nd. (Complete).

2,740. "Method of producing electric impulsive discharges." R. C. Galletti. February 2nd. (Complete).

2,741. "Signalling-apparatus." Soc. d'Electricite Mors. February 2nd. (Convention date, February 3rd, 1913, France). (Complete).

2,744. "Electric mine lamp." J. Bolton and J. W. Rigby. February 2nd.

2,793. "Electric cooking and boiling utensils." F. Barron. February 3rd.

2,795. "Telephone or like apparatus and telephone systems." W. K. L. Dickson. February 3rd.

2,808. "Electric bells." W. M. Thornton. February 3rd.

2,815. "Devices for obtaining Rontgen-ray images." G. Bucky. February 3rd. (Convention date, February 5th, 1913, Germany). (Complete).

2,822. "Conversion or transmission of electric current." A. Scherbius. February 3rd. (Addition to 24,306/13. Convention date, February 3rd, 1913, Germany). (Complete).

2,827. "Electric train-lighting, ventilating, and heating systems and the like." Stone & Co., Ltd. and A. H. Darker. February 3rd. (Complete).

2,837. "Means for increasing the efficiency of electric incandescent lamps." O. L. Peard. February 3rd.

2,843. "Electric incandescent lamps." F. Loewenstein. February 3rd. (Complete).

2,844. "Devices for amplifying feeble impulses of electric energy." W. L. Richards. February 3rd. (Convention date, February 8th, 1913, United States). (Complete).

2,849. "Electrical insulators." K. von Kando. February 3rd. (Complete).

2,850. "Electrolytic meters." British Thomson-Houston Co., Ltd. February 3rd. (General Electric Co., United States). (Complete).

2,870. "Earthenware tiles and the like." C. E. Morris. February 4th.

2,871. "Earthenware troughs for electric cables." C. E. Morris. February 4th.

2,872. "Earthenware troughs for electric cables." C. E. Morris. February 4th.

2,903. "Automatic electric switches." A. Thode & Co. February 4th. (Convention date, February 5th, 1913, Germany). (Complete).

2,924. "System of synchronising electric clocks." C. F. O'Keenan. February 4th. (Addition to 23,570/13. Convention date, February 5th, 1913, France). (Complete).

2,935. "Crystal detectors for wireless telegraphy." A. L. Chaudet. February 4th. (Convention date, March 27th, 1913, Belgium). (Complete).

2,940. "Connectors for wires adapted to convey electric currents." D. N. Milestone. February 4th.

2,959. "Electric locomotives." British Thomson-Houston Co., Ltd. February 4th. (General Electric Co., United States).

3,000. "Electrical battery connectors." C. W. Read. February 5th. (Complete).

3,004. "Electric releasing device for drawing-off apparatus composed of a plurality of weighing and measuring devices and intended for use in connection with goods-packing machines." Fr. Hesser Maschinenfabrik Akt. Ges. February 5th. (Convention date, March 7th, 1913, Germany). (Complete).

3,011. "Electric switches." H. Lucas and W. H. Edwards. February 5th.

3,013. "Electrical-distributing systems." C. Vernier. February 5th.

3,020. "Magnetic tachometers." W. Beckmann. February 5th. (Convention date, March 15th, 1913, Germany). (Complete).

3,021. "Eddy-current speed indicators." W. Beckmann. February 5th. (Convention date, April 14th, 1913, Germany). (Complete).

3,035. "Electroplating process." C. J. Charlton. February 5th.

3,036. "Electric battery." C. J. Charlton. February 5th.

3,055. "Electro-motor starters." T. S. Hill. February 5th.

3,056. "Indicating devices for electrical tail-lights of motor cars." A. W. [illegible]. February 5th.

3,057. "Dynamo-electric machines." J. L. M. Yardley. February 5th. (Convention date, March 28th, 1913, United States). (Complete).

3,061. "Electric pocket lamps." W. Krafft. February 5th.

3,080. "Wireless telegraphy." A. T. M. Johnson, F. H. Varley, and A. C. N. Dixey. February 5th.

3,086. "Igniting device for explosion engines." G. Nagel and Unionwerk Mea Ges. m. b. H. February 5th. (Complete).

3,104. "Ignition apparatus for internal-combustion engines." W. Lofthouse. February 6th.

3,149. "Electrical regulators." F. W. Merrill. February 6th. (Complete).

3,150. "High-air-tension electrical insulators." A. Watkins. February 6th. (Complete).

3,169. "Arrangement of electric valves." A. Scherbius. February 6th. (Convention date, February 7th, 1913, Germany). (Complete).

3,171. "Method of periodically modifying high-frequency electric currents." F. von Lepel. February 6th. (Convention date, February 11th, 1913, Germany). (Complete).

3,181. "Electro-chemical treatment of liquids." C. P. Landreth. February 6th. (Convention date, February 21st, 1913, United States). (Complete).

3,191. "Radio-telegraphic and radio-telephonic receiving systems." G. O. Squier. February 6th.

3,192. "Radio-telegraphic stations." E. Girardeau. February 6th. (Convention date, February 17th, 1913, Belgium). (Complete).

3,195. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. and J. Savin. February 6th.

3,197. "Method of and means for equalising the potentials of grounding points." A. B. Clark. February 6th. (Convention date, October 29th, 1913, United States). (Complete).

3,209. "Manufacture of incandescent electric lamps." C. Gladitz. February 6th.

3,217. "Locks for handles for controllers and the like." British Thomson-Houston Co., Ltd. February 6th. (General Electric Co., United States).

3,231. "Electric heaters or resistance elements therefor." J. R. Quain. February 6th.

3,232. "Frequency transformers." W. P. Thompson. February 7th. (R. Goldschmidt, Germany). (Complete).

3,236. "Electrical influence machines." V. E. Johnson. February 7th.

3,237. "Switches." W. Duddell and J. S. Highfield. February 7th.

3,240. "Sparking-plugs for internal-combustion engines." Electric Ignition Co. (1913), Ltd., and A. Cox. February 7th.

3,241. "Electric welding systems." Liverpool Electric Welding Co., Ltd., and W. A. M. Wachsmuth. February 7th.

3,254. "Electric heating elements." W. H. Sturge. February 7th.

3,282. "Telephone receiver." J. Parr. February 7th.

3,291. "Single- or multi-phase electric furnace for treating molten metal." P. Lescure. February 7th. (Convention date, February 7th, 1913, Germany). (Complete).

3,295. "Motor-car starting and lighting sets." H. C. E. Jacoby. February 7th.

3,310. "Synchronising devices for electric motors or other rotating electric machines." R. P. Howgrave-Graham. February 7th.

3,311. "Protection of electric circuits against the influence of alternating currents." K. von Kando. February 7th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

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23,417. Electrical Token Apparatus for Railways. A. T. Blackall & C. M. Jacobs. October 14th.

23,689. Turbo-Electric Machines. A. Rolfe. October 17th.

1913.

1,442. Supports for the Filaments of Incandescent Electric Lamps. J. M. Roux & J. Sanchez. January 17th.

1,467. "Dimmers" for Electric Lamps. E. T. Middlemiss. January 18th.

1,591. Electric Motor Control Systems. Siemens Bros. Dynamo Works, Ltd., F. Lydall and A. M. Duke. January 20th.

1,617. Winding Machines. Western Electric Co. (Western Electric Co.). January 20th.

1,678. Apparatus for Heating Water. V. S. Needham & F. G. Needham. January 21st.

1,902. Telephone-Exchange Systems. Western Electric Co. (Woodward, acting for Western Electric Co.). January 23rd.

1,939. Oscillation Gaps or Dischargers, for Use in Radio-Telephony, Radio-Telegraphy, and Like Purposes. W. Torikata, E. Yokoyama, M. Kitamura. January 23rd.

1,964. Railway Signalling Apparatus for Use at Places Where Speed Restrictions Obtain. J. N. C. Kennedy. January 24th.

2,198. Devices for Closing and Disinfecting Telephone Mouth-pieces and Other Articles. M. Dickinson. January 27th.

3,829. Lattice, Masts, Poles, Towers, and Columns for Wireless Telegraphy Stations, Transmission Lines, Windmills, and the Like. B. C. Barton & P. C. Barton, & Robert W. Blackwell & Co. February 14th.

6,226. Rheostats for Controlling Electric Motors and the Like. P. S. Swan. March 13th.

7,376. Telephone Call Registers. A. Sterry. March 28th.

7,656. Insulators for High-Tension Oil-Immersed Electrical Apparatus. A. Bitter & E. Weissberg. April 1st.

10,841. Method of Operating Rotary Converters and Other Alternating Current Machinery. A. H. Railing & C. C. Garrard. May 8th.

11,135. Apparatus for Automatically Starting or Braking Electric-Motors. H. Delvenne. May 10th.

11,991. Metallic Vapour Electric Lamp. F. Kerschbaum. May 22nd. (January 8th, 1913).

12,377. Manufacture of Stable Boron Nitride. British Thomson-Houston Co. (General Electric Co.). May 27th.

14,122. Arrangements for Converting Continuous Currents of Electricity into Isochronous Undulatory Currents. Soc. des Telegraphes Multiplex (Systeme E. Mercadier H. Magunna). June 18th. (June 21st, 1912).

15,571. Controlling Means for Electric Motors. Otis Elevator Co. (Otis Elevator Co.). July 5th.

16,267. Telephone Exchange Systems. Western Electric Co. (F. T. Woodward, acting for Western Electric Co.). July 15th. (Divided Application on into Isochronous Undulatory Currents. Soc. des Telegraphes Multiplex

16,481. Process of Manufacturing an Electric Lamp Filament Containing Cobalt. C. Kanazawa. July 17th. (July 17th, 1912).

21,758. Electric Signalling Apparatus for Ship's Telegraphs and the like Purposes. H. L. Stocks. September 26th.

22,159. Induction Coils. A. Hiorth. October 1st. (November 30th, 1912).

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COMMERCIAL SUPREMACY AND INDUSTRIAL UNREST.

REPLYING to the toast of "His Majesty's Ministers" at a dinner of the City of London Solicitors' Company a few days ago, Lord Haldane claimed that lawyers, however unpopular they might be, were the leaders of public opinion in this country, and that they exerted a tremendous influence on the country's future welfare.

Whether we agree or not with this dictum, we may perhaps admit that lawyers—due no doubt to their legal training—have the faculty of summing up and expressing tersely the trend of current thought, which otherwise finds expression in many forms which are sometimes apparently contrary in direction.

To take the case of the present industrial unrest, the dissatisfaction of organised labour with its conditions, and the feeling among employers that our commercial supremacy is threatened—all are agreed that we are faced with problems of immense magnitude, so immense as to be almost appalling, and yet it is not possible to lay the finger on any particular spot and say: "there is the cause of it all."

No would-be reformer pretends that his own particular scheme, whatever it may be, will cure all the industrial ills from which we are suffering.

It is interesting, therefore, to turn to Lord Haldane's speech (as reported in the *Times*) to see how, as a lawyer and leader of public opinion, he sums up the situation. In his opinion, we occupied our present position of "first in the world in industrial output per head of population" partly by reason of national qualities, but partly also because in the old days we had no such competitors as we have to-day. A new movement had arisen during the last six or seven years, a movement of which we were yet hardly conscious—a definite and scientific effort made abroad to raise the level of the skilled workman to a height which we as yet had not set before ourselves. This was being done by a new system of training.

The old days of apprenticeship, he considered, and we agree with him, had gone by. The apprenticeship system had done much for us in the past, but it could not successfully compete with the modern Continental and American substitute of training in trade continuation schools.

British manufacturers are inclined to scoff at the workshop training given in technical schools, and many workmen would still claim that to become efficient it is necessary to serve about seven years in the shops. This means that a boy must leave school at 14 years of age in order to become a fully-fledged workman by the time he is 21. But we must not overlook the fact that when the seven years' apprenticeship system was introduced, handicraft meant much more than it does to-day, when labour-saving machinery has entirely eliminated many of the old manual operations, so that there is now very much less for an apprentice to learn in the shops than was the case before handicraft had been so largely superseded by machinecraft. An intelligent youth can learn as much in six months in a properly-equipped college workshop, so far as the use of tools is concerned, as he would learn in as many years of an ordinary apprenticeship under modern factory conditions.

In many parts of the Continent, as Lord Haldane pointed out, instead of boys leaving school at 13 or 14, as in this country, the training is continued until they are 16, 17 and 18 years of age, and that training is not merely in general knowledge, but in the chief point of the calling which the future workman is going to exercise.

This is a problem which, the speaker said, we shall have to face six or seven years hence.

We are really facing it now: the conditions of apprenticeship, so far as the engineering trades are concerned, have been the subject of discussion before the leading engineering societies on many occasions during the last few years, and many firms, as we have from time to time recorded in our columns, have adopted modified conditions of apprenticeship in order to meet the changed circumstances. So far as we know, the Trade Unions have taken no active steps to assist this movement, although their co-operation is most essential if we are to maintain our leading position among the great industrial nations of the world.

This lack of co-operation is, no doubt, a result of the same cause that is producing the industrial unrest which is so prevalent, not only in this country, but in the Colonies and dependencies of the Empire, and also in France, Germany, and other parts of the Continent, as well as in America.

This, as Lord Haldane suggested, is due to the fact that Labour is better educated than before, and the working classes have become conscious that the gap between those who work with their hands and those who work with their heads is unduly great, so far as remuneration and participation in the comforts of life are concerned. This is a factor which has to be reckoned with. We have to deal, the speaker remarked, with a majority, the rightness of whose cause we cannot deny. A change is bound to come, and it is of the highest importance so to prepare for it that the change may come peacefully and quietly, and in such fashion that it will make for the well-being of the State, and not its detriment. The recent disturbances in South Africa and elsewhere are all part of the same discontent, and it is essential to get down to the deep root-cause, because the movement cannot be repressed. Organised as Capital and Labour are to-day, strikes have become very serious things, and when they touch railways, the coal industry, and transport, they touch the life of the nation.

Concluding his remarks, Lord Haldane said that what we had to do was to endeavour to bring about a sense of the absolute necessity of the solidarity of conscience between the workmen and employers of this country. It could not all be on one side. Employers would have to recognise the position of the workmen, and the workmen would have to recognise that they had some further concern than the mere getting as much as they could in wages. Any man who could think out completely and adequately that problem of the future, and other problems cognate to it, and make a substantial contribution to progress along the path which must be followed by those who succeeded him, would deserve well of his country.

In what direction shall we look for that man? And when we find him, are we in a mood to follow him? Opportunity, it is said, makes the man; we certainly appear to be at the fulness of the opportunity—maybe the man is at the door! He will require to be one who is above all suspicion of partiality, and he must know both sides of the case completely. May it not happen that the expert amongst us who has conducted so many inquiries into labour disputes during the last few trying years is as well able as anybody to understand the problem of the present, and is more qualified than most to guide both master and man as regards the future, so that industrial development and prosperity may continue parallel with improvement in the condition of all ranks of workers?

British Motors and Transformers for Canada.

Our Canadian correspondent informs us that British-made motors sometimes receive a good deal of criticism over there, apparently on account of the power factor being lower than that of those made in Canada. It would perhaps be worth the while of those home firms who are doing business in electric motors in that market to look into this question, as it is not desirable that the reputation of any of their products should suffer for want of a little attention to Canadian requirements. The writer regards it as curious that very few, if any, of the thousands of transformers used in Canada come from Europe. He is at a loss to know the reason, but the fact exists that neither Britain, Germany nor any other European country seems able to find a foothold for this class of product in the Canadian market.

Whether it be on account of price, efficiency, reliability, or other cause, is not known. He continues:—"Surely if makers at home can compete in respect of electric motors, they should be able to with transformers. Perhaps as yet no sufficiently determined effort has been made. Even if the type and characteristics of the transformers used here are not familiar to British manufacturers, it should not be a difficult matter for any enterprising firm to secure one or two second-hand ones to examine and test. One can understand that it would be difficult to compete for large transformers built for very high voltages, such as 110,000 volts or over, but ordinary potentials up to 10,000 volts or so should form no serious bar to successful competition."

Numerous reports from authorities on both sides of the ocean state that trade in Canada has been decidedly quiet for some time now, and that owing to the shortage of money many projected undertakings have been held up. It is considered, however, that the splendid harvest which was obtained last year should have a very healthy effect on the situation, and no doubt the spring will see much new work put in hand. The Canadian winter, of course, puts a temporary check on a great deal of work, owing to its severity.

The Rubber Position.

Since last writing the rubber market has at times worn quite a strong appearance, and there were some of the cheerful optimists in shares who began to wax reminiscent of the good old days when prices went soaring gaily regardless of the inevitable consequences. The general opinion is, however, that the article has really undergone a substantial improvement from the worst, so far as market conditions are concerned, and there are but few who hold a very poor opinion as to the future. Among these, however, is a Mincing Lane house which has issued a lengthy document bitterly attacking the rubber position, and while stating that the statistical outlook is about as bad as bad can be, and that the next few months will show an alarming excess of supplies over consumption, suggests that the price will drop to somewhere round 7d. or 8d. a lb. The writer of the circular is very dogmatic in his utterances, and altogether is evidently badly obsessed with the idea that rubber is "rotten," as the phrase goes, but it must be remarked that the trade has taken the utterances with cheerful philosophy, and clearly does not regard the situation as being anything like as hopeless as is it represented by this particular interest. In spite of what is said in the circular there cannot be any serious question but that the prosecution of harvesting operations in most of the wild rubber-producing countries must have been very seriously interfered with by the slump in prices, and the consequent acute depression entailed, and still in force, notably in Brazil. The receipts at Para have been checked very substantially, which is a notable feature, and while it is just possible that supplies have been held back up country, there is no reason to think that the quantities which might be affected in this way are of any substantial importance. It is true of course that the falling-off in the receipts of wild rubber the world over has been more than compensated for by the increased quantities of plantation material which are coming forward, but consumption seems to be quite able to take care of what becomes available. The remarkable elasticity of the demands from manufacturers since the price of best plantation grades fell to near 2s. a lb. testifies to the possibilities of the consuming industries, while constituting the mainstay of the market. A further point in favour of the position is that industrial conditions in the trans-Atlantic trade are by degrees being restored to the normal, and if general developments there should be as favourable over the rest of the year as they at present promise to be there should be a greatly increased consumption in progress as the months pass.

The official returns of United States imports of crude rubber for last year are interesting, for they disclose an increase of 10,000 tons in plantation grades, the total imports of which were 22,300 English tons, which is a quantity considerably in excess of the imports of Brazilian rubber, and, indeed, an amount slightly in excess of the combined Brazilian, Central American, and African rubber which entered the country.

Regarding the trade as a whole it is a foregone conclusion that a moderate price for the article will enormously stimulate consumption. It may take a little time for new uses to be devised, but they will assuredly come, and the efforts being made in influential quarters to effect an extension of the present uses are certain to be of effect sooner or later. One of these is undoubtedly rubber flooring, for which there is a practically unlimited market if only the price is "right." The flooring which has been laid already in various parts has so far given unqualified satisfaction, and there are a number of further contracts in hand, making it clear that the material is being appreciated for this use. Generally with the improved financial position, thanks largely to easier money and to the signs of returning activity in trade at home and abroad, the outlook is improving, though it is not probable that there can be much advance in prices until fundamental conditions as regards American trade are distinctly improved.

The result of the plantation auction sales held this week at Mincing Lane was not very satisfactory compared with the previous sales, closing prices showing a fall of about 3d. a lb., though as regards recent private rates, there was not much alteration. The total quantity brought forward for sale was round 1,300 tons, a heavy amount, the bulk finding buyers with a moderate demand.

Lessons on Coal Gas.

The ingenuity and enterprise of the British Commercial Gas Association in propagating a knowledge of the sovereign merits of their products deserve all praise; we only regret that there is no corresponding association charged with the duty of upholding the pre-eminent advantages of electricity. One of their latest innovations is designed for the education of the rising generation, and is advertised in the London County Council *Gazette*. It is announced that a series of notes of lessons on coal gas as a fuel, as an illuminant, and as a source of power will appear in the *Gazette* in 1914; the notes will be written by an expert, and will be so arranged that the experienced teacher can adapt and utilise what is most suitable for the needs of his or her own class, and discard the rest. Object or picture lessons are provided for the infant classes, in addition to the more advanced presentation of the subject for use in boys' and girls' schools; the secretary of the Association will answer questions put to him by teachers, and local gas-works managers will co-operate by lending specimens of appliances or materials, drawings, &c.

"The object of the Notes is to make common knowledge of the interesting scientific facts connected with gas manufacture, distribution and use." No one can cavil at the praiseworthy purpose of the series; anything that will tend to a reduction in the number of fires, explosions, suffocations, and other accidents due to ignorance of the properties of gas tends to the public benefit. But if such teaching is necessary in the case of gas, which has been in use in London for over a century, how much more necessary is it in the case of electricity, which has been used barely one-third as long, and which is distinguished from all other agencies for lighting, heating and power production by the fact that it, like gravity, apparently has no corporeal existence, is imperceptible to the senses, and is known only by its effects on matter. To the child its operations are enshrouded in mystery, and instruction of the young is imperatively called for. And what a fertile field the science of electricity affords for the enthusiastic teacher! We grown-ups are so accustomed to the marvels of electricity that they have become to us more or less commonplace; but marvels they remain, and they constitute an inexhaustible store of interesting material for lessons and experimental demonstration. We have on previous occasions urged that popular lectures should be given for the edification of the public on the infinite variety of the applications of electricity to domestic and industrial uses; we now commend to the attention of the supply authorities the example so wisely set by their rivals.

Professional Etiquette.

The Council of the Institution of Civil Engineers recently issued a circular calling attention to the practice favoured by local authorities, whose clerks—themselves belonging to a profession in which rigid etiquette is observed—contemptuously ignore the claim of engineering to be a "profession," and invite by advertisement engineers to submit in competition with others their terms for preparing plans for engineering schemes. The Council naturally condemns this practice, and calls upon the members of the Institution to decline to respond "in any way" to such advertisements.

We have on previous occasions commented on the procedure in question, which obviously opens the door to the incompetent, and is admirably adapted to ensure that the local authority concerned shall be provided with professional advice of the worst possible quality. It is only the inexperienced and unknown "consultant," struggling for a foothold, that is likely to answer such an advertisement. But we may suggest that the more expert in such matters who see the advertisement, while not replying to it directly, know methods of indirectly making their names and terms known to the advertiser, and we take it that the comprehensive words "in any way," used by the Council, are intended to cover the back-door methods also.

If we are not mistaken, it is the practice of the Association of Consulting Engineers to send a list of the names of its members to such advertisers. Thus the Association is enabled to do as a corporate body that which its individual members may not do. The ethics of the matter are somewhat obscure; but we wonder whether the Council of the Institution approves of this proceeding.

We are not blind to the difficulty experienced by the clever and highly qualified but little-known man in making a start as a consulting engineer; his duty, according to his established elder brethren, is—to efface himself. We sympathise with him, and we see little objection to the American practice of publishing his visiting card in the advertisement pages of the technical Press; but that is by the way. The practice condemned by the Council, as mentioned above, is most objectionable on all grounds.

AUTOMATIC TELEPHONES, &c., AT KING'S COLLEGE HOSPITAL.

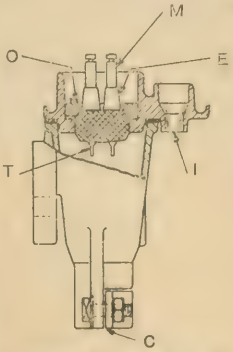
By the courtesy of Messrs. Siemens Bros. & Co., Ltd., we were recently enabled to pay a visit to their telephone works at Woolwich, and to inspect the automatic telephone exchanges which they have installed for the service of their works, and in the new King's College Hospital at Denmark Hill. The former installation has an ultimate capacity of 1,000 lines, but is at present equipped for some 200 lines, and provides intercommunication throughout the whole of the various departments of the company's extensive works at Woolwich; we understand that the convenience, rapidity and reliability of the system have been so cordially appreciated by the staff since the automatic apparatus was installed, that a return to the slower methods formerly in use would result, if not in a general riot, at any rate in consternation and a storm of protest. Not least of the advantages of the system is the immediate clearing of the line, a quality in which all manual exchanges are conspicuously and painfully deficient; thus it is possible for the head of a department, on arrival at the works in the morning—perhaps a few minutes late? Certainly not, but in a hurry to get to the heart of things—to call up half-a-dozen of his subordinates, and receive their reports as to the state of their respective branches in the space of half as many minutes. The "engaged" signal is given at once, if appropriate, and the caller always knows whether his call has been effective, for if the called subscriber's telephone is not engaged he receives a "free" tone signal.

As a rather special favour the Post Office has permitted the automatic exchange to be coupled to the public exchange system, for experimental purposes; this, of course, necessitates the addition of a private manual exchange through which the Post Office calls are passed to the local stations, the automatic apparatus being cut out of circuit when a line is through to the Post Office exchange; but the same instruments are used, with hand-combination sets, and the service appears to operate with perfect smoothness and facility. As the automatic exchange is essentially the same as that at the hospital, one description will serve for both.

In the telephone factory a variety of work was in progress, a considerable number of exchange boards of various sizes being in course of construction, chiefly for export. We noted with interest that in the latter case the boards were completely built up and wired to the distributing frame, the cables and strips of jacks being afterwards withdrawn and packed so that they can be placed in position without difficulty on arrival at their destination.

The automatic exchange at the King's College Hospital is designed for an ultimate capacity of 150 lines, of which some 90 are already in use; as the system will necessarily run into three figures, in which case *all* the numbers must contain three digits, and it is undesirable to change the numbering after the exchange is brought into use, the numbers commence with 101. Two storage batteries of 30 cells each are provided, which feed also the clock, signalling and bell circuits (at low voltage); these are mounted in a room close to the power station.

Fig. 1.—External Distributing Box.



O, Insulating oil; M, Metal terminals; E, Ebonite; T, Terminals for cable leads; I, Inlet for wires; C, Inlet for cable.

Fig. 2.—Section of Box.

The system of wiring adopted is to use 12½-lb. copper wires, enamelled, wrapped with paper saturated with beeswax, twinned and enclosed in a lead sheath. The enamel alone would provide adequate insulation. This type of wire can be run on the outside of the walls, buried in plaster, or otherwise fixed in any position without fear of breakdown, and is very inconspicuous.

The total area of the hospital site is 12½ acres, and most of the buildings are completed. In each block there is a distributing box in a convenient position, and all the boxes, numbering eventually some 18, are coupled by cables of 10 to 26-pair with one or other of six junction boxes situated at suitable points. Thus, future wiring is limited to the short distance between one of the distributing boxes and the point where the instrument is to be fixed, all other wiring being permanently in place. The junction boxes are joined together by 52 and 120-pair cables, the main box A being at the telephonic "centre of gravity" of the buildings, where, in the ordinary way, the exchange would be situated. But in order to bring all the apparatus under the immediate supervision of the electrician in charge of the generating plant, the exchange has been erected in a convenient room adjoining the engine room and the battery room, and is connected with the central box A by a 200-pair cable. The main cables are all of 10-lb. copper conductors insulated with paper, twisted up in pairs, and lead-sheathed. As the boxes provide for other circuits besides the telephones, junction box A is designed to accommodate terminal strips for 600 pairs of wires, which can be cross-connected at pleasure.

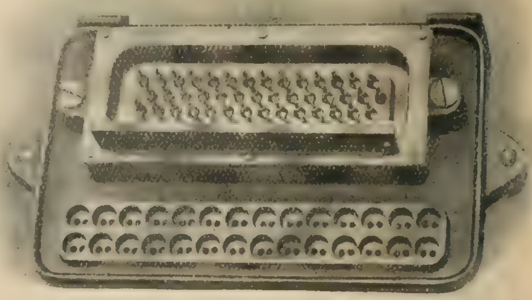


Fig. 3.—Plan of External Distributing Box (Cover removed).

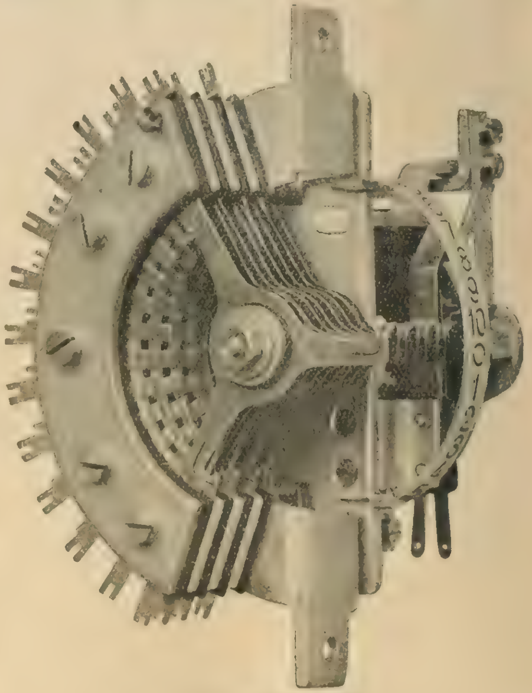


Fig. 4.—Preselector.

Fig. 1 shows one of the external distributing boxes, and fig. 3 a plan of a similar box with the cover removed, showing the holes through which the distributing wires enter the box, and the screw terminals. A section of the box is shown in fig. 3. The lower part of the box is filled with melted compound, and the terminals are surrounded with insulating oil. The wires are taken into the rooms through the window frames.

In fig. 7 is shown one of the wall instruments used at the hospital, with the calling dial and a neat quick-reference directory devised by the makers. The mode of operation of the system resembles that usually employed, and for a two-figure system would be as follows :—

Immediately the receiver is lifted, the instrument is connected to a "preselector," shown in fig. 4, which at once picks out the first disengaged connecting line—10 lines are provided in this case. The subscriber is now through to a connector, one of which is illustrated in fig. 5 ; this carries the contacts representing 100 subscribers' line circuits, with their corresponding test contacts, and is controlled by a set of relays on the same rack, which are actuated by the motion of the subscriber's calling dial. The complete set of racks is shown in fig. 6. It will be understood that the first motion of the connector switch is to rise vertically to the level corresponding to the tens digit, and the second motion to rotate in a horizontal plane to the point corresponding to the units digit of the called subscriber's number. If the latter is disengaged, his bell is rung every five seconds, and the calling subscriber receives a "free" tone in his instrument ; but if the number is engaged, the "busy" tone is given ; on the calling subscriber replacing his receiver, the whole of the apparatus is automatically restored to its normal state. The average time occupied in making a call, up to the moment when the bell is rung, on a two-figure system is 3 to 4 seconds.

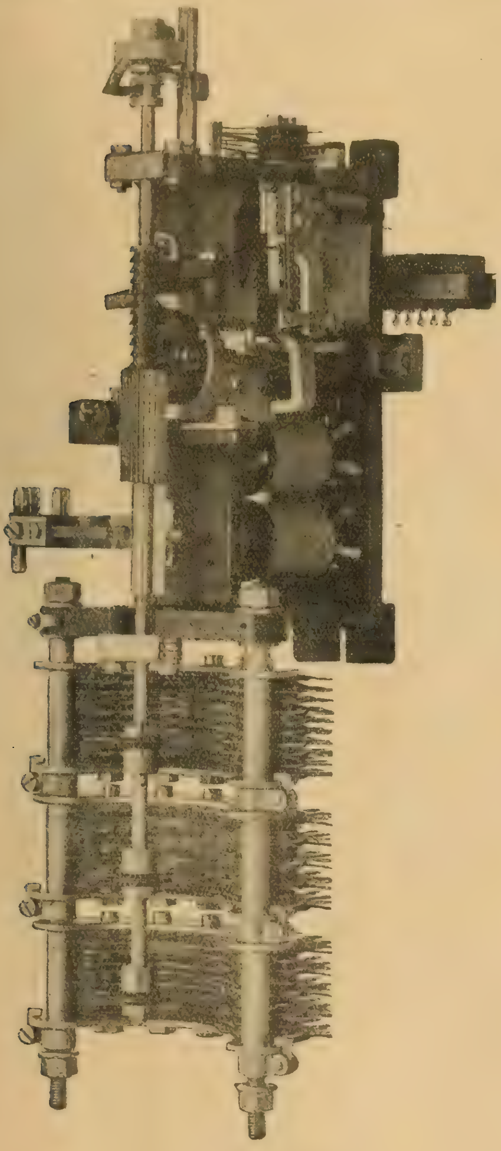


Fig. 5.—Line Connector.

It will be remembered, however, that the hospital system is a three-figure one, but only the first two hundreds are required. In the ordinary way, the third figure necessitates a complete set of selectors in addition to the apparatus already mentioned. Messrs. Siemens Bros., however, having in view the fact that the number of subscribers cannot exceed 200, and that therefore 80 per cent. of a full-size selector would be wasted, have devised an alternative method which has now for the first time been brought into use. A "preselector" provided with contacts for 15 lines replaces the costly selector ; it is called a "discriminator," its function being to connect the calling subscriber's line to a connector in the particular hundreds group in which the called subscriber's line is situated, and it can be applied to equipments up to 400 lines, by increasing the number of contacts.

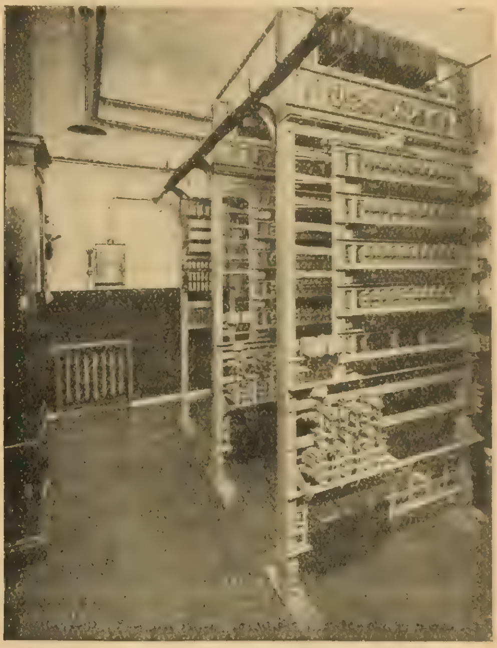


Fig. 6.—Apparatus Racks.

Thus, the apparatus successively brought into operation in putting a call through are : subscriber's dial, preselector, discriminator, connector, called subscriber's instrument.

We may mention that the ringing and tone apparatus is normally at rest, but automatically starts up directly a call is initiated. The present equipment consists of 90 subscribers' preselectors and eight connecting circuits ; the discriminators are fitted, but will not be required until more than 100 stations are in use.

Besides the telephone exchange there is in the hospital an installation of 120 electric clocks and a double-faced out-door clock, controlled by a master clock with automatic winding, which is appropriately fixed in the exchange room (fig. 7). An automatic alarm is provided to inform the attendant when the battery voltage is low. The secondary dials are absolutely silent in operation. The current is derived from the telephone battery, at 26 volts.

The dials are connected in parallel on seven circuits, each of which is provided with an impulse counter and key in the exchange room ; thus if any circuit gets out of order, the maintenance man can see at a glance that the counter has stopped, and after clearing the fault he can bring all the clocks on that circuit into synchronism with the others without visiting them, by means of the impulse key.

Another special apparatus is a staff arrival system, by means of which the porter at the main entrance can at once notify to all the rooms concerned the arrival of any member of the staff, whose names are recorded on an indicator. Two keys are employed for each circuit; the arrival key rings a bell and operates an indicator on each board; the departure key merely restores the indicator without ringing.

Thirty-six of these circuits are provided, with five boards; provision is made for 18 additional circuits on the board in the entrance hall, of which 14 are equipped at present; these circuits do not appear on the other boards. Buzzers in each ward inform the Sister in charge that the surgeon or doctor is about to visit it.

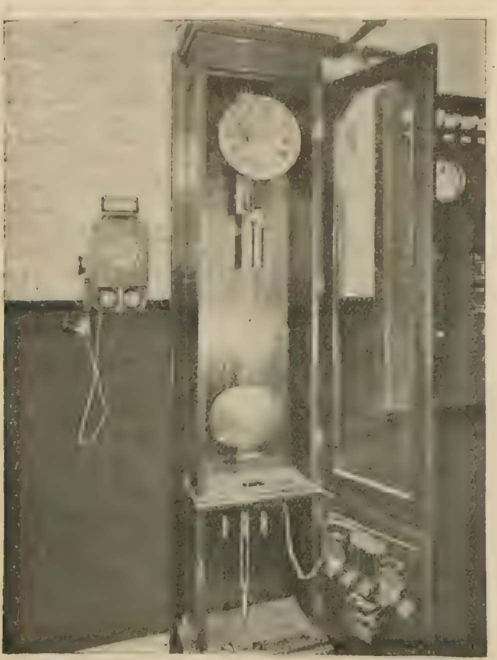


Fig. 7.—Master Clock and Wall Telephone.

A number of bell circuits has also been provided between various rooms. All the indicators and bells are wired in the same manner as the telephones, and are fed from the same battery.

It will be seen that the installation has been carried out on the most up-to-date lines, and constitutes a model of what such an installation should be. The architect was Mr. W. A. Pite, and the consulting engineer, Prof. D. S. Capper.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Protection or Tyranny?

If it is not now too late, may I draw attention to Mr. Purse's reply to my letter which appeared in your issue of the 6th inst.?

Mr. Purse appears to be very curious to know who I am, and to think it very mean of me to conceal my identity.

I can assure Mr. Purse that I meant nothing more or less than what I said, and am not trying to "get at" him, and also that I should not use a nom-de-plume if I had not very good reason for doing so.

It is very good of him to offer me one of his copies of the B.E.A.M.A.'s conditions, but I'm not to be drawn. I do not see, however, why he should not send one to you, Mr. Editor, for publication.

The fact (if it is a fact) of the B.E.A.M.A. absolutely refusing to budge from their own conditions of contract is no reason why the general electrical public should not discuss these conditions *and* those desired by the other side—the supply engineers—if they can find out what these two sets of conditions actually are, for it is quite certain that neither side can stand long against public opinion.

I repeat, perhaps Mr. Purse will take the opportunity of sending them to you and asking you to publish them.

Pollux.

February 23rd, 1914.

The Design of Regulating Resistances.

Although I appreciate the kindly interest of Dr. C. C. Garrard as evinced by his letter in your current issue, I do not agree that the formula: "Square the mean of the maximum and minimum amperes and multiply by the rheostat resistance" is the better.

By example A in the article, the rheostat resistance is roughly 3½ times that of the field, but this formula denotes a rheostat size 67 per cent. greater than that actually required.

In example B both formulæ give similar results, but they differ again for example C, whereas the formula I advocate closely results to the actual "summation watts" in each case.

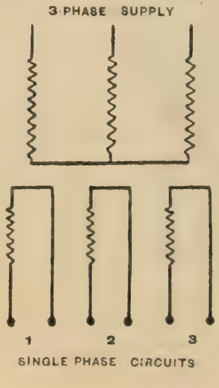
In conclusion, the greater the departure from a straight line the field current becomes (see fig. 1 in article), the greater the inaccuracy of the formula Dr. Garrard inclines to.

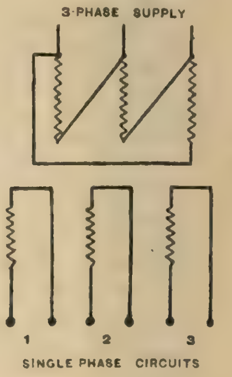
L. Boothman.

Stretford, *February 21st*, 1914.

A Query.

In reply to the query of "Ignoramus", regarding a method of connecting transformers to obtain single-phase current from a three-phase supply, the only way would be to couple up as shown in the accompanying diagram. About one-third of the load should be connected to each single-phase circuit. If the load is very variable, account must be taken of what lights or motors are likely to be on at the same times, and these small groups must be evenly distributed on the three circuits, one-third the power required by each group being connected to each circuit. Trusting this will solve your correspondent's difficulty.



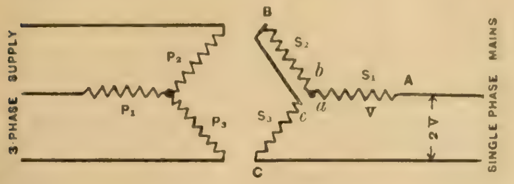


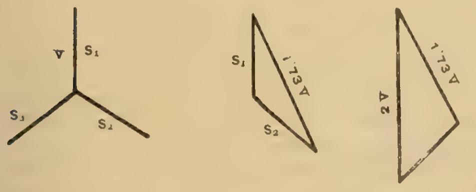
A. B. Johnstone.

Gateshead on-Tyne,
February 21st, 1914.

In reply to query by "Ignoramus," *re* coupling of transformers to obtain single-phase from three-phase supply, I submit the following method:—

First of all let primary of transformer be connected star, as is general, then find the neutral point of secondary by temporarily connecting in star, detach one phase from this star connection, leaving two phases with their neutral points connected together, the neutral point of this detached phase then to be connected to the free end of either of the other two phases. The two remaining free ends are the points from which single-phase supply may be taken.





Phases S_1 and S_2 to have their neutrals *a b* connected together; phase S_3 to have its neutral point *c* connected to B of phase S_2. Then the voltage of single-phase across A and C is equal to twice the voltage per phase, as shown in the vector diagrams.

D. D. Rayner.

Leeds, *February 23rd*, 1914.

In answer to the letter of "Ignoramus," there is no direct method of obtaining single-phase current from a three-phase supply with transformers. If, however, he uses "Scott"-connected transformers, he can obtain a single-phase supply from each pair of tappings on the secondary, and by balancing the load on these the load on the three-phase supply will be also balanced.

F. G. Miller,
Second Assistant Engineer,
City of London Mental Hospital.

Dartford, *February 23rd*, 1914.

[A solution of the problem consists in using a "Gramme" armature, surrounded with a laminated iron cylinder or provided with an internal laminated core, to complete the magnetic circuit. On connecting the three-phase leads to three equidistant points in the winding, a rotating field is obtained, and a single-phase current can be tapped off from any two diametrically opposite points on the winding. There are, of course, practical objections to this method.—Eds. Elec. Rev.]

BUSINESS NOTES.

German Wire Lamp Prices.—The recent collapse in the price agreement in relationship to metallic-filament lamps, to which reference was made a few weeks ago, has now been followed by the circulation of rumours on the Berlin Exchange to the effect that negotiations were proceeding between the A.E.G. and the German Incandescent Gas Light (Auer) Co. for the re-establishment of an understanding. It turns out, however, that there is no foundation for the rumours or for other versions respecting a price arrangement in regard to other lamps, as keen competition continues and is becoming increasingly manifested in the constant advance in the discounts for wire lamps.

Argentine Orders.—The Empresa de Luz y Fuerza, of Buenos Ayres and Mendoza, which is a subsidiary of the German Transmarine Electricity Co., is having a dam constructed near Mendoza with the object of establishing hydro-electric works at an estimated expenditure of £550,000. It is stated that the largest portion of the work has been entrusted to the Compania General de Obras Publicas, which is the Argentine subsidiary of the firms of Philipp Holzmann & Co., of Frankfort-on-Main, and Gebruder Goedhart, of Dusseldorf.

German Electrical Industry.—Prof. Max Levy, of the Berlin electrical instrument manufacturing firm of that name, in the course of a recent lecture, said that the production of the aggregated German electrotechnical industry per annum totalled about one milliard marks. Of this amount, about 290,000 000 marks represented the value of the exports. The installation branch had developed into an independent entity, represented by some 4 000 firms, some of which might be relatively small. The number of electricity stations existing, according to statistics brought up to April 1st, 1913, was over 4,100. Above three-fourths of the population of Germany were at the present time able to avail themselves of the electric current. The total capacity of the electric stations was about 2,095,000 KW.; the total output amounted to about 2 milliards KW.-hours. The Berlin electricity works represented the largest single German undertaking. Its current output stood for one-eighth of the aggregate current output of German public electricity stations. The significance of the electrical industry from a national economic point of view was very considerable. It paid in general not only the best wages, but also the number of employés was very high. The profit returns of manufacturing firms were satisfactory, but not brilliant. The profit returns of electricity stations were steadily increasing, and amounted, with the limited companies, to an average of 9 9 per cent. They are considerably larger with the big stations than with the smaller. A characteristic feature of the electrical industry was its quick development everywhere; while the aggregate of industrial companies in the period from 1901 to 1911 showed an increase in the number of insured persons of 43 per cent., the advance in the electrotechnical industry amounted to 187 per cent. While the aggregate amount of wages in those callings in the period named advanced about 80 per cent., in the electrotechnical industry alone, the increase totalled 266 per cent. The only hindrance which was feared as being likely to affect the continuous flow of progress of the electrical industry was apparently, according to Prof. Levy, the intervention of unfavourable treaties of commerce.

German Imports and Exports.—A German newspaper, in dealing with the expansion of the export trade of that country in recent years, publishes the following figures in relation to electrical machinery, cables, &c.:—

Imports.	1907.	1912.	1913.
Dynamos, motors, transformers, &c.	£95,000	£105,000	£155,000
Electric cables	75,000	75,000	105,000
Exports.			
Dynamos, motors, transformers, &c.	£1,715,000	£2,565,000	£2,825,000
Electric cables	2,260,000	1,610,000	1,965,000

As to the respective positions occupied in the markets of the world by Germany, Great Britain and the United States, the accompanying figures are cited by the newspaper in relation to the exports and imports of the machinery and electrical industries of the three countries in 1909, 1912 and 1913:—

	Germany.	*United States.*	*United Kingdom.*
Exports in 1909	£35,600,000	£23,150,000	£34,650,000
Imports in 1909	5,550,000	1,680,000	9,200,000
Exports in 1912	£52,800,000	£42,300,000	£39,550,000
Imports in 1912	6,450,000	2,050,000	16,100,000
Exports in 1913	£59,450,000	£52,500,000	£45,750,000
Imports in 1913	7,550,000	2,050,000	17,300,000

The figures have been converted on the basis that one mark is equivalent to a shilling, although in reality about 20 marks 40 pfennigs are equal to £1 sterling.

Australian Contracts.—The Commercial Intelligence Branch of the Board of Trade has now received from the office of the High Commissioner in London for the Commonwealth of Australia, a copy of standard specification (No. 460*b*) for paper-insulated, lead-covered, multiple twin cable, for which supplies may from time to time be required by the Postmaster-General's Department. This specification may be seen by United Kingdom manufacturers of electrical supplies at 73, Basinghall Street, London, E.C.

Cable Manufacture in Holland.—The Nederlandsche Kabelfabriek Maatschappij is the name of a new company which has just been formed in Amsterdam, with a capital of £160,000, to establish works in the country for the manufacture of telegraph, telephone and electric cables of all kinds, with the exception of submarine cables. As there is a duty of 5 per cent. on all cables imported into Holland, it is considered that the new company has every prospect of success; a German engineer has been engaged as manager of the works.

Patent Application.—Mr. Justice Warrington, in the Chancery Division, will, on June 23rd, hear the petition of Graf Botho Schwerin and of Elektro-Osmose Aktiengesellschaft, of Frankfurt-on-Main, for an extension of the term of patent No. 12,431 of 1900 (granted to Graf Botho Schwerin).

Stoker Contracts.—Among recent stoker contracts of the Underfeed Stoker Co. have been the following for Corporation electricity departments:—Sheffield, 6 "E"; Wolverhampton, 4 "E"; Leicester, 2 "E"; Bury, 1 "E"; Leigh, 1 "E."

Catalogues and Lists.—The Carron Co., Carron, Falkirk.—Advance copies of a 8-page well-illustrated and priced pamphlet describing some new electric cooking appliances, including small cookers, grillers and toasters. Another list is in course of preparation containing particulars of new appliances suitable for use in hotels, restaurants and institutions.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—Two supplementary illustrated and priced catalogues dealing with "Plexsim" electric cooking and heating apparatus. The 12-page list (No. 531) includes the usual range of cooking appliances for all domestic purposes, among them being a specially rapid boiling plate in 6 and 7 in. sizes, loaded to 800 and 1,200 watts respectively. These boiling plates can be supplied with a special extension piece giving a much greater heating surface. A new type of coffee maker, curling tong heaters, bed-warmers and electric irons are also listed. List No. 527 (16 pages) contains similar information respecting the full range of designs of radiators and convectors, the radiators including a series in period designs; the "Plexsim" electric fire is also shown. Supplementary sheet T6 (No. 530) containing illustrations, details and prices of new accessories for use with their steel conduit system.

Messrs. James McMillan & Co., Clun House, Surrey Street, Strand, W.C.—Illustrated price list giving particulars, weights and dimensions, of "Hydra" condensers in rectangular insulated jars and soldered rectangular metal cases.

Messrs. Watson, Laidlaw & Co., Ltd., 98, Dundas Street (South), Glasgow.—Twelfth edition of their catalogue of centrifugal machines and accessories. It consists of 180 pages well bound, and it contains a host of well-illustrated notices of centrifugals driven by water-motor, electric motor, and by belt, and a great deal of machinery for sugar treatment, trucks, conveyors, engines, &c. The information relating to electrical centrifugals occupies a fair share of the book.

Messrs. Kelvin, Bottomley & Baird, Ltd., of 16, Cambridge Street, Glasgow, have sent us a neat wall calendar for 1914, with monthly slips, above which there appears a picture in colour of vessels ploughing the deep, with an aeroplane in flight above them. "Compasses for all craft" is the appropriate legend.

Westinghouse Cooper Hewitt Co., Ltd., York Road, N.—List No. 59 relates to silica mercury vapour lamps for use in the laboratory. Prices are stated.

Electrical Engineering and Equipment Co., Ltd., 109-111, New Oxford Street, London, W.C.—12-page publication (BJ) containing descriptive information relating to their "Viaco" insulators made of a special moulded insulating material. A table of prices and weights is given, also plates showing a number of insulators actual size.

Messrs. Scholey & Co., Ltd., 151, Queen Victoria Street, London, E.C.—12-page pamphlet dealing very fully with their tool steel gears and pinions and giving illustrations, notes and test figures, showing the excellent life records obtained with same, and figures of comparative costs.

Messrs. Ross & Co,, 62, Robertson Street, Glasgow.—Leaflet "R" contains particulars and prices of "Rosa" ignition batteries.

The Benjamin Electric, Ltd., 1a, Rosebery Avenue, London, E.C.—Supplementary list (No. 53) of 48 pages containing full particulars and prices of Benjamin lighting specialities, also information on industrial and other lighting, together with illustrated examples of good illumination for various classes of work obtained with reflector fittings as shown in the list. The matt paper used is effective in showing the illustrations to advantage, and is restful to the eyes.

Electrical Exhibition at Lowestoft. — What is described as an "Electrical Home Exhibition" is to be held at Lowestoft from Wednesday, April 22nd to Saturday, May 2nd. It will be under the auspices of the Corporation electricity department, and will take place in the new Skating Rink, Fremantle Road. According to a prospectus that is before us a considerable part of the building will be given up to furniture, decoration, sanitation, household requisites, food and general cookery exhibits, but an ample space has been allotted for the electrical section, which will contain cooking and heating apparatus, wiring, motors, water heaters, fittings, irons, soldering apparatus, lamps, fans, &c. The Exhibition will be opened by the Mayor and Corporation, and Messrs. H. H. Saunders and W. R. May, of the Corporation electricity department, have been appointed managers of the Electrical Section, while Mr. H. W. Larcher, of 20, Pimlico Road, London, S.W., is organising manager. There will be a number of popular features, such as baby incubators, electric cooking and ironing demonstrations, and a band of H.M. Royal Marines has been arranged for. Application forms may be obtained from the organising manager.

Boiler Contracts.—Messrs. Clarke, Chapman and Co., Ltd., have recently booked the following among other orders for "Woodeson" patent water-tube boilers:—Rochdale Corporation, Admiralty, for Chatham Dockyard, and the Distillers' Co., Ltd., repeat orders; the Coal Distillation Co., Messrs. Dobson and Barlow (for shipment), and the North Metropolitan Electric Power Co. Orders are also in hand for the Bury, Luton and Loughborough Corporations, and for H.M. Naval Base, Rosyth.

Parliamentary Map.—Messrs. Edward Stanford, Ltd., of 12-14, Long Acre, W.C., have issued (price 2s.) a map showing the proposed railways, tramways, and other schemes affecting London in connection with this Session's Parliamentary Bills.

Book Notices.—*Debentures and other Charges.* By H. W. Jordan. Jordan & Sons, Ltd. 6d. net.—This booklet contains a lecture by Mr. H. W. Jordan to the members of the Secretaries' Association, Ltd., concerning which association a little more information might be useful. Mr. Jordan's lecture forms bright and entertaining reading, but it is rather in the lighter vein than didactic, and, therefore, not of much moment to the practical secretary. Some of the pleasant chapters into which the subject is divided in treatment are: Borrowing, Use of the Debenture, Abuse of the Debenture, "Freak" Debentures, Safeguards, with various sub-titles. In the course of his remarks on "freak" debentures, Mr. Jordan refers to debentures issued by a golf club company on its entire assets, of which the only articles worth anything at all were golf balls. If the company were in difficulties a cartload of balls would be required to pay off even a small issue. Unfortunately, however, golf balls have a habit of disappearing, and therefore the debentures could hardly be deemed gilt-edged securities. Debentures of football and other club companies of a sporting character charged on gate money are, it would appear, by no means of rare occurrence, and we may learn of church debentures, or debentures issued by churchwardens, containing a charge not on the building, but on the donations, subscriptions and offertories. Reference is made to the charging of ecclesiastical incomes, "chapel" debentures, or debentures charged on the fabric of a chapel, and various other matters. There is no doubt that the law in regard to the issue of debentures and debenture stock is in urgent need of considerable revision.

"A Text-Book of Physics." Parts I and II.—Electricity and Magnetism. By J. H. Poynting and Sir J. J. Thomson. London: Charles Griffin & Co., Ltd. Price 10s. 6d.

"Wireless Telegraphy." By W. H. Marchant. London: Whittaker & Co. Price 5s. net.

"Elementary Principles of Illumination and Artificial Lighting." By A. Blok. London: Scott, Greenwood & Son. Price 3s. 6d. net.

"Mechanical Engineers' Pocket-Book, 1914." By D. K. Clark and H. H. Powles. London: Crosby Lockwood & Son. Price 4s. 6d. net.

"The Russian Year Book for 1914." By H. P. Kennard. London: Eyre & Spottiswoode, Ltd. Price 10s. 6d. net.

"Examinations in Science and Technology, 1913." London: Wyman & Sons. Price 9d. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 2. February. New York: The Institute. Price $1.00.

"*Transactions* of the Illuminating Engineering Society. Vol. IX, No. 1. January. New York: The Society. Price 75 cents.

"Accuracy of the Formulas for the Ratio, Regulation and Phase Angle of Transformers." By P. G. Agnew and F. B. Silsbee. Washington: Government Printing Office.

"Die Elektrischen Metallfadenglühlampen." By C. H. Weber. Leipzig: M. Jänecke. Price M.16.

Albania's Commercial Future.—With the constitution of Albania as an autonomous principality under a European prince and the relief of the country from internal disturbances, a new epoch of industrial and commercial progress may be expected to supervene, concurrently with the development of the country's resources. As a subject of growing interest to the traders of the world, therefore, the following observations on its commercial circumstances will be found opportune.

The chief port for imports and exports and for the moment the most considerable business place for transactions with Southern Albania is Valona. Direct dealing with inland localities is, for the present, hardly feasible.

Shipments either outwards or inwards are effected mainly by Austrian and Italian ships. All the articles of daily requirement are comprised among the goods imported, for the country possesses no industries. Later on, with the gradual development of the country, a certain demand for machines will arise, and, of course, in the first place, for those appertaining to agriculture and the tilling of the soil. The circumstances of payment in Valona may be described as on the whole good. No bankruptcy has occurred for some years, and the war has made no difference in this respect. The usual terms are cash against documents. The sending of travellers to Albania is recommended, as signs of an economic awakening are evident, and exports in late months have shown a rising tendency. With respect to the Customs treatment of travellers and their samples, the Turkish regulations for the moment are those prevailing. A permit to travel must be obtained; but at Valona the regulations are not strictly enforced, and there is no need to have passes *visé.* The coinage in use is gold Napoleons (of 10 or 20 fr. value), which are current everywhere. In Valona their value is 95 piastres. The construction of both an Austrian and an Italian hotel is proceeding.

Annual Supper.—The annual supper and smoking concert of Messrs. Van Raden & Co., Ltd., of Great Heath, Coventry, was held on Friday evening last. The programme was very lengthy and varied.

The Half-Watt Lamp.—The A.E.G. Electric Co., Ltd., inform us that the half-watt "Nitra" lamp is now manufactured with a consumption of 100, 200 and 400 watts, for the lower voltages.

Dissolutions and Liquidations.—The Harrington Electric Light Co., Ltd. This company is winding up voluntarily, with Mr. W. B. Smith, of 34, Market Place, Long Eaton, as liquidator.

The Electromotor Equipment Co., Ltd.—Creditors should send particulars of debts, &c., to the liquidator (Mr. O. Steiner, 21, Old Broad Street, E.C.), by March 6th. The company is winding up voluntarily. A meeting of creditors is called for March 6th at 59/65, Paul Street, London, E.C.

Brighten, Malcolm & King, Ltd.—A meeting of creditors is called for March 2nd at the offices of Messrs. Foord & Son, 16, Philpot Lane, E.C., by the liquidator, Mr. W. Lambert, Dock House, Billiter Street, E.C., to whom particulars of claims should at once be sent.

Boiler Scalers, Ltd.—March 7th is the last day for claims to be sent to the liquidator, Mr. R. B. Woodward, of 83, Queen's Circus, Battersea Park, S.W.

Pioneer Pump Patents, Ltd.—This company is winding up voluntarily, with Mr. G. H. Smart as liquidator.

Holford & Phillips, boiler composition makers, 110, Warwick Road, Earl's Court, S.W., and other addresses.—Adelina Mary Holford and Thomas Edward Phillips, also known as Frederick Phillips, have dissolved partnership. Debts due to the late firm will be received by Mr. William Holford, of Hill Rise, Kingston Hill, Surrey. Debts and liabilities owing will be paid by Mr. F. Phillips, who will continue the business at 110, Warwick Road, Earl's Court, and 6, Park Road, Ilford.

Prested Miners' Gas Indicating Electric Lamp Co., Ltd.—The accounts filed under the compulsory liquidation of this company show liabilities, £1,579; debenture claims, £768; and assets valued at £1,011. Appended is a list of the principal creditors, viz.:—

Unsecured.

Abel & Imray	£168
Benton & Stone	15
Coventry Plating Co.	13
Delta Metal Co., Ltd.	19
Greenberg & Sons	26
Gillingham & Co.	11
Hunter, W. & J., Ltd.	12
James & Co., Ltd.	21
Prestwick & Co., J. A.	709
Peat & Co., W. B.	52
Putney, Samuel, Ltd.	29
Reynolds, Ltd., G.	45
Siemens Bros. & Co., Ltd.	43
Smith & Sons	32
Tyler, T.	29
Temple Press, Ltd.	115
Uhlhorn & Co., D.	29
Walkers, Parker & Co., Ltd.	19

Globe Associated Cable and Telegraphic Services, Ltd.—A compulsory winding-up order was made by Mr. Justice Astbury on 17th inst.

Trade Announcements.—Mr. H. E. Davis announces that he has acquired the business of the late Davis Electrical Co., Ltd. (in liquidation), from the debenture-holders, and is trading under the same name, without the word "limited," at the same address, 17, Moor Street.

In consequence of increased demand for Pitter multiblade fans, British Empire business in these will in future be conducted by Messrs. Pitter's Ventilating and Engineering Co., Ltd., of 20, Bishopsgate, London, E.C.

Messrs. H. C. Poole & Son, electrical engineers and contractors, of Ealing, W., have removed to 14, Spring Bridge Road.

Mr. Heinrich Lanz, of Mannheim, maker of portable engines, &c., has established an agency at 63, Queen Victoria Street, London, E.C., and has appointed as manager Mr. P. F. Zils, who has been with the firm for many years.

Bankruptcy Proceedings.—Charles Blake (trading as the Bilston Electrical Co.), electrical engineer, 4, Church Street, Bilston, Stafford.—This debtor attended at the County Court, Wolverhampton, on February 18th, for his public examination, which had been adjourned for him to file an amended deficiency account and a trading and cash account. The Official Receiver informed the Registrar that the debtor had handed in a statement which was altogether incomplete for the purpose for which it was required. He was told that the debtor was now in a situation, and was unable to give the time necessary to the affairs of his creditors, but the order of the Court must be obeyed, and if not, he should have to apply for the examination to be adjourned *sine die*. Debtor stated that he had complied with the request to the best of his ability. The examination was adjourned.

Walter Norman Berry, 69, Atwood Road, Didsbury, Manchester, and Harry Bamber, 33, Ansdale Street, Cheetham Hill, Manchester, lately trading together as W. N. Berry & Co., at 32, Queen Street, Manchester, Lancaster, electrical engineers.—The first meeting of creditors herein was held on February 18th, at the Official Receiver's offices, Byrom Street, Manchester, but there was not a quorum of creditors present, and the matter was left in the hands of the Official Receiver. The public examination was held on Friday last at the Court House, Quay Street, Manchester. The debtor, Berry, stated that prior to entering the electrical business, he was a shipping clerk for nine years, earning a salary of 67s. 6d. per week. He commenced business in March, 1911, at Queen Street, with £463 cash capital. Altogether, however, he received over £600 from his mother's estate, of which £400 went to the bank and £63 was paid off certain advances owing to relatives. In March, 1912, he entered into partnership with Bamber, who was an electrical engineer, each debtor contributing £10. The business was successful for a time, but they afterwards extended its scope and obtained machinery on the hire purchase system. That venture, however, was unprofitable, as they could not compete with the old-established firms. In June 1913, in the hope of obtaining more capital, a private limited liability company was formed under the style of W. N. Berry & Co., Ltd., which agreed to take over their assets and liabilities, the latter amounting to £165. The nominal capital was £1,000, divided into 990 ordinary shares and 10 deferred shares of £1. Each debtor received [illegible] ordinary and five deferred shares. They had promises that other shares would be subscribed for in cash, but they only obtained £75 in this way, this amount being paid away for debts. In January, 1914, the company sublet its premises to the Northern Power and Lighting Co., the debtor Bamber entering their employ at 40s. per week. That company undertook to execute any orders which debtor obtained at a certain fixed price, but the firm of Berry and Bamber had practically no assets when these arrangements were made. They attributed their failure as a firm to insufficient capital, and to the inability of the limited company to discharge the firm's liabilities. The examination was closed.

The s.s. "Umgeni."—This vessel, which brought the South African Labour leaders to our shores, is fitted with marine type tantalum traction lamps. We are given to understand that the lamps stood even this strain satisfactorily. Messrs. Bullard, King & Co., who control the Natal line of steamships (to which the *Umgeni* belongs) have been using tantalum lamps for lighting their fleet of steamers during the past three years.

Exhibition.—The Manchester Building Trades Exhibition is to be held in the City Exhibition Hall, from March 3rd to 14th.

LIGHTING and POWER NOTES.

Aberdeen.—Plant Extensions.—The T.C. has approved a report by the electrical engineer on alterations and extensions of plant necessary. The engineer has been authorised to obtain tenders for enlarging the pump chamber on the river bank, and for the provision of a new motor-driven pump and delivery pipe to the generating station. The cost is estimated at £3,982.

Argentina.—La Electrica del Norte, which has recently disposed of its works at Tucuman to the Hydro-Electric Co., will shortly sell its works at Santiago and Jujuy, and has entered into negotiations for the disposal of one of them.—*Review of the River Plate.*

Bampton.—E.L. Proposals.—Messrs. Brooking & Co., of Exeter, promoters of an E.L. scheme for the town, have informed the U.D.C. that they propose to proceed with the erection of a power station in the town. The Council is to hold a meeting to go into the E.L. question.

Barnsley.—The T.C. has asked the local Member of Parliament to support the I.M.E.A. Bill.

Bradford.—Municipal Trading.—At a meeting of the Council of the Chamber of Trade, on Monday, a letter of protest was forwarded to the Corporation against its proposal for an extension of municipal trading in gas appliances, by opening a large shop in Darley Street, where it was intended to exhibit 200 models of cooking, heating and other appliances. The matter arose out of a complaint by Messrs. Taylor & Parsons, who objected to the Corporation setting up in direct opposition to them in practically the same street. Mr. Thos. Pratt, in moving that a strong protest be entered by the Chamber, said dealers in electrical appliances had the same grievance. The managing director of Messrs. G. A. Steinthal & Boydell, Ltd., electrical contractors, said the Chamber would have the support of the electricians in any protest it might make.

Bury.—The B. of T. has sanctioned the erection of an overhead electric main between Cemetery Road and the Gigg Paper Mills.

The Electricity Committee is submitting terms to the B. of G. for the supply of current to the Workhouse.

The Lancashire E.P. Co. has received permission from the Electricity Committee, provided an agreement is entered into, to supply current to the works of Messrs. W. Holt & Sons, Walshaw.

Chesterfield.—Loans Sanctioned and Proposed.—The T.C. has received from the L.G.B. sanction to loans of £2,500 for additional plant at the electricity works, and £4,000 for mains.

The Council has applied for another loan of £15,000 for a 2,000-kw. steam turbo-alternator, with pipe work, condensing and air filtering apparatus, switchboard and cables, a water-cooling tower, a water-tube boiler with mechanical stoker and superheaters, mechanical stokers and superheaters for three existing boilers, and the equipment of a works sub-station, and extension of the engine room.

Canada.—The Toronto Corporation hydro-electric plant made a profit of $150,000 last year.

The Kaministiquia Power Co. proposes extending its electrical plant, at an approximate cost of $500,000, including a new 14,000-h.p. hydraulic turbine and generator.—*Canada.*

Continental Notes.—Denmark.—A large English company, the Nitrogen Product and Carbide Co., has recently surveyed the Dettifos, the largest waterfall in Zeeland, with a view to erecting a large power plant. The energy will be employed for the manufacture of nitrates by extracting nitrogen from the atmosphere. The necessary capital has already been found, and work will be commenced during the year.

Sweden.—It is reported that the Stora Kopparbergs Bergstag A/B have recently resolved to convert their large steel rolling mill, which is now worked by steam, to electrical driving, using power derived from the company's power station at Ballerfos. It is estimated that the capacity of the steel mill will be greatly increased, and that the production will be about 80 metric tons per hour. As far as is known, there are only two plants of this kind and size in existence abroad worked by electricity. The order for the installation has been placed with the Allmäna Svenska Elektriska A/B.

Spain.—Electric Ploughs.—Great success is stated to have attended the experimental use of electric ploughs in the Province of Aragon, and a further 1,000 hectares is to be experimentally treated

Austria.—Negotiations are pending between the Galizische Industrie Bank of Lemberg and the Vereinigte Elektricitäts Gesellschaft, of Vienna, respecting the erection of a bulk supply station at Drohobycz to supply electricity to the oil region. It is proposed to form a company, with a capital of 3,000,000 kn., to carry out the scheme.

France.—La Société Metallurgique de l'Ariege has commenced the establishment of a plant to utilise the water power of the Guilliot Falls, near its works, to generate electricity. Three sets of 1,000-h.p. turbines and dynamos are to be installed. The work is expected to occupy about two years.

It is reported that a scheme has been mooted for utilising the falls above the Pont du Coudray to supply electricity on the two highways of the Orne; on the one side to Maizet, Sainte Honorine du Fay, Vaux, Maltot, Geugnerolles, and Amayé; on the other to Clinchamps, Mutrécy, Saint Laurent de Coudel, and Bouloy. Authorisation has been applied for, and a company is to be formed. The principal generating station will be at the old mill of Buquet.—*Revue Pratique de l'Electricité.*

Belgium.—The municipal authorities at Hamoir (province of Liége) have invited tenders for the electric lighting of the town.

Germany.—On the 20th inst. the rotor of a large turbo-alternator burst whilst on test in the Berlin municipal electricity works. Two mechanics were killed and one injured. Messrs. Brown, Boveri's engineer was very severely injured.

Having finally declined to form a semi-public company with the A.E.G., the Cassel Municipality proposes to spend over £50,000 on extensions to its plant. A large number of neighbouring districts are to be supplied, and the station is to be linked up as a stand-by to the Government hydro-electric system in the Eder valley.

Dumbarton.—Prov. Order.—The T.C. is promoting a prov. order which includes the confirmation of an agreement between the T.C. and the Electric Supply Corporation and the Clyde Valley E.P. Co. *re* the supply of electricity in bulk in the burgh.

Durham.—Blackhall Colliery, on the East Durham coast, which is being developed by the Horden Collieries, Ltd., is to be all-electric so far as power and lighting is concerned, except that compressed air from electrically-driven compressors will be used underground. Electric winding, hauling and pumping are installed, and electric safety lamps used underground, while the village, which is to be laid out as a garden village, and will contain 1,000 houses, is to be lighted entirely by electricity.

Lighting of Villages.—A meeting of ratepayers has decided to adopt the Lighting Acts for the purpose of lighting the villages of Bowburn and Tursdale and the main road to Coxhoe with electricity supplied from Bowburn Colliery, and Quarrington Hill and Cassop with electricity obtained from Kelloe Colliery.

Hornsey.—The T.C. has decided to oppose the N. Metropolitan E.P.S. Co.'s Bill. The L.G.B. has sanctioned the borrowing of £6,000 for mains extensions.

Ipswich.—The East Suffolk C.C. has decided to have the E.L. installed at the County Laboratory at Ipswich, and to have the work carried out by the Corporation E.L. department.

Kingstown (Co. Dublin).—E.L. Bill.—The U.D.C. has decided to oppose the Dublin Southern District E.S. Co.'s Bill.

Llandyssul.—E.L. Scheme.—A number of local residents have guaranteed the preliminary expenses in connection with a scheme of E.L. for the town, and have decided to approach landowners for rights of water power. Reports on a scheme are to be invited from competent engineers.

Leicester.—Annual Accounts.—The E.L. undertaking shows a net surplus for the past year of £6,598, of which £5,000 has been carried to the reserve fund, and £1,598 towards the provision of new cable.

North Ormesby.—The Middlesbrough T.C. having received an application for a supply of electricity to North Ormesby, which is in the area of the Cleveland and Durham E.P. Co., has decided to see if terms can be arranged with the company for the Corporation to supply electricity in that district.

London.—The L.C.C. has been recommended by its Finance Committee to sanction the loan to the St. Pancras B.C. electricity undertaking of £1,300 for the purchase of property, £4,978 for mains, £595 for plant, £2,543 for services, and £427 for meters.

By an alteration in the assessment of the profits of the St. Pancras electricity undertaking, a saving of £250 per annum in income-tax will be effected.

The L.C.C. is petitioning against the London Electric Supply Bill, 1914.

Woolwich.—The B.C. is applying to the L.C.C. for sanction to borrow the following amounts in connection with the electricity undertaking:—£1,200 for mains, £880 for services, £740 for meters, £2,940 for hire-purchase, and £1,520 for hire rentals.

Pendlebury.—The chairman of Messrs. Andrew Knowles and Son announced at the annual meeting of the company that the electrical installation at its Pendlebury and Clifton Hall Collieries had been so satisfactory that it has been decided to electrify the haulage and pumping plant at Agecroft Old Pit, cables having already been laid.

Plymouth. — Tramway Supply. — The Electricity Committee has reduced the price of electricity supplied to the Tramways Committee, as from April 1st next, to 1⅝d. per unit up to 350,000 units and 1½d. per unit after; this is a reduction of about £420 per annum.

Rawtenstall.—Street Lighting.—The T.C. has resolved to light Burnley Road East and Burnley Road West by electricity, at a cost of £1,000; 146 gas lamps are to be superseded by 130 100-c.p. electric lamps.

Ruthin.—Workhouse Lighting.—The B. of G. has decided to light its workhouse and infirmary by electricity from a plant which a Bristol firm proposes to install in the town this year.

Salford.—Street Lighting.—The annual report of the lighting and cleansing department states that 117 arc lamps, each of 1,000-c.p., are used for lighting important streets, the Electricity Committee charging £14 10s. per lamp per year for supply and maintenance.

The T.C. has decided to abolish the existing concession whereby users of electricity for power purposes are allowed to use current for lighting at the power rate up to 10 per cent. per quarter of their power consumption.

Torpoint.—Street Lighting. — A poll of the ratepayers on the question of public lighting by electricity or gas, has resulted in a majority in favour of the former.

Wadhurst (Sussex).—Proposed E.L.—The P.C. has decided not to oppose the proposals of Messrs. J. B. Saunders and Co., for the E.L. of the parish.

Walthamstow.—Proposed Loan.—The Council is applying to the L.G.B. for sanction to borrow £5,900, the estimated cost of extensions to the boiler house at the electricity works. The Finance Committee recommends that the Council assent to the assignment of the contract for the erection of a cooling tower at the electricity works to Laverack & Goddard, Ltd.

West Yorks.—E.L. Proposals.—The following additional authorities have decided to oppose the Yorkshire Electric Power Co.'s Bill for extended powers:—Holme U.D.C., Bingley D.C., Shipley D.C., and the gas companies at Yeadon and Guiseley, Elland-cum-Greetland, Hemsworth, Grimsthorpe, Kippax and District, South Elmsall, South Kirby, North Elmsall, Boston Spa, Kirkburton, Wakefield and Otley. Messrs. Samuel Fox & Co., the Duke of Norfolk, the Trustees of the Hospital of Gilbert, Earl of Shrewsbury, at Sheffield, and various railway companies are also opposing the application.

Willesden.—Proposed Meter Loan.—The Council is to apply to the L.G.B. for sanction to the borrowing of £2,000 for meters.

Worksop.—A recent failure of the supply in the early hours of the morning, has drawn the attention of the Council to the fact that the electricity works are usually closed and unattended between midnight and 6 a.m., the battery being relied on during those hours. It is stated that this matter will be remedied in future.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—New Depot.—The T.C. has now decided to purchase the Militia Barracks for a central tramway depôt. The cost of the scheme will be £25,987.

Australia.—According to the *Australian Mining Standard*, the first shipment of railway motors for the Melbourne electrified lines will take place in about six months. About 1,600 motors are required; the General Electric Co., New York, has the contract, though it is stated that a large part of the work is being carried out by the B.T.H. Co., at Rugby.

Accrington.—Rate Relief.—The Electricity Committee has voted £2,000 from the profits of the tramways undertaking towards the relief of the rates in the next financial year.

Birmingham.—First-Class Cars.—The Corporation is to experiment with a system of first-class tramcars on the Alcester Lanes End route ; double fares are to be charged.

Blackpool.—At the tramway and electricity staffs' dinner, on the 18th inst., the tramway manager said he anticipated the tramways department would be able, at the close of the year, to show a profit of £25,000, and that a profit of £7,000 would be available from the electricity undertaking.

The Tramways Committee has decided to purchase six more single-deck holiday cars, bringing the total up to 24.

Bury.—L.G.B. Inquiry.—An inquiry has been held with reference to the proposed granting of a prov. order to empower the T.C. to purchase land required for the widening of several streets to permit of the laying of a double line of tramway track.

Canada.—According to the *Pall Mall Gazette*, Mr. George Bury, vice-president of the Canadian Pacific Railway, is at present in New York for the purpose of studying railroad electrification. It is understood that his study of the subject is connected with a project for electrifying the new tunnel through the Selkirks near Roger's Pass, British Columbia. The tunnel, which is five miles in length and carries two tracks, will be completed in the autumn of 1915, and its estimated cost is £1,600,000.

Continental Notes.—Bavaria.—On February 19th the Bavarian Ministry of Communications published its long-expected report on the national water powers in relation to railway electrification, and it must be admitted that the most encouraging feature in connection with the issue of this report is its public reception. There seems to be a general desire that the natural resources should be developed, and there is impatience at the official delay in dealing with the subject. The total available power is estimated to be 90,000 H.P. from eight stations which were originally projected by the Government for the supply to the railways. Of these only the Soolach plant has so far been erected, and this supplies only 4,350,000 units per annum to the local railways and industries, as compared with an available 14,400,000. The report withholds comment on the financial result of this undertaking on the grounds, first, that sufficient experience is not yet available regarding the operation of the electrified railways, and secondly, that negotiations are at present proceeding with a private company, which proposes to distribute the surplus energy and also to develop other powers at Watzmann and Hohen Göll. But the largest available source of energy is the Walchensee, which it was originally proposed to use also for the railways. In the negotiations with the landowners and other interested parties no fewer than 160 light railways have, however, been demanded as compensation, and whilst the scheme is not rejected, the Ministry of Communications regard it as impracticable so long as the sole purpose is the electrification of the railways. They propose, therefore, that the Ministry of the Interior shall work out the scheme with a view to the establishment of a general public supply system. They state, moreover, that recent improvements in steam locomotive design have materially decreased their interest in electrification, which they regard as being now less economical than steam traction, although it is not possible to determine this definitely until the national resources have been developed on a comprehensive scale for general electrical supply. Such large systems might well be in a position to offer energy to the State Railways at favourable prices. In effect, therefore, the Ministry of Communications wishes to retire from the hydroelectric field.

The negotiations for a "mixed" semi-public undertaking have now fallen through, and the report recommends that the water-powers should be worked for the national benefit by the Ministry of the Interior, from whom the matter is not likely to receive less progressive or prompt treatment than it has done in the past.

Germany.—The A.E G. has just formed in connection with the Berlin Electricity Works Co., the A.E.G. Schnellbahn A.G., which takes over the contract held by the first-mentioned for the construction of an elevated and underground railway between Gesundbrunnen and Neukölln, Berlin. The capital of the new company has been fixed at £1,125,000 in 4½ per cent. preference shares, and £1,000,000 in ordinary shares, and authority is taken to issue £2,125,000 in 4 per cent. debentures, the interest and redemption of which will be guaranteed by the City of Berlin. In addition, the city has undertaken in the event of the estimates, apart from power station, offices and the train sidings depôt, exceeding the sum of £3,900,000, to make a contribution up to £295,000, which is to be repaid out of the company's profits after 5 per cent. has been paid. The contract further provides that the city is authorised to take over the railway on the expiration of 30 years, and then at succeeding periods of five years on giving two years' notice, on the basis of 25 times the annual average receipts in the last five years, but, if acquired at the end of the 30th year, the purchase price is to be at least 115 per cent. of the share capital. It is proposed to begin the railway in Christiania Strasse, Gesundbrunnen, and to terminate it in the Hermann Platz, on the borders of Neukölln. The railway, which will be provided with 15 stations, will have a total route length of 5·77 miles, of which 4·69 miles will be built underground, and it is to be completed within a period of five years from the date of the Government sanction.

Norway.—A company is being formed to take over and work a concession for an electric tramway about 3½ miles long, in the outskirts of Christiania, the estimated cost of the line is about £47,200.—*Board of Trade Journal.*

Spain.—According to *Industria e Invenciones* a well-known Spanish engineer has laid before the Ayuntamiento, of Barcelona, a scheme to construct an aerial railway from the Plaza de la Bonanova, in Barcelona, to San Pedro Martin, in the Vallvidrera mountain district.

France.—One of the conditions of the Franco-Spanish agreement in regard to the trans-Pyrennean railway service was that the lines should be worked electrically. In this connection, the Midi Railway Co., of France, has electrified its line between Urdox and Canfranc, and proposes to adopt electric traction on the whole of its system between Toulouse and Bayonne. Although the first named line is now practically complete, it is reported that a difficulty has sprung up, which, although the power station and the rolling stock are quite ready, will prevent the running of electric trains for some time. The difficulty referred to is that the high-tension current employed for traction purposes interferes with the proper working of the State telegraph and telephone lines, which run by the side of the line. Some trials have already been made with one protective device, but this was not found altogether satisfactory, and consequently it will not be possible to put the electric trains in service until the telegraph and telephone wires have been removed a distance of at least 430 yards away from the railway.

Italy.—The *Bulletin de la Chambre de Commerce Francaise*, of Milan, states that the following schemes are now under consideration for the installation of electric tramways :—From Pordenome to Portegruaro : electric railway from Bresseo to Ponte di Barbarano (Venice) ; electric tramway from Rapollo to S. Margherita and Portofino, which the Communal Council has ceded to a company for 30 years ; tramway from Canonica di Cavo to Fogliaro (Varese) ; an electric tramway from Orzinnovi to Qunzano, Verolanova and Asola ; an electric line uniting Ravenna with Porto Corsini ; and the conversion of the steam line between Bologna and Imola to electric traction.

The construction of the electric main line railway from Milan to Genoa will be taken in hand so soon as the Chamber of Deputies has voted the credit of 150,000,000 fr. required for this undertaking. The final course of this line has not yet been decided upon ; several of the schemes under consideration effect a considerable shortening of the track as first proposed.

Coventry.—New Plant.—The Tramways Committee has recommended that a new condenser, &c., be purchased for the Priestley's Bridge plant, at an estimated cost of £1,100, and that new mechanical stokers be fitted to two of the boilers at an estimated cost of £500.

Hull.—Rate Relief.—The Tramways Committee has decided to set aside £7,000 out of the £12,000 profit on the tramways undertaking in relief of rates, as against £12,000 last year. The expenditure during the year increased by £2,188, and the income by £2,182. Salaries and wages had increased by £2,355.

Doncaster.—Tramways Extensions.—The Light Railway Commissioners have consented to the proposed extension of the Corporation tramways to Warmsworth and Woodlands.

Japan.—It is proposed to extend the electric tramways in Tokio by about 15 miles during the present year. Fifty new cars are to be added to the rolling stock.

L. & N.W. Railway Electrification.—The annual report of the above company states that good progress is being made with the conversion of the Chalk Farm to Willesden section of the line. The power station at Stonebridge Park is under construction, and contracts will shortly be let for six sub-stations and the new carriage sheds. The track work for the electrification of the line between Willesden (High Level) and Earl's Court Junction is nearly complete.

Lancs. and Yorks. Railway Electrification.—At the annual meeting of the above company last week, the chairman said the estimate of capital expenditure for the ensuing year was £684,810, including £125,000 for electric power stations. That referred to a new power station about to be erected at Clifton Junction. It was proposed to electrify the existing lines from Manchester, through Crumpsall, to Bury, and they had little doubt, judging from experience in the Liverpool district, that the additional traffic would well justify the expenditure. Referring to the electric power and light account, he said that the small cost of generating electricity, showed the expediency of the company generating its own power. Included in the statistical returns are figures relating to electric power and lighting, from which its appears that generation and distribution costs amounted to £35,769, and that £10,000 was provided for renewals. The H.T. energy generated and supplied, is classified as follows :—Traction, 28,719,591 units ; power, 1,576,484 units ; and lighting, 1,753,679 units.

Leicester.—Annual Accounts.—The gross receipts of the Corporation tramway undertaking (including electric power supply) for 1913 were £58,165. The net surplus was £20,048, of which the Tramways Committee has recommended that £10,000 should be applied to rate relief.

Newcastle-on-Tyne.—Rate Relief.—The Tramways Committee has granted a further £6,000, making £18,000 in all, towards the relief of the rates out of the estimates for next year. This will practically wipe out the estimated deficiency on the Corporation expenditure next year.

London.—At the inquest on the driver of the tramcar which got out of control and dashed into a stationary car at Harringay on the 16th inst., a brake specialist employed by the M E.T. Co. said that when he examined the car, which was eight or nine years old, after the accident, the hand-brake was in perfect order; there was an abrasion on one of the cables of the electric brake which would cut off the current if it came into contact with another metallic substance. The driver was killed through jumping off the car, and a rider was added to the verdict of "Death by misadventure," to the effect that cars should be examined by Scotland Yard more than once a year.

U.S.A.—The New York Edison Co., which is deriving an annual income of £50,000 from the charging of the batteries of electric motor vehicles, has established a special office to advise traders as to the advantages of electric vehicles for delivery work. No charge is made for the service, the only recompense the company expects being the revenue derived from the sale of energy.

South Shields.—Year's Working.—The estimates of the Corporation tramways department for the year ending March 31st next, show a net surplus of £7,410, an increase of £1,092 on the previous year. The estimated total revenue amounts to £38,080, an increase of £3,928. The adoption of the universal 1d. fare resulted in an astonishing increase of traffic, the passengers carried totalling over 10 millions, an increase of 1½ millions. Working expenses increased from £19,221 to £22,020. The Tramways Committee has decided to recommend that £1,700 be transferred to the relief of the rates.

TELEGRAPH and TELEPHONE NOTES.

Germany.—A large 8,000-cycle alternator has recently been brought into use in the Telefunken station at Nauen. With this plant spark-gaps are dispensed with, only a transformer and a condenser being used.

Japan.—Messrs. Siemens are constructing a large wireless telegraph plant for the Imperial Government. There will be two 160-kw. Diesel-driven D.C. generators, a large battery, and a 500-cycle motor-driven alternator, the spark system being used.

A project is under consideration for the installation of a wireless telephone system between Japan and the Island of Formosa, a distance of between 600 and 700 miles.

New Belgian Cables.—The Belgian Minister of Marine has signed an agreement with the Eastern Telegraph Co. for the establishment of two new submarine cables, one connecting Belgium with Porthcurno, on the British coast, and another connecting Loanda with Banana, in the Belgian Congo. All telegrams from the British African coast to the European continent will henceforth pass through Belgium *viâ* Ostend or Antwerp, thus effecting a great saving in time and expense; while the cost of telegraphing between Belgium and the Congo will be reduced 40 per cent., in addition to the gain in speed.—*Daily Telegraph*.

New Telephone Cable.—A new cable is to be laid jointly by the British and Dutch Governments during this year, and will be the longest cable of its kind in the world, covering a stretch of 79 nautical miles between Aldeburgh and Walcheren. It will be of the four-core coil-loaded type.

Safety of Life at Sea.—The full terms of the International Convention for the Safety of Life at Sea were published last week in the form of a Blue-book (Cd. 7,246). We have already given the principal features of the Convention as far as they relate to wireless telegraphy.

Spain.—The Marconi Co. has opened three new wireless stations at Finisterre, Santander and Cape Palos.

The Imperial Wireless Contract.—On Thursday last week the motion for the appointment of a Committee of the House of Lords to inquire into charges against Lord Murray was carried without dissent, but the Government refused to take any part in the matter.

Wireless Telephony.—It is reported from New York that a Marconi operator on an American coasting steamship has developed a simple transmitter for wireless telephony, with which he can speak to any ordinary receiver within a radius of 25 miles.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—February 28th. U.D.C. Transformer, high and low-tension switchgear and instruments. Supply of cables and feeder pillars.

March 2nd. U.D.C. Service cable; D.C. and A.C. meters; joint boxes, &c. See "Official Notices" February 13th.

Aberaman.—March 12th. Electrical goods for a year for the Powell Duffryn Steam Coal Co., Ltd. Stores Manager.

Ardee.—March 2nd. Public lighting by electricity for three years, for the Town Commissioners, from September 1st. Particulars from Mr. T. Malone, Town Clerk.

Australia.—Sydney.—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" February 6th.

Newcastle.—April 29th. P.M.G. Electrically-controlled clocks at Post Office, Newcastle, N.S.W. Schedule No. 361. See "Official Notices" to-day.

Melbourne.—March 5th. 20,000-volt and 1,500-volt underground cables and accessories, for Agent-General for Victoria. See "Official Notices" February 6th.

April 7th. P.M.G. Accumulator batteries (Tudor) for radio-telegraph stations. Relays, non-polarised. Stores Schedule 996. See "Official Notices" to-day.

April 21st. P.M.G. Telephone switchboards. Schedule No. 1,005. See "Official Notices" to-day.

March 24th. P.M.G. Automatic switchboard apparatus for Geelong. Schedule No. 1,016. See "Official Notices" to-day.

Adelaide.—April 8th. P.M.G. Switchboards, various. Schedule No. 315. See "Official Notices" to-day.

Perth.—March 7th. High-tension cables, telephone cable and accessories for the West Australian Government. See "Official Notices" February 13th.

Aylesbury.—March 7th. U.D.C. Contract 2. Two 100-kw. Diesel oil engine D.C. generating sets, with static balancers, battery boosters and accessories. See "Official Notices" February 13th.

Barnes.—March 9th. U.D.C. Distributor cables. See "Official Notices" February 20th.

Barrow-in-Furness.—March 2nd. Corporation. Twelve months' supply of electrical stores for the Electricity Department. Forms of tender from the Borough Electrical Engineer.

March 3rd. Corporation. Installation of electric light at Blake Street Infants' School for the Education Committee. Specifications (£1 1s.) from the Borough Electrical Engineer.

Bedford.—March 7th. Corporation. Electrically-driven centrifugal pumping plant (four single-phase, 2,000-volt motors, &c.). Specifications, &c., from Major Tulloch & Haworth, 28, Victoria Street, S.W.

Bedwas.—March 5th. Electrical goods for a year for the Bedwas Navigation Colliery Co., Ltd. The Secretary.

Belfast.—March 11th. 36 cwt. of electric copper wire for the Harbour Commissioners. See "Official Notices" to-day.

Blackburn.—Corporation. Supply of iron, steel, bolts, screws, &c., for the Tramways Department. Lists from Mr. J. H. Cowell, General Manager.

Burton-upon-Trent.—March 14th. Corporation. One 1,250-kw. three-phase turbine-alternator and condenser, pipe-work, valves and accessories. Extensions to high-tension switchboard. See "Official Notices" February 13th.

Cape Colony.—March 16th. Water-power plant for Municipality of Paarl, Cape Province (see Electrical Review, page 183, January 30th). Time extended to March 16th. Specifications can be seen in London (C.I. Department, Board of Trade).

Carshalton (Surrey).—March 11th. Motor-generator, switchgear, battery charging board and connections, &c., at the Queen Mary's Hospital, for Metropolitan Asylums Board. See "Official Notices" to-day.

Colchester.—March 2nd. Corporation. Twelve months' supply of stores for the Electricity Department. Forms of tender from Mr. W. Frisby, Borough Electrical Engineer, 36, Osborne Street.

Coventry.—Guardians. Extension of E.L. system at the workhouse. Particulars from T. F. Tickner, architect, High Street Chambers.

Crete.—March 13th. Tenders for the concession for electric tramways and water supply. See this column Feb. 20th.

Dover.—March 10th. Electric cables and electrical sundries for a year for the Harbour Board. Mr. Martyn Mowll, registrar, Castle Street (2/6 each schedule).

Dublin.—March 2nd. Corporation. One 210-B.H.P. three-phase E.H.T. motor. See "Official Notices" February 20th.

Dundalk.—March 10th. U.D.C. Twelve months' supply of stores for the electricity department. See "Official Notices" to-day.

Dundee.—March 4th. Corporation. Twelve months' supply of electrical stores for the Tramways Department. Specifications from Mr. P. Fisher, General Manager, Tramways Office.

East Ham.—March 14th. Corporation. Supply of uniform for tramway employés. Forms of tenders from Town Clerk.

Edinburgh.—February 28th. Corporation. Electric lighting installation at the South Gray's Close and Fountainbridge Wash-houses. Specifications from Engineer's Office. Town Clerk.

March 9th. Corporation. Maintaining house telephone and electric bell installations. Forms of tender from Superintendent of Works, City Road.

March 9th. Corporation. Twelve months' supply of electrical and insulating material. Specification from the Resident Electrical Engineer, Dewar Place.

Exeter.—March 7th. Corporation. Supply of uniform and caps for the tramway department. Particulars from Manager, Eaton Place.

France.—SAINT ETIENNE.—April 30th. Tenders are invited for the supply of the following telephone material, in three lots:—(1) 165 magnetos; 155 trembling bells; 670 cords to pattern. Particulars, cahier des charges, &c., from the Bureau des Approvisionnements de la Manufacture Nationale d'Armes de Saint-Etienne. Readjudication on lots not adjudged upon will take place on June 1st.

PARIS.—March 10th. The Administration des Chemins de Fer de l'Etat (72, Rue de Rome), invite tenders for the supply of electric machine tools for the central electric material workshops at Garenne. Particulars obtainable from the Bureaux du Service Electrique (3e Division).

Gillingham.—March 6th. Corporation. Twelve months' supply of meters, cables and other stores. See "Official Notices" February 20th.

Gorton (Manchester).—March 3rd. Great Central Railway Co. Six months' supply of stores. See this column February 20th.

Heston and Isleworth.—March 7th. U.D.C. Twelve months' supply of stores, including cables, meters, &c., for the electricity works. See "Official Notices" February 20th.

Leeds.—March 3rd. Tramways and Electricity Committee. Reconstruction of certain portions of tramway track. Specifications from Tramway Offices.

Liverpool.—March 9th. Electrical fittings for a year, for B.G. Mr. G. W. Coster, Clerk, Parish Offices.

London.—L.C.C. March 2nd. Twelve months' supply of electrical sundries; forms of tender from the office of the Asylums Committee, 6, Waterloo Place, Pall Mall, S.W.

It is proposed to invite tenders from selected firms for the installation of electric light at the Belsize fire station.

March 18th. Electrical installation at the Upper Marylebone Street Elementary School, Gt. Portland Street, W. (148 points, 200 lights). See "Official Notices" to-day.

FULHAM.—March 5th. Guardians Supply for various periods of electrical requisites. Particulars from Clerk to the Guardians.

ST. PANCRAS—March 2nd. Corporation. Supply of arc lamp carbons. See "Official Notices" February 6th.

SHOREDITCH.—March 3rd. Corporation. Extra-high-tension and low-tension switchgear. See "Official Notices" February 6th.

March 12th. Bellhangers' work to buildings in the London district during three years. See "Official Notices" February 20th.

BATTERSEA.—March 3rd. Corporation. Twelve months' supply of stores for electricity department. See "Official Notices" February 13th.

WESTMINSTER.—March 11th. Guardians. 12 months' supply of electrical lamps, fittings, &c. Form of tenders from Mr. W. J. Lickley, Clerk, Prince's Row, Buckingham Palace Road, S.W.

Londonderry.—March 14th. Corporation. Meters and cables for the Electric Light Department. Specifications from the City Electrical Engineer.

Macclesfield.—March 11th. Electrical goods for one year for the Cheshire County Asylum, Parkside, Macclesfield. Forms from Mr. W. Tingay, Clerk of Asylum.

Madeira.—March 31st. General Council of Administration of the District of Funchal, on the Island of Madeira. See this column February 20th.

Newport (Mon.)—March 3rd. E.L. fittings for the B.G. Mr. A. H. Rees, Clerk, Queen's Hill.

Natal.—March 11th. Corporation. Supply of 12 miles steel girder tram rails, fish plates, bolts, nuts, tie bars, 3,000 copper rail bonds, and 275 cross bonds for the electric tramways. Specifications (£2 2s.) from Webster, Steel & Co., agents to the Durban Corporation, 5, East India Avenue, E.C.

New Zealand.—March 26th. The Dominion Portland Cement Co., Ltd. Hydro-electric plant, Wairua Falls. See "Official Notices" February 13th.

AUCKLAND—April 21st. The Harbour Board. 1-ton and 2-ton truck cranes. Specifications from London agents, Messrs. W. and A. McArthur & Co., 18, Silk Street, Cripplegate, London, E.C.

Pembroke (Dublin).—March 2nd. U.D.C. For 12 months' supply of electrical stores. Specification from Mr. J. C. Manly, Clerk, Town Hall, Ballsbridge.

Plymouth.—March 19th. Corporation. Registering punches for tramways system. Town Clerk.

Rotherham.—March 12th. Corporation. One 2,000-KW. high-pressure turbo-alternator with condensing plant, switchgear, steam and exhaust piping and accessories; one 1,000-KW. rotary converter, transformer and switchgear; one 20-ton overhead crane. See "Official Notices" February 20th.

Southampton.—March 9th. Corporation. For supply of rotary converter, balancer, and direct-current meters. Specification from the Borough Electrical Engineer.

Southend-on-Sea.—Six Diesel oil engines for new substations for the T.C. Mr. R. Birkett, Electrical Engineer.

Spain.—March 7th. The municipal authorities of Ribadesella (province of Oviedo) are inviting tenders for the concession for the electric lighting of the town during a period of five years.

Swansea.—March 4th. Steam coal for three, six, nine, or twelve months, for the Corporation electricity works. Borough Electrical Engineer.

March 13th. Corporation. Cable ducts, cables, pilot and telephone wires, joint boxes, &c. See "Official Notices" to-day.

Swindon.—March 7th. Corporation. Twelve months' supply of stores for electricity and tramways departments. See "Official Notices" February 18th.

Warlingham.—March 2nd. E.L. sundries for a year, for Croydon Borough Mental Hospital. Clerk of the Hospital.

Warrington.—March 14th. Corporation Gas Committee. Dynamo, 220 volts direct-current, 30 KW. Particulars from Mr. W. S. Haddock, General Manager, Gas Offices.

West Ham.—March 5th. Guardians. Six months' supply of electrical fittings. Specifications from Mr. T. Smith, Clerk to Guardians, Board Room, Union Road, Leytonstone, N.E.

Wimbledon.—March 6th. Corporation. Twelve months' supply of stores for electricity department. See "Official Notices" February 20th.

Worle (Somerset).—March 19th. Street lighting for the Parish Council. Mr. Robert K. Clay, Clerk, Virginia Villa, Worle.

Wrexham.—February 28th. Meters, carbon-filament lamps, oils, coal and boiler solution, for the Corporation electricity department. Borough Electrical Engineer, Willow Road.

CLOSED.

Belgium.—Seven German and three Belgium concerns submitted tenders last week to the Société Nationale des Chemins de fer Vicinaux, of Brussels, for the supply and laying of the underground and sub-river armoured electric cables required in connection with the supply of current to the local railway between Brussels and Haecht. The lowest offer was that of the Société A.E.G. Union Electrique, of Brussels.

Bexhill.—The Council has accepted the tender of Messrs. Pettet & Co. for 1,000 tons of coal (Shipley peas, Tibshelf peas, or Manners' Kilburn peas), at 18s. 10d. per ton.

Australia.—Victoria. — Postmaster-General's Department —

78,000 pattern "A" porcelain insulators.—Webster & Co., Ltd.

Western Australia.

25 interior distributing boxes, 52 pairs, £1 7s. 3d. each; 25 ditto, 26 pairs, 18s. 9d. each; 100 ditto, 13 pairs, 13s. 6d. each.—Orde Powell.
60 tons galvanised iron wire, 400 lb. per mile, £10 6s. 2d. per ton.—Malloch Bros.

Victoria Railways Department.

Vulcanised rubber electric light wire.—Noyes Bros. (Melbourne) Pty., Ltd.
60-h.p. electric motor, &c., £140.—Australian Metal Co.
Two-ton "Lansden" electric vehicle chassis, £800.—Federal Storage Battery Car Co., Ltd. (in liquidation).

N.S.W. Public Works Department.

Six electric truck and goods lifts, £4,468.—Standard Waygood Hercules, Ltd.

Sydney Municipal Council.

Bare copper cable, £5,666.—B. I. & Helsby Cables, Ltd.—*Australian Mining Standard.*

New Zealand.—The Auckland City Council has accepted the tender of Messrs. Richardson, McCabe & Co., for overhead and V.I.R. cables, at £5,458.—*Tenders.*

Blackpool.—The Tramway Committee has awarded contracts for new uniforms to Messrs. Briggs, Jones & Gibson; for caps to Messrs. Donnelly & Sons; and for straw hats to Mr. J. Anderson.

Bury (Lancashire).—The Tramways Committee has placed a contract for clothing with Messrs. H. Lottery & Co., of London.

Great Yarmouth.—The Corporation has accepted the tender of the Brush Electrical Engineering Co., Ltd., for the supply of a 600-kw. turbo-alternator, at £3,530.

Grimsby.—The Electricity Committee has accepted the tender of Messrs. E Bannister & Co., for Sherwood slack coal for nine months, at 6s. 4½d. per ton.

Harlech.—Messrs. Johnson & Phillips, Ltd., have secured the order for a complete plant for Harlech, including an oil-driven generating set, switchboard, accumulators and overhead lines for the public and private lighting supply.

Huddersfield.—The Corporation has accepted the tender of the Glasgow Railway Engineering Co. for steel tires and tram-car wheels.

India Office.—The India Office has accepted a tender from the Edison & Swan United Electric Light Co., Ltd., for Royal Ediswan lamps.

London.—Hammersmith.—The B.C. Electricity Committee recommends that two 9-h.p. motors be purchased from the Langdon-Davies Motor Co., at £29 16s. each, for hire to W. A. S. Benson, Ltd.

The Committee recommends the acceptance of the following tenders for annual contracts:—

Pryke & Palmer.—Packing and jointing materials, and steam and gas tubes and fittings.
Wiggins & Co.—Firebricks, clay, lime, &c.
Glenboig Fireclay Co.—Glenboig firebricks, &c.
Timmins & Co.—Coke oven firebricks.
City Glass Co.—Arc lamp globes and lamp shades.
Chamberlain & Hookham, Ltd.—Ordinary and prepayment meters.
Electrical Apparatus Co., Ltd.—Ordinary meters.

For the supply of draw boxes the following tenders have been received:—

W. Lucy & Co.		£425
W. T. Henley's Telegraph Co.	(recommended)	427
Sykes & Sugden, Ltd.		519
Johnson & Phillips		554
British Insulated Co.		559
Callender's Cable Co.		588
Siemens Bros. & Co.		681
W. T. Glover & Co., Ltd.		1,192

Battersea.—The B.C. has accepted the tender of Mr. W. Morgan, for the installation of arc and metallic lamps on consumers' premises.

The Metropolitan Asylums Board has accepted the offer of the Electrical Power Storage Co., Ltd., to maintain the storage battery on the training ship *Exmouth* for a further period of five years at an increased charge of £13 10s. per annum.

Deptford.—B.C. The Library Committee reports the receipt of the following tenders for electric light fittings at the Central Library:—

Haycraft & Son		£81
Siemens Bros...	(not to specification)	71
W. M. Williamson		84

The Committee has accepted Messrs. Haycraft's tender, as the wiring of the building is being carried out by that firm.

Lymington.—The T.C. has accepted the tender of Messrs. Crompton & Co., Ltd., for electrically-driven pumping plant at the sewage station, at £316.

New Zealand. — The Auckland Harbour Board has accepted the tender of Hawthorne & Co., £2,780, for the installation of an electric hauling slipway and winch.—*New Zealand Shipping and Commerce.*

Southampton.—The Corporation has placed a contract with the British Thomson-Houston Co., Ltd., for one year's supply of their type R. H. electricity meters.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, February 27th. At 8 p.m. At 39, Victoria Street. Paper on "Operation and Upkeep of Electric Motors," by Mr. E. F. Butler. Saturday, February 28th. At 6.30 p.m. At Holborn Restaurant. Annual dinner.

Northampton Engineering College Engineering Society.—Friday, February 27th. At St. John Street, E.C. Paper on "The Forth Bridge," by Mr. H. J. Nichols.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, February 27th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

Physical Society.—Friday, February 27th. At 8.30 p.m. At Imperial College of Science, South Kensington. Guthrie Lecture, by Prof. R. W. Wood, on "Radiation of Gas Molecules Excited by Light."

Royal Institution of Great Britain.—Friday, February 27th. At 9 p.m. At Albemarle Street, W. Paper on "Surface Combustion," by Prof. W. A. Bone, F.R.S.

Manchester Association of Engineers.—Saturday, February 28th. At Grand Hotel, Aytoun Street. Paper on "Mechanical Filtration," by Mr. A. J. Clark.

Batti-Wallahs' Society.—Saturday, February 28th. Annual Dinner.

Society of Engineers.—Monday, March 2nd. At 7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "Esperanto: an International Language for Engineers," by Mr. T. J. Gueritte.

Wireless Society of London.—Tuesday, March 3rd. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. General meeting. Debates on the "Design of Receiving Apparatus," opened by Mr. E. Russell Clarke, and "The Relative Importance of Constructional Features of Telephones," opened by Mr. W. J. Fry.

Institution of Civil Engineers.—Tuesday, March 3rd. At 8 p.m. At Great George Street, S.W. Papers to be further discussed:—"Rail Steels for Electric Railways," by Mr. W. Willox; and "Rail Corrugation and its Causes," by Mr. Stephen Sellon.

Institution of Civil Engineers of Ireland.—Wednesday, March 4th. At 8 p.m. At 35, Dawson Street, Dublin. Ordinary meeting.

Institution of Electrical Engineers (Students' Section).—Wednesday, March 4th. At 7.45 p.m. At Victoria Embankment. Discussions on "Synchronous *v.* Induction Motors," opened by Mr. H. K. Whitehorn, and "The Prospects of Electrical Engineers," opened by Mr. J. W. Kilby.

(Manchester Students' Section).—Tuesday, March 3rd. At 7.30 p.m. At Municipal School of Technology. Paper on "The Possibilities of Electric Traction on Railways," by Mr. J. L. Moffett.

(Scottish Students' Section).—Tuesday, March 3rd. At 8 p.m. At Royal Technical College, Glasgow. Paper on "The Maintenance and Repair of D.C. Plant," by Mr. H. A. Stewart.

Royal Society of Arts.—Wednesday, March 4th. At 8 p.m. At John Street, Adelphi. Ordinary meeting.

Royal Institution of Great Britain.—Thursday, March 5th. At 8 p.m. At Albemarle Street, W. Paper on "Heat and Cold," by Prof. C. F. Jenkin. Saturday, March 7th. Paper on "Recent Discoveries in Physical Science," by Prof. Sir J. J. Thomson.

Chemical Society.—Thursday, March 5th. At 8.30 p.m. At Burlington House, W. Ordinary meeting.

Greenock Electrical Society.—Friday, March 6th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Paper on "Power Transmission," by Mr. A. Zoller.

Junior Institution of Engineers.—Friday, March 6th. At 8 p.m. At 39, Victoria Street. Paper on "Maihak Indicator and Battcher's Power Counter," by Mr. F. E. Rainey.

Nottingham Society of Engineers.—Friday, March 6th. At 7.30 p.m. At Welbeck Hotel, Milton Street. Annual Dinner.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION)

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week:—

Monday, March 2nd.—"A" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Tuesday, March 3rd.—"B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Wednesday, March 4th.—Recruits only. Infantry drill, 7 to 8 p.m. Technical instruction, 8 to 10 p.m. Rating examination for all Companies, 7 to 10 p.m.
Thursday, March 5th.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Friday, March 6th.—"D" Company. Technical instruction, 7 to 9.30 p.m. Miniature range practice, 7 to 9 p.m.
Saturday, March 7th.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Institution and Lecture Notes.—Birmingham and District Electric Club.—Mr. W. Y. Anderson presided, on Saturday last, at the fifth annual dinner of the Electric Club. Responding to the toast of "The City of Birmingham," Mr. Chattock referred to the forward policy of the City Council in developing the electric supply undertaking, and said that the provision of a cheap supply of electricity for power purposes was vital to the progress of a great industrial centre like Birmingham. The price of electricity in Birmingham was among the lowest in the kingdom, and last year about 70 million units of electricity were generated in the city.

Physical Society of London.—At the annual general meeting on February 13th, the reports of the Council and treasurer were adopted.

The following is a list of officers elected for the ensuing year :—President : Sir J. J. Thomson, F.R.S. Vice-presidents : Prof. T. Mather, F.R.S., A. Russell, D.Sc., F. E. Smith, R. S. Whipple. Secretaries : W. R. Cooper, 82, Victoria Street, S.W. ; S. W. J. Smith, D.Sc., Imperial College of Science and Technology, South Kensington. Foreign Secretary : R. T. Glazebrook, F.R.S. Treasurer : W. Duddell, F.R.S., 56, Victoria Street, S.W.

Papers entitled "On the Moving Coil Ballistic Galvanometer," by R. Ll. Jones, M.A., and "On Vibration Galvanometers of Low Effective Resistance," by Mr. A. Campbell, were read. A paper "On Vacuum-tight Lead Seals for Leading-in Wires in Vitreous Silica and other Glasses," was read by Dr. H. J. S. Sand. The author has found that lead which has been allowed to solidify in contact with glass will, if free from oxide, form a vacuum-tight joint with the latter. Owing to the very great firmness with which the metal adheres, and owing to its great plasticity, these joints can stand temperature changes without damage. When applied to quartz, the joints are usually made inside a tube in conjunction with a molybdenum wire seal as follows :—The tube is shaped so that the molybdenum wire can be placed loosely inside it. A short piece of the latter is later sealed into the quartz, whereas one of its ends projects a few millimetres into the space in which the lead seal is to be made. Connected with this space by a short capillary there is an upper chamber in which the piece of lead is placed. The air is first blown out with hydrogen, and the tube then closed at the top and evacuated to a pressure of a millimetre or two. The quartz is then softened and pinched on to the molybdenum wire. After this the lead is melted and allowed to filter from oxide through the capillary and run into the space shaped to receive it, which has been highly heated. Before it has solidified, the tube is broken at the top to allow the pressure of the atmosphere to force the lead well against the surface of the glass. The tube is then cut at a suitable place and a tinned leading-in wire introduced into the lead. Such seals have been successfully fitted to vacuum tubes, mercury lamps, &c., and when made as described have so far not been known to fail. Prof. C. H. Lees asked how the cost of the process compared with that of the ordinary platinum seals in the case of glass. Dr. Sands, in reply, stated that platinum seals could be made with such small quantities of platinum that it was hopeless to try to compete with them in point of cheapness.

Institution of Civil Engineers.—At the meeting, on Tuesday last, a paper on "Rail-Steels for Electric Railways," was read by Mr. W. Willox, who said that the reduction of the life of rails in tunnels from an average of five years to less than three years, and in certain places to less than one year, on the electrified portion of the Metropolitan Railway, induced him to make tests of various kinds of steel rails in the curve between Farringdon Street and Aldersgate. The paper describes the results of these and other tests. The author has come to the conclusion that open-hearth basic Bessemer rails, manufactured by the late Mr. C. P. Sandberg's process, and under careful supervision, have proved the most economical. A paper on "Rail-Corrugation and its Causes," was read by Mr. Stephen Sellon. The author stated that investigations organised by many Associations in various parts of the world had not discovered a solution of the trouble, or propounded any theory of the causes which had found general acceptance ; nor had they put forward any remedy. Large expenditure was being incurred by many tramway undertakings in grinding out corrugations, thereby shortening the life of the rails abnormally. It was estimated by the general manager of the City of Glasgow Tramways that his undertaking spent not less than £10,000 per annum in this grinding operation. The author was of opinion that the rail-steel now used for rails was not hard enough or tough enough for its work. He believed that hard rails—*i.e.*, with a high proportion of carbon—were essential, and gave some evidence from his own and others' experience that such high-carbon rails resisted the corrugating actions of the wheels, as well as ordinary wear. At ordinary speeds the usual pitch of the corrugations on tramway rails corresponded with a frequency of the order of 100 per second. The evidence seemed to show that a comparatively small increase in the compressive strength of the steel would prevent the particular kind of wear under consideration. The British standard specification prescribed an ultimate tensile strength of 40 tons per sq. in. Probably steel with an ultimate tensile strength of 50 to 60 tons per sq. in. would be hard enough to resist the destructive stresses, but it was essential that it should not have a high degree of ductility.

Association of Mining Electrical Engineers.—A meeting of the General Council of the Association was held on February 7th at the Institution of Electrical Engineers, London, the President of the Association (Mr. Alexander Anderson) being in the chair. It was decided to hold the next Council meeting in London on July 4th next. The next examination for certificates of competency in mining electrical engineering will be held on March 14th and 21st simultaneously in about eight different centres in the United Kingdom. At the present time there are 128 certificated members on the register of the Association.

At a meeting of the West of Scotland Branch on Saturday last at Glasgow, discussion was resumed on a paper previously contributed by Mr. J. P. C. Kivlen, on "The Choice of Mining Electrical Machinery."

At a joint meeting of the South Wales Branches of the A.M.E E. and the Colliery Managers' Association at Swansea, the president, Mr. Lewis Watkins, of Bargoed, stated that his company had ordered 6,000 electric safety lamps. Mr. J. Glynn Williams read a paper on "Electrical Equipment for Low Energy Consumption."

At a joint meeting of the North Staffordshire Branches of the Colliery Managers' Association and the A.M.E E at Stoke, the use of electric lamps in mines was discussed, and Dr. T. L Llewellen stated that he hoped that by this means the eye disease known as miners' nystagmus would be eventually done away with. Mr. F. J. Turquand read a paper on the various types of electric lamp now on the market.

At a meeting of the Huddersfield Engineering Society, last week, a lecture was given by Mr. S. Simpson, of Bradford, on "Electrical Power : Its Production and Utilisation."

Institution of Electrical Engineers.—The annual dinner of the Yorkshire Section of the Institution was held at the Hotel Metropole, Leeds, on Friday, the 20th inst. The chair was occupied by Mr. W. B. Woodhouse, chairman of the Section, and there was a large company.

The loyal toast having been duly honoured, Mr. A. G. Lupton (Pro-Chancellor of Leeds University) proposed "The Institution of Electrical Engineers," and said the country owed a debt of gratitude to the Institution for the services which it had rendered to the electrical industry and to the whole community thereby and for the high standard of honour and uprightness which it had maintained. The President of the Institution (Mr. W. Duddell, F.R.S.) responding, said the Institution had done a great deal, but it had still more work to do, and he made an appeal to members of the Local Sections to help to increase its prestige. They hoped in the future to extend their usefulness, not only with reference to the driving of mills and factories, but also in connection with agriculture. Mr. Robert Hammond, who also responded, spoke of the remarkable development of electrical undertakings in South Africa in particular. As illustrating the general advance, he remarked that his first visit to Leeds to test a set of plant had been in reference to one of 7 kw., and he was so impressed with the importance of the occasion that he travelled first-class. In 1913 his own firm had dealt with a set of 7,000 kw. Whilst in South Africa recently he had been greatly struck with the progress of electricity in that country. In 1905 he had read a paper before the British Association at Johannesburg, and advocated the application of electric power in all the Rand mines, laying special stress upon the advantages of electrical winding. The idea had then been looked upon as ridiculous. On arriving at Vereeniging last year he had found a 40,000-kw. station with a transmission at 80,000 volts instead of his suggested 70,000 volts, and the works in which he was interested were being supplied at ·77d. per unit instead of his suggested ·7d. He had found 180,000 kw. installed ; of 60 Rand mines, 48 were electrically operated, and half of those had adopted electric winding with a power amounting to 70,000 kw. If that could be done on the Rand, it could be done in Yorkshire.

The Chairman, who proposed "Our Guests," spoke of the close association in the future between the development of electricity and coal and agriculture. Coal was nowadays found to be not merely a fuel, but also the source of a very valuable fertiliser, and a growing industry was that of the production of sulphate of ammonia from coal. He believed the future developments in Yorkshire would be even greater than those in South Africa mentioned by Mr. Hammond. The multiplicity of authorities was a source of difficulty ; in Yorkshire there were 50 authorities controlling electrical supply to a population of two millions, whilst in Chicago, with a similar population, the supply was handled by one company. The utilisation of electrical power would rid the farmer of his great bane, smoke, and give the agriculturist a convenient form of power for his own operations, and from the scientific and economical use of coal, the agriculturist would derive a valuable fertiliser. The chairman concluded by paying a tribute to the work done in Leeds by Mr. Harold Dickinson, who briefly responded to the toast.

Prof. G. F. Charnock, Principal of the Engineering Department of Bradford Technical College, proposed "The Electrical Industries." He showed their development by a series of tables. The capital invested in electrical companies and the money borrowed by local authorities for similar purposes in this country, he said, amounted to £435,000,000 in 1913, and the value of the units supplied had increased to £1,317,000,000. It had been proved that the lowest capital cost of installation and the maximum economy in coal consumption could only be obtained by the use of large generating units. The future would disclose interesting and important developments in the utilisation of waste gases from coke ovens, blast furnaces, &c., throughout the country, which would be more than sufficient to serve the existing public supply stations, assuming their combined output to be equal to 800,000 kw., and this could be done without using any coal. Prof. Charnock appealed for every encouragement for the young men of the industry, and pointed out that only good treatment in the matter of pay and other respects could produce good men to carry on the work for the benefit of the country. The toast was responded to by Mr. H. H. Wright, who reviewed the conditions of the industry in recent years.

Upon the motion of Mr. T. Roles, of Bradford, the toast of "The Chairman and Hon. Secretary" (Mr. J. D. Bailie) was honoured.

At the meeting of the Birmingham Local Section on Wednesday, a paper was read by Mr. F. Lydall on "Motor and Control Equipments for Electric Locomotives." The discussion was closed.

At the meeting of the Manchester Local Section on Tuesday last, Mr. R. T. Smith read his paper on "Some Railway Conditions Governing Electrification." The discussion was adjourned.

Greenock Electrical Society.—A paper on "Power Station Design" was given by Mr. J. Punch on Friday last, before a good attendance of members.

Association of Electrical Station Engineers.—A meeting was held at Bradford on February 19th, at which there was a small but representative attendance. Mr. Eakin was in the chair. The meeting was in favour of the A.E.S E. supporting the "Weekly Rest Day Bill." A resolution was passed condemning the insertion of a strike penalty clause in Power Supply Bills. The recent events in London were discussed, and the following resolution was passed:—"That this meeting expresses its confidence in the dealings of the London Executive Committee in view of recent events." A meeting was held at Birmingham recently, at which the members emphatically stated that the A.E S.E. should proceed to obtain the objects of the Association by peaceful measures and not take action with any Trade Union; the Bradford and Manchester branches have also expressed similar opinions.

INSTITUTION OF MECHANICAL ENGINEERS.—The annual report, presented to the meeting on Friday last, states that the total membership has increased from 6,160 to 6,346 at the end of 1913. The total revenue for the year was £17,320, and the expenditure £13,633. The net capital of the Institution amounted to £67,924. The Benevolent Fund incorporated in September now amounts to £4,350.

Modern Methods of Welding.—That the future, in the field of welding, belongs to various electric and oxy-acetylene systems is the general conclusion to be drawn from a paper read recently by Mr. T. T. Heaton before the Institution of Mechanical Engineers. The technical details of these systems are now known almost as widely as the blacksmith's coke fire and hammer method. Electrical methods in extensive application fall into one or other of the categories arc welding and resistance welding, with the exception of the Strohmenger-Slaughter system, in which both arcing and contact resistance are operative. In Mr. Heaton's opinion, the Benardos arc system is the most generally useful method of electric welding, and acetylene the best blowpipe gas. Other electric systems, and possibly other fuel gases, are applicable to special work. Delicate adjustment as to time and current is required in contact-welding systems; skilled labour is, indeed, essential to success, whatever the electric or gas welding system employed, and insufficient attention is frequently paid to the design and arrangement of pieces to be joined, in such manner as to avoid internal contraction stresses on cooling. Owing to its lower temperature, the oxy-acetylene flame is better than the electric arc for welding thin material, since the risk of burning is not so great in the latter case. In general, however, electric welding is more rapid and effective, since heat is produced within the work itself. In any case, the character of the metal at the weld is changed to some extent, but the loss in ductility and strength is far less than occurs in a blacksmith's weld, particularly if the electric or gas weld be subjected to suitable mechanical and thermal treatment before being placed in service. Many tests have shown that 89 per cent to 96 per cent. of the original strength of metal can be relied upon in an electric weld. It has been said that the Benardos system yields unsatisfactory results by loading the weld metal with carbon; this only occurs if the manipulation is faulty, the polarity wrong or the metal never of properly weldable quality.

In the course of the discussion on the above paper, Mr. Clarkson (National Steam Car Co.) expressed himself as disappointed with oxy-acetylene welding which, he said, did not bring metal to a plastic condition permitting the pieces to be forced together to form a homogeneous joint. He exhibited a motor-'bus wheel which demonstrated clearly the extreme utility of the electric resistance process. The nave was a drop forging made with eight radial bosses, which were turned externally and bored internally to form tubes of exactly the same section as the drawn steel tubular spokes. The latter were butt-welded on to the hub bosses by the electric contact resistance method, and bell-mouthed rim attachment flanges were then secured to the outer ends of the spokes by the same method. After machining the rim flanges, the pressed steel rim was shrunk on. The whole construction is exceptionally light, and every spoke is tested to 5 tons, though the normal maximum load on the wheel does not exceed 30 cwt. The spoke tubes, when cut longitudinally, opened and flattened, will stand bending through 180° at the weld without failure of the latter. Mr. Clarkson contended that no acetylene weld would stand this treatment, and that though acetylene welding was satisfactory for many purposes, and particularly for tension joints, it could not be relied upon where bending was to be resisted. This contention was disputed by other speakers, and it appears likely that some interesting demonstrations will be arranged. Mr. Richardson stated that the average proportion of oxygen and acetylene used by the nine best makes of welding torches in this country was 1·26 : 1·0. This did not agree with the 1·5 : 1·0 ratio recommended by the author. The ideal—realised where high-pressure torches and dissolved acetylene were used—was a 1 : 1 ratio. The advantage was emphasised of using constant-current dynamos in the Benardos system, to maintain practically constant flow from short circuit up to a 4-in. or 5-in. arc, meanwhile eliminating all regulator loss. The numerous examples illustrated by the author, and quoted by speakers in the discussion, demonstrated the vast present importance, and almost universal applicability, of modern welding systems.

Electrolytic Corrosion of Iron in Soils.—In No. 25 of the *Technologic Papers of the Bureau of Standards*, U.S.A., Messrs. B. M Collum and K H. Logan give details of an extended research on this subject. The following are some of the conclusions drawn from the experimental data presented

The current density has a marked effect on efficiency of corrosion of iron in soils, the efficiency of corrosion being, in general, greater the lower the current density. In saturated soils the corrosion may vary between 20 per cent. and about 140 per cent. for the range of current densities between 5 milliamperes and 0·05 milliampere per square centimetre.

Moisture content in the soil also has a marked effect on efficiency of corrosion, the corrosion efficiency being in general greater with increasing moisture content up to saturation of the soil. Beyond this point increased moisture content has comparatively little effect.

Temperature changes within the limits commonly met with in practice have no important effect on corrosion efficiency.

The depth of burial of pipes has no direct effect on corrosion efficiency, provided other conditions remain constant.

The amount of oxygen present has a marked effect on the end products of corrosion. If the corrosion is rapid and the supply of oxygen small, there will be a preponderance of magnetic oxide, while if the rate of corrosion is low and the supply of oxygen abundant, the ferric oxide will predominate. Owing to the fact that the supply of oxygen around pipes buried in earth is always more or less limited, the character of the oxides formed gives some indication as to the rate of corrosion, and thus indirectly the cause of the corrosion, if local conditions are properly considered.

There is no material difference in the efficiency of corrosion shown by the various kinds of iron commonly used in the manufacture of underground pipes.

The fact that a given chemical tends strongly to inhibit either self-corrosion or electrolytic corrosion in liquids is no indication that it will materially retard electrolysis of iron embedded in soils.

The efficiency of corrosion was found not to be a function of the voltage except in so far as the current density may be affected. Voltages as low as 0·1 and 0·6 volt showed practically the same efficiency of corrosion as 5 to 10 volts or higher. Corrosion efficiencies between 50 and 110 per cent. may usually be expected under most practical conditions.

The resistance of soils varies throughout a very wide range with variations in moisture content, the resistance of comparatively dry soil being of the order of several hundred times the resistance of the same soil at about saturation. Above saturation, increase in moisture content has but little effect on the resistance of the soil. Because of the great variations in resistance of earth with moisture content, voltage surveys should not be made at times when the earth is extremely dry.

The resistance of the soil varies greatly with temperature within the ordinary range encountered in practice. At about freezing temperature the resistance will be several times that at summer temperatures. This not only has an important bearing on the magnitude of the electrolysis trouble that may occur at different seasons, but also indicates that where practicable, voltage surveys should not be made when extremely low temperatures prevail.

The experimental results given in this paper have an important bearing on the subject of electrolysis mitigation through the limitation of voltage drop in the negative return. For some years the chief means of preventing trouble from electrolysis in certain countries has been the limitation of the permissible voltage drop between any two points on the return circuit. In some places the limit has been placed on the maximum voltage during peak load, whereas in other cases the average voltage for 24 hours has been the determining factor. It appears from the data presented in this paper that the rate of damage does not increase as fast as the voltage increases, because of the tendency toward lower corrosion efficiencies at higher current densities. This indicates that, with a given average all-day current, the actual amount of electrolysis that would occur would be less with a bad load factor than with a good load factor, and hence points to the undesirability of penalising a high peak of short duration. It would appear more logical, therefore, in so far as the damage itself is concerned, to make the average all-day voltage the basis of the limitation rather than the voltage at time of peak load.

Air-Brake Tests.—Important improvements in the braking of heavy passenger cars were to be described in a paper read before the American Society of Mechanical Engineers on February 10th, by Mr. S. W. Dudley, of Pittsburg. These tests were conducted jointly by the Pennsylvania Railroad and the Westinghouse Air-Brake Co. The results are considered the most important recent contribution to the subject of air-brakes. A train of 21 steel cars travelling at 60 miles per hour stores up 224,000,000 ft.-lb. of energy. This is sufficient to raise the entire train 120 ft. With prevailing brake equipment such a train would be stopped by an emergency application in a distance of 1,600 to 2,200 ft., according to the truck rigging and brake shoe design. These tests showed that this distance has actually been reduced to 1,000 ft. or to within the length of the train. The improvements centre in the electric control of the brakes, giving quick, simultaneous and responsive action. The tests constituted a progressive development of brake rigging and brake shoes in connection with the scientific study of the air-brake as a whole.

Appointments Vacant.—Superintendent of telephones and foreman of electric light, for Dominica Government (£200, travelling expenses, free passage); chief traffic inspector (47s. 6d. to 50s.), and switchboard attendant (20s. to 25s.), for Erith Electricity and Tramways Department. Particulars are given in our advertisement pages.

Patent Restored.—An order has been made restoring Patent No. 5,522 of 1907, granted to James Hawley, Ltd., and Albert Savory Jones, for "An Improved Electro-Magnetic Separator Drum for Grain and Similar Conveyors."

Electrical Wages in Australia.—According to the *Sydney Herald*, Mr. H. Montgomerie Hamilton, chairman of the Government Tramways Group, No. 4 Board, has issued an award (for three years) dealing with the electrical trades. The main provisions include the following :—

The minimum rates of pay for the following classes of labour shall be :—Electrical fitters, 12s. per day ; armature winders, 10s. (and bonus) ; electrical testers and running testers, 12s. 6d. ; power signal electricians, 11s. 6d. when not in charge of a squad ; men in charge of a squad shall receive 12s 6d. ; battery mechanics, 12s. ; electrical mechanics, 11s. ; electrical mechanics when engaged on battery work shall receive 1½d. per hour extra ; arc lamp trimmers, 9s. 6d. ; leading hands shall receive 1s 6d. per day over their usual journeyman rate ; apprentices, 10s., 15s., 20s., 27s. 6d. and 30s. per week for the first, second, third, fourth and fifth years respectively.

Forty-eight hours shall constitute a week's work for all employés engaged on day work, and the working hours are to be between 7.30 a.m. and 5 p.m. on five days of the week, and between 7.30 a.m. and 12 noon on Saturday. All time worked in excess of the ordinary hours of labour is to be paid for at the rate of time and a half. All work done on Sundays and public holidays, and on Christmas Day and Good Friday, in all cases where men are not allowed a day off in lieu of such days, is to be paid for at the rate of time and a half.

When either an electrical fitter or mechanic is required periodically to take a shift on maintenance work he is to be allowed 1s. extra per shift, provided three-quarters of such shift is worked outside the ordinary working hours. Country work is work performed outside of a limit of 25 miles from the workshop to which an employé is attached. Travelling time is to be allowed to and from such place of employment, but is not to be paid for in excess of eight hours for any 18 hours travelled.

Railway electricians.—Wages, 70s. per week for the first year ; thereafter 80s. When away from home station, railway electricians shall be allowed the following expenses : Nine hours, 2s. ; 12 hours, 4s. ; 18 hours, 5s. 6d. ; 24 hours, 7s.

Wages in the power house and sub-stations include the following :—Power-house shift electricians, D.C. boards, 14s. ; A.C. board, 15s. ; sub-station shift electricians, 11s. 8d. for the first six months ; thereafter 12s. 8d., 13s. 4d. and 14s. ; shift electricians while in charge of construction staff, 1s. extra ; shift electricians while employed on instrument maintenance, 14s. ; shift electricians while employed on general sub-station maintenance, 13s. 4d. ; assistants on A.C. switchboard (power house), 9s. ; dynamo attendants, 10s. 6d. ; compressor house electricians, 12s. ; battery attendants, 8s. 6d. ; shift electricians, country and suburban generating stations, 12s. 8d. ; senior shift electrician (Clyde), 13s. 8d. ; six eight-hour shifts will constitute a week's work. All time worked in excess of eight hours is to be paid for at the rate of time and a half.

The Patents and Designs Act.—The Manchester Chamber of Commerce has issued a pamphlet in reply to arguments used by the Council of the Chartered Institute of Patent Agents regarding a resolution of the Chamber of Commerce, urging that, in view of the fact that Mr. Justice Parker's comments in Hatschek's case, in the year 1909, as to the extent of the onus devolving upon any applicant who seeks revocation of a patent for non-working under Sec. 27 of the Patents and Designs Act, 1907, have deprived that section of its effectiveness, the rules be amended in such terms as will place the burden of proof on the patentee—an effect which was the object of those who drafted the Act in 1907.

Prior to the ruling of Mr. Justice Parker, any applicant for revocation of a British patent could call upon the patentee to prove that he, the patentee, was not manufacturing the patented article, or carrying on the process exclusively or mainly outside the United Kingdom, while now, by the ruling of Lord Parker, the applicant must, with his application, leave at the Patent Office evidence by way of statutory declaration stating the particulars upon which he relies in support of his allegations. Lord Parker's decision, says the Chamber of Commerce, has practically annulled the benefits that had, prior to his decision, been brought about—owing to the compulsory working clauses of Sec. 27.

The pamphlet states that Sec. 27 undoubtedly had, and still has, the warm approval and support of the great majority of the trading and industrial community of this country. Opposition to it is confined almost exclusively to certain patent agents and lawyers.

A trader who applies to the Railway Commissioners for a lower railway rate is entitled to call upon the railway company to prove that the rate demanded by them is a reasonable one. In the same way, the Manchester Chamber considers it perfectly reasonable that it should be for the patentee to prove that he is carrying out his part of the bargain with the State when he is called upon to do so. Only a *bona fide* interested party should be allowed to make an application for revocation. It should be considered that he has made out a *prima facie* case if he declares on oath that he has made every legitimate endeavour to discover to what extent, if at all, the patent is being worked in this country, and how far there is importation of the patented article, if any.

The question of compulsory working is a commercial and an economic one, very little appreciated by most lawyers and patent agents, and the commercial and industrial community strongly favours compulsory working of patents quite independently of any political party questions. The Act came into force on January 1st, 1908, and there has so far been no retaliation worth considering. It is quite erroneous to contend that an English patentee, in order to maintain his foreign patents in those countries where compulsory working is enforced, must erect a factory, for the grant of licenses to manufacture is quite sufficient to meet the demand of the patent laws of such countries.

The Chamber adds that the patent which is not worked in this country, but worked abroad, frequently becomes a permanent monopoly, because at the expiration of the patent there are no skilled workmen, foremen, managers, and others acquainted with the details of the manufacture of the patented article, and there is no organisation for selling the products which have been the subject of the patent for many years. If the patent be worked here, there are many advantages to British trade and industries ; work is found for British workpeople, the new industry creates further industries and helps collateral existing ones. As examples of new industries thus created, the case of the "Otto" gas engine, the "Heilmann" cotton combing machine, and the soda process worked by Messrs. Brunner, Mond & Co., Ltd., are cited. "The question of the working of patents is of the greatest moment, *because* we are a Free Trade country, and is of correspondingly less importance to countries with high tariffs."

The reply of the Chamber concludes by pointing to a number of industries introduced during the short time of 14 months that Sec. 27 was really effective, including the manufacture of Diesel engines and metallic-filament electric lamps, as well as to the numerous cases in which English manufacturers have been appointed licensees to work British patents by foreign firms, in order that the latter might comply with the terms of the Patent Act.

Calcium Carbide.—The world's production of carbide of calcium reached about 300,000 tons in 1912. This progress is due less to the more extended use of acetylene than to the extension in the manufacture of cyanamide. Germany is the greatest consumer of carbide in Europe. Her imports in 1912 were 47,984 tons ; in 1911, 36,943 tons. Exports in 1912, 970 tons ; in 1911, 2,147 tons. The German consumption is advancing rapidly, and exceeds that of the United States. The autogenous welding of metals is responsible for a noteworthy portion of this consumption, which has now risen to 55,900 tons. In Sweden the carbide works operate for the production of cyanamide, and the Odessa establishment is equipped for an out-turn of 80,000 tons of carbide destined for this fertiliser. Very little carbide is exported from Sweden. Norwegian exports are expanding in a remarkable manner, to meet more particularly the huge demand from Germany ; they have almost doubled in four years, rising from 36,895 tons in 1908 to 64,000 tons in 1912. In the United States, exports touched 16 000 tons in 1912, against 13,000 tons in 1911. Shipments were directed mainly towards South America and Central America, where the consumption for private lighting has reached such a pitch as to induce the erection of works for its manufacture on the spot. Switzerland exported carbide in 1912 to the value of 5,500,000 fr. In 1910 the imports were 176 tons and the exports 24,105 tons ; in 1911 imports stood for 161 tons and exports 24,272 tons. In Austria-Hungary, imports in 1911 and 1912 were practically nil ; but exports were, in the same years, 11,729 tons and 10,820 tons. In England, imports totalled 14,000 tons in 1911 and 18,857 tons in 1912. Italy exported to a value of 12,200,000 lire in 1912 ; in 1911 the exports were 8,400 tons against imports of 7 tons only. The local production is utilised to manufacture 20,000 tons of cyanamide per annum. In France the imports during the years 1910, 1911 and 1912 were respectively 445, 2,162 and 3,302 tons ; the exports : 4 824, 5,058 and 6,225 tons. There is a steady increase in the exports to the French colonies, owing to the extension there of acetylene lighting.

Physical Exercises for Engineers.—On Monday Lieut. Müller is giving a demonstration of his system of physical exercises before the combined staffs of the Marylebone Electricity Supply Department and Messrs. Selfridge & Co. This is considered a very special favour, as Lieut. Müller has given up personal demonstrations.

Electrical Trades Benevolent Institution.—The chairman of Committee, Mr. Justus Eck, informs us that at the present time a strenuous effort is being made by the friends of the above institution to secure a handsome collection, to be announced as an addition to the funds at the annual Festival on March 25th. That the institution has justified its existence is beyond doubt ; during the year 1913, despite the activity in electrical circles the demand for relief was twice that of the previous year, and it must inevitably increase. Membership is becoming of added importance, and it cannot be too earnestly impressed on all those engaged in the electrical trade in the United Kingdom, whether as employers, managers, teachers, or on the engineering, designing, drawing, sales or office staff, or in any other similar capacity, that they should qualify as members without delay.

Membership is secured to qualified persons by a payment of 10s. in each year, payable in one sum or by small amounts monthly or weekly. Many of the members, however, contribute sums in excess of this, £5 being not at all unknown. Contributions of this kind as well as other are collected by authorised holders of collection books, who receive rewards for their work in the form of free membership and votes in proportion to the amount of their collections.

We cordially endorse Mr. Eck's appeal to all firms in every branch of the electrical industry in the United Kingdom, if unable to collect themselves, to nominate one or more members of their staffs willing to become active collectors. Prompt application to the secretary of the Electrical Trades Benevolent Institution at 18, Park Mansions, Vauxhall Park, S.W., will enable even the new collectors to report results before the next Festival.

We have great pleasure in announcing that Sir David Salomons, Bart., M.A., M.I.E.E., has accepted the position of president of the Electrical Trades Benevolent Institution, which became vacant on the death of Sir William Preece. With Sir David as president, and Mr. H. Hirst as chairman of the coming annual dinner, there should be a successful year before the fund.

In their report for the year ended December, 1913, the Committee state as follows:—

"The year 1913 will be remembered as the date of the inauguration, with most gratifying financial results, of the system under which heads of large electrical firms preside at the annual festival dinners. The total income was £1,300, which is a larger amount than has been received in any previous year. The subscriptions from members have increased, and the donations were £835, as compared with £512 in 1912. The result of the year's work has been a net income of £1,116. Of this amount, together with £150 which was placed on deposit at the bank at the end of 1912, £719 has been invested in New Zealand 3½ per cent. inscribed stock, and £383 in Metropolitan Water Board 3 per cent. stock, bringing the total of the invested funds to £4 920. It should be specially recorded that donations were received from the Electrical Contractors' Association, and for the fifth year in succession from the Electrical Engineers' Ball, and the second year in succession from the Garrick Dramatic Society. It may be noted with satisfaction that the total working expenses in 1913 were slightly less than in the previous year, the percentage of expenses as compared with the amounts collected being considerably less. The system of collectors' books came into full operation in 1913, and a list of the collectors, together with the amounts collected, is shown for the first time in the year-book of the Institution. The total amount collected by this means was £350.

"The Committee again wish to draw the attention of firms in the electrical industry to the great desirability of appointing as collectors some of the members of their staff, as the subscriptions of members of the Institution can be paid to such collectors by instalments, while subscriptions and donations can be obtained from other persons and firms with advantage to the collector.

"The total amount of the grants for 1913 was more than double that in 1912, which in turn was more than double that for the previous year. This demonstrates the need and utility of the Institution, and as it is becoming better known year by year, the calls upon it are bound to continue to increase rapidly."

The income for the year, including dividends on investments, subscriptions and donations, and sale of dinner tickets, totalled £1,363, and the expenditure was as follows:—Printing, &c., £57; secretary's salary and commission and office expenses £130; 14 grants made, £154; cost of annual festival £60. The balance carried to balance-sheet was £962. The investments of the fund now stand at £4,920. We should like to see that figure doubled or trebled straightaway, but at present it seems that the process of gradually building up the capital account will have to be continued. Therefore, we would urge all of our readers to do their utmost just now to assist the movement.

Parliamentary.—*London United Tramways Bill.*—The company are objecting to the petitions of the London and South-Western Railway Co., the Railway Carriage and Wagon Builders' and Financiers' Parliamentary Association, and the Middlesex County Council.

Lurgan Gas and Electricity Bill.—Mr. Moore has given notice of his intention to move the rejection of this Bill in the House of Commons.

London Electric Supply Bill.—Notices have been given by Messrs. Lough, Radford, Wiles and Dickinson, and Sir Stephen Collins, of their intention to move the rejection of this Bill.

Telephone Charges.—The Postmaster-General, in reply to Mr. Goldman, says he hopes to be able to announce the proposed new telephone rates before Easter.

Smoke Prevention.—Last week Mr. G. B. Burnside gave a lecture at Glasgow on experiments which he has carried out on the precipitation of smoke and fog at the University. The use of charged electrodes suffers from various drawbacks; but excellent results have been obtained with damp steam electrically charged by friction in passing through nozzles, as in Lord Armstrong's experiments. The vapour, directed into a chimney, provides charged nuclei upon which the soot particles collect, with the result that the aggregates thus formed are precipitated by gravitation.

Sheffield Engineers' Demands.—Men employed in the engineering trades in Sheffield are making demands for more wages and shorter hours. The five years' agreement between masters and men will expire at the end of this month, and the men are asking for 5s. per week advance all round, a 48-hour week, and restriction of overtime. The engineers are at present receiving 39s., pattern-makers 41s. and 42s., steam engine makers and blacksmiths 39s. The question affects 9 000 men.—*Financial Times.*

Electric Roller Skates.—It is reported that a young American named Bruce Eytinge has applied electric motors to roller skates, and with the aid of a pair of batteries weighing 20 lb. is propelled without effort other than that required for steering.

Radium and Cancer.—An American authority on the treatment of cancer with radium, Dr. Robert Abbe, states that the beta rays, which have hitherto been considered dangerous, have a more powerful effect upon cancerous growths than the gamma rays, which have been relied upon until now.

Apparatus for Winding Electrical Machines.—An ingenious system of winding the stators of induction motors and similar machines has been brought to our notice by Mr. Geo. de-Curtis, of the British Thomson-Houston Co, London. Hitherto there has been no means of avoiding or shortening the tedious process of threading the wires repeatedly through the interior of the core and through the very narrow spaces between the end connections of the coils already in position; the insulation of the wire may suffer considerable injury during the process, especially when, as is often the case, it is allowed to come in contact with the floor. Mr. de-Curtis's method, however, not only shortens the time occupied by 50 per cent., but also greatly diminishes the risk of abrasion of the insulation, and entirely avoids injury to the wire through contact with the floor. The apparatus required is extremely simple, and easily made in any workshop.

As the device is not at present covered by letters patent, we are unable to give further details at the moment. Mr. de-Curtis, however, will be pleased to answer inquiries from would-be users, addressed to this office.

Inquiry.—Makers of bakers' electric ovens are asked for.

The Brighton Railway Electrification.—Speaking at the meeting of the London, Brighton and South Coast Railway on Wednesday last, the Earl of Bessborough stated that the company were pushing on with the electrification of additional suburban lines, and hoped to have the section from Balham (the junction with the Crystal Palace electrical line) through Streatham Common to West Croydon and Wallington completed by the end of the year and in use by the following spring. The other sections would follow, and, it was expected, be completed within four years from now. Since the establishment of the existing electrical services, four years ago, they had carried an average of over six million passengers per annum in excess of the last year of steam operation.

The policy of electrification of the company's suburban services had been the means not merely of arresting the serious diminution of traffic arising from the competition of electric tramways and motor-'buses, but of regaining all that had been lost and obtaining an increase on that. The whole of the alterations consequent on the adoption of electrical working had been made by their own officers and staff.

Last year the speaker, with his principal officers, had inspected various electric railways on the Continent, and it was gratifying to find that the single-phase system, which they had installed on the advice of their consulting engineer, Mr. Philip Dawson, was becoming the most favoured one. He understood that the Swiss Federal Railways had decided to adopt it on the extensions of the St. Gothard line.

The Electrical Engineers' Ball.—Nearly 300 votaries of terpsichore enjoyed a delightful evening at the Hotel Cecil on Friday last; indeed, the opinion was universal that the scene of revelry by night had never been surpassed in any of the preceding gatherings. The hon. secretaries are to be heartily congratulated on the success of their untiring labours; and as for the two hard-working but lightly-thought-of supper stewards—well, they will probably get their reward in the next world; the dancing stewards got theirs at the time!

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Leslie Float, of the Townmead Electricity Works, Fulham, has been appointed as a switchboard attendant at the Corporation Electricity Works, Gunwharf Road, Portsmouth.

The Warrington Corporation electricity staff have presented a rosebowl to Mr. E. Fenton, a member of the staff, on his departure to take up an appointment in Yorkshire.

Tramway Officials—The L.C.C. Highways Committee recommends the following annual revisions of tramway department staff; Mr. J. Welling, permanent way engineer, increase from £575 to £600 a year; Mr. A. R. Owen, tramways and marine claims superintendent, increase from £500 to £550 a year; Mr. W. E. Ireland, rolling stock superintendent, increase from £500 to £525 (an assistant rolling stock superintendent is to be appointed); Mr. H. S. May, on his appointment as assistant rolling stock superintendent, increase from £300 to £325 a year; Mr. H. T. Hider, assistant in the third class, increase from £180 to £190 a year; Mr. G. Potter, assistant in the fourth class, Section (*a*), increase from £140 to £150 a year. Special-duty pay is to be granted to Mr. R. G. Thomas, assistant in the first class, £25; and Mr. G. H. Brooks, assistant in the third class, £10. The Committee also recommends that the salaries of Messrs. C. H. Pardoe, S. R. Geary, A. C. Bond, W. W. Kinton and A. H. Boggis, officers of the fourth class Section (*a*) tramways department, be increased to £120 a year; and that Messrs. H. J. Jacobs, O. Weick, H. E. A. O.

Tilley, C. H. Townsend, S. H. Steel, D. E. G. Quelch, C. R. E. Osmond, M. A. Moss, W. J. Lias, J. Leates, N. Lawson, J. H. Hutchings, F. W. Hubbard, A. Hodge, F. Harris, W. N. Halliwell, H. J. T. Hales, J. Hadlow, G. A. Gascoine, F. French, E. A. Foley, C. H. Fitch, H. T. Dene, B. Davies, P. S. Davenport, H. H. Burgum, W. Best, A. S. Barnes, B. T. Anderson, and H. H. Stollery, assistants in the fourth class Section (*b*) be advanced to Section (*a*) at the commencing salary of £120; and that Messrs. W. E. Barnes, C. A. P. Netz, W. J. Platt, H. J. R. Marson, T. W. Brown, D. C. Brown, E. H. R. Banks, H. Allen, and S. Shackell, assistants in the fourth class Section (*b*) be advanced to Section (*a*) at a commencing salary of £110 a year.

Mr. R. F. Dixon, of the Hull Corporation tramways department, has been recommended from among 91 applicants for the post of works superintendent in the Southampton Corporation tramways department.

At the Doncaster tramway offices recently Mr. E. S. Rayner, borough electrical engineer and tramways manager, presented, on behalf of the Tramway and Electricity Departments, a marble clock and pair of bronzes to Mr. J. Brown, who has vacated the the post of traffic inspector at Doncaster. Mr. Rayner congratulated Mr. Brown on having obtained the position of traffic manager to the Ayr Corporation Tramways. Mr. G. A. Roberts (assistant engineer), Superintendent Strachan, Inspectors Baker and Teal, and motorman Maw also made reference to Mr. Brown's abilities, and wished him success. Mr. Brown suitably responded.

At a smoking concert under the auspices of the Aberdeen branch of the Amalgamated Association of Tramwaymen, Mr. Wm. Joyner, president, and Mr. David Paterson, treasurer, were presented with gifts as tokens of their fellow-members' esteem.

General.—The Postmaster-General has appointed Mr. G. F. Mansbridge to be Assistant Controller of the Stores Department, G.P.O.

Mr. T. J. Giltinan has been elected instructor in wireless telegraphy for the Cork Technical Instruction School.

We are informed that Mr. R. H. Willis has resigned his position as general manager of the British Electric Plant Co., Ltd., in order to commence business on his own account as an electrical and mechanical engineer and merchant at 211, Produce Exchange, Manchester, where all communications should now be addressed.

Mr. A. J. Wray, who has for nearly 12 years been manager of the Banbury and District Electric Supply Co., Ltd., was last week presented by the staff with an engraved brass inkstand, on his leaving for Kidderminster.

Mr. C. McKinlay is resigning his position as manager of the electrical showrooms for Messrs. Falk, Stadelmann & Co., Ltd., Farringdon Road, E.C., having been appointed the London representative for the Carron Co. in connection with the sale of their electrical cooking and heating apparatus. Mr. McKinlay is also representing the Carron Co. in the South of England.

Obituary.—Mr. E. L. Moulton.—The death is announced of Mr. Edward Lavender Moulton, who was for many years the proprietor of the business now carried on at 35, High Street, Bedford, by Messrs. Bacchus & Ison, electrical engineers. Mr. Moulton was 77 years of age, served on the Town Council for a long period, and was Mayor of the borough in 1903 and 1908.

The death is announced from Vienna, at the age of 86 years, of Prof. Dr. Adalbert V. Waltenhofen. The deceased was the oldest electrical engineer in Austria, and was one of the founders of the Austrian Electrical Engineers' Association.

The death occurred, on 16th inst., of Mr. A. L. Gillespie, electrical engineer, Dunmanway. Mr Gillespie, who was only 23 years of age, went over from Newcastle-on-Tyne three years ago to take up the electric lighting contract of the town of Dunmanway, Co. Cork, for the Rural District Council.

NEW COMPANIES REGISTERED.

City School of Wireless Telegraphy, Ltd. (134,059)—This company was registered on February 19th, with a capital of £1,500 in £1 shares, to take over the business of a school for wireless telegraphy carried on by J. R. Halliwell at 43, Thomas Street, Shudehill, Manchester. The subscribers are:—J. R. Halliwell, 43, Thomas Street, Manchester, electrical engineer, 50 shares; R. B. King, Holmleigh, Waterpark Road, Broughton Park, Manchester, traveller, 100 shares; J. Taylor, 154, Grange Avenue, Werneth, Oldham, secretary, 100 shares; R. Scott, Whitestones, Chapel-en-the-Frith, wire-rope manufacturer, 200 shares; L. Hirtly, 73, Oak Road, Crumpsall, Manchester, manager, 100 shares; T. Rushworth, Tabley Villa, Bennett Road, Crumpsall, Manchester, bristle merchant, 100 shares; J. D. Jeremiah, Ennismore, Lindon Road, Didsbury, company director, 100 shares; A. Chapman, 46, Thomas Street, Manchester, merchant, 125 shares. Private company. J. R. Halliwell is the first managing director, and may retain office while holding £200 shares; remuneration, £104 per annum and 20 per cent. of the net profits. Solicitors, Bond & Son, 19, Dickinson Street, Manchester.

Prentice Wireless Train Control, Ltd. (134,096).—This company was registered on February 20th, with a capital of £30,000, in £1 shares, to acquire rights in the Prentice automatic system of wireless train control, and the benefit of certain inventions and patent rights relating thereto and to signalling apparatus, &c. The subscribers (with one share each) are:—G. A. Phillips, 51, Bishopsgate, E.C., member of Stock Exchange; G. M. Miles-Bailey, J.P., Abbess Grange, Stockbridge, Hants.; F. W. Prentice, 45, Cranley Gardens, Muswell Hill, London, N., electrical engineer. Private company. The number of directors is not to be less than three or more than five; the first are G. A. Phillips, G. M. Miles-Bailey, J.P., and F. W. Prentice. Registered by Bristows, Cooke & Carpmael, 1, Copthall Buildings, E.C.

Midland Electric Rotary Blowing Co., Ltd. (134,088).—This company was registered on February 19th, with a capital of £1,000 in £1 shares, to carry on the business of electric organ blower makers and engineers, as formerly carried on by D. Cameron, at 12 and 14, Traffic Street, Derby, as Midland Electric Organ Blowing Co. The subscribers (with one share each) are:—C. Harvey, Beaulieu, Shoal Hill, Cannock, secretary; M. Harvey, Beaulieu, Shoal Hill, Cannock, hardware manufacturer. Private company. The number of directors is not to be less than two or more than five; the first are C. Harvey and M. Harvey (both permanent), qualification, 100 ordinary shares. Solicitors: Enoch Evans & Son, Walsall.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Wellingborough Electric Supply Co., Ltd.—Issue on February 3rd, 1914, of £1,500 debentures, part of a series of which particulars have already been filed.

Renton Holdsworth & Co., Ltd.—Resolution, charged on freehold lands and premises in Norfolk Street and Sycamore Street, Sheffield, dated January 29th, 1914, to secure all moneys due, or to become due, from company, to Williams Deacons Bank, Ltd.

Napier-Kimber, Ltd.—Issue on February 4th, 1914, of £100 debentures, part of a series of which particulars have already been filed.

Worcester Electric Traction Co., Ltd.—Mortgage, dated February 12th, 1914, to secure £1,000, charged on certain lands in Worcester. Holders: Worcester and Malvern Steam Laundry and Carpet Beating Co., Ltd., George's Square, Worcester.

Woking Electric Supply Co., Ltd.—Issues on various dates from July 13th, 1912, to December 29th, 1913, of £3,160 debentures, parts of a series of which particulars have already been filed. A memorandum of satisfaction to the extent of £2,800 on various dates from June 17th, 1913, to December 30th, 1913, of trust deed dated March 1st, 1906, securing debenture stock for an indefinite amount, has also been notified.

James Keith & Blackman Co., Ltd.—Issue on February 9th, 1914, of £5,000 debentures, part of a series of which particulars have already been filed.

Rugby Lamp Co., Ltd.—Issue on February 7th, 1914, of £600 debentures, part of a series of which particulars have already been filed.

Naylorgraph, Ltd.—Fourth debenture dated February 6th, 1914, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holders: J. M. Hunt, Fairlawn Park Road, Southborough, Kent.

Keynsham Electric Light and Power Co., Ltd. (64,034).—Capital, £5,000, in £1 shares (3,000 pref.) Return dated December 29th, 1913. All shares taken up. £5,000 considered as paid. Mortgages and charges: £2,980 (excluding interest).

Costa Rica Electric Light and Traction Co., Ltd. (56,447).—Capital, £130,000, in £1 shares. Return dated January 5th, 1914. All shares taken up, £7 paid. £129,993 considered as paid. Mortgages and charges: £286,500.

Cordoba Light, Power and Traction Co., Ltd. (99,640).—Capital, £1,000,000 in £1 shares (300,000 preference, 600,000 ordinary and 100,000 preference or ordinary). Return dated December 31st, 1913, 300,000 preference and 600,000 ordinary taken up, *£170,100 paid, £429,900 considered as paid. Mortgages and charges: £899,800.

Douglas Southern Electric Tramways, Ltd. (45,701).—Capital, £50,000 in £1 shares (30,000 preference and 20,000 ordinary). Return dated December 30th, 1913, 25,973 preference and 15,472 ordinary shares taken up, £18,370 paid on 12,566 preference and 5,804 ordinary, £23,075 considered as paid on 13,407 preference and 9,668 ordinary. Mortgages and charges: Nil.

Bullers, Ltd. (62.020).—Capital, £400,000 in 20,000 ord. and 20,000 pref. shares of £10 each. Return dated January 1st, 1914; 15,000 ord. and 15,000 pref. shares taken up; £150,070 paid on seven ord. and 15,000 pref.; £149,930 considered as paid on 14,993 ord. Mortgages and charges: Nil.

Bogota Telephone Co., Ltd. (69,059).—Capital, 45,000 in £1 shares (20,000 pref. and 25,000 deferred). Return dated January 14th, 1914; 15,200 pref. and 18,607 deferred shares taken up; £24,607 paid on 6,200 pref. and 18,607 deferred; £9,000 considered as paid on 9,000 pref. Mortgages and charges: Nil.

Collieries Electric Power Development Syndicate, Ltd. (90,729).—Capital, £10,000 in £1 shares. Return dated January 14th, 1914. 6,007 shares taken up. £1 called up on 4,000, nil on 7. £4,000 paid. £2,000 considered as paid on 2,000. Mortgages and charges: Nil.

Trowbridge Electric Supply Co., Ltd.—Particulars of £2,400 debentures, created January 26th, 1914, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking and property, present and future, including uncalled capital and freehold hereditaments at Trowbridge. Trustees: J. H. Blake, Beechfields, Melksham, and A. H. Dougals, Brenda, Queen Drive, Colwyn Bay.

Osram Lamp Works, Ltd. (95,312).—Capital, £100,000 in £10 shares; 7,500 "A" and 2,500 "B." Return dated January 14th, 1914; all shares taken up; £10 per share called up on 5,000 "A": £50,000 paid; £50,000 considered as paid on 2,500 "A" and 2,500 "B." Mortgages and charges: £30,000.

Phœnix Dynamo Manufacturing Co., Ltd. (77,6[illegible]).—Capital, £60,000 in 50,000 shares of £1 each, and 1,000 shares of £10 each. Return dated December 11th, 1913. 28,007 £1 shares and 1,000 £10 shares taken up. £1 per share called up on 7,007, and £10 on 1,000. £17,007 paid. £21,000 considered as paid on 21,000 shares. Mortgages and charges: £20,000.

North Wales Power and Traction Co., Ltd. (78,193).—Registered July 30th, 1903. Capital, £270,000 in 44,000 ord. and 10,000 pref. shares of £5 each. Return dated January 12th, 1914. 38,100 ord. and 7,300 pref. shares taken up. £5 per share called up on 34,100 ord. £170,475 paid, leaving £25 in arrears. £66,000 considered as paid on 4,000 ord. and 9,200 pref. Mortgages and charges: Debt of £40,000 secured by issue of £80,000 first mortgage debs.; also £7,000 "B" debs. and £10,000 mortgage debs. (Total debt: £147,000. Total debs. issued: £187,000.)

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* This should probably be £470,100. The return does not account for payments on 300,000 preference, but balance-sheet says issued capital £900,000.

CITY NOTES.

Bath Electric Tramways, Ltd.

The annual report states that the traffic and other receipts show an increase of £4,807 over those of the previous year. The following are the earnings for several years:—1911, £43,834; 1912, £45,998; 1913, £50,805. The mileage run by the company's vehicles has increased during the year—in the case of the tramway cars by 19,880 miles, and the omnibuses and torpedo cars by 58,898 miles. Four new torpedo cars and two omnibuses had been added The foundry belonging to the company continues to give excellent results. After charging the expenses of operation and administration for the year ended December 31st, 1913, there remains a balance of £17,003, or with the carry forward a total of £18,433, from which has to be deducted interest on 4½ per cent. first mortgage debenture stock paid and accrued to date £5,908; fifth instalment of sinking fund for first mortgage debentures, £1,000; interest on loans, £1,151; dividend on the preference shares for the year £3,750; total, £11,809, leaving £6 624. Of this there has been appropriated to contingencies and renewals account £4,000, leaving a balance of £2,624, which is to be carried forward.

It has been found impossible during the past year to issue capital for the purpose of redeeming the bank loan; nevertheless, it was absolutely necessary that the company should keep pace with the public demand put upon it in connection with the extension of its torpedo-car and omnibus business. It consequently acquired the vehicles referred to above, and must obtain still further vehicles to meet the necessities for the growing traffic. The provision of funds for this purpose, and for the repayment of of the bank loan, as well as for the cost of relaying the tramway track, which it is estimated will have to be carried out 10 years hence, has been a matter of great concern to the board. The directors therefore resolved to ask the auditors, Messrs. Franklin, Wild & Co., as officers elected by the shareholders, to furnish a report and frame a scheme to meet the position of the company as it stands to-day. The board are prepared to adopt these, and will recommend to the shareholders their adoption at the approaching annual general meeting. They feel that this will enable the company to combat any competition likely to present itself, and will at the same time greatly strengthen the position in every way. Mr. Esmond Caillard, the retiring director, does not offer himself for re-election. The board will not ask for the vacancy to be filled, and, with a view to economy, they propose a still further reduction of their number.

The scheme referred to above provides for the suspension of the preference dividend for four years, during which time out of the profits the bank loan will be paid off, and the capital expenditure for the motor fleet provided for. At the end of four years the payment of the preference dividends will be resumed, and an annual sinking fund policy premium of £4,638 paid to secure £30,000 at the end of 1923, the arrears of the preference dividends which are made cumulative being paid off. At the end of the 10 years the company would be in a much stronger financial position than it is at present, with the preference dividends all paid, the bank loans paid off, £30,000 found for track renewals, and a reserve standing at £54,000, of which £20,000 had been put into the business. The scheme, therefore, secures new capital, which is absolutely necessary, without the introduction of any addition to the actual capital of the company. It is believed that this will be regarded as a sound scheme from the point of view of the company and all classes of shareholders.

British Electric Transformer Co., Ltd.

The directors' report for the year ended December, 1913, states that they consider the result satisfactory. After paying all manufacturing costs and expenses of administration there remains a net profit of £22,007, plus £4,116 brought forward, making £26,123. It is proposed to place to reserve account £7,500, to depreciation reserve £1,500, to preference dividend of 6 per cent. for the year £3,531, to dividend of 10 per cent. on the ordinary shares (3 per cent. of which was paid as interim dividend) £8,541, carrying forward £5,052.

The articles of association of the company provide that the directors shall be paid by way of remuneration £750 per annum, and a further sum equal to 10 per cent. of the net profits of the company remaining in each year after payment of a dividend of 10 per cent. on the ordinary shares. Under this article the directors are entitled for the past year to a sum of £848, but they prefer to leave this matter in the hands of the shareholders, and to ask them to vote such remuneration (not exceeding £848) as they may think fit.

The meeting is to be held on March 5th.

Bastian Meter Co., Ltd.—Dividend on ordinary shares for 1913, 2½ per cent. per annum.

Chelsea Electricity Supply Co., Ltd.—A dividend at the rate of 6 per cent. on the ordinary shares, making 5 per cent. for the year, is announced; £2,765 is carried forward. The total dividend for 1912 was at the same rate.

County of Durham Electrical Power Distribution Co., Ltd.—The directors recommend a dividend of 5 per cent. for the year to December 31st on the preference shares, including the interim dividend already paid.

Reduction of Capital.—The British and Colonial Zoelly Turbine Syndicate, Ltd., and Reduced.—A petition for the confirmation of the reduction of capital from £20,000 to £10,000 has been presented, and will be heard on March 6th.

Continental.—Hungary.—The Ungarische Elektricitäts Gesellschaft, of Budapest, reports a net profit of only £104,918 for last year, as compared with £115,824 in 1911. The dividend is being reduced from 15½ to 15 per cent.

France.—A new company has lately been formed in Paris (5, Rue Bondreau), with a capital of £1,000,000, and the title La Compagnie Générale de Radiotelegraphie.

A new company has lately been formed at St. Dizier (Haute Marne) with a capital of £48,000, and the title La Société de l'Energie Electrique Meuse et Marne.

Spain.—The amalgamation of the Compania Co-operativa Electra and the Compania Chamberi was decided upon at meetings of the two companies on December 7th and 9th last. The terms of the amalgamation are:—The Chamberi Co. will hand over all its capital to the Co-operativa Electra, receiving in exchange 5 millions in shares of the latter. The service of the Chamberi bonds will be assumed by the Electra, with a reduction of interest from 5 to 4 per cent., but with an increased security on the assets of the two companies and the payment of the Chamberi coupons in arrears.—*Electron.*

Among the new electrical undertakings formed in Spain during the past year are the following:—La Sociedad Hidroelectrica del Genil, Seville (capital £120,000); La Sociedad Electricidad Nuestra Senora del Rosario, Madrid (£45,000); La Sociedad Fuerzas Hidraulicas del Alto Perineo, Barcelona (£40,000); La Sociedad Hidrodinamica del Ebro, Barcelona (£40,000); La Cooperativa Electrica Donostiarra, San Sebastian (£20,000); La Sociedad de Lamparas Electricas Wolfram, Barcelona (£8,400); La Sociedad Electra de Galdacana, Galdacana (£8,000); and La Sociedad del Tranvia Electrico de Ferrol a Juvia y Neda, Ferrol (£3,200).

Sweden.—The annual report of the *Allmäna Svenska Elektriska A-B.* has not yet been published, but a preliminary statement about the company's activity during the last six years is to hand; the figures in the following table need no explanation:—

Year.	Number of electrical machines delivered.	Capacity in kw.
1908	3,760	140,000
1909	3 845	105,000
1910	5,500	230,000
1911	6 011	220 000
1912	8 001	272,000
1913	10,816	340,000

Norway.—A new electro-chemical company has been formed at Fredrikstad for the purpose of erecting a manufactory for the production of soda and metallic soda and superoxides of soda. The capital of the new company is £19,500 in 700 fully-paid shares. Engineer Moltke-Hansen is appointed managing director, and the name of the new company is the "Fredrikstad Elektrokemiske Fabriker."

Germany.—A meeting of the shareholders of the Rheinische Schuckert Gesellschaft für Elektrische Industrie is about to be held in Mannheim to consider a proposal to increase the capital of the concern from £400,000 to £550,000, and to issue 5 per cent. debentures to the extent of £300,000.

Austria.—The report of the Felten & Guilleaume Gesellschaft, of Vienna, for the last financial year shows a net profit of only £73,260, as compared with £97,909 in the preceding 12 months. The dividend is being reduced from 17½ to 15 per cent.

Switzerland.—La Société Franco-Suisse pour l'Industrie Electrique, of Geneva, is declaring a dividend of 5½ per cent. for the last financial year, as compared with 5 per cent. in 1912.

Russia.—According to the *Rossija*, the Belgian companies which have working concessions in many Russian cities have amalgamated. The companies alluded to are the General Electricity Co., which controls the tramways in Odessa, Riga and Simpferopol and the telephone in Odessa; and the Tramway Co., which owns the tramways in Kiev, Saratov, Kasan, Karsk, Orel, Bjelostok, and also the lighting services in the same cities. The latter company has taken over the former, and an issue of 25,000,000 fr. new capital is to be made, with a view to purchasing new concession in Russia.

Bournemouth and Poole Electricity Supply Co., Ltd.—The directors recommend a final dividend on the ordinary shares at the rate of 9 per cent. per annum, less income-tax, for the December half-year, making 7 per cent. for the year, as compared with 6 per cent. for 1912.

Metropolitan Electric Supply Co., Ltd.—The directors recommend a dividend for the half-year to December 31st at the rate of 5 per cent. per annum, making a total of 4½ per cent. for the year. £22,000 is placed to reserve. For 1912 the dividend totalled 4 per cent.

Direct West India Cable Co., Ltd.—The directors (according to the *Financier*) have declared an interim dividend at the rate of 6 per cent. per annum (1s. 6d. per share), free of income-tax, for the half-year to December 31st.

County of London Electric Supply Co., Ltd.—The directors have declared a final dividend of 4½ per cent. per annum on the ordinary shares, making 7 per cent. for the year 1913, as compared with 6 per cent. for 1912.

Prospectus.—*City of Dunedin.*—The list of applications was to close on February 23rd in an issue of £150,000 City of Dunedin 4½ per cent. Waipori Falls Electric Power Loan at £100 per debenture.

(*Continued on page* 366.)

THE ALL-ELECTRICAL OPERATION OF THE PANAMA CANAL.

BY JOHN GEO. LEIGH.

(*Continued from page* 334.)

Fig. 9.—Edward Schildhauer, Electrical Engineer, Isthmian Canal Commission, under whose supervision the specifications for the entire control system were prepared.

In preceding articles of the present series I have devoted particular attention to (1) the elaborate and far-reaching precautions to safeguard from the deteriorating influences of the Isthmian climate all electrical equipment installed for the operation of the Panama Canal; (2) the arrangement, special features and functions of the hydro-electric power station at Gatun; (3) the manner in which the energy there generated will be transmitted and distributed to the points where it is required; and (4) the systems which have been selected with a view to securing for the illumination of the locks a diffusion of light best suited to the varying conditions. Strict reference to correct sequence would demand that the next points to be touched upon should be the many unusual and distinctive features found in the switchboards for the distribution of power, and the scarcely less interesting transformer units, 36 in number, and possessing a 9 to 1 ratio, which link the power circuits from the generating station to the mains feeding the motors of the locks. Of these, however, I propose for the moment to reserve any description, giving pride of place instead to what, beyond all question, are the most distinctive and remarkable electrical features of the Canal. I refer, of course, to the centralised control, interlocking and indicating systems which will be in force at the locks in connection with the operating machinery described more or less fully in articles contributed to the Electrical Review, rather more than two years ago ("Electric Power for the Panama Canal," January 12th, 19th and 26th, and February 9th, 1912). The whole of this portion of the work was entrusted to the General Electric Co., of Schenectady, N.Y., whose valuable co-operation with the Canal Commission will be dealt with more fully in a following article.

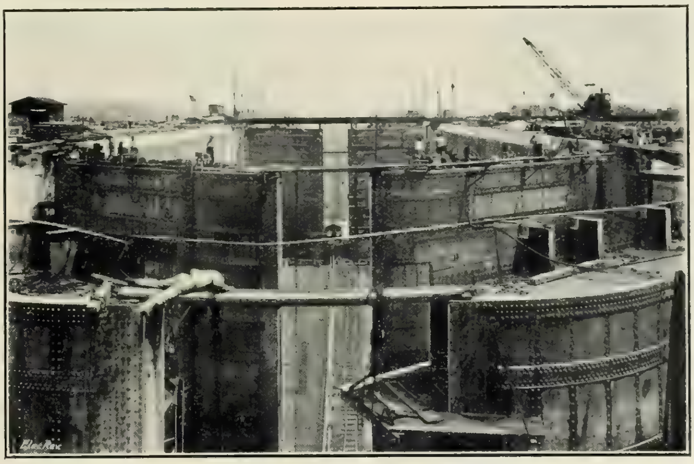


Fig. 10.—View of Three Sets of Gates at Gatun Upper Locks.

It is impossible to praise too highly the system—cohesive and comprehensive, yet, at the same time, comparatively simple—which has been adopted for the electrical control of the multifarious machinery installed in the locks. In passing a vessel through the locks, as has been pointed out in preceding articles, it will be necessary to open and close mitreing gates weighing from 300 to 600 tons, to fill and empty lock chambers containing from 3,500,000 to 5,000,000 cb. ft. of water, to raise and lower fender chains each weighing over 24,000 lb., and to provide electrical energy for the towing locomotives. All these operations, except those connected with the towing—which were described fully in the Electrical Review of February 9th, 1912—will be controlled remotely from a central station for each of the three series of locks: in other words, by a single man in charge of a switchboard.

Consequent upon the length of the lock flights—that at Gatun extends over 6,200 ft., the principal operating machines being distributed over a distance of about 4,000 ft.—central mechanical transmission of control would be almost impossible. On the other hand, to control the machines locally would mean a large operating force distributed practically along the full length of the locks, and such a force would be difficult to coordinate into an efficient operating system. The situation, therefore, has resolved itself into centralised electrical control, with the result of reducing the number of operators, operating expense and liability to accident.

The control station is placed in a building sufficiently high above the lock wall to permit of the passage underneath

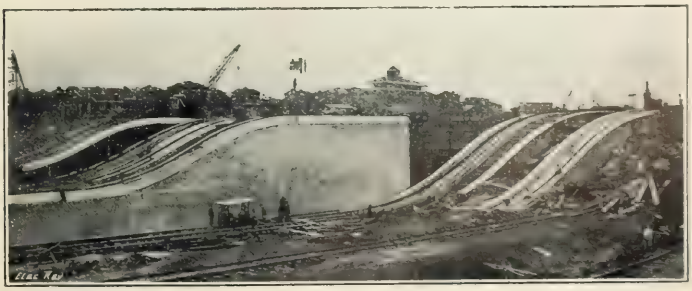


Fig. 11.—Inclined Railways for Towing Locomotives.

of the towing locomotives, and to allow an uninterrupted view of every part of the locks (fig. 12). In it is a double control board, or bench, raised 2 ft. 6 in. above the floor, duplicated to conform to the duplication of the locks, and containing a representation, part model and part diagrammatic, of the series of locks controlled by the respective series of switches. Standing at his switchboard the operator will throw the switches, and before him see, in model or diagram, the progress of the fender chains as they rise or fall, the movements of the mitring gates inch by inch, the opening and closing at every stage of the gate valves in the main culverts, the operation of the cylindrical valves, and the gradual rise or fall of the water in the lock chambers. The switches controlling the various motors, together with their indicators, are mounted upon the board in the same relative position as the machines in the lock walls. In order that the operator may be able to reach beyond the middle, the board does not exceed 4 ft. 6 in. in width, and, for reasons of like character, the length is limited to 64 ft. at Gatun, and proportionately less at the other locks, viz., 36 ft. at Pedro Miguel and 52 ft. at Miraflores (fig. 15).

The side and centre walls of the locks are represented on the board by cast-iron plates, and the water in the locks by blue marble slabs. The receivers, transmitters and lamps are operated at 110 volts, while the control circuits are 220 volts, both using 25-cycle alternating current.

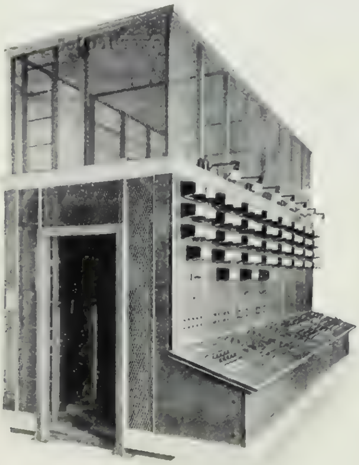


FIG. 13.—INSTRUMENT AND CONTROL BENCHBOARD, WITH GALLERY FOR FIELD RHEOSTATS ; GATUN HYDRO-ELECTRIC STATION.

Attached to all machines are limit switches for opening the control circuit when a machine has reached the proper point in its travel. When, as in the case of the rising-gate stem valves and mitre gates, it is necessary for the attendant in the control house to follow up the progressive movements, the machines are provided with synchronous indicating devices, showing, by means of instruments on the control board, the movement and position of the machines at all times. The cylindrical valve, mitre-forcing and other machines, however, only call for indication when their movement is completed, and to convey this knowledge to the operator there is attached to the limit switch an indicator switch showing, by a lighted lamp or otherwise, that the machine has reached the end of travel.

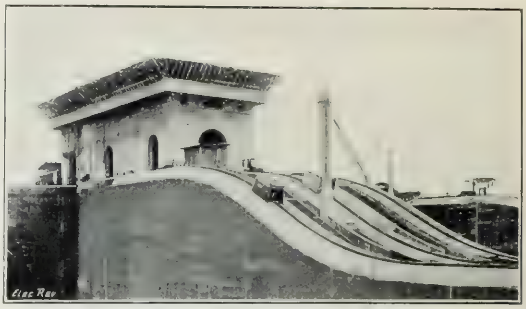


FIG. 12.—CONTROL HOUSE ON CENTRE WALL OF UPPER LOCKS AT GATUN, SHOWING TOWING TRACKS.

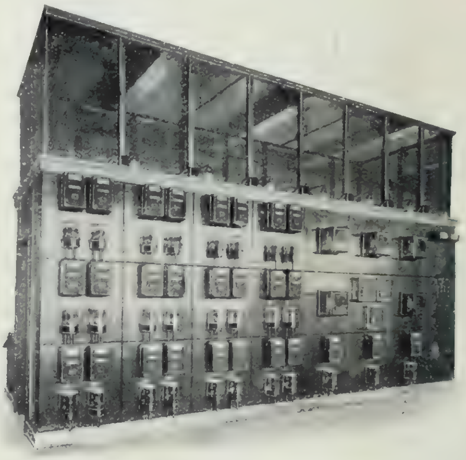


FIG. 14.—METER AND RELAY PANELS OF BENCHBOARD.

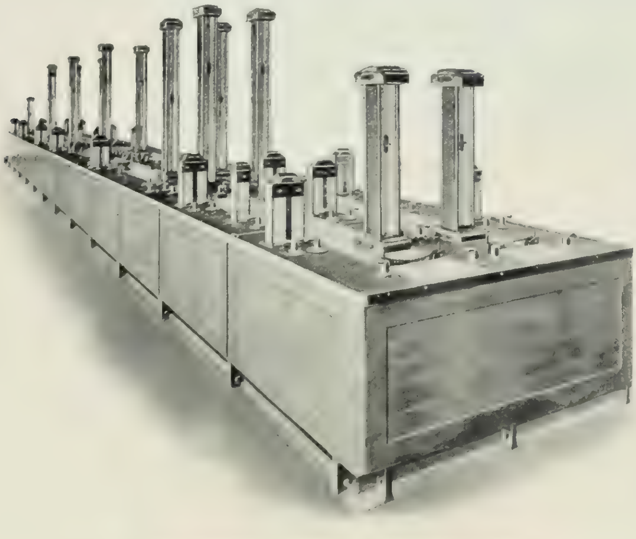


FIG. 15.—CONTROL BOARD AT MIRAFLORES LOCKS.

For the indications required, appliances with commutators, multiple contacts or ratchet mechanisms would not be suitable, particularly because devices of this character move step by step, and fail to indicate all points in the movement of the main machinery. The indicators on the Panama control boards, however, show accurately and synchronously every movement of the machinery to which they are connected, whether in the extremes of travel or at any intermediate point.

A complete synchronous indicator consists of a transmitter placed at, and operated by, the machine in the lock wall, and a receiver operating an indicator at the switchboard in the control house. Both transmitter and receiver have stationary and rotating parts. The stators have three-phase windings, with leads from three corresponding equidistant points brought out and connected together, but not connected to a source of power, the stator coils being energised by induction from the rotors. The rotors are bipolar and are connected in parallel and energised from a 110-volt, 25-cycle, single-phase source. The movement of the lock machinery, and with it the connected transmitter rotor, produces a field in the stator polarised in the direction of the rotor magnetic axis, which induces voltage in the stator coils. This voltage is transmitted by the three-phase connection above-mentioned to the receiver stator coils, and duplicates in them, but in the reverse direction, the same conditions of polarity and voltage which are present in the transmitter. The rotor of the receiver being energised by the external source in the same direction as that of the transmitter, is reacted upon by the polarised receiver stator until the magnetic axes coincide and the rotors of both transmitter and receiver are in the same relative position. Any difference in the position of the transmitter and receiver rotors causes a difference of potential between the stator windings, with a consequent flow of current and resultant torque, which again moves the receiver rotor to the same relative position as that of the transmitter rotor. The receiver rotor follows closely and smoothly the movement of the transmitter rotor, and consequently imparts to the position indicator a movement identical with the movement of the lock machine, although on a scale reduced to the requirements of the control board.

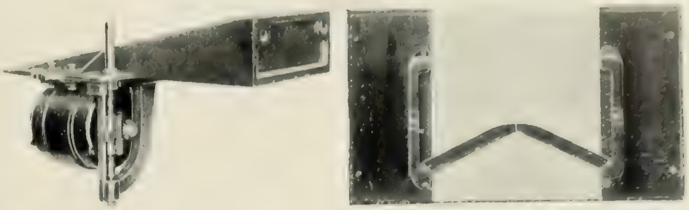


Fig. 16.—Mitre Gate Transmitter (cover removed) and Indicator.

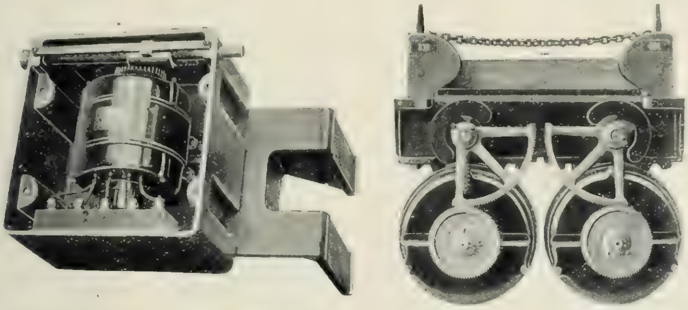


Fig. 17.—Chain Fender Transmitter (cover removed) and Indicator.

In the case of the mitreing gates, the vertical operating shaft is connected to a shaft which operates the transmitter machine. The latter shaft is threaded, and carries a nut, on which is mounted a rack. The rack engages a gear on the rotor shaft, and this turns the rotor as the gates operate. The mitreing-gate indicator comprises a pair of aluminium leaves, shaped to correspond to the plan view of the top of the gates, which travel horizontally just above the top of the board, the hinge ends being connected to shafts extending down through the surface of the board, where they are geared to the receivers by means of bevel gears. When the miniature gates are completely opened, they are covered by shields to give the effect of the gates folding back into recesses in the lock walls.

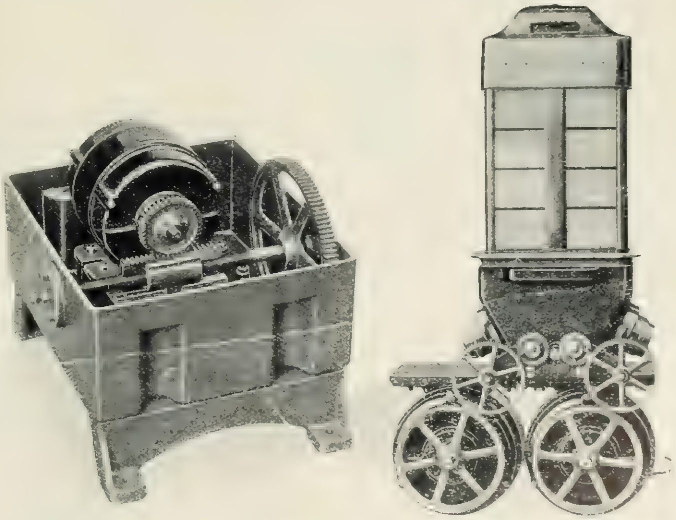


Fig. 18.—Rising-Stem Valve Transmitter (cover removed) and Indicator.

For the chain fender, the position indicator transmitter is driven by the shaft operating the limit switch, which controls the stroke of the piston. The indication on the board is given by a small aluminium chain, which, like the large chain, is raised and lowered, each end operating independently, the large chain being lowered to the bottom of the lock and the small chain into a slot on the control board. The ends of the miniature chain are fastened to semaphore arms, which are connected to segmental gears meshing with the driving gears on the receiver machines. As the receiver rotors turn, the chain is either lifted or lowered, the position of the large chain above the bottom of the lock being indicated by the angle of the semaphore arms.

As the rising-stem valves occur in pairs, their position indicator machines occur in pairs also. The transmitter rotor is driven by a shaft and gearing similar to that described for the mitreing gates. Each indicator is similar to a small elevator, a car being used to indicate the position of the valve gate. Both front and back of the shaft are fitted with opal glass marked with black lines for the $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ positions. A small aluminium cage moves up and down in each compartment. A drum for operating the cord which raises and lowers the cage is placed underneath the control board, and is operated by the receiver through a suitable train of gears. To make the indications visible from points up and down the control board, the elevator shaft under each car is always illuminated, while the portion above is dark.

The specifications covering the water-level indication required an accuracy of $\frac{1}{20}$ ft., or $\frac{1}{10}$ of 1 per cent. in actual water level. In the transmitters and receivers for the machines already described, the rotors turn less than 180°, with an inherent lag in this distance of $1\frac{1}{2}$ per cent. between transmitter and receiver rotors. This obviously prevents such an arrangement from being employed to give the water-level indication. It was found that if the rotors were revolved 10 complete revolutions, the required accuracy could be obtained; but since this arrangement makes it possible for the rotors to be in synchronism every 180°, or in 20 different positions for the entire travel, the indicators would not indicate correctly if, for some reason, the transmitter rotors were turned more than half a revolution with the power off. Therefore, the required accuracy was obtained by two sets of transmitters and receivers, one set connected to a fine index in which the rotors make 10 complete revolutions, and the other set connected to a coarse index operating through less than 180°.

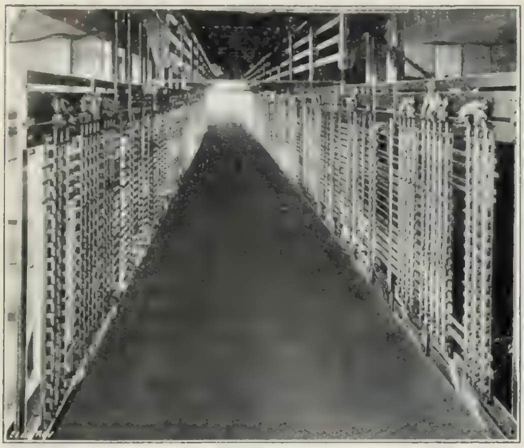


Fig. 19.—Interlocking Racks below Control Board.

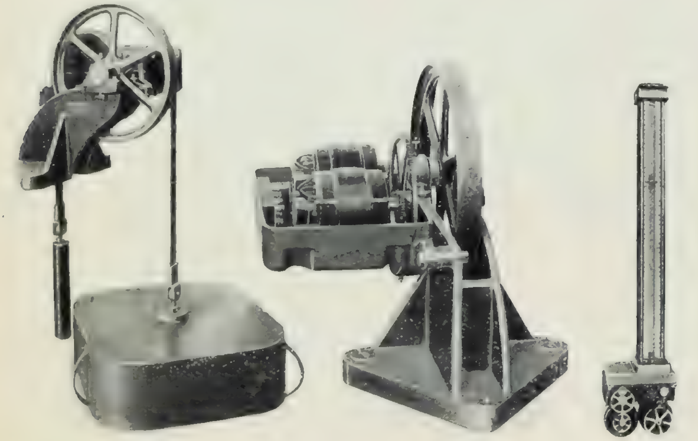


Fig. 20.—Water-Level Transmitter with Float; Ditto, with Cover Removed, and Indicator.

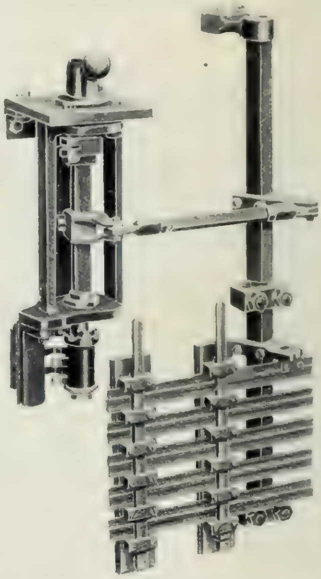


Fig. 21.—Control Switch and Portion of Interlocking Mechanism.

The fine index is a hollow cylinder carrying a pointer, the length of the cylinder being such that when an aluminium ball representing the coarse index, which can be depended upon for coarse indication, is within the limits of the cylinder, the reading of the fine index is correct within the limits specified. The scales are illuminated by lamps in both base and top caps of the indicator.

For water-level indication, wells 36 in. sq. in the lock walls, with communication to the lock by a small opening at the bottom of the well to dampen surges, contain a welded steel box float, 30 in. sq. × 9 in. deep. A non-slipping phosphor-bronze belt transmits the movement of the float to a sheave fitted with pins on the transmitter mechanism, the pins registering with holes punched in the belt. The sheave shaft is carried in ball bearings with oil cups for lubrication and drainage cocks at the bottom of the bearings.

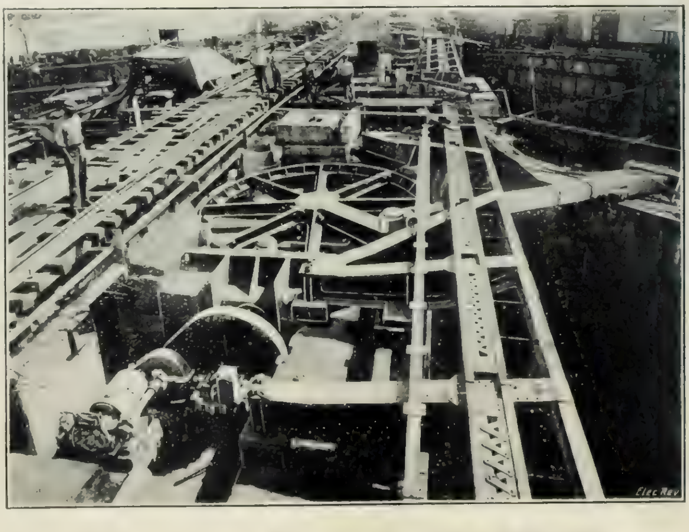


Fig. 22.—Mitre-Gate Moving Machine, Gatun Upper Locks.

The position of the mitre forcing machine is not indicated by synchronous indicators, but its open and closed positions are shown by red and green lights, and a mechanical indicator on the control board representing the machine.

The control system at all the lock flights is identical. Water is let into or withdrawn from the lock chambers by means of culverts under the lock floors, connecting with larger culverts in the lock walls, through which water is carried from the higher to the lower levels. The main supply culverts are 18 ft. in diameter, and the flow of water through them is controlled by means of rising-stem gate valves, which can be completely opened or closed in a minute. The culvert in the centre wall feeds both lock chambers, and, consequently, at each outlet to the lateral culverts there is a valve of the cylindrical type, by which either chamber at will may be filled or emptied. A complete opening or closing of these valves can be effected in 10 seconds. It should be noted that the mitreing gates are never opened or closed with a head of water on either side, the chambers being first emptied or filled by means of the culvert system.

When, from the northern end of Gatun Locks, a ship requires to be raised to the Lake level, she comes to a full stop in the forebay of the lower lock, preparatory to being taken charge of and towed by electric locomotives through one of the series of duplicate lock chambers. The water in the first chamber having been equalised with the sea-level channel, the gates will be opened, the fender chain lowered and the vessel permitted to enter. Then the gates will be closed and mitred; the rising-stem gate valves above will be opened so as to fill the chamber below, and the vessel will be raised 28 ft. 4 in. to the second level. These operations will be repeated in the middle and upper locks until the ship has reached the summit level of the Canal, 85 ft. above the ocean surface.

At Gatun, when passing a large vessel through the locks, it will be necessary to lower four fender chains, operate six pairs of gates and force them to mitre, and open and close eight pairs of rising-stem and 30 cylindrical valves. Altogether, not fewer than 98 motors will be set in action twice during each lockage of a ship, and this number may be increased to 143, according to the previous condition of the gates, valves and other devices. Each gate leaf, valve and fender chain is operated by an individual motor mounted near the machinery in the lock wall, the motors acting through suitable gears—or a pump, in the case of the fender chains—upon the various machines. In each machinery room is a starting panel, containing contactors, by which current is supplied to the motor, and these panels in turn are controlled from a main unit in the central control house. Ninety per cent. of the machinery rooms at Gatun Locks are within 2,000 ft. of the point of control, 50 per cent. of the total are within 1,200 ft., but others are distant 2,700 ft.

All contactors are operated directly from the central control house without the intervention of relays, and without resistance in the control circuit. Small and medium-sized motors are started and reversed by throwing directly on the line, which will be normally at 220 volts and 25 cycles; but motors above 25 h.p. have, in addition, one starting point in each direction with resistance in the primary. All motors are of the squirrel-cage type, except those for the locomotive traction, which are of the slip-ring type. Starting resistance has been preferred to compensators, in order to secure the simplest possible arrangement with a minimum number of contactors, and to obtain an unlimited range of adjustment in the starting resistance. Reversing is done by double-pole contactors, mechanically interlocked, and, in order to have all contactors on a panel alike, when a starting resistance is used, the resistance will be in two legs only of the three-phase circuit, and short-circuited by means of a double-pole contactor. The contactors are designed for normal operation at 220 volts and 25 cycles, but will continue to operate successfully if the voltage at the contactor coil terminals falls as low as 70 per cent. of the normal.

Motors for the rising-stem gate valve machines have a rating of about 50 h.p.; the mitre-gate moving and guard valve motors of 35 h.p.; the fender chain pump motors of about 25 h.p., and the cylindrical valve and other motors 7½ h.p. The aggregate number of motors at all the locks, including 207 required to drive various pumps and pumping machinery, is 951. The following table shows the sizes and number of those employed in driving machinery:—

Machine and operation.	H.P.	Number of motors.			Total H.P.
		Gatun.	Pedro Miguel.	Mira-flores.	
Mitre gate, moving, each leaf	25	40	24	28	2,300
Mitre gate, mitre forcing	7	20	12	14	322
Fender chain, main pump	70	16	16	16	3,360
Fender chain, operating valve	½	16	16	16	24
Rising-stem gate valve ...	40	56	24	36	4,640
Cylindrical valve	7	60	20	40	840
Guard valve	25	6	6	6	450
Auxiliary culvert-valve ...	7	4	4	4	84
		218	122	160	12,020

Interlocking is an essential feature of the control system, with consequences that certain motors cannot be started in a certain direction until other motors are operated in a proper manner to ensure consistent operation on the whole, and undesirable combinations will be avoided in the positions of gates, valves or fender chains. By the use, also, of limit switches, the factor of personal equation will be reduced to a minimum. For example, before the operating pair of valves in the main culverts can be opened, at least one pair of valves at the up-stream and down-stream ends of the lock must be closed. This limits an operator at this stage to the act of equalising water levels between lock chambers, and restricts him from allowing water to flow from, say, the Lake level to the middle lock past the upper lock, thus preventing a possible flooding of the walls and machinery rooms.

Interlocks devoted to the control of action between the gate valves in the main culverts and the mitreing gates prevent the opening of valves a lock length above or below a gate which is being opened or closed, and thus render it practically impossible for an operator to cause a flow of water while the gate is being moved. Again, interlocks for the cylindrical valves guarding the openings from the centre wall culvert to the lateral culverts will keep those of one side or the other closed at all times, except when it may be desired to cross-fill the chambers, when they may be opened by special procedure. Other interlocks prevent the operator from starting to open a mitre gate before unlocking the mitre-forcing machine, and ensure that the switches must be thrown in such order that a mitre gate guarded by a fender chain must be opened before the chain can be lowered, and that the chain must be raised again before the gate can be closed.

The interlocks are contained in two vertical racks under each edge of the control board, and some distance below (fig. 19); the space under the board is left open, so that all parts on the underside of the board are accessible from the floor below. The interlocking system is essentially a bell-crank mechanism (see fig. 21), connecting the shaft of the control switch through a movable horizontal bar to a vertical operating shaft, which may or cannot move, according to the relative positions of the interlocking bars and dogs. Every control switch uses a horizontal bar from 3 ft. to 50 ft. long.

The interlock system depends mainly on the action of engaging bevel dogs placed on the horizontal and vertical bars, the movement of a horizontal bar tending to lift a vertical bar by bevels on the dogs. A horizontal bar cannot be moved without raising a vertical bar. Consequently, if, at any time, a dog on a horizontal bar rests against the upper end of a dog on a vertical bar, no movement of the horizontal bar where the dog engages with the vertical bar can take place, and the control handle connected to that particular horizontal bar is locked.

As has been stated, interlocks prevent a chain fender being lowered until adjacent mitreing gates have been opened, and also prevent the gates being opened until the chain is in the raised position. Thus it is assured that the chain fender will always be in the "up" position to protect the gate when the gate is closed. To avoid unnecessary complication, each end of the chain is interlocked only with the leaf on its side of the lock, because, as a rule, both leaves of a gate, as well as both ends of a fender chain, will be opened simultaneously, and further inter-locking is unnecessary. After the mitreing gates are closed, a mitre-forcing machine is operated by a control handle and locks the ends of the gates closed. This machine cannot be operated until the gates are closed.

The rising-stem valves of the side wall, next above or below a mitre gate, must be closed while the mitre-forcing machine is open. As the latter machine cannot be closed until the gates are closed, this means that the valves either above or below the gate must remain closed until the gate itself is closed, thus preventing the operator from creating a current of water around the gates while they are open, or are being moved in opening or closing. This interlock is not included on the middle wall valves, because these will be used with the locks on either side, and consequently must be free.

Either pair of rising-stem valves may be opened first, at the choice of the operator, an interlock becoming effective when the first valve of the second pair of duplicates is opened. This is effected by a novel arrangement of equalising levers acting against the ends of the interlock bars, with a certain definite amount of lost motion which is taken up on opening the first pair of valves, thus putting the interlocks in operation on the next pair.

In most cases the locks are divided into two unequal parts by the intermediate mitreing gates. This arrangement makes it necessary to divide the 10 cylindrical valves into two groups of, respectively, seven and three, for the long and short lengths. A selecting lever is provided for these interlocks, and may be set as indicated by a nameplate on the lever to "three," "seven," or "ten" respectively, whereupon the corresponding valves are subject to that interlock, and the others of the group of 10 are locked closed if three or seven only are to be used. A failure on the part of the operator to make his selection properly in advance will simply cause him the trouble of going back and doing so, as the remaining valves are locked closed. This arrangement permits the handling of small vessels without causing waste of water due to operating such vessels in the large chambers.

When a large vessel is to be locked through, the interlocks on the intermediate gates can be made ineffective by the operation of a Yale lock, which uncouples a clutch and disconnects the central switch from the operating mechanism. A turn of the key removes the interlock and permits the intermediate gates to be thrown open to obtain a 1,000-ft. chamber, and the valves are operated independently of these gates.

A commutating switch used in connection with the mitregate moving machinery serves two purposes. First, when the gate leaves come to the closed position, and not until then, the switch completes a circuit from the control house, by means of which the machine for forcing and holding the gate in proper position may be closed. Thus there is given an interlock, by virtue of which the operator cannot close too soon the mitre-forcing machine. The other function is to alter the circuits controlling the rising and falling of the handrail of the footbridge over the gate, so that should the rails be up when the gates commence to open, they will be automatically lowered. Were the rails allowed to be up when the leaves were opened back into the recesses of the lock walls, they would interfere with a passing towing locomotive. Consequently the circuits for raising the rails are disconnected so that they cannot be raised as long as the gates are open.

As illustrated in fig. 22, and described in the Electrical Review of January 26th, 1912, the lock gates are opened and closed by means of a strut or connecting rod acting between the gate and a crank pin on a large driving gear. The relation of the parts is such that a toggle effect is produced near the ends of travel, and the motor would be capable of causing damage to some of the parts in the event of the gate leaf meeting with an obstruction. One end of the strut, therefore, is allowed a telescopic movement of a few inches against a nest of springs, which latter hold the telescopic parts against stops with sufficient initial tension to ensure that, with ordinary water resistance to the gate in normal operation, there will be no change in the length of the strut. Should the gate, however, meet a solid obstruction near one end of its travel, when the motor is capable of producing overload on the mechanical parts, the strut is compressed or extended, according to the direction of the forces. The cut-out switch is mounted upon one end of the telescopic device, while a rod entering the switch casing is attached to the other. The movement of this rod in and out of the casing operates the switch to open the control circuit and stop the motor, and is so arranged that if the switch is operated by compression of the strut that side of the control circuit is opened which produces a rotation of the motor corresponding to compression, the other circuit remaining unbroken for reversing and drawing the gate from the obstruction. If operated by tension and the motor is stopped, it is possible to reverse and apply compression to the strut.

(To be continued.)

Whist Drive.—The members of the Portsmouth Royal Dockyard Electrical Engineer Ex-Apprentices' Association recently held their fifth whist drive and dance at Madden's Hotel, Portsmouth; 200 members and friends were present.

CITY NOTES.

(Continued from page 360.)

City of Buenos Ayres Tramways Co. (1904), Ltd.

Mr. John Heaton presided on February 16th at Winchester House, E.C., over the annual meeting of this company.

In moving the adoption of the report (see Elec. Rev., page 284), the Chairman said it would be satisfactory to all, and the only remark he had to make was as to the further improvement in their position. The annuity from the Anglo-Argentine Co. had been received and distributed to the debenture and shareholders, and from every point of view it was satisfactory to know that the revenue of the Anglo-Argentine Co. still continued to increase. Their share in the prosperity of the Anglo-Argentine Co. was, of course, a very small one comparatively, but it was all-important to them. They received from the Anglo-Argentine Co. £70,660 a year, which was a first charge upon the revenue of that company, which now amounted to considerably over £1,000,000 a year. Their amortisation funds had been more than fully maintained, and the basis on which they originally established them had been proved to be very satisfactory. It was first by the investment of certain sums for the debenture-holders, and then for the general amortisation fund. They applied the rents of various farm and other properties they had, to the funds, and whereas in 1911 they placed £3,650 to the funds, last year they placed £4,500, and this year they were applying the sum of £5,000. With reference to this fund, it would be satisfactory to shareholders if he just read a passage from the auditors' certificate. Messrs. Cash, Stone & Co. said: "In our opinion the position of both the funds is quite satisfactory, and the purpose for which they were instituted has, up to the present, been more than fulfilled." He thought that must be satisfactory to them all. The only item in the accounts to which he need refer, was £144 for the registration of their debenture stock trust deed under the new Argentina Debenture Law. That, of course, was an item which would not recur.

Mr. E. H. Woods seconded the motion, and after Mr. Cuffe had expressed his satisfaction, the report was adopted.

New Companies in 1913.—The *Investors' Guardian* has published its annual analysis of company registrations. The statistics of new registrations are stated to faithfully reflect the cramping influence of a money market stringency. There was an increase of 1 per cent. in the number of registrations, but the total capitalisation at £146,766,000 is 11 per cent. less. We select the following figures relating to certain sections:—

English registrations.	1911.	1912.	1913.
Number of companies	5,959	6,796	6,871
Coal and fuel	£4,305 680	£4,973,845	£6,644 388
Electric	8,166 645	7,579,780	6 102,389
Engineering and hardware ..	8,424 402	8,885,757	10,774 891
Gas	838,125	407 900	281,700
Motor, cycle and carriage.. ..	2,721 345	7 253,879	8,934 266
Oil	15,860 820	23,533,182	12,978,939
Plantation and rubber	9,458 775	3,209,965	4 338,500
Railways and tramways	5,186,855	3,164,200	2,704,007

Scarborough Electric Supply Co., Ltd.—The report for the year ended December 31st states that there has been connected to the mains the equivalent of 4,546 (30-watt) lamps, making a total to date of 122,875. The units supplied, including the 300,000 minimum supply to the tramways, were 997,503. After placing £1,000 to depreciation account there is a balance on revenue account of £3,847. The directors recommend a dividend at the rate of 3 per cent. for the year, absorbing £3,000, leaving £847 to be carried forward. Mr. J. B. Simpson has retired from the board after 20 years' service.

Wemyss and District Tramway Co.—The directors report that the traffic receipts for the year are £15,845, and the profits £4,351. It is proposed to write off £500 for the betterment of the undertaking, to add £1,306 to the depreciation reserve fund, to pay £1,255 in dividends of 7½ per cent. on the ordinary and preference shares, and to carry forward £1,072. This is the first time the cumulative preference shares have exceeded the guaranteed 6 per cent. The line is being doubled from Leven to Buckhaven, the first stage in the provision made to accelerate the service to Kirkcaldy.

Aberdeen Suburban Tramways Co.—The profit earned for the half-year ended January 31st, amounted to £1,484, making, with the sum carried forward from the previous half-year's accounts, a balance of £2,453. The directors recommend that the sum at the credit of profit and loss account should be carried forward as usual at this time. A new agreement has been concluded with the Corporation of Aberdeen for the supply of electric energy to the company at a price of 1⅜d. per unit, being a reduction of ⅜d. per unit from the price at present payable.

Vulcan Boiler and General Insurance Co., Ltd.—The directors report £62,160 at credit of revenue account, including £9,035 brought forward. After placing to current risk and reserve fund £7,500, £1,200 to superannuation and benefit fund, a final dividend of 6s., together with 2s. bonus, per 50s. paid share is recommended, making 25 per cent. for the year, carrying forward £9.320.

Ascot District Gas and Electricity Co.—The directors' report for the year ended December, 1913, shows a profit on gas account of £5,320 and £1,592 on the electricity account.

Consolidated Diesel Engine Manufacturers, Ltd.

Mr. J. M. Fells presided on Friday at Salisbury House over a largely attended extraordinary meeting of Consolidated Diesel Engine Manufacturers, Ltd., to consider resolutions put forward by the majority of the shareholders' committee and amendments by Mr. E. A. Richardson, who was also a member of the shareholders' committee.

The resolution before the meeting was to the effect that the report of the majority of the shareholders committee (the principal points of which were given in last week's Elec. Rev.) should be approved, that the provisional agreement dated February 28th, 1914, made between Messrs. Alphonse, Georges, Gaston and Charles Carels, and Usines Carels Frerés, Ltd., on the one part, and Mr. J. C. Inglis on behalf of the shareholders' committee on the other part, be ratified; that the company be voluntarily wound up and re-constructed, and the new company be registered as the British Diesel Oil Engines, Ltd., or some other similar title.

The Chairman expressed the hope that shareholders would do nothing to unduly depreciate the property of the company, but would bear in mind the permanent interests of the company. He proposed that the meeting should first vote on the resolution of ratifying the agreement with Messrs. Carels, as this was proposed not only by the majority of the committee but also by Mr. Richardson, who would move an amendment.

Mr. J. H. Davidson, in moving the resolution of the majority of the shareholders' committee, pointed out that unless a majority of three-fourths of the shareholders was obtained they could neither reconstruct nor go into voluntary liquidation. It would mean a deadlock and compulsory winding-up, which would be ruinous to the company. He ought to mention that Mr. Gregson had cabled withdrawing his name from the report. The committee had considered the legal liability of the promoters and directors, and saw no reason to doubt the honesty and integrity of the directors. Hence they had decided to abandon all legal proceedings against the directors.

At this stage, at the request of shareholders, the full agreement proposed with Messrs. Carels was read.

Mr. Davidson, continuing, explained the reason why the committee recommended the abandonment of their half-share in the works of Messrs. Carels. He said that from a report by Messrs. Deloitte, Griffiths and Co., the liabilities of Messrs. Carels, apart from trade creditors, was on January 14th, 1914, £215,000; and if their company held half of these shares, they would be liable for half of this amount. The majority of the committee suggested reconstruction on the basis of the English works only, and that would mean an assessment on the shares. On the other hand Mr. Richardson simply suggested that they had had enough of such a miserable company, and that they should wind up and cut their inevitable loss. Mr. Fells again wanted to reconstruct on the basis of retaining the half interest in Carels. It was for the shareholders to choose which course they though fit.

Mr. Peddie seconded the resolution, and charged the directors with considerable neglect of the interests of the shareholders in their dealings with Carels. Incidentally he mentioned that the high-speed engine had to be abandoned and the other types of engines supplied by Carels during 1913 had been satisfactory, and a profit had been made but not a large one. The committee had inspected the Ipswich works, and could not complain as to the capital expenditure there.

Mr. E. A. Richardson then moved as an amendment that the provisional agreement with Messrs. Carels be ratified, and that the company be wound up voluntarily. He said he had repeatedly asked for a certified statement of their financial position to date, but it had not been forthcoming. It was unthinkable that any commercial or technical men would undertake the position of directors until they knew everything was satisfied. The orders they had got had not proved satisfactory, for they were orders taken at any price. To subscribe to a reconstruction scheme simply meant prolonging the agony.

Mr. Gover seconded the amendment.

Mr. Lawson (a member of the committee) said up to a point he sympathised with Mr. Richardson, but he felt after a visit to the Ipswich works that they had a property worth saving. He also had the assurance that suitable men could be found to carry out a scheme. Before voting he thought they ought to know what scheme the board intended to produce at the adjourned meeting.

The Chairman said that Mr. Gregson, who had 12,000 shares and had signed the report of the shareholders' committee, had withdrawn his name from the circular. The main difference between him and his colleagues was the question of the retention of their interest in Carels Frères. He considered that the committee had gone astray in endeavouring to do something without taking technical advice either as regards engineering or financial questions. The committee had referred to the obligations of the Carels business, but, as a matter of fact, the amount owing to the firm was in excess of their obligations. As the holder of £100,000 shares in the company, the Carels Co. could have used their vote in favour of the tempting offer made by the committee, but with the high sense of honour which the firm had they would not do so. Although the capital, etc., required adjustment, yet he had no reason to modify his previous view, that, given that the company was wisely directed and well managed, it had great potentialities. In conclusion he characterised the proceedings of the shareholders' committee as being those of "Alice in Wonderland."

Answering Mr. Spencer, the Chairman said the company had no monopoly in the manufacture of Diesel engines.

Mr. Brendon, representing Messrs. Carels Frères, said that he was informed by his clients that the obligations of Carels Frères were in no sense debentures or mortgages. They were simply loans, and would rank with the claims of other companies. The scheme in the agreement would in no way care for his clients.

A show of hands was then taken on the question of the agreement with Messrs. Carels Frères, and this was lost by a large majority.

The amendment of Mr. Richardson to wind up the company voluntarily was then put, and carried, and stood as the substantive motion.

The Chairman then moved an amendment that the meeting be adjourned till March 10th, and that in the meantime the directors, with an advisory committee, consider a scheme for the carrying on the company which might be considered with Mr. Richardson's proposition.

The Chairman's amendment was carried on a show of hands.

It was stated that the Chairman had proxies for 110,000 votes.

Waste Heat and Gas Electrical Generating Stations, Ltd.

The directors report that the profits earned during the year ended 31st January, 1914, after deducting administration expenses, amounted to £38,245 (for 1912 £36,010), less transferred to the credit of reserve account £9,500 (£9,500), plus the balance brought forward £8,965 (£7,555), and the profits available were £37,710 (£34,565). The directors propose a dividend at the rate of 8 per cent. for the year, absorbing £25,600 (£25,600); of this an interim dividend of 2½ per cent was paid in August, 1913. There is a balance to be carried forward of £12,110, as compared with £8,965. Including the amount transferred from the profits of this year, the total amount standing to the credit of the reserve account is now £42,851, and the redemption funds in respect of plant supplied on hire-purchase terms amount to £5,679. The company acquired during the latter part of the past year two new generating stations at Horden and Shotton, in the County of Durham, where exhaust steam from the works of the Horden Collieries Limited is utilised. Each of these stations has a capacity of 1,350 h.p. and satisfactory agreements have been made for their operation and maintenance. The shares which the company holds in the Bankfoot Power Co., Ltd., are now fully paid and have yielded a satisfactory return. The company has taken up £45,100 second debentures of Cleveland and Durham Electric Power, Ltd., which have been issued recently under the re-arrangement of that company's debenture stocks. These debentures carry interest at the rate of 6 per cent., and are re-payable by means of a sinking fund in 25 to 30 years. The whole of the company's generating stations and plant have been maintained in thoroughly efficient repair during the year. Certain proposals under which the company will erect further generating stations for the utilisation of waste heat or gas are still under consideration, and it is hoped that the negotiations will be concluded during the course of the present year.

The meeting is to be held to-day at Newcastle-on-Tyne.

City and South London Railway Co.

The annual meeting was held on February 18th at the Westminster Palace Hotel, the Right Hon. C. B. Stuart Wortley, K.C., M.P., presiding.

In proposing the adoption of the report (see Elec. Rev. p. 280), the Chairman said there had been a heavy drop in receipts, coupled with a serious rise in expenses. These were showings which all would hope were due to temporary causes, and would disappear with the removal of those causes. There had been an enormous development in surface competition. Both in quantity and quality the rival means of transport had been improved in ways which their present resources did not enable them to adopt. Those adverse influences were already in operation a year ago. Their view of their importance and their menacing nature prompted the advice which they gave to the ordinary shareholders to exchange their shares for London Electric, and to their preference stockholders to join with their new partner (the Underground Electric Railways Co. of London, Ltd.) in seeking power to modernise and re-equip the whole installation of the City and South London Railway. The only matter in which their foresight fell short of reality was that they under-estimated the rapidity of the development of the new forces arrayed against them. They claimed, however, that that unexpectedly more rapid development of that competition, to the extent by which it exceeded their forecast, only added to the justification of the policy that they advised. That policy was that they should apply to Parliament for powers to effect a physical junction at

Camden Town with the Hampstead Tube of the London Electric Railway from Euston, and to make such enlargements of their own tunnels and renovations or replacements of the rolling stock as would be suitable for an up-to-date modernised tube railway service right through from Clapham Common, through the Bank, King's Cross, and Euston, to Hampstead, and eventually to Edgware. They made in due course their application to Parliament and obtained these powers. Their bill received the Royal Assent in August last, and it was under the special powers therein conferred that they were proposing to charge to capital the shortage in the interest of their 1903 preference stock for the latter half of the year under review. The engineers were actively at work on the preparation of the working plans for the reconstruction of the tunnels, and, with the improving conditions of the money market it was hoped that in the near future arrangements could be consummated for financing the contemplated alterations and improvements. He might say that they had not left untried such means as their existing resources permitted of bringing back or retaining the traffic that was leaving them. They had run more train miles by 2.71 per cent., and more car miles by the lesser percentage of 6.36 per cent. These figures showed that they had sought to make their service more attractive by running more frequent trains. But they showed also that this had not been extravagantly done, because the increase in car mileage measured against the increase in train mileage, suggested care taken in seeing to it that where possible some of the added trains should draw no more cars than the public wanted. Another evidence of the same economy was the fact that their total costs per train mile were less than in 1912, being 14.396d. against 14.632d. Unfortunately this improved service did not get from the public the full response desired, for the number of passengers was down by 7.36 per cent., and the total passenger receipts were down by 9.25 per cent. Likewise the passenger receipts per train mile were down by 4.54 per cent., and the total receipts per passenger were down by 0.32 per cent., while the cost per passenger was up by 0.129d. (about one-eighth of a penny). This explained the heavy decrease in net receipts; but on the receipts side he might add that the financial result of the decrease in the number of passengers were made worse by the fact that in consequence of a lowering of fares on the L.C.C. tramways in their district, they considered it advisable to make certain reductions in their own fares. These took effect on November 1st last. The increase in expenses was contributed to by improved conditions of service granted to certain of the staff, and to the higher price paid for coal, during the year under review; their increased train mileage also caused them to consume a larger tonnage than in 1912. In conclusion he reminded them that they were now in a period of transition, and transitions and changes generally brought about discomfort and anxiety. They must hope that in their case they were now in the most uncomfortable and anxious stage of their change, and that before very long the changes in their condition would be for the better.

Mr. C. T. Jenkin seconded the motion, and the report was adopted.

Newcastle and District Electric Lighting Co., Ltd.

The directors' report for the year ending 31st December, 1913, shows that the units sold were 16,863,440 as against 14,789,149 sold in 1912, an increase of 14 per cent. The gross profit was £30,824, plus £8,695 brought forward, making £39,519, less interest on 4½ per cent. first mortgage debenture stock, 6 per cent. second mortgage debentures, temporary loans, &c., £15,829, and deducting interim dividend paid 16th August, 1913, £4,201, leaving an available balance of £19,489. It is proposed to pay a dividend at the rate of 5 per cent. per annum (less income tax) for the December half-year (making with the interim dividend 4 per cent. for the year) absorbing £7,002, to transfer to second mortgage debenture redemption fund £2,001, to write off second debenture issue expenses £400; and to carry forward to 1914 £10,076. The directors have redeemed during the year a further £2,200 of the company's 6 per cent. second mortgage debentures. As in previous years the whole of the property owned by the company, including plant, machinery, mains, etc., has been maintained in a high state of efficiency out of revenue. At the meeting to-day, Friday, the shareholders will be asked to sanction an extension of borrowing powers by £50,000 beyond the limit fixed by the articles.

Para Electric Railways and Lighting Co., Ltd.

The directors report that the revenue for the year ended 30th November, 1913, after providing for all expenses in London and Para, is £128,857, plus £9,870 brought forward, and difference in exchange, interest and transfer fees, etc. £2,178, making a total of £140,906. Deducting therefrom interest and sinking fund on debenture stock £38,500, and interim dividends paid for the half-year to 31st May, 1913:—On preference shares, 3 per cent. for half-year, £9,600, on ordinary shares, 5 per cent. for half-year, £19,500, there remains a balance of £73,306. Out of this it is proposed to place to depreciation and renewals reserve £15,000, and to contingencies reserve £10,000, to pay a final dividend of 3 per cent., less income tax, on the 6 per cent. cumulative preference shares for the half-year to 30th November, 1913 (making six per cent. for the year) £9,600, and a final dividend of 5 per cent. less income tax on the ordinary shares for the half-year to 30th November, 1913 (making 10 per cent. for the year) £19,500, leaving a balance to be carried forward of £19,206. A new boiler has been installed in the power house and 11.5 kilometres of new underground cables have been laid, replacing an old boiler and old underground cables of the value of £6,201, which amount has been charged against the renewals reserve and credited to construction capital account. The capital expenditure of £8,722 represents the addition of eight new cars and other minor additions to equipment. The physical condition of the plant, and operating conditions generally, have further improved. The directors report the death on 31st October, 1913, of their chairman, Sir Williams Evans-Gordon. Mr. Follett Holt was elected a director on 7th January, 1914, and subsequently elected chairman.

The annual meeting is being held to-day.

Liverpool Overhead Railway Co.

The annual meeting was held on February 17th, at Liverpool, Mr. H. C. Woodward presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev., p. 283) said that it showed the best results obtained since the year 1900, when the severe electric tramway competition was started. They had carried during the past year on railway and tramway a million passengers more than in the previous year, and the greatest number since the railway was opened for traffic, now just twenty-one years ago. This increase was general in all classes, and had yielded an increased revenue of £6,840, at an extra expenditure of £1,694. They had placed £4,000 to renewal fund, which now stood at £49,842, they had added £400 to contingent fund, and the usual premium to the insurance fund, which stood respectively at £2,100 and £1,646. A further £340 had been applied to extinguishing the cost of the new debenture issue. With reference to the amount placed to the credit of the renewal fund, he stated that for a few years after the opening of their tramways between Seaforth and Crosby they allocated £4,000 a year to that fund, but owing to increased competition and falling receipts this was reduced to £3,000 after 1905. They had now been able to reinstate this figure, deeming it wise in good years to strengthen their financial position, so as to provide for any necessary expenditure due to an expanding business. The expenditure for the year on the railway amounted to £44,501, and on the tramways to £10,975, making a total of £55,476, an increase of £1,694, accounted for principally by increase in wages, extra cost of coal, and National Insurance premiums. The maintenance of the structure and the rolling stock and electric equipment had received careful attention, and the whole were in excellent condition, being periodically overhauled. Their traffic was keeping up well. The opening of the Gladstone dock had resulted in the transfer to it of several of the Cunard liners from the Huskisson and Canada docks, and this was no doubt bringing them increased revenue. Their recent issue of debenture stock amounted to £165,580. This was £40,920 less than they had previously to pay interest upon, and was £60,920 short of the total amount that they proposed to issue in replacement of the terminable debentures, which expired on January 1st, 1913. Although their accounts showed a considerable saving of interest due to this circumstance, yet with the view of correctly adjusting their capital account, the directors would be pleased to allot the whole or any portion of this unplaced balance, and if there were at the meeting any capitalists suffering from the present three per cent. bank rate, and the consequent reduction of interest on their bank deposits, they would be well advised to consider whether a home railway debenture of this quality, paying four per cent., and with its interest guaranteed by the Mersey Dock Board, would be much longer procurable at par. After referring to the retirement from the board of Sir Wm. Forwood, who had given long and valued services as chairman of the company, and to the election of Mr. Joseph U. Hodgson as a director, the chairman gave hearty acknowledgment of the capacity, industry, and energy displayed by the engineer and general manager, Mr. E. J. Neachell. The entire staff of the railway had gone through an extremely busy year with great credit, and they had happily been entirely free from serious accidents. Before concluding he referred to a subject that had been freely discussed lately, the question of cross-river traffic between Liverpool and Birkenhead, and whether this should be further catered for in the shape of a tunnel or a bridge across the Mersey. That did not at the moment directly affect their interests, but it might do so ultimately, both as to traffic and local taxation, if the Corporation of Liverpool should decide on adopting either of the schemes spoken of. If they looked at the question from a financial point of view, they should remember that no competent person had expressed the opinion that either tunnel or bridge was likely to pay reasonable interest on the capital sunk in the enterprise. The Mersey Tunnel Railway already existing, carried in 1913 about the same number of passengers as the Overhead Railway, but its total capitalisation was over 3½ millions, as against rather less than one million in their own case, and the results to the original shareholders did not tend to encourage the construction of a second tunnel.

The report was adopted.

Metropolitan District Railway Co.

The annual meeting was held at the Westminster Palace Hotel on Thursday of last week, the Rt. Honourable Lord George Hamilton, G.C.S.I., in the chair.

The Chairman, in moving the adoption of the report (see Electrical Review, p. 323), said that owing to the change in the form of the accounts it had not been possible to give detailed comparisons between the accounts and statistical returns of the present and preceding years. Whilst therefore it had not been practicable to make detailed comparisons in the accounts themselves, they had been able to adjust the 1913 figures on the basis of the 1912 figures. Those comparisons showed that the gross receipts on revenue account amounted to £709,558, being an increase of £18,618 or 2.7 per cent. over the receipts for the corresponding year. The passenger receipts amounted to £670,636, an increase of £17,966 or 2.75 per cent., whilst the average receipt per passenger was 1.82d., which was exactly the same as for the corresponding period. The working expenses increased by £11,666 over the corresponding period, or 5.06 per cent. This increase was principally due to the increased cost of coal, namely £5,442; increases in the wages of the staff, due to new and improved conditions of service, approximately £7,000; National Insurance £1,040; whilst rates went up £488. The car mileage on the District Railway proper increased by 44,773 or 0.27 per cent., whilst the passenger receipts per service car mile was 10.039d. or an increase of 2.66 per cent. over the corresponding period. The percentage of operating expenses to gross receipts was 42.95 per cent. compared with 41.98 per cent. for the corresponding period. Referring to the accounts, the Chairman said that comparing 1913 with 1912, they were able to pay ½ per cent. more on the second preference stock, and carry forward an enhanced balance of £4,130. A considerable improvement had been effected during the year in the work connected with the flying junctions at Earl's Court. These improvements enabled them to handle expeditiously and without stoppage the increased volume of traffic. The work at Charing Cross Station would be very shortly completed, when a really effective means of interchange would be established between the railway and the Bakerloo and Hampstead lines, and he thought the station must become a large exchange centre for passenger traffic between the abovementioned railways. Looking back at the somewhat abnormal circumstances of the past year, he did not think they need be dissatisfied with the results obtained. The price of coal was exceptionally high, and the weather during the last six months abnormally warm and fine and consequently prejudicial to underground travel. They also had to meet for the first time the full cost of the Insurance Act, and the conditions of service of certain classes of their employees had been improved. Such increases of expenditure from time to time were unavoidable, and where the revenue against which they were charged was, from the nature of the enterprise, constant rather than elastic, they temporarily curtailed the record of increased profit. The fact that the District Railway carried no freight and was only a passenger railway of limited dimensions made the development of its revenue much slower than was the case with companies carrying both freight and passengers for long distances; but whilst the growth of the revenue was slower, it was less liable to fluctuations. The past year's experiences confirmed previous hopes that, though slow, the progress was unbroken and should so continue to be.

Mr. W. H. Brown seconded the motion and the report was adopted.

London Electric Railway Co.

The Right Hon. Lord Farrer (chairman) presided on February 19th at the Westminster Palace Hotel over the ordinary general meeting of the above company.

In moving the adoption of the report (see Elec. Rev., p. 321) the Chairman referred to the change in the form of the accounts and statistical returns owing to the new rules presented by railway companies, and also mentioned the capital powers given under the Companies' Act of 1913. During the year £36,923 of debenture stock was issued and sold, the proceeds of which were used towards the payment of the costs of extensions to the railways. Temporary loans were obtained from their bankers of £200,000 on the security of £260,000 of debenture stock, but in January, 1914, £404,971 of debenture stock was sold, and out of the proceeds the temporary loans had been repaid, and the balance placed the company in a satisfactory financial position. The capital expenditure for the year was £638,074. Of this amount on lines open for traffic £71,368 was expended in connection with the Paddington extension, which was opened for traffic on 1st December; the results from operation had so far been encouraging, and showed that the linking up of the great termini of London was useful alike to their undertaking and to the public. £34,622 had been expended on the improvements at Oxford Circus station, where escalators were being installed and provisions made for a concourse booking hall at the basement level, thus freeing the ground floor area which was being let on very advantageous terms. £806 had thus far been expended on escalators which were being installed in conjunction with the Metropolitan Railway Co. at Baker Street station. On lines belonging to the company not yet open for traffic there had been expended at Charing Cross £111,2[illegible] and it was hoped that these works would be finished early in March, when the complete transformation of traffic facilities at that spot should begin to materially help the revenue. Further land had been acquired for the Edgware and Hampstead extension necessitating an expenditure of £22,[illegible]. On the Richmond extension £1,[illegible] had been expended, and on the Queen's Park extension £51,925. £23,[illegible] had been expended on electric power stations, etc., on miscellaneous improvements and additions. When all improvements which were now being carried out had been constructed and completed the railway would be linked up with other existing railways in a comprehensive manner and would enable passengers to take advantage of the convenient means of interchange from one railway to another and from all parts of London with rapidity and the least possible inconvenience. The estimate of further expenditure on capital account was £219,100. The estimated cost of works not yet commenced and in abeyance was £1,156,500 which comprised the cost of the extension to Richmond, the extension from Golders Green and the linking up of the City and South London railway at Camden Town with the Hampstead line. The capital powers and other assets available to meet these expenditures were £2,160,596. The gross receipts had amounted to £715,319 being a decrease of £3,293 or 0.46 per cent. compared with the receipts for the corresponding year. The expenditure had increased by £11,858 or 1.67 per cent. Of this amount upwards of £4,000 represented increase in wages due to new and improved conditions of service, and £640 for National Health Insurance. £9,000 was represented by increased cost of coal. Rates and taxes had increased by about £500. The car mileage showed an increase of 645,600 miles or 3.47 per cent., while the passenger receipts per car mile were 8.85d. compared with 9.18d. for the corresponding year. The percentage of operating charges to gross receipts were 43.61 compared with 41.64 for the corresponding period. During the year nearly 96,000,000 passengers (excluding journeys by season ticket holders estimated at 4,500,000) had been carried at an average fare of 1.70d. per passenger. He could not end his remarks without paying a tribute to the managing director, Mr. Stanley, and all the officers and staff for the manner in which the work had been and was being carried out. Some of their pictorial advertisements to-day were almost a new National Gallery in themselves. Railway Directors came in for a good deal of criticism at the present day. They obviously could not attend to the details of daily operation, but they could see that these were efficiently performed. The management of the lines were always desirous to please the public and ready to welcome suggestions for improving services or accommodation, subject of course to the necessary financial exigencies. The price for transportation in London was exceedingly moderate, and he asked those who were ratepayers to consider the enormous saving to the London ratepayer that had been made by private enterprise working underground railways, in cheap transport for the masses, and the improvement to the health of the community which resulted by enabling workers to obtain a larger area for their residence. They hoped and believed that as the traffic needs of London increased, so their railways would prosper and enable them to continue the same policy with the full financial success that such an enterprise certainly deserved.

Sir Algernon West seconded the motion and it was adopted.

Subsequently a special meeting was held, and resolutions approving of the Bill deposited by the company in Parliament, were carried.

Paisley District Tramways Co., Ltd.

The annual meeting was held at 83, Cannon Street, E.C., on February 19th, Mr. Owen Hugh Smith presiding.

The Chairman said that the directors had only to report that the traffic had increased very satisfactorily and that all the additions to the profit had gone to the maintenance of the tramways system and roadway. That was a trouble that they would always have to face. The result of the year's working was that the revenue amounted to £62,876, and the expenses to £41,475, leaving a balance of £21,400. The Chairman, having referred to the manner of dealing with this (see Electrical Review, p. 281), said that the traffic receipts showed an increase of £4,129, and the expenses an increase of £5,807 as compared with the receipts and expenses for 1912. The increase in expenses, although partly due to running an additional service of cars and the increase in the local rates, was mainly owing to increased cost for the maintenance of the track and roadway. This was largely due to damage caused by the increase in the heavy traffic of motor lorries and other heavy traffic. The matter was engaging the very serious attention of the directors, but they regretted to say that during the current year they did not anticipate any relief in this respect. A dividend on the ordinary shares was paid for the first six months of the year at the rate of 2 per cent., but owing to this heavy expenditure they thought it advisable not to pay any further amount this year but to increase the carry forward.

Mr. John Young seconded the motion.

In the course of a conversational discussion which ensued, and which was joined in by Mr. Young, Mr. W. M. Murphy, and the Chairman, it was stated that the company paid everything out monthly and provision was made in the sinking fund for any repairs and maintenance. It was pointed out that the company had not yet got through half its life, and the directors were trying to make good out of revenue the items of depreciation of stock, repairs, etc. The only increase practically in the cost of working expenses had been in regard to the rates and taxes, but there had been an increase in the cost of repairs. On the question of the renewal of the lines, the opinion was expressed that when that had to be done the cost would be about £5,000 a mile. It was urged that it was a great pity that people who helped to wear out the lines could not be made to help them in renewing them, and it was suggested that if this course was carried out it would be the local authorities who would have to do it. They had as heavy motor traffic over their lines as was to be found in any part of England, and the Chairman expressed the opinion that it would be impossible to find any part of England where people suffered more in this respect, as very heavy boilers and other heavy traffic passed over the tramways and on the tramway track. In making a new track it would undoubtedly be necessary to have at least eight inches of concrete, although he believed that it was considered that six inches was generally enough for ordinary traffic.

The motion was adopted.

Central London Railway Co.

Lord George Hamilton took the chair on February 19th at the annual meeting held at the Westminster Palace Hotel.

The Chairman, in moving the adoption of the report (see Electrical Review, p. 322), said that owing to the new form of accounts they had not attempted the customary comparisons between the working of the current and the preceding years. The Liverpool Street extension was opened and in working order in July, 1912. In making the comparisons he proposed to do, it must be borne in mind that the year 1913 had the benefit, so far as the passenger receipts were concerned, of the working of the extension for the whole year as against five months only of 1912. Working expenses, on the other hand, were relatively increased in 1913 as against the preceding year. The receipts from passengers had given them an increase of £3,260 over the preceding year, parcels £195, and miscellaneous receipts £2,368. On the other hand, they had received £3,112 less from general interest. As a result they got a net increase for the year of £2,771. The working expenses amounted to £147,780, and the net receipts were £107,056. To this had to be added £36,502 for miscellaneous receipts, and, including the total brought forward from 1912, viz., £27,218, they got a total of £170,776. After making the provisions and payments mentioned in the report there would be left a balance of £20,878 as against £27,218 carried forward from the preceding year. During the year they had consumed 28,918 tons of coal, as compared with 26,384 tons, an increase of 2,534 tons. The cost was £18,426 against £16,714, an increase of £1,712. The number of passengers carried was 37,505,424 as compared with 35,939,202, an increase of 4.36 per cent. The working expenses were 58.56 per cent. of traffic receipts as against 57.99 per cent., an increase of .57 per cent. The capital account gave the amount of the nominal capital authorised and created, showing a balance of unissued capital of £750,000 and £250,000 borrowing powers. The share capital and stock created was the same as last year, but there had been a further conversion of ordinary into preferred and deferred stock. The amount expended during the year 1913 on capital account had been £67,749, the main item being the Liverpool Street extension £38,230. The Ealing extension cost £9,031. The estimate of further expenditure on capital account, excluding the Gunnersbury extension of £802,000, which was still under consideration amounted to £189,540. Of this, £91,000 was the estimated cost of the Ealing extension, for which a tender had been accepted, and £69,000 for additional rolling stock. The working of the railway during the year had not been associated with any incidents of exceptional importance. The weather during the latter part of the year was exceptionally fine and therefore not conducive to underground travel, and an investigation of the receipts of the various stations on the line presented the same phenomena as were associated with the working of the other tube railways. The traffic between intermediate stations did not increase rapidly, but for long distances or where there were good exchanges, the railways held their own. It was clearly, therefore, the policy of all enterprises of this nature to have terminal stations located on sites where there was a large and constant daily inward and outward flow of passengers. He had no doubt that the receipts of this line would be considerably augmented when the continuation to Ealing was completed and in working order. The service on the line had been punctual and was popular, and although he could not hold out hopes—looking to the limitations imposed upon their traffic by competition—that there would be a great expansion of profits, he saw no reason why they should not continue during the next few years to steadily improve their position.

The Hon. A. H. Mills seconded the motion.

Answering a question by Mr. Tate the Chairman said the letting of the contracts for the Ealing extension had been practically completed, and it was hoped that their trains would be running to Ealing within about a year.

The report was adopted, and subsequently the meeting passed a resolution approving of (1) the Bill to empower the Central London Railway Co. to enlarge a portion of their railway, tunnels, etc., and (2) a Bill to empower the London Electric Railway Co. to construct new subways, etc.

Bristol Tramway and Carriage Co., Ltd.

Sir George White presided at the yearly meeting of the Bristol Tramways and Carriage Co., held on February 18th, at Bristol. He expressed satisfaction that the report and accounts bore evidence of substantial progress. The gross revenue for 1913 amounted to £423,816, made up of £243,700 from tramways, £174,700 from carriages, and £5,400 miscellaneous. With the great extension of business it was natural that some items should show an increase, such as wages of staff, £10,573; coal, petrol, and traffic stores, £14,500; and in general expenses £6,730. This last sum was chiefly made up of three items—£2,121, compensation; £1,147, employés superannuation fund, provident society, and medical aid; and £2,123, rates and taxes. Rates and taxes now amounted to no less than £13,147. They paid the Bristol Corporation alone nearly £10,000 a year, and if some of the enterprising councillors would take the trouble to compare this with the absolutely absurd and inadequate rating of their docks and electric light undertaking and impart their knowledge to the ratepayers, it would be more generally understood that the company's rates were a real levy in aid of the city purse, and not a mere pretence, as in the case of municipally owned concerns. Again, by undertaking their part of the maintenance of the streets the company saved the ratepayers £20,000 or £25,000 a year. Sir George asked them to assume that the Corporation had owned the tramways when the motor business began to develop, and asked did they imagine the Corporation would have permitted it to do so? The company, on the other hand, had started a great industry that meant huge expenditure and employment for 1,500 men, in addition to the 1,500 on the tramways. Sir George then alluded to some of the figures given in the report published in the Electrical Review for February 13th, and spoke with pleasure of the fact that they were paying 5 per cent. as the final half-year's dividend, and on their having got out of the 4 per cent. stage. Without making rash promises, he thought they might look hopefully to not having to retrace their steps in that direction. Reference was then made to the success of the motor omnibus service, and next the speaker touched on the Bristol Corporation Bill giving the municipality power to work the tramways they might acquire. This Bill was premature and without precedent, and in a few weeks' time the company would place their case against it before the House of Lords. They would go into the committee room confident in the strength and justice of the company's case. The report was adopted and a final dividend for the half-year at the rate of 5 per cent. per annum declared. Sir George White, in a subsequent speech, said the whole situation was very complex and difficult, and he asked the shareholders to be confident that the best would be done on their behalf.

Underground Electric Railways Co. of London, Ltd.

The directors report that the results of the year ended December 31st, 1913, are as follows:—

The net revenue from investments and properties (including general interest), after deducting general expenses and including balance brought forward, amounted to £623,838; the service of the 4½ per cent. Bonds of 1933 required £84,488, leaving a surplus of £539,350, which will be applied as follows: Payment under the guarantee on Central London Railway Co. Assented Stocks for the year, £26,830; interest at the rate of 6 per cent. per annum on £1,273,000 6 per Cent. First Cumulative Income Debenture Stock for the year, £76,380; interest at the rate of 6 per cent. per annum plus Income Tax on £6,136,050 6 per Cent. Income Bonds of 1948 for the year, £390,970, leaving a balance to carry forward of £45,179.

Under the terms of the respective Trust Deeds, the Auditors have certified that the profits of the Company are sufficient to pay, for the year ended December 31st, 1913, the full interest at the rate of 6 per cent. per annum on the 6 per Cent. First Cumulative Income Debenture Stock, and full interest at the rate of 6 per cent. per annum plus income tax, on the 6 per Cent. Income Bonds of 1948. The interest on the 6 per Cent. First Cumulative Income Debenture Stock and Coupon No. 12 off the 6 per Cent. Income Bonds will be payable on and after March 2nd, 1914.

The report proceeds to refer to the progress of the various associated railway companies, whose statements have already appeared in our pages; also with the L.G.O. Co., the Associated Equipment Co., and the New Central Omnibus Co.

In accordance with the arrangement set forth in the last report, the exchange of the shares formerly held by this company in the London United Tramways, Ltd., for shares in the

London and Suburban Traction Co., Ltd., was duly carried out. The results of the latter company for its first year may be considered as satisfactory.

The main provisions of the London Electric Railway Co.'s Bill are:—

Construction of subways and escalators (*a*) at the company's Tottenham Court Road Station, (*b*) at the Company's Piccadilly Circus Station, and (*c*) at the company's Trafalgar Square Station; acquisition of lands for general offices; agreements with the Metropolitan District Railway Company, the City and South London Railway Company, and the Central London Railway Company in reference to construction, maintenance, occupation and user of subways, passages, escalators, offices and buildings; power to raise additional share and loan capital and to apply capital to purposes of Act; power to issue (with sanction of a resolution of a general meeting of the company) additional capital and unissued capital authorised by former Acts, with preferential dividend not exceeding 5 per cent.; payment of interest out of capital during construction; power to charge to Capital Account interest on Debenture Stock during construction of subways.

The main provisions of the Central London Railway Co.'s Bill are:—

Power to enlarge the running tunnels in High Holborn, power to the Central London Railway Company on the one hand and the District Railway Company, the City and South London Railway Company and the London Electric Railway Company or any of them on the other hand to enter into agreements with reference to the construction, maintenance, ventilation, erection, occupation and uses of subways, passages, escalators, offices, and buildings for and in connection with carrying on their respective undertakings; power to acquire additional lands and raise additional capital.

In the balance-sheet the item "Stocks, Shares and Other Property" stands at £13,593,696, and consists of stocks and shares in associated companies, as well as lands and buildings.

	Half-year ended			Year ended
	Dec., 1911.	June, 1912.	Dec., 1912.	Dec., 1913.
Metropolitan District Railway—				
Passengers …………	39,897,061	42,910,560	43,092,589	89,438,332
Receipts ……………	£300,625	£325,434	£327,236	£686,177
London Electric Railway—				
Passengers …………	48,666,842	51,691,661	49,190,925	100,263,755
Receipts ……………	£342,451	£363,325	£350,304	£709,872
Central London Railway—				
Passengers …………	—	—	—	37,505,424
Receipts ……………	—	—	—	£250,257
City and South London Railway—				
Passengers …………	—	—	—	22,723,856
Receipts ……………	—	—	—	£145,652
London General Omnibus—				
Passengers …………	—	221,032,378	266,169,251	580,205,335
Receipts ……………	—	£1,217,207	£1,467,122	£3,191,205
Total—				
Passengers …………	88,563,903	315,634,599	358,452,765	830,136,702
Receipts ……………	£643,076	£1,905,966	£2,144,662	£4,983,163

Calgary Power Co.—The report for 1913 states that the gross earnings amounted to $240,116, as compared with $191,846 for 1912, showing an increase of 25 per cent. for the year. The net earnings amounted to $188,060, compared with $151,707, being an increase of 24 per cent. After deducting net interest charges amounting to $100,034, $88,026 was transferred to surplus account, being equivalent to 4¾ per cent. on the common stock. The sum of $9,000 was transferred to reserve account, leaving the balance at credit of surplus account $155,655. The fourth unit at Horseshoe Falls plant was installed during the year, bringing the equipment at that point up to its ultimate capacity. An entirely new plant was installed by the company's forces during 1913 at the Kananaskis Falls, a distance 2 miles above the Horseshoe Falls development, and the first 6,000-H.P. unit was put into service on December 27th. The other 6,000-H P. unit is now being installed, and should be ready for operation in February, thus completing all construction work at present in hand. Duplicate transmission lines to Calgary are now in successful operation and a third line to Exshaw was installed during the year for the purpose of avoiding any possible transmission trouble. When the Kananaskis plant is in full operation, which will be about the middle of February, the earnings should show a substantial increase, as the company will then be in a position to fill all requirements for power and provide efficient and satisfactory service to its customers. During the year a new contract was entered into with the city of Calgary on terms mutually satisfactory to the company and the city. In order to provide the necessary funds for the new development, the directors have sold during the year £205,300 of bonds, bringing the amount issued up to £616,400.—*Financial Times.*

New York Telephone Co.—The report for the year 1913 shows (says the *Financial Times*) net telephone earnings $11,996 605, to which must be added dividends and interest earnings $5,770,394, and miscellaneous earnings $15,278. Total $17,782,278. Deducting interest $3,494,694, and adding surplus January 1st, 1913, $14,666,002, there is a credit balance of $28,953,586. The directors have declared dividends amounting to 8 per cent., placing to reserve for contingencies $2,500,000, miscellaneous items $37,817, leaving a surplus of $16,415,768. On December 31st, 1913, there were 1,082,765 stations in the system directly operated by the company and its local connecting companies, an increase during the year of 96,985. Including the associated and connecting companies, there were in service in the whole system at the end of the year 1,931.984 stations, an increase during the year of 175,641 stations. Under the plan for employés' pensions, disability benefits and insurance, adopted January 1st, 1913, there has been paid out from the fund during the past year $224,439. The interest added amounted to $76,358, leaving a balance of $148,081, which has been appropriated to restore the fund to its original amount of $2,000,000.

Mackay Companies.—The regular quarterly dividends of 1 per cent. on the preferred shares and of 1¼ per cent. on the common shares are announced.

Lancashire United Tramways, Ltd.—The directors report that the result of the working of this and the operating companies comprised in the company's system worked out as though they were one combined undertaking, shows traffic receipts £81,908, miscellaneous receipts £5,653, a total of £87,561. Working expenses absorbed £51,039, general charges £5 362, and rent of leased lines £5,011, leaving £26,119. Adding the dividend on holdings in the new St. Helens and District Tramways Co., Ltd., the profit of the combined undertaking is £27,653. The receipts, compared with those of the previous year, show an increase of £11,165, which includes an increase of £1,072 from the sale of electrical energy. The traffic earnings amounted to 9·04d. per car-mile. The increase in expenditure amounted to £3,278. This was due principally to the working of the Little Hulton and Farnworth extensions, the increased output of electrical energy to outside consumers, and to a further advance in the price of fuel. The interest and dividends received by this company from the operating companies, together with sundry receipts, amounted to £13,936. After deducting interest on the prior lien debenture stock and expenses, there remains £158, which has been carried to depreciation account, and there is also an undivided surplus on the year's working of the operating companies, after payment of interest and dividends before mentioned, of £14,994. The depreciation and renewal accounts and amounts carried forward in the combined companies amount to £29,290.—*Financier.*

Minehead Electric Supply Co., Ltd.—The directors report that there was a satisfactory expansion of business during the year ended December, 1913, the total units sold amounting to 220,969, as compared with 181,417 in 1912. The greater part of the increase has been for heating and cooking. The plant has been well maintained, and a large suction gas plant has been added. The profit on trading, after payment of interest on debentures, &c., amounts to £1,742 plus £11 brought forward. Deducting income-tax £41, and dividend on preference shares for the year £453, there remains £1,259, out of which a dividend of 8 per cent. per annum on the ordinary shares (less tax) is to be paid, absorbing £201, bonuses to managing director and manager and secretary, £77, placing to depreciation and reserve fund (making same £3,000) £960, carrying forward £21. Mr. R. H. Holman, a director of the company since its formation, has resigned. Mr. J. B. Marley, of Minehead, has been elected to fill the vacancy.

Telegraph Construction and Maintenance Co., Ltd.—The directors' report for 1913 states that there was a net profit of £114,863, after charging the interest on the debentures. Adding £106 637 brought forward, there is a total of £221,500. From this is deducted the interim dividend of 5 per cent., amounting to £22,410, leaving £199,090 to be dealt with. Of this the directors propose to distribute a further dividend of 10 per cent., together with a bonus of 12s. per share, absorbing £67,230, and to supplement the reserve fund by £20,000 (making it £125,000), leaving £111,860 to be carried forward. The general business of the company during the past year has been satisfactory. The works and steamships have been maintained in their usual state of efficiency. The meeting was held yesterday.

Llanelly Electric Lighting and Traction Co., Ltd.—The directors' report states that the available profit, including the balance brought forward, is £12 939, and after payment of loan and debenture interest there remains £9,179; out of this the following appropriations have been made:—Transfer to general reserve £1,000, to reserve for depreciation £1,000, to renewals account £1,500, leaving £5.679. which less interim dividend on preference shares to June 30th, 1913, leaves £3,879. It is proposed to pay the dividend on the 6 per cent. cumulative preference shares for the half-year to December (£1,800) and to carry forward £2,079. The result of the year's trading is considered satisfactory. In future the preference dividend will be paid half-yearly, on March 1st and September 1st.

Carmarthen Electric Supply Co., Ltd.—The directors report for the year ending December 31st 1913, a profit of £1,067 after providing for all charges against the working. They have paid an interim dividend on the preference and ordinary shares at the rate of 5 per cent. per annum. After paying interest on the debentures, &c., and the interim dividend, and setting aside the sum of £300 as a reserve fund for renewals of plant, there remains £326, out of which the preference dividend has been paid, and a further dividend at the rate of 5 per cent. per annum on the ordinary shares for the second half-year is recommended, leaving £218 to be carried forward. The number of consumers has increased from 250 to 374, and these are still being added to.

Cairo.—A *Financial News* dispatch from Cairo states that for the first time the Cairo Electric Railways and Heliopolis Oases Co. will not pay any dividend. This company reckons among its directors well-known London people who represent important English interests. The chief reason of the lack of dividend seems to be the fact that last year the company was unable to sell much land. It has also been defeated in its action against the Egyptian Government for obtaining exemption from certain taxes, which consequently had to be paid in 1913 in one single stroke.

Brompton and Kensington Electricity Supply Co., Ltd.—The directors, after appropriating to depreciation and sundry reserve accounts £12,669, recommend a final dividend on the ordinary shares at the rate of 11 per cent. per annum, making 10 per cent. for the year, £7,232 to be carried forward. The dividend for 1912 was at the same rate.

Compania de Electricidad de la Provincia de Buenos Aires, Ltd.—The directors' report for the year ended July 31st, 1913, as given in the *Financial Times*, states that the gross profit amounts to £80,340, which compares with £66,799 for the preceding year, showing an increase of £13,541. The administration and general charges in Buenos Ayres were £20,037, as against £21 073. This figure includes £5,396 for interest and discounts, which will be materially reduced during the present year. The average ratio of the working expenses for the year has been reduced to 54¾ per cent., and the directors anticipate that in the current year it will not exceed 50 per cent. During the year £88 314 has been expended on capital account in increasing the capacity of some of the power houses, as well as in the purchase of land, and erecting and equipping the two new stations at Ramos Mexica and Caseros, the first of which was inaugurated in November last by the municipal authorities. The directors have again appropriated the whole of the balance of the revenue account to depreciation, which amount represents all the provision that can be made at present, but the directors trust that in future years the annual revenue will be able to bear the full charge that may be found necessary in that connection.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

Anglo-Argentine Tramways Co., Ltd.—Scrip, fully and partly (£20 per cent.) paid, for a further issue of £1,500 000 5 per cent debenture stock.

British Columbia Electric Railway Co., Ltd.– Further issue of £240,000 deferred ordinary stock £240,000 preferred ordinary stock ; and £240,000 5 per cent. cumulative perpetual preference stock.

To appoint a special settling day in :—

Georgia-Carolina Power Co.– Fully-paid scrip for $500,000 5 per cent. first mortgage 40-year sinking fund gold bonds.

And to allow the following to be quoted in the official list :—

Metropolitan Railway Co.– £975 000 consolidated ordinary (deferred dividend) stock and £75 000 3½ per cent. "A" preference stock (ranking for dividend from July 1st, 1916).

Underground Electric Railways Co., of London, Ltd.– Further issue of £21,400 4½ per cent. bonds of 1933 for £100 each, Nos. 17,448 to 17 661.

Wycombe (Borough) Electric Light and Power Co., Ltd.– The directors' report shows that during the year ended December 31st, 1913, further progress has been made, the connections having risen to 65.250, an increase of 1,745 equivalent 8-C.P. lamps. The result of trading, including £56 brought forward, shows a profit to the credit of net revenue account of £6,298, and after paying interest on debentures and outstanding accounts amounting to £3,129, there remains £3 169 available for distribution. A dividend at the rate of 2½ per cent. for the year is recommended, and will absorb £1,000 ; £2,000 is to be placed to reserve fund for renewal account, leaving £169 to be carried forward. The meeting is to be held on March 3rd.

Tramways Light and Power Co., Ltd.– The directors announce a dividend at the rate of 6 per cent. per annum on the preference shares for the half-year. A meeting of the company was held yesterday.

STOCKS AND SHARES.

Tuesday Evening.

Markets in the Stock Exchange have relapsed into much the same condition of depression, combined with stagnation, that characterised them during the greater part of 1913 This is all the more disappointing, because of the promise of better business which came with the beginning of the current year. In place of the buoyant optimism which then ruled, there has arrived a gloomy pessimism that is probably unjustified, and which the course of events will prove to have been overdone. The money market naturally tends to become harder towards the end of the quarter, but when a few more stale "bulls" have cut their losses, the way should be open to improvement in prices. For there is plenty of capital about, and investors are only holding their hands at present in strict accordance with the usual precedent, which makes them refuse to buy when things are depressed, and to take a ready hand when markets are on the mend.

The heated discussion which continues to rage around Lord Claud Hamilton's statement that the Great Eastern Railway was forced to go to the United States. for a new general manager, has done the market no good. It is contended that the Great Eastern has added another disturbing ingredient to the ferment of Labour discontent which is always on the simmer. Prices have fallen substantially in all departments. Metropolitans slumped to 43, but recovered to 44½, leaving them ½ down on the week ; while Districts are 1½ lower at 31. To this latter result the report of the Underground Electric Railways contributed indirectly. Better things had been expected, and Underground Electric £10 shares dropped 7s. 6d. to 3, while both classes of bonds are a point lower.

The acrimonious controversy which has been going on around the board of the Metropolitan Railway Company apparently led to sales on the part of some of the more timid holders, although, so far as can be seen, there was no special reason for this. London Electric Railways issues are steady, the report having little effect. London and Suburban Debenture stock is easier, and British Electric Tractions are also down, except the 5 per cent. Debenture stock, which gained ½. Another 2 points rise carried Lancashire United Debenture to 86, and Metropolitan Electric Tramways Debenture advanced to 94½. There was ⅛ rise in Yorkshire preference shares.

The Electricity Supply list holds its ground with a good deal of steadiness. Bournemouth and Poole Ordinary and the Second Preference shares are both higher, upon an increase in the dividend on the former to 7 per cent. for the past year. London Electric Ordinary are also better, thanks to the dividend increase, and St. James's advanced to 10. Against these have to be set falls of ⅛ in Westminsters and in South London Ordinary, while amongst the Debenture issues the only movement is a rise of 1 in County Seconds. Business in this market's shares has dwindled to meagre proportions, and the interest stimulated a little while back by the dividend anticipations has been dimmed by the drabness prevailing elsewhere. There seems little doubt that when the other markets get into a more bullish stride the firmness of Electric Lighting shares will be renewed.

Certainly dividend announcements from the London companies have been very satisfactory, and would appear to show that the changed conditions introduced by the metal-filament lamp are now working for the benefit of the companies, instead of otherwise. It is interesting to set out the results in tabular form :—

Share.	Dividend per cent.		Increase per cent.	Present price.
	1912.	1913.		
Brompton and Kensington (£5) ..	10	10	—	9½
Charing Cross (£5)	5	6	1	6⅛
Chelsea (£5)	4	5	1	6¼
City of London (£10) . ..	9	10	1	18½
County of London (£10)	6	7	1	18
Kensington and K'bridge (£5) ..	8	9	1	8⅛
London Electric (£8)	2½	3	½	2
Metropolitan (£5)	4	4½	½	4
St. James's (£5)	10	12	2	10⅛
South London (£4)	5½	5½	—	3⅜
Westminster (£5)	10	10	—	9¼

All the quotations are *cum* dividend, from which it will be seen that the returns average fully 5½ per cent. on the money.

Affairs in Mexico have become more complicated and more critical than ever, by reason of the murder of the Englishman, Mr. Benton. This indefensible action was deemed so grave as to make it certain that the Mexican trouble would be brought at once to a head. So many incidents, however, have been claimed in the past as links which made up an intolerable chain, and yet have failed to produce results ameliorating the situation, that it was feared the latest might also have similar indefinite consequences.

Mexico Trams are flat at 70½, and the Company's Second Bonds show a fall of 2. Mexican Light and Power Preference shares and bonds have both dropped about 3 points. Monterey Debenture shed 2, and Mexican Electric Light bonds went back to 65. The whole of this group has been depressed, suffering, in addition to its other troubles, heavy sales from Paris in connection with the financial difficulties in that centre. Rio Tramway bonds have fallen, British Columbia Deferred is easier, and Brazil Tractions dropped 3. Para Electric Railways issues are unchanged.

The Anglo-Argentine Tramways group is firm, but City of Buenos Ayres Trams shed another $\frac{1}{16}$. The new Debenture issue of the Anglo-Argentine Tramways Company is quoted about ¼ discount.

From a correspondent we have received an inquiry with reference to Kalgoorlie Electric Power and Lighting Preference shares, the yield on which—namely, 12 per cent.– gives them an attractive appearance. Any return of such a nature is in itself a good reason for looking carefully into the security ; while the fact that the 10s. Ordinary stand about 1s. 3d. is another warning signal that ought not to be missed. Kalgoorlie is a mining town, dependent upon an industry which in Western Australia has been none too flourishing for several years past, and anyone buying Kalgoorlie Electric shares now should recognise that he is embarking upon a very speculative proposition.

We have also been asked for an opinion about La Plata Trams, to which favourable consideration was given here some time ago. Since then, the company has been through a most unhappy time. It was discovered that heavy defalcations had taken place. The traffics, instead of showing that expansion which might reasonably have been expected, have proved disappointing, and the depression that has tinged most South American companies has also played a part in depressing the price of La Plata Trams. We fear the only thing to do is to await the course of events, but must add that the position is anything but satisfactory ; while the misfortunes that have dogged the undertaking, and which arose after the shares were mentioned here, are sufficient to curb any desire to point out what may seem to be useful and profitable suggestions.

The Telegraph market is noticeable mainly for the fall of 10s. in Reuter's shares, which has taken the price to 9, and for a further slump in Marconis, due, of course, to the dragging out of the old scandal by reason of the debate in the House of Lords in connection with Lord Murray's purchases. The shares in the parent and in the subsidiary companies have all fallen. West India and Panamas lost ⅛, and Anglo-American Deferred again went back ½, thanks principally to the wave of depression that overspread stocks and shares with a speculative flavour. Mackay issues are good, on a little support from New York.

British Westinghouse Preference are one of the firmest features of the week, the price rising to 30s. and holding its gain. Edison and Swan slipped back to 2s. 6d. middle, and the rest of the fluctuations in this division consist mainly of small declines. Henley's retained their big rise of last week on the good dividend. The Rubber share market has been weakened by a fall in the price of the raw material, while this week's auction sale in Mincing Lane assumed fairly substantial proportions.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.*	Dividends for 1912.	Dividends for 1913.	Closing Quotations Feb. 24th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	½ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	16 — 18	— ½	..
Do. Do. Deferred ..	100	..	..	7 — 9	— ½	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	90 — 93	..	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	8	..	57 — 60	..	5 0 0
Do. 5 % Perp. Deb. ..	100	5	5	93½ — 96½	+ ½	5 5 6
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Central London Railway, Ord. ..	100	3	3	59 — 64	..	4 13 9
Do. Gtd. Assented	100	..	4	83 — 85	..	4 14 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 2
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5% Pref., 1891	100	5	5	97 — 99	..	5 1 0
Do. Do. 1896	100	5	5	97 — 99	..	5 1 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	93 — 95	..	5 5 0
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	67 — 73	..	6 6 0
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 8
Lancashire United, 5 % Deb. ..	100	5	5	85 — 87	+2	5 15 0
London and Suburban, Ord. ..	1	..	..	¼ — 5/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅝ — ¾	..	6 13 4
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	79 — 84	—1	5 7 2

NAME.	Stock or Share.*	Dividends for 1912.	Dividends for 1913.	Closing Quotations Feb. 24th.	Rise + or Fall	Present Yield p.c. £ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	63 — 67	..	5 19 [illegible]
Metropolitan Railway Consol. ..	100	1⅝	1⅝	44½ — 44¾	−1	3 12 6
Do. Surplus Lands	100	2⅝	2¾†	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	+1	3 19 7
Do. 3½ % Pref.	100	3½	3½	84 — 86	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	82 — 84	..	4 4 4
Metropolitan District Ord. ..	100	Nil	..	80¾ — 81½	−1½	Nil
Do. 6 % Deb.	100	6	6	138 — 141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	89 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	93 — 96	+1	4 13 9
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Potteries, Ord.	1	3½	..	⅜ — ½	..	..
Do. 5 % Pref.	1	5	5	17/32 — 21/32 xd	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	2⅞ — 3⅛	− ⅜	Nil
Do. "A"	1/-	..	..	⅜ — 7/16	— 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	116 — 118	..	5 1 7
Do. 4½ % Bonds	100	4½	4½	99 — 101	—1	4 9 0
Do. 6 % Income	100	6	6	93½ — 94½	—1½	6 6 10
Yorkshire (West Riding), Ord. ..	5	Nil	..	5/16 — 7/16	..	Nil
Do. 6 % Pref.	5	3	4	3⅞ — 4⅜	+ ⅛	4 11 5
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅞ — 5⅛	..	5 7 5
Do. 2nd Pref.	5	5½	5½	5/16 — 9/16	— 1/16	6 0 7
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	97 — 100	— ½	4 10 0
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 — 106	..	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 — 100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	88 — 90	−3	6 13 4
Brisbane Trams Invt., Ord. ..	5	8	8	7⅝ — 8⅛	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	99 — 102	..	4 8 3
B. Columbia Elec. Rly., Def. ..	100	8	8†	120 — 124	—1	6 9 1
Do. Pref. Ord.	100	6	6	107 — 111	..	5 8 1
Do. 5 % Pref.	100	5	5	103½ — 106½	..	4 13 0
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	95 — 98	..	4 6 9
Calcutta Trams, Ord.	5	7½	5†	6 — 6½	..	5 15 5
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5 5/16 — 5 9/16	— 1/16	4 10 0
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	N	..	0 — 1/16	..	Nil
Do. 5% A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6% B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord. ..	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4¾d.	6	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1⅛ — 1⅜	..	4 7 8
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	5 — 5⅜	..	5 11 7
„ Elec. Tr. (1904), Deb. ..	100	5	5	101 — 103	..	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 — 100 xd	..	5 0 0
Mexico Trams Com	$100	7	7	69 — 72	—1½	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	78 — 83	.	6 0 6
Do. 6 % Bonds	100	6	6	81 — 85	—2	7 1 2
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	4⅞ — 5⅜	..	9 6 0
Do. 6 % Pref.	5	6	6	4½ — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	93 — 95	— ½	5 5 3
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	100 — 102	—1	4 18 0
Do. 5 % Mort. Bonds	100	5	5	92 — 94	—2	5 6 5
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	100 — 103	..	4 17 0
Singapore Trams, 5 % Deb. ..	100	5	5	88 — 92	+1	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	97 — 99	..	5 1 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	94 — 97	..	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord. ..	10	6	7	9½ — 10½	+ ½	6 13 4
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord. ..	5	10	10†	9⅛ — 9⅝	..	5 4 0
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 9⅛	..	3 16 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	6	6	4¾ — 5¼	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅞	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10	18 — 19	..	5 5 3
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	99 — 102	..	4 8 1
County of London, Ord.	10	6	7	12⅝ — 13⅛	..	5 6 8
Do. 6 % Pref.	10	6	6	11¾ — 12¼	..	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	101½ — 103½	..	4 7 0
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 — 103	+1	4 7 5
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4⅛	..	7 5 5
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	91 — 93	..	4 16 9

Hove	5	8	8†	8¾ — 9¼	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	9	7¾ — 8¼	..	5 9 1
Do 4 % Deb.	Stock	4	4	89 — 91	..	4 8 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅞ — 2	+ ⅛	4 10 0
Do. 6 % Pref.	5	6	6	5 — 5⅜	..	5 11 7
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4¼	4½	3⅝ — 4⅛	¼	5 9 1
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort Deb.	Stock	3½	3½	83 — 86	+1	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford	5	7	7†	6 — 6½	.	5 7 8
St. James' and Pall Mall, Ord. ..	5	10	12	9¾ — 10¼	+ ¼	5 17 1
Do. 7 % Pref	5	7	7	6⅞ — 7⅜	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5½	5½	3⅛ — 3½	− ¼	6 1 9
Do. 5 % First Mort. Deb. ..	100	5	5	98 — 101		4 19 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/32 — 1 7/32	.	5 14 9
Do. 4½ % First Deb. Stock ..	100	4½	4½	94 — 97	1	4 13 9
Urban, Ord.	£3	Nil	..	⅜ — ⅝	.	
Do. 5 % Cum Pref.	5	3‡	..	2⅜ — 2⅞	..	4 12 0
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86 — 89	..	5 1 3
Westminster, Ord.	5	10	10	8¾ — 9¼	— ¼	5 6 8
Do. 4½ % Cum Pref.	5	4½	4½	5 1/16 — 5 5/16	..	4 4 5

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 8s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 24th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅝	..	5 11 7
Calcutta, Ord.	5	8½	5†	7⅝ — 8	..	5 6 3
Do. 5 % Pref.	5	5	5	$5\frac{1}{16}$ — $5\frac{5}{16}$	..	4 14 1
Calgary Power, 1st Mort. Bds. ..	100	5	5	90 — 92	+1	5 8 8
Canadian Gen. El. Com.	$100	7	8	112 — 116	—1	6 18 0
Do. 7 % Pref.	$100	7	7	123 — 128	..	5 9 5
Cordoba Lt., Power and T., Ord.	1	5	..	$\frac{7}{16}$ — ⅞	..	7 12 0
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87½ — 89½	..	6 14 1
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	96 — 98	..	5 2 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	¼ — $\frac{9}{32}$	..	Nil
Do. 6 % Pref.	1	6	6†	⅜ — ⅝	..	12 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 — 104	..	4 16 2
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 — 109	..	4 14 4
Mexican El Lt., 5 % 1st M. Bds.	..	5	5	63 — 67	—1	7 9 3
Mexican Lt. & Power, Common	$100	4	4†	43 — 46	..	..
Do. 7 % Cum. Pref.	$100	7	7	80 — 85	—2½	8 4 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	76 — 80	—3	6 5 0
Do. 5 % 2nd Mort. Bonds ..	100	5	5	64 — 68	..	7 7 1

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 24th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	54 — 59	—2	..
Montreal, Lt., H. and Power ..	$100	9	10†	228 — 233	..	4 5 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 — 217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	103 — 108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 — 103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	102 — 104	..	4 6 7
Shawinigan Water, Capital ..	$100	5½	6†	144 — 148	..	4 1 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 — 108	..	4 12 7
Do. 4½ % Per. Deb.	Stock	4½	4½	98 — 101	..	4 9 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Victoria Falls Power, Pref. ..	1	6	6	¾ — $\frac{13}{16}$	..	7 7 8
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 8

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	$\frac{11}{16}$ — $\frac{13}{16}$	..	8 12 4
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	6 17 2
Babcock & Wilcox	1	16	14†	3⅛ — 3¼	+ $\frac{1}{16}$	5 18 6
Do. Pref.	1	6	6	$1\frac{5}{16}$ — $1\frac{7}{16}$	..	4 8 6
British Aluminium, Ord. ..	1	..	..	$1\frac{1}{16}$ — $1\frac{3}{16}$	..	..
Do. 6 % Cum. Pref.	1	6	6	$\frac{13}{16}$ — $\frac{15}{16}$	..	6 8 0
Do. 5 % Prior Liens Debs. ..	100	5	5	96 — 99	..	5 1 0
Do. Deb. Stk.	100	5	5	89 — 94	—1	5 6 5
B.I. & Helsby Cables	5	10	8†	8⅞ — 9⅜	..	5 6 8
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	102 — 105	..	4 5 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref. ..	2	Nil	..	$1\frac{7}{16}$ — $1\frac{9}{16}$	+ ⅛	Nil
Do. Deb.	100	4	4	68 — 71	..	5 12 8
Do. 6 % Prior Lien	100	6	6	102 — 105	..	5 14 6
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	8/- — 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	39 — 43	..	10 9 4
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 18 4
Callender's Cable	5	15	5†	11¾ — 12¼	..	6 2 4
Do. Pref.	5	5	5	$4\frac{15}{16}$ — $5\frac{3}{16}$	+ $\frac{1}{16}$	4 16 5
Do. Deb.	100	4½	4½	97 — 100	..	4 10 0
Castner-Kellner	1	20	22½	2¾ — 2⅞	..	..
Do. Deb.	100	4½	4½	103 — 106	..	4 5 1

Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	$\frac{5}{16}$ — $\frac{9}{16}$	..	..
Do. Pref.	1	6	6	$\frac{23}{32}$ — $\frac{29}{32}$	..	7 2 2
Edison & Swan, A, £2 paid ..	5	Nil	..	$\frac{1}{16}$ — $\frac{3}{16}$	— $\frac{1}{16}$	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	$\frac{9}{16}$ — $\frac{11}{16}$	..	7 5 6
Do. Pref.	1	7	7	$\frac{15}{16}$ — $1\frac{1}{16}$	..	6 11 7
Greenwood & Batley, Pref. ..	10	7	7	6¾ — 7¼	..	9 18 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref. ..	10	6	6	10⅛ — 10½	..	5 14 3
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	20	14 — 15	..	6 18 4
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	101 — 103	..	4 7 5
India-Rubber, G. & T.	10	7½	7½	11 — 12	..	6 5 0
Do. Pref.	10	5	5	8¾ — 9¼	— ½	5 5 3
Telegraph Construction	12	20	20	39 — 41	..	5 17 0
Do. Deb.	100	4	4	98 — 100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref. ..	100	..	..	50 — 55	—1	..

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	4½	6½ — 6¾	..	6 18 4
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 — 126	..	6 7 0
Do. Collat. Trust	$1000	4	4	92 — 95	..	4 4 3
Anglo-American Telegraph ..	Stock	3	3	65 — 68	..	4 8 3
Do. 6 % Pref.	Do.	6	6	108¾ — 109¾	..	5 9 4
Do. Def.	Do.	30/-	30/-	24⅛ — 24⅝	— ½	6 1 10
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	103 — 105	..	4 15 2
Chili Telephone	5	8	..	7⅜ — 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	81½ — 83½	..	4 16 0
Cuba Telegraph	10	6	6†	8¾ — 9¼	..	6 8 1
Do. 10 % Pref.	10	10	10	15¾ — 16¾	..	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	..	7½ — 8	..	6 5 0
Direct United States Cable ..	10	4	4†	6⅞ — 7⅜	..	5 8 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	134 — 137	..	5 3 0
Do. 3½ % Pref. Stock	Do.	3½	3½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	..	4 2 4
Eastern Extension	10	7	7	12⅜ — 12⅞	..	5 8 9
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust ..	10	6	6†	11⅜ — 11⅞	..	5 1 1
Do. 6 % Pref.	10	6	6	12½ — 13	..	4 12 4
Great Northern Telegraph ..	10	20	5†	32½ — 34½	..	5 16 0
Indo-European Telegraph ..	25	13	5†	58 — 60	..	5 8 4
Mackay Companies Common ..	$100	5	5	86 — 90	+3	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	+2½	5 9 7

Marconi's Wireless Telegraph ..	1	20	20	$3\frac{9}{16}$ — $3\frac{11}{16}$	— $\frac{3}{16}$	5 8 5
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2⅞ — 3⅛	— ¼	5 8 7
Monte Video Telephone, Ord. ..	1	6	6	$\frac{13}{16}$ — $\frac{15}{16}$	..	6 8 0
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 14 8
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 — 101	..	4 9 0
Oriental Telep. and Elec. ..	1	10	10†	$1\frac{15}{16}$ — $2\frac{3}{16}$	+ $\frac{1}{16}$	4 11 4
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	4 0 0
Reuter's	10	10	10†	8½ — 9½	— ½	10 10 6
Submarine Cables Trust	Cert.	6	6	126 — 129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½ — 98½	..	4 11 5
United River Plate Telephone	5	8	6†	6⅝ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 9 0
West Coast of America	2½	2½	..	$1\frac{5}{16}$ — $1\frac{7}{16}$	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	1½	$2\frac{7}{16}$ — $2\frac{11}{16}$	— ⅛	4 18 0
Do. 6 % Cum. 1st Pref. ..	10	6	6	9¾ — 10¼	..	5 17 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd. ..	10	7†	7	13⅛ — 13⅝	..	5 2 8
Do. 4 % Debs.	Stock	4	4	95 — 97	..	4 2 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 — 98	..	4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Cheap Electricity for "Other Uses."—Three German linesmen have discovered that inventive genius is not always appreciated; they have been fined £2 in all for conducting researches. As is well known, the barges on the Teltow Canal are towed by electric locomotives taking current from an overhead wire. Having heard that fish were stupefied by electricity, the experimenters connected a wire net to the trolley wire and immersed it, apparently without themselves receiving any shock. The result was so successful that the inventors boasted loudly of it and were convicted of "unlawful fishing and theft of electrical energy."

Electricity in Jerusalem.—It is reported that two Greeks have obtained a concession for the electric lighting of the city of Jerusalem and the construction and working of an electric tramway. The constructional enterprise, the Omnium Co., which is supported by the banking firm of Perier & Co., of Paris, is seeking to secure a concession for an electric tramway from Jerusalem to Bethlehem, the transport of the water of the Wadai-Forah to Jerusalem, and the electric lighting of Jerusalem. As the last-mentioned concession is already held by Greeks, it is assumed that they will co-operate with the Omnium Co. in the extension of the proposed works.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JANUARY, 1914.

THE returns of electrical export and import business for the month of January show an improvement in the case of the former to the extent of £35,000, and a falling off of some £37,000 in imports, as compared with the previous month.

Thus the actual total of the January exports, £554,878, compared with £519,549 for December, and while it included considerably decreased amounts for telegraphic, telephonic, cable and lamp exports, the total value of machinery exported, *i.e.*, £304,000 approximately, was greatly in excess of anything previously recorded in our monthly returns. The only other increase of note in this section of the returns were the fittings exports, which were some £10,000 above the previous month.

The imports total of £258,175 compared with £291 841 in December, and included much smaller values for machinery, cable, lamps, &c., than in that month. A considerable increase occurred in battery imports, while telegraphic and telephone imports were also slightly higher.

The re-exports for January amounted to £28 011 or, roughly, some £1,000 less than in the previous month. The month was an exceptionally good one for Indian business, while the South American countries, Australia and Japan were also good customers.

The imports from the United States into this country, which were brisk during the whole of last year, continue on the upgrade.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1.243	272	42	276	793	400	4,626	3	387	159	22	3,066	11,289
Germany	2.208	3,499	127	...	416	187	3,021	...	60	...	299	12	9,829
Netherlands, Java and Dutch Indies ...	726	358	355	...	33	10	1,001	26	38	14	...	19,000	21,561
Belgium	2,059	377	245	34	11	48	1,293	...	145	15	1,298	42	5.567
France	717	...	4,337	...	...	...	14,126	48	134	...	336	67	19,765
Portugal	30	72	7	15	...	...	372	118	19	10	2.473	222	3,338
Spain, Canary Isles and Spanish N. Africa...	1,368	45	34	...	...	132	9,500	...	...	379	158	253	11,869
Switzerland, Italy and Austria-Hungary ...	222	60	179	...	15	244	7,087	55	...	470	22	1,654	10,008
Greece, Roumania and Turkey	265	61	231	22	...	...	188	70	38	...	239	474	1,588
Channel Isles, Gibraltar, Malta and Cyprus...	88	...	95	34	...	47	386	...	...	...	12	2,069	2,731
U.S.A., Philippines and Cuba	55	...	...	270	...	...	1,326	...	35	...	...	220	1,906
Canada and Newfoundland	1,153	...	1,980	644	...	695	13,074	5	243	16	64	2,599	20,473
British West Indies and British Guiana ...	65	...	64	26	...	...	12	...	20	...	2	13	202
Mexico and Central America	10	164	...	...	...	...	427	104	2	...	...	...	707
Peru and Uruguay	291	47	17	...	51	376	3,706	...	537	31	15	...	5.071
Chile	337	638	105	236	...	66	2,186	368	207	...	68	113	4,319
Brazil	1,782	2,064	1.070	164	...	883	17.980	2,645	470	...	494	1,477	29,029
Argentina	5,053	4,937	763	1,746	269	1,823	31 788	2,255	3.044	305	1,703	742	54.428
Colombia, Venezuela, Ecuador and Bolivia...	249	22	2,143	10	...	40	832	...	124	...	12	206	3,638
Egypt, Tunis and Morocco	89	296	27	26	15	20	1,113	326	198	37	592	1,136	3,875
British West Africa	127	57	75	44	...	...	635	...	62	...	292	138	1,430
Rhodesia, O.R.C. and Transvaal	2,128	555	112	696	...	20	3,772	39	38	38	...	23	7.421
Cape of Good Hope	1,760	3,957	440	354	46	179	12,654	26	651	13	6,061	1,535	27,676
Natal	767	7,581	295	152	321	7	3,690	4	166	58	283	1,333	14.657
Zanzibar, Brit. E. Africa, Mauritius & Aden	263	30	250	49	...	...	303	26	83	16	10	178	1,208
Azores, Madeira and Portuguese Africa ...	232	277	204	31	...	143	17,781	885	27	...	3	97	19,680
French African Colonies and Madagascar ...	111	12	44	...	...	65	...	...	...	...	...	...	232
China and Siam	920	816	4,112	130	46	438	4,979	390	22	11	275	69	12,208
Japan and Korea	1,390	665	1.225	272	36	499	27,125	505	209	...	1,355	142	33 423
India	4,586	10,022	4,603	2,250	25	1,967	59.976	8,113	...	124	3,109	1,917	96,692
Ceylon	1,024	292	241	38	...	4	1,128	48	992	...	265	...	4,032
Straits Settlements, Fed. Malay States, and Sarawak	202	678	452	22	65	404	1,536	501	8	107	615	511	5,101
Hong Kong	321	950	352	74	...	588	2,007	3	1,400	...	36	714	6,445
West Australia	541	265	176	69	24	161	1,071	19	43	...	2,750	...	5,119
South Australia	219	1,813	224	80	...	10	4,403	3	59	...	940	421	8,172
Victoria	394	3,696	1,824	1,243	135	1,338	9,427	...	782	24	577	7.361	26,801
New South Wales	1,789	4,430	534	2,125	206	862	11,605	1,705	781	76	4,596	3,196	31,905
Queensland	585	974	135	314	...	37	1,472	1,121	213	...	101	3,190	8,142
Tasmania	5	174	...	55	...	...	1,536	...	6	...	...	75	1,851
New Zealand and Fiji Islands	846	2,253	1,066	939	478	546	4,988	1,342	386	5	6,392	2,249	21,490
Total, £	36.220	52.404	28,185	12,440	2,985	12,239	284,132	20,753	11,629	1,908	35,469	56,514	554,878

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	25	...	...	6	90	125	2,207	3,304	563	...	12,623		18.943
Germany	3,982	23,480	2.364	9,832	7,066	9,460	48,052	8,502	5,501	9,177	5,694		133,110
Holland	6	48	19	514	673	...	75	389	...	18	...		1.742
Belgium	429	3.359	10	249	...	28	6,272	18	247	258	4,862		15,732
France	214	787	668	1,610	649	1.509	1,556	...	1,584	3,753	460		12,790
Switzerland	509	2,490	80	9	...	510	2,808	8	6	14	6		6.440
Italy	44	4,355	...	...	...	...	418	63	...	...	54		4.934
Austria-Hungary	...	593	...	177	...	...	...	...	231	...	120		1,121
United States	15,961	140	2,559	190	300	61	11,176	23,286	428	16	8,345		62.462
Total, £	21,170	35,252	5,700	12,687	8,778	11,693	72,564	35,570	8,560	13,236	32,164		257,274

Additional imports : Spain, carbons, £686 ; Canada, electrical goods, £150, glow lamps, £15, machinery, £50.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	8,836	683	...	1,422	310	...	14,958	...	536	604	659		28,011

TOTAL EXPORTS : £554,878 TOTAL RE-EXPORTS : £28,011. TOTAL IMPORTS : £258,175.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. **Imports are credited to the country whence consigned, which is not necessarily the country of origin.**

THE GRADING OF ELECTRICIANS.

By H. R. TAUNTON.

It is doubtful whether the Electrical Trades Union has given any but the most cursory consideration to the economic questions involved in its demand for so large an increase as three-halfpence an hour. It is true that it is some years, during which the cost of living has largely increased, since any advance has been made in electricians' rates of pay; while other trades, whose work is no more difficult, and requires no greater skill of head and hand, rejoice in 11d. and 1s. an hour. These may be excellent motives for asking for an increase, but they provide no reasons for granting it. The only vital factor to be considered is, what is the real value of the average electrician's services to his employer, and through him to the community? That is the value the electricians will finally have to accept, in the absence of a union strong enough, as in the case of these other trades, to force an artificial rate upon the community.

The Electrical Trades Union, for basic reasons, is not likely to become strong enough to do the same for its members. Their work still largely ministers to a luxury, and is therefore particularly subject to trade cycles. Electric lighting and heating, and even power, can all at a pinch be dispensed with, in favour of their many rivals. Unless the Electrical Trades Union is in a position to guarantee the future prosperity of the country, the greatly increased cost of installation work, following increased cost of labour, will result in many potential customers withholding their orders, with consequent diminution of trade. Electrical contracting work, again, is largely seasonal, and the labour is to some extent casual—there is in normal times a large floating surplus of unemployed. The men work in small gangs, and, except in new buildings, come little into contact with other union men. The trade, as practised by the usual nondescript wireman, is not difficult to acquire, and is easily recruited.

All these facts taken together militate against a strong union; so that the electricians as a body are not, nor are likely to be, in a position to demand more than they are worth. They must be content to be subject to the practical laws of supply and demand. And on this basis, 9½d. an hour would appear to be the fair market price of the *average* wireman: that is to say, any contractor can take his pick of any number of non-unionists willing to work at that price, or even less. On the face of it, £2 2s. a week of fifty-three hours is a fair living wage for the work, neither arduous nor difficult, which the average wireman is called upon to do. Doubtless he would be well satisfied with it, if it could be depended upon all the year round. But he—the average wireman—finds his earnings considerably reduced by the fact that he may be out of a job for a fortnight, after being employed for a month. The natural result is discontent and unrest.

On the other hand, continuity of employment is an ideal difficult to realise in the contracting trade. The Union's suggestion of a fifty-hour week would go some way towards spreading labour more evenly. For that reason alone, it ought to be adopted, apart from the fact that, within limits, shorter hours mean greater efficiency. On a fifty-hour week basis the men would require 10d. an hour in order to earn the same weekly wage; and employers would be justified in granting that rate, as they would probably get as much work done for the same amount of money. No contractor needs telling that a short day's work or a short week's work will last a full day or a full week, irrespective of the precise number of hours.

But the mere raising of the minimum rate cannot provide more than a temporary palliative, for it leaves dissatisfied the better men in the trade, the men whose presumably greater energy and intelligence sway the policy of the Union. And they are restless and discontented without perhaps realising the fundamental cause: and that is, that they cannot command their true value in the labour market. They are worth more, but cannot get more, than the minimum rate. The union rules may, in theory, permit the employer to pay more if he will; but, on the other hand, all their members are "equal"—the careless clumsy worker *must* not be paid less than *may* be given to the highly skilled man. The result is that, however willing an employer may be to give one man who is worth it 11d. an hour, he cannot always afford to do so while he has to pay 9½d. to another man who is only worth 8d. an hour. Forced to overpay the one, he usually strikes an average by underpaying the other; and the man who suffers is the man who is better than his fellows. That is the result of the inherently false principle on which modern trade unionism works: essential to it, albeit opposed to common sense, for without it it could never attract and keep the membership of the men at and below the average, who together form the majority of the trade. Their interests must be secured, although at the expense of the men whose value is above the average.

Grading, then, is unlikely to find favour in the eyes of the Electrical Trades Union; but, nevertheless, grading, with judicious safeguards, is the true solution of the labour problem in trades where the work is varied and makes unequal demands on the workers' skill and stamina, as in installation work. Now is the time for that very undistinguished body, the Electrical Contractors' Association, to distinguish itself. Hitherto it has done little for its members, and less for the trade at large, with the result that many important firms are not members. It is, however, the only body sufficiently representative of the trade to be able to organise a grading scheme, such as that outlined below, which would provide a permanent solution of the present labour problem.

Strictly speaking, grading—paying men according to their value to their employer—would entail some men being paid less than the present minimum. But a minimum that will give the worker a fair living wage, irrespective of his merits, must be retained. Not only is it bad from the point of view of the community that a man should receive less than a living wage, whether he deserves it or not, but it is bad from the point of view of the employers. Without a fixed minimum, unscrupulous firms would scamp their labour as they do their material, and the more scrupulous firms would suffer. A minimum rate for labour acts, as does a specification in the case of material, in equalising competition.

For the present argument, let the minimum rate for wiremen be 10d. an hour. In view of the superior gradings hereinafter suggested, this may appear high; but with a fifty-hour week it means little more than £2 a week—surely the least that a skilled London worker, of married age, should be asked to exist upon. Besides, any scheme that involved the reduction of the weekly earnings of the majority would, whatever its compensating advantages, stand no chance of acceptance by the men.

It will be generally conceded that the *average* length of time a man retains his employment forms a rough and ready, if not the only evidential, index of his merits. It provides a convenient standard by which he can be graded. If, then, a man works 50 weeks for one firm in any consecutive 52 weeks, let him be entitled to claim an extra ½d. an hour, one year after the expiration of the qualifying period. If he were entitled to the higher rate *immediately* after the qualifying period, a firm who did not wish to pay him the extra ½d. might be tempted to get rid of him just before he completed it, and so he would lose his benefit. They would have no such motive if there were an interval of a year before the higher rate came into operation. They might still discharge him at the end of say twenty-three months; but a month after leaving them he would get, from the next firm that took him on, the extra ½d. for which he had qualified. If he fails to command continuous employment at the higher rate—if within the year he does not stay with any one firm for, say, thirteen weeks—let him fall back, at the end of the year, to the lower grade from which he was advanced. These two simple principles, providing for promotion or relegation, would between them ensure an automatic and accurate grading of the men.

The poor worker, for instance, who is not worth 10d. an hour, will never rise above that rate—would, indeed, fall below it were it not the minimum—for he will never, except under extraordinary circumstances, be employed by any one firm long enough to qualify. Moreover, he will pay for his inefficiency, as he does now, by being only casually employed.

The marginal man, the man who is just worth 10d. an hour, may, if his employer be busy, stay with him long enough to qualify for 10½d. an hour; but when the time comes for him to be paid at that rate his employers will successively find he is not worth so much to them; and, after a year, he will sink back to his former grade, with advantage to himself. He, although paid at the same rate as the poorer worker, is rewarded for his greater efficiency by being able to command more continuous employment. These two classes of men will be no worse off than they are at present. There will be a slight advantage, in fact, to the efficient 10d. man, resulting from the fifty-hour week, and the lessened competition of the higher grade men.

Finally, the good man, who is worth more than the minimum, which is all he commands under the existing circumstances, will qualify and find employment continuously—that is, for more than three months at a time—at 10½d. an hour. Or he may qualify for a further advance, to 11d., or 11½d., or more an hour, until he reaches a rate at which he cannot secure continuous employment. He must then be content with the rate immediately below, which represents his normal grade.

It will be objected that employers would be no more willing to pay 11d. an hour to men, under such a scheme, than they are now. But the conditions would be entirely different. At present men can be got for the minimum who are worth more, but know it is useless to ask more from an employer who knows nothing about them. Few of them stay long enough in one employment to prove their worth, lacking any strong inducement. The suggested scheme would provide it; there would be less of the slackness, bad time-keeping, and irresponsibility which spoils many who have the ability, without the ambition, to become valuable workmen. There would thus be a larger number of men worth more than the minimum than there are now, and unless an employer were content to take the lower grade of men, he would have no option but to pay the higher rate. Even now, there are few firms of repute who do not pay one or two men, whose worth they know from experience, more—sometimes much more—than the minimum, in order to retain their services. If they could take on a stranger whose credentials showed him to be the particular class of man they wanted for a particular job, there would be no reason why they should demur at paying him the same as the man whose value they had proved for themselves. Moreover, if they wanted that class of man, they would have no choice. The whole scheme presupposes an organisation which would enforce the due payment of each grade on all employers and men: either the trade union, if they be willing, or a representative association of the employers, or both.

The higher grade men need not fear lack of employment. The openings for the 1s. an hour man will, of course, be rarer than for the lower grade men, just as there are fewer billets for engineers at £1,000 a year than at £100. But any sane contractor would rather pay 11d. an hour to a man who does elevenpence-worth of work an hour, than 10d. an hour to the man who does tenpence worth. For the extra penny an hour represents more than the value of work done. It stands for freedom from petty worries, increased confidence, and saving of supervision, and, ultimately, enhanced reputation. The better class of employers would employ higher grade labour as they use C.M.A. cable, or seamless tubing. It is reasonable to suppose that consultants would specify that certain jobs should be done by a certain grade of labour. Indeed, it is possible that in this way there would be built up a demand for higher grade labour which would outstrip the supply, were it not that some of the marginal men would thus be enabled to qualify for a grade higher than that which their intrinsic merits would enable them to attain.

There would be no extra money as now, for charge-hands. What would amount to the same thing would be a regulation to the effect that only higher grade men could be charge-hands. For instance, while a wireman at 10d. could work on a small job with a mate, a gang of four would have to include a charge-hand at 10½d., and one of eight or more, a foreman at 11d. an hour. This regulation alone, apart from any other consideration, would ensure adequate employment for the higher grade men. Needless to say, when, as suggested above, a specification called for all the wiremen to be, say, 10½d. men, the charge-hand, or foreman, would have to be a relatively higher grade man.

The case of the man who wanted to remain with a firm who were equally desirous of keeping him has to be considered. According to this scheme, they would have to give him a rise of ½d. an hour every two years, and it is obvious that, in time, the rate per hour would become prohibitive; and the man would have to go, however much he might prefer safe permanent employment with the one firm to the risks of intermittent employment at higher rates. In his interests, therefore, some rule would be desirable to the effect that no firm should be obliged to give more than two rises to the same workman remaining continuously in their employment. After a further two years, he would have the option of remaining with the same firm at the same rate, or of leaving them, qualified for the next higher grade. There would be nothing, of course, to prevent an employer giving a further increase by mutual agreement.

The question of mates is not an easy one. At present, as far as one can gather, a mate may dub himself a wireman as soon as he has acquired a sufficiency of self-confidence and a kit of tools. Many never become, nor are fitted to become, fully qualified electricians. Those who have the capacity should be assisted in every way; but any rigorous system of qualification by length of employment would make promotion an impossibility for them. Mates cannot, as a rule, keep their jobs as long as wiremen. Their conditions of labour are more casual. Their retention or dismissal depends largely on the wireman whom they are mating, and the employer rarely has an opportunity of discovering their merits at first hand. He makes no special effort to retain their services, knowing that he can get others at an hour's notice, equally suitable for his purpose. For the same reason, mates who demand more than the minimum would, under present conditions, find it hard to get employment at all.

(*To be concluded.*)

THE "CASCADE" INDUCTION MOTOR.

By L. J. HUNT, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Leeds, February 11th,* 1914.)

IN 1907 the author read a paper on this subject before the Manchester Local Section of this Institution when the motor was in its early stages of development. Since that time large numbers of these machines have been built and numerous new windings have been worked out and tried, with the result that the modern machines differ materially from those described in the paper to which reference has been made.

The "Cascade" idea has been used for many years in the control of three-phase locomotives, for obtaining several speeds in rolling-mill work, and for the driving of fans, &c. It is almost exactly analogous to the coupling of two or more motors in series on a continuous-current circuit. If two similar continuous-current motors be connected in series, with their shafts mechanically coupled, the speed of the combination will be half that of either motor directly connected to the line. Next consider one of the motors wound for a speed of 1,500 R.P.M., and the other for 750 R.P.M., with the two machines in series. As the torque is proportional to the back electromotive force and the current in the armature, it follows that the low-speed motor will develop two-thirds, and the high-speed motor one-third of the total torque developed by the combination. It will be obvious that for any given speed the back electromotive force generated by the low-speed motor will be equal to twice that generated by the high-speed motor, and therefore the back electromotive force of the two machines in series will be equal to three times that generated by the high-speed motor alone. The set will therefore run at one-third the speed of the 1,500-R.P.M. machine, or two-thirds of that of the 750-R.P.M. motor, *i.e.*, 500 R.P.M.

In the case of two induction motors wound for speeds of 1,500 and 750 R.P.M. the speed of the two coupled in series or "Cascade" will similarly be 500 R.P.M. In this case the secondary of the first machine is connected in series with the primary of the second machine, and, therefore, as the same currents circulate in both, the frequency must be the same. As in the case of the continuous-current machines, the low-speed motor will develop two-thirds of the total torque. In an actual case the pressure-drop due to resistance in the first motor slightly affects the relationship. If the rotor of the first machine is connected to the stator of the second machine, the windings must produce a flux in both stators revolving in the direction of the mechanical rotation. At 500 R.P.M. the slip of the first motor will be 250 R.P.M. if the low-speed motor is connected to the mains. This motor will have eight poles if wound for a 50-cycle circuit. The second motor will have four poles, and consequently the speed of the stator field will be equal to twice the speed of the slip of the first motor, or 500 R.P.M. It follows that the frequency of the currents in the second rotor will be zero—the condition for synchronous speed.

The speed of the combination is equal to that of a motor wound for the sum of the numbers of poles of the two machines.

At the synchronous speed of an induction motor no energy is transmitted to the rotor, and if we assume that the distribution of flux follows a sine law there will be no current in the secondary windings. If, then, the mains are connected to the rotor of a machine the latter will revolve in a direction opposite to that of its magnetic field, so that at synchronous speed the field will be stationary in space and no electromotive force will be generated in the stator windings which now form the secondary of the motor. Instead of connecting the rotor windings of the first motor to the stator windings of the second machine we may connect them to the second rotor windings, taking care to reverse two of the connections so that with currents circulating in both windings, the magnetic fields produced will rotate in opposite directions. The stator winding of the second motor now becomes the secondary, and the rotor windings may be permanently connected without slip-rings. Control of the speed and starting torque is obtained by connecting resistances to the stator windings of the second machine. Here, then, we have a combination of two motors forming a single unit with their rotor windings permanently connected, and as no currents are brought out from the rotors the windings may consist of several parallel circuits, so that the voltages in them will be quite low even when the rotors are standing. This construction meets the requirements of a machine with a rotor winding approximating to that of a squirrel-cage machine, and with the same facilities for control of the starting torque and speed that can be obtained with a machine with wound rotor and slip-rings. We have, however, sacrificed much in obtaining these results. The necessity of using two machines leads to a greatly increased cost; and, further, the efficiency and power factor will be low, so that the construction is of little practical value. It was, however, the fundamental idea from which the motors described in this paper were developed, and will serve as a key to the explanation of their windings and properties.

There are examples of "cascade" coupling in nearly every power plant in the country. We install a step-up transformer and then a step down transformer in a sub station; these are coupled in cascade and exactly represent a cascade motor at standstill. The energy current taken from the mains by the first transformer is dependent on the resistance (or load) connected to the secondary windings of the second transformer, and the first transformer takes from the line not only its own magnetising current but also that required by the second transformer. In fact the calculations necessary for determining the currents in the windings, the power factor, &c., are identical in both cases.

The next step in the development of the motor was to make a single stator and rotor which would take the place of the two separate machines. The problem to be solved was so to arrange the two sets of windings that there should be no mutual interaction, electrically or magnetically, between them, except by the agency of the interconnected rotor windings.

The first motor built at Sandycroft in 1905 showed that it was possible to construct a single cascade motor; but it was at once apparent that the electrical properties were inherently bad. Electrically and magnetically the motor described later is identical with this machine, but new types of windings are used in it which overcome the bad features of the original design.

The cascade motor is essentially a low-speed machine; and it is when designed for speeds which are abnormal for single-field motors that it shows to best advantage. The number of poles for which the machine can be constructed are determined by the following conditions:—

(*a*) The number of poles in the two fields must be so chosen that their windings are mutually non-inductive.

(*b*) The two fields when superimposed must not produce an unbalanced radial pull on the rotor.

Condition (*a*) is satisfied when the two numbers of poles are such that when divided by their "greatest common factor" the quotient is in one case an even and in the other case an odd number.

To satisfy condition (*b*) the two superimposed fields must give a symmetrical resultant field; the "greatest common factor" must be a number greater than two. The most usual numbers of poles are in the ratio of 2 : 1.

If was evident that to make the machine commercially successful a way had to be found to obviate the necessity for two separate sets of windings. What was required was a single winding suitable for two entirely independent currents, one at line frequency and the other at the frequency of slip. This was a stator problem; the treatment of the rotor windings, requiring a different solution, was left till a later date. The required winding had not only to be suitable for the circulation of these two independent sets of currents, but had to be so connected that the induced or low-frequency currents could only circulate when paths outside the windings were provided for them. This was necessary in order that the starting torque and speed could be controlled by causing the induced currents to flow through variable external starting or regulating resistances. Two sets of terminals were therefore required, one set for connecting to the mains and the other set to the resistances. The main currents must not be allowed to flow through the external secondary paths, and consequently it was essential that any one pair of secondary terminals should be connected to two points in the windings between which there existed no "main" potential difference. To meet these conditions a parallel-connected winding was necessary. Fig. 1 shows a suitable form of winding. The main terminals are lettered "T," and the six pairs of tappings are those to which separate sets of resistances would be connected for starting and speed-regulating purposes. When running at full speed each pair of tappings would be short-circuited. Arrow-heads shown inside the diagram indicate the direction of flow of the main currents at a given instant; those outside the diagram similarly show the direction of flow of the induced currents.

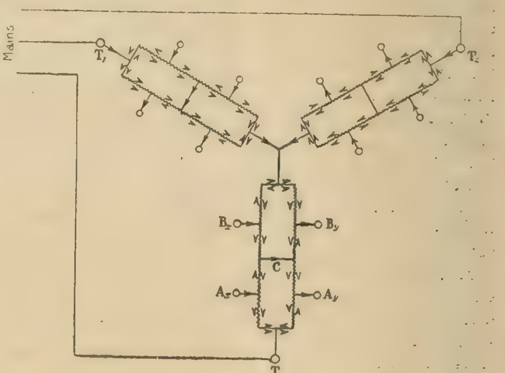


FIG. 1.

Fig. 2 shows an eight-pole winding which could be connected up in accordance with it.

The application of this winding to machines having a larger number of poles introduces no difficulties. The effective value of the ampere-bars is 70·7 per cent. of the total ampere-bars, compared with the two separate windings of the original machine, the whole of the copper being merged into one winding gives a greatly reduced effective value to the resistance, so that for a given weight of stator copper the I^2R loss is reduced to rather less than one-half.

Having obtained the required stator winding, attention was next paid to the rotor. As both windings carry currents of the same frequency and no external connections are required, the treatment is quite different from that applied in the case of the stator. As there are only two axes of coincidence in a motor having four and two poles, such a machine is not practicable, as the shaft would be subjected to unbalanced radial forces. It will, however, save needless repetition if we work out the rotor windings for this number of poles.

In practice the best results have been obtained with rotors having main and auxiliary windings in the ratio of 1·73 to 1·0.

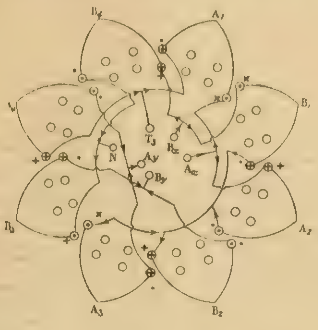


FIG. 2.

This ratio gives an auxiliary field with a flux per pole 73 per cent. greater than the main flux, and an average figure for the reactance of the auxiliary windings is 40 per cent. of that of the main windings.

Fig. 3 shows a developed diagram of a four-pole winding. The slot pitch has been shortened to two-thirds the normal, so that bars carrying currents differing in phase by 60° occupy the same slot. In the same slots is shown a two-pole winding of full pitch with 1 bar per slot. The two windings are interconnected so that the same current circulates in each; consequently with 1 ampere per bar there are 1·73 ampere-bars in the four-pole winding and 1·0 ampere-bar in the two-pole winding.

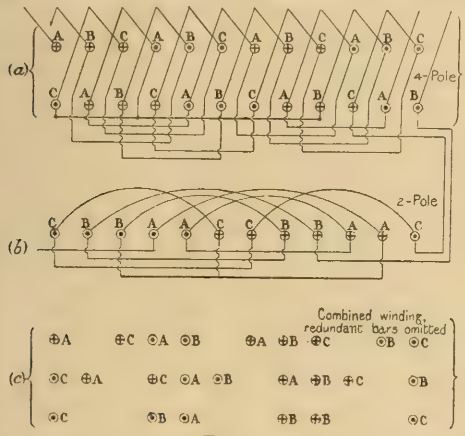


FIG. 3.

In this diagram as well as in all the others in the paper instantaneous values of the currents are taken at the instant when the current in B is 1·0, and those in A and C 0·5 each.

From an examination of the winding it will be seen that in slots 2 and 3 there are two bars carrying currents of the B phase which are equal and opposite. In slots 6 and 7 the bars carry equal and opposite currents of the C phase, and the same conditions are found with currents of A phase in slots 10 and 11. It is clear that two conductors carrying equal and opposite currents in the same slot can produce no useful magnetomotive force. We therefore omit these bars. There are now left six slots each containing only one bar, as shown in the figure below the original four-pole and two-pole windings. In each of the slots containing three bars, two of the bars carry currents of the same phase, and the current in the third bar differs in phase from the others by 60°.

If a conductor carries two currents of the same amplitude differing in phase by 60°, the crest value of the resultant current equals 1·73 times the crest value of either of the component currents, and the phase of the resultant current lies midway between the phases of these component currents. This phase relationship is found in an interconnected star and mesh winding.

By connecting up the combination winding, fig. 3, to form a star and mesh construction we can use two bars per slot instead of three, and thus simplify the winding. It is only necessary to merge two bars carrying currents differing in phase by 60 and call all such bars star bars. All that is required to complete the winding is to provide suitable end connections to give a star mesh construction. This has been done in fig. 4. The combination winding will require 7·8 per cent. more copper than the original four-pole winding.

The arrangement of the end connections was changed and a barrel type of winding of the usual type was developed. This is shown diagrammatically in fig. 5. The slot pitch of all the coils is the same and the end connections can be supported on rings in the usual manner and held in position by binding wire. A rotor with this winding resembles an ordinary rotor except that one-quarter of the bars have been omitted.

The back electromotive forces induced by the two-pole field are equal and opposite to those induced in the winding by the four-pole field. The voltages taken round the mesh are in balance. No currents can therefore circulate except by way of the star windings. There are then only three circuits, and the back electromotive forces in each circuit are equal and opposite to the electromotive forces induced by the main field.

This completes the description of the cascade machine in its simplest form. In another section of the paper, motors with two or more efficient speeds are described, but in these the extra speeds are not obtained by cascade coupling. The windings already described are used in all the machines, and only certain additions are made to the rotor to enable it to operate at non-cascade speeds.

The completed motor closely resembles a machine of ordinary construction. The stator windings are identical in appearance, and only differ in the cross-connections of the coils. Standard construction is also used for the rotor. The efficiency and power factor curves of a 330-B.H.P., 50-cycle, 200-R.P.M. motor having 20 main and 10 auxiliary poles are shown in fig. 6. The gap diameter of the motor is 56 in. The stator slots are of the completely open type, and those of the rotor are semi-closed.

The cascade machine has a very small slip, because the resistance of the rotor does not directly affect it.

The core of a cascade machine has to carry both the main and auxiliary fluxes, but as the secondary flux is only rotating at the speed of slip, the loss due to it is small and the flux density behind the teeth can be raised to a high figure. The density in the teeth must, however, be kept within reasonable limits, otherwise the power factor may be considerably reduced. The actual iron loss in a motor of standard design is practically unaffected by the presence of the auxiliary field.

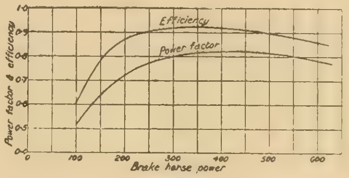


FIG. 6.

The presence of the auxiliary field has a marked effect upon the behaviour of the motor when starting and "creeping." It gives the machine a more even turning moment; the motors will run quite steadily with resistances connected to the stator tappings, at less than 1 per cent. of their full speed, and at starting they develop a very steady pull. For these reasons the machines have been extensively used in the driving of all classes of hauling machinery, and they give satisfactory inching in the driving of printing presses and similar machines.

Owing to the very low-voltage windings used in the rotors and the absence of slip-rings, single-speed motors are found to be very successful in the driving of all classes of mining, cement and quarry machinery, and they are now being introduced into rolling mills.

Machines of this type develop full-load starting torque with approximately full-load current, and they can be designed to suit all conditions of starting. The standard design of motor starts against any load up to 2 to 2½ times the full-load torque, and regulation of the starting torque is obtained by varying the resistances connected across the stator tappings. At full speed these tappings are short-circuited in the same way that the rings are short-circuited in motors of the usual slip-ring type.

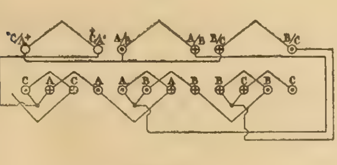


FIG. 4.

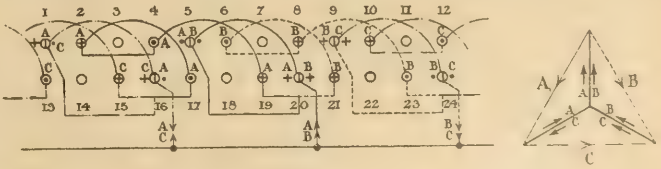


FIG. 5.

Unless the machines are required to run at reduced speeds for a considerable time it is unnecessary to provide resistances for all the stator tappings. Tests made some time ago showed that with resistances connected to two pairs of tappings in one leg of the winding the motor would start against a torque equal to a little more than full-load. With three resistances, one in each leg of the star, the motor starts against a torque approximately equal to its maximum running torque. In the usual way either three or four resistances are used at starting and for moderate speed regulation, and the remaining tappings are short-circuited when the machine has attained full speed.

If an ordinary slip-ring rotor wound for the same number of poles as the stator be substituted for the cascade rotor the machine will run as an ordinary one-field motor. The machine will run 50 per cent. faster than with its own rotor, and will possess the actual characteristics of a motor of standard design.

In the first two-speed motors two windings were used on the rotors, one wound for the same number of poles as the main flux and connected in star, and the other wound for half the number of poles and connected in mesh. From the points of inter-connection of the two windings leads were taken to three slip-rings. When the motor was required to run at cascade speed the slip-rings were open-circuited and the machine was started by resistances connected to the tappings. When required to run at non-cascade speed, the tappings were open-circuited and the motor was started by means of resistances connected to the slip-rings in the usual manner. When running at top speed the short-circuited slip-rings prevented any appreciable current from flowing into the second rotor winding. This type of winding required very deep motor slots in order to keep the losses down, and this made it very difficult to get enough iron into the teeth to prevent over-saturation.

We have already noted that the cascade rotor winding is non-uniformly distributed. If the winding can be made uniform when desired, the second field can be suppressed and non-cascade speed obtained. To do this it is necessary that all slots should carry the same number of bars. All that is necessary is to take the "cascade" winding, fig. 5, insert the three coils which were omitted, and connect one end of each to a slip-ring and the other ends to the middle points of the delta parts of the winding. The winding thus produced is shown in key diagram in fig. 7A. The three slip-rings are open-circuited and the currents shown correspond with those in fig. 5 for cascade working. When the three slip-rings are short-circuited, as in fig. 7B, at each point where three bars meet, the B current divides into A and C currents, so that each point is in reality a neutral point, and there are 8 such points in the winding, which is equivalent to four interconnected star windings, fig. 8. The currents must necessarily all have the same amplitude and they will all be controlled by an ordinary three-branched resistance connected to the slip-rings.

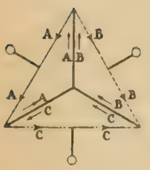


FIG. 7A.

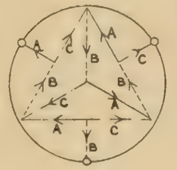


FIG. 7B.

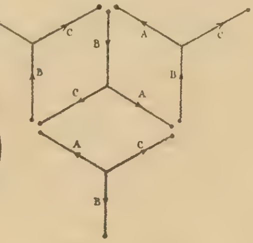


FIG. 8.

The weight of copper in this type of rotor winding is less than one-half of that in the original double windings; and as quite shallow slots will accommodate it, the reactance is naturally very much less. The construction of the winding follows standard lines for barrel-type rotors, and any rotor with this type of winding can be made to give the extra cascade speed by changing its cross connections.

A motor of this type is designed in exactly the same way as a machine of the ordinary type wound for the main number of poles.

The pull-out torque of the two-speed motor is approximately the same at both the speeds, and the no-load current at cascade speed exceeds that at non-cascade speed by 75 per cent. When a motor is required to drive a fan or any machine which requires less torque at its second speed than at full speed, a star-mesh switch is mounted on the motor so that the machine may be run with its stator windings connected in mesh at full speed and in star at cascade speed. This arrangement reduces the no-load current at cascade speed to one-third of its usual value, or 58 per cent. of the full-speed current. The overload capacity is similarly reduced, but is ample for a fan driven at two-thirds its normal speed. The arrangement brings the cascade power factor well up on the curve and also permits of the use of a smaller motor, because the machine at cascade speed is operated with a main flux reduced to only 58 per cent. of its value at full speed. The machine can therefore be designed for standard densities at full speed.

The curves in fig. 9 are those of a two-speed motor driving a colliery fan. The machine gives 120 B.H.P. at 580 R.P.M. and 30 B.H.P. at 397 R.P.M. on a 40-cycle circuit, and is wound for 2,750 volts. It operates at eight-pole and 12-pole speeds, but as deeper slots than the standard were required to take the high-tension windings the power factor at the second speed is a good deal below the figure for low-voltage machines. Any speeds between the limits of 397 R.P.M. and 580 R.P.M. are obtained by resistances connected to the slip-rings, and speeds below 397 R.P.M. by resistances connected to the stator tappings.

In the majority of cases speeds below cascade are not required and the control of the machine can then be considerably simplified.

For operating foundry cranes the single-speed machine is generally used on account of its inching qualities; but two-speed motors are used for the longitudinal motion of travelling cranes in long shops. When travelling with a load the machine runs at the second speed, and the high speed is only used when the crane is travelling light. The controller, which is generally of the tramway type, is provided with three extra contacts with an extra high-speed notch. When the motor is required to run at top speed the controller handle is brought over to the extra notch, in which position the stator tappings are opened and the slip-rings are short-circuited. This arrangement is very simple and has proved entirely satisfactory.

The application of these motors to the driving of winding engines and rolling mills is a development of recent date. Two winders have been put into commission in South Africa during the last few months.

The cascade system offers the advantage of gradual change from cascade to full-speed coupling with the motor connected during the whole time to the line. The stator is never disconnected from the mains until the brakes have been applied and the motor has been brought to rest. There is no fierceness in the control at creeping speed and when starting; consequently decking is under complete control.

Machines wound for speed ratios of 3 : 1 are used where a large difference between the two efficient speeds is required, or where regeneration down to low speeds is desired. This occurs in connection with electric winders and electric lift work.

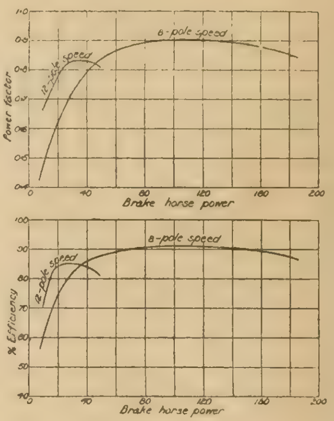


FIG. 9.

The two-speed motor can be operated at a third speed if the stator windings be so arranged that they can produce two different numbers of main poles. For example, a two-speed motor wound for eight main and four auxiliary poles, and running at 750 or 500 R.P.M. on a 50-cycle circuit, can be made to run at a third speed of 1,500 R.P.M. by changing the stator winding in such a way that the line currents will produce a four-pole field.

Particulars of two three-speed machines may be of interest; the first was built to the specification of Mr. G. H. T. Hooghwinkel, and drives an air compressor at a colliery in South Wales. It gives 400, 200 and 133 B.H.P. at speeds of 300, 150 and 100 R.P.M. on a 25-cycle 2,200-volt circuit. It is wound for 10, 20 and (20 + 10) poles.

The second machine gives an output of 300, 150 and 100 H.P. at speeds of 300, 150 and 100 R.P.M. on a 25-cycle 440-volt circuit. This machine also drives an air compressor used for refrigerating purposes.

This concludes the description of the machine as it stands at the present time. It would be futile to say that its development is complete, for cascade operation is full of possibilities.

DISCUSSION AT LEEDS.

DR. POHL congratulated Mr. Hunt on his success in having developed the cascade motor from a purely theoretical idea into a practical motor, in regard to which he considered that the engineering world owed the author a debt of gratitude. The advantage of Mr. Hunt's motor was that the rotor had no slip-rings, and, therefore, some people believed that it was the equivalent of a squirrel-cage motor. The cascade motor, however, was something quite different from the squirrel-cage motor, which was the most reliable type of machine, because it was practically invulnerable. The cascade motor relied upon the safety of the insulation, and it seemed to him that if they got such a breakdown of the insulation in the rotor that it failed to superimpose the four-pole field, the rotor would run up to the speed of the eight-pole rotor. The actual winding, which consisted of two circuits connected together, was rather a complicated affair, and altogether different from the squirrel-cage motor. In the high-tension stator winding they already had a fairly thin wire, and yet it was proposed to split that into two wires, which he did not think was an improvement at all. Also, there were a considerable number of extra connections, which increased the danger of a breakdown. He preferred the ordinary series winding, because it had fewer connections. He would expect a great disadvantage also with regard to the power factor, in consequence of the long connections of the coils and the longer projections from the stator iron. In the case of variable-speed motors the cascade had a useful application, but the steps in the speed were very great. They could not get any steps between 500 and 750 R.P.M. on the 50-cycle circuit, which was very unfortunate because that was the most useful range of speed variation. When they had to deal with the problem of driving a fan at two distinct speeds the best engineering solution was not what Mr. Hunt had done, but to use an ordinary 120-H.P. motor for one speed, and put on the same shafting a common squirrel-cage motor running at the other speed. He was always in favour of using the simplest type of machine whenever it was possible, and there was no objection to using the ordinary squirrel-cage motor up to 80 or 100 H.P. on the large A.C. mains. He suggested to Mr. Hunt that useful as the cascade motor was in some ways, it was a kind of blind alley development, and not in the line of true progress. What was coming, he thought, was the variable-speed three-phase motor, the speed of which could be varied within very wide limits without definite steps. The repulsion and commutator motors were constantly being improved upon, and they would ultimately reach the variable-speed repulsion motor.

Mr. Wilson Hartnell said he also, if he wanted to run a fan at two speeds, would put down a motor for the full speed, and another simple short-circuited motor for the other speed. He could not help thinking that a commutator motor of some kind would get over the difficulties that Mr. Hunt had in mind. Modern thought in connection with engineering was all in favour of simplicity.

Mr. H. H. Wright said he thought that the cascade motor could be profitably used in the case of the Lacour motor converters, and in winding engines and haulages, and asked if Mr. Hunt had ever proposed to apply it to the propulsion of ships.

Mr. Creedy said that though they could all see the complexity of the theory of the cascade motor, the machine as practically built was the very reverse of complex. He had seen it both in the factory and in use, and it seemed to him to be superior in robustness to the ordinary induction motor. He wondered whether there had ever been carried out an internal cascade commutator machine having the gradual variable speed, which was so desirable in many cases, combined with the properties of the Hunt motor. The complexity which appeared in the cascade motor which had been described arose in grasping the method and its operation, and this did not affect the working in the least. He thought the two principles of speed variation should co-operate. Neither was likely to supersede the other, but both were likely to be used side by side, both independently and in combination.

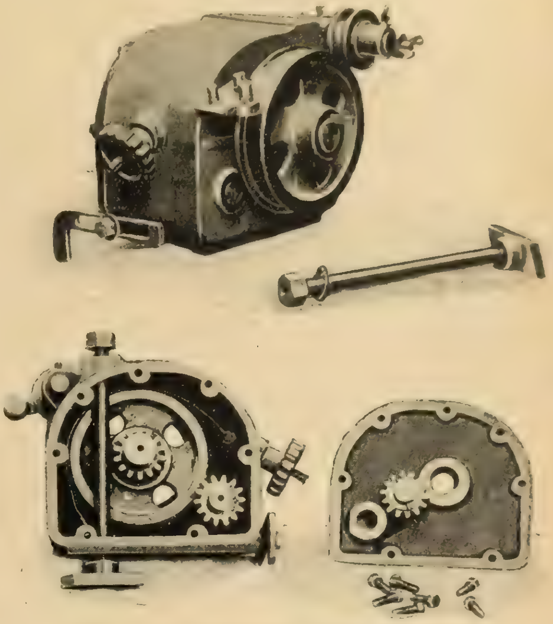
Mr. Burnand said that he did not know whether the cascade motor had any advantage over the ordinary pole-changing arrangements as described by Nicholson and Haigh last year. He had been struck by the similarity in principles that they kept finding in widely-varying applications. The cascade arrangement appeared to be practically the same as one that they came across in certain provisions for high-frequency current in connection with wireless telegraphy. Fig. 1 was practically the phantom circuit arrangement used in telegraphy, where they got two circuits acting as three as the result of one acting upon the other. The craving for simplicity could be carried too far, and he thought the cascade motor had a niche of its own to fill. The complication was more imaginary than real.

Mr. Hunt, in replying, said Dr. Pohl's criticism brought the question down really to a matter of squirrel-cage machine *versus* cascade machine. He had never attempted to say that the cascade machine was the best possible under all conditions. It had a special field under conditions where the slip-ring motor might give a considerable amount of trouble, especially in quarries and mines, where it was constantly replacing motors of the slip-ring type. The squirrel-cage motor had an ideal construction. They could not have anything simpler, but it was an absolute fallacy to push it in large sizes and where they had to start against considerable torques. Many used under such conditions had had to be pulled out and slip-ring motors put in their places. As to the safety of the insulation, there was a large number of parallel circuits in the motor, so that they always had a very low voltage. He had never known a case of the motor running up to non-cascade speed; in actual operation it was an utter impossibility for the machine to attain a high speed. These motors had been wound up to 3,000 volts, and there had been no difficulties at all. It was found in actual practice that the machine would operate with the rotor very badly out of the centre, owing to the parallel windings, because it was capable of balancing the effects of the uneven wear. The power factor of the cascade motor was up to the average, and in some cases it was above the power factor of other motors of the same H.P. As to the two-speed motor for fan driving, the position was that at one speed it was connected in mesh, and in the other in star, so that it was possible to take a standard 120-H.P. motor and turn it into a fan motor, and change the connections, so that they did not lose any advantage with the two-speed motor, except that there was the little extra expense of the winding. Of course, the ratios in the speeds were fixed. The cascade motors had been very largely put in for driving fans. The cascade machines were actually cheaper to make than the ordinary machines, because there was very little copper in them. Mr. Creedy's idea of an internal-cascaded commutator was a very fascinating one.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A Special Tool for Armature Banding.

The illustrations show a special equipment for armature banding, which, although capable of use in connection with any method of rotating an armature which has to be banded, is primarily designed to be used directly on a lathe taking the place of the tool post. It has been made by the United Engine and Manufacturing Co., of Hanover, Pa., and fig. 1 shows its external appearance completely assembled, fig. 2 indicating the interior construction of the mechanism. It will be seen that it consists of a main drum round which the banding wire passes, being guided to it by the three studs shown in fig. 1, immediately behind the drum. It then passes over a grooved pulley shown, to the armature which has to be banded. The large drum is subject to a retarding force inside the case, which is given as shown in fig. 2, by means of a metal strap covered on the inside with leather, the tension of which can be adjusted by means of a knurled-headed screw. The brake drum and the external wire drum are free to rotate with respect to one another, but inside the case is a reduction spur gearing, by means of which a magnification of the effect of tension exerted by the internal strap is obtained on the external brake drum. In this way a very strong retarding force is obtained. The complete tool is mounted on the lathe carriage by means of the removable rod shown in fig. 1, lying at the side of the tool, and in fig. 2 placed in position. Clamping arrangements are also provided for holding the band wire tight when the banding is finished until the armature banding operation has been completed and the wire can be severed.



Figs. 1 & 2.—Armature Banding Equipment.

A Simplex Interior Fitting.

Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., send us supplementary sheet T6, dealing with their well-known conduit system of electric wiring particularly adapted for use in factories, warehouses, &c., where girders are encountered. Amongst the items illustrated and described may be mentioned an

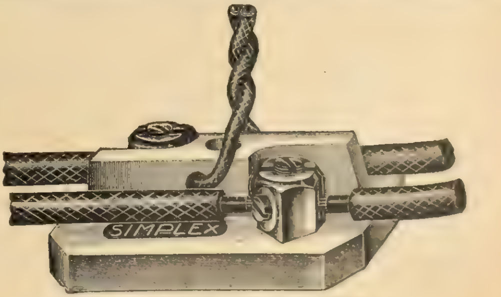


Fig. 3—Simplex Interior Fitting.

interlocking switch plug, watertight switch, girder clips for right angle and parallel runs of conduit, spacing saddles, &c., and an improved type porcelain interior, which we illustrate in fig. 3, and which is intended for use with standard types of rectangular junction boxes as a means of taking tappings off the main circuit wires or for connecting a flexible wire to a lighting point. The interior is double pole, and has two main terminals of unique design. These terminals are hexagonal in shape, and have a central slot, which slot is threaded internally to take a grub screw. The particular advantage of this type is that it is not necessary to actually sever the conductor to secure efficient connection. The insulation is bared back for the space of about ½ in., and the exposed conductor dropped into the slot and secured by the grub screw referred to. These terminals are of sufficient size to allow of a small cheese head screw being tapped into the side for connecting the branch wires. Copies of this leaflet can be had on application to any of the company's branches.

Half-watt Lamp Fittings.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, send us particulars of some new lanterns for half-watt lamps, which are specially adaptable to interior and exterior shop lighting. In designing these lanterns a special point has been made of ensuring an efficient system of ventilation, whilst they are also provided with an adjustable carrier to regulate the position of the lamp in the lantern. They are made of black, vitreous enamelled iron, and provided with an insulated shackle suspension.

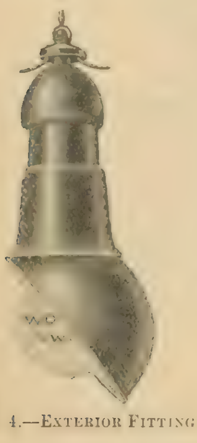


Fig. 4.—Exterior Fitting.

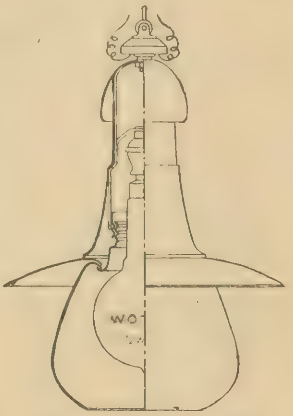


Fig. 5.—Interior Fitting.

One of these lanterns has a metal reflector of parabolic pattern, and is intended for the exterior illumination of shop windows; it will be seen that a maximum illumination is focussed in one direction, whilst the source of light is well screened from the eye on the opposite side.

The other lantern is fitted with a distributive type of metal reflector and an opalescent globe, which is open at the bottom; the effect is a soft diffusion of light without diminishing the floor illumination—at the same time being open at the bottom it aids the effective ventilation of the lantern.

The size of lantern for use with a 1,000-c.p. half-watt lamp is 19 in. × 14 in. A price list embodying these designs will shortly be issued.

BRITISH PRACTICE IN THE CONSTRUCTION OF HIGH-TENSION OVERHEAD TRANSMISSION LINES.

(*An abstract of paper read by* Mr. B. Welbourn *before the* Institution of Electrical Engineers, *see* Electrical Review, *pp.* 114, 127 *and* 202.)

Discussion at Edinburgh.

Mr. MacLeod (Glasgow) said that the delay in getting an overhead line approved was a most serious handicap to power development. In his opinion the Board of Trade and the Postmaster-General's requirements could quite well be met by the issue of suitable regulations framed on similar lines to those recently issued by the Home Office, specifying the requirements of the two departments. Detailed constructional plans, approved and certified, might be held as evidence of their consent, and as such could be submitted to the local authority; such plans could be approved for a period of five years, unless revoked earlier. It seemed unnecessary that the same formality should require to be gone through for every new line. It was particularly gratifying to note the remarks by Mr. A. P. Trotter in favour of carrying overhead lines alongside public highways. These remarks augured well for relaxing the stringency of the Board of Trade Regulations governing the angle at which a public highway might be crossed. In some cases it was necessary to use underground cable for road crossings on account of its being impracticable to meet the conditions for an overhead crossing. The success of an overhead line depended almost as much upon its position as upon its construction, and due allowance must be made for the fact that in the United Kingdom the prevailing wind in stormy weather was south-westerly in direction. If through ignorance or neglect of this fact an engineer built a line immediately to the northward of a tree or plantation, when a gale come along, small branches were detached from the swaying trees and carried bodily sometimes 15 or 20 yards, and deposited across two or more of the conductors. This factor was so important that it ought to be laid down as a standing regulation that no high-tension line should be carried past the north side of a tree or plantation at a less distance from it than 40 yards. The split conductor system as applied to overhead construction had very little to commend it, for the reason that for a given total sectional area of line, one must of necessity use double the number of insulators that would be required if only one circuit were employed, thus doubling the risk of failure. For three-phase overhead construction he was of opinion that a single set of conductors with Merz-Price balanced protective gear, employing bare pilot wires, was hard to beat. It seemed to him to be inherently bad practice to attempt to carry more than one circuit on any given pole line on account of the great risk of fatal accidents. Celluloid envelopes for attachment to the top of insulators were used very much all over the Continent. In practice it was a matter of great difficulty, without some such device, to locate punctured insulators. As soon as the line went to earth the celluloid cap was burned up. For a while the Clyde Valley Power Co. were very much troubled with punctured insulators, and at first were inclined to blame the make of the insulators, but they found by careful observation that the cause was unequal expansion in the insulator itself. After a spell of warm weather, when the long steel arms were baking in the sunshine of a warm day, it was found that the heat was conducted from the arms to the steel pins, which were maintained at a high temperature. When the cool breeze came along internal pressure was set up, and it was only a question of time before fissures began to develop in the internal structure, and led to a failure. They had had as many as six punctured insulators in a stretch of a mile. The terminal pole arrangement shown seemed to be liable to disturbance from birds settling on or about the choke coils. On the lines he was responsible for, the bird trouble had been effectually overcome by the use of treble insulation on all terminal and turning poles.

Mr. Seddon said that if they were to realise the scheme for utilising the series of locks from Fort William to Fort Augustus they would have a transmission system to rival those of their Continental friends. In comparing the relative costs of the two systems the author had been too conservative in calculating the price of cables. When a new road was started there was a temptation to lay down more copper than was wanted in the immediate future. The money spent thus would be outlying capital for many years, though it might be found a good enough investment if the business had a great and rapid extension. He asked if concrete poles were unsuitable and what objections there were to earthing one phase of the line. It seemed to him that this would considerably cheapen the structure, as only two insulated wires would be required and the line would then take the place of the earth wire. Arrester horns were likely to gather dust inside, and he found that charging the horns every day for dislodging the dust obviated hand-cleaning.

The Chairman asked—in connection with the tables on the cost of overhead in comparison with underground cables—how the latter cable was laid, directly in the ground or in troughing. That had an important bearing on the cost of the work. He had some time ago to make an estimate comparing the cost of an underground cable with overhead construction for a distance of over three miles, with a particular size of conductor, working at 10,000 volts, and the cost of the cable laid in the ground was £1,250, but the cost for the overhead line was only £620, being much less than Mr. Welbourn's estimate. In this particular case there was no question of paying for wayleaves. He thought Mr. Welbourn had capitalised the annual value of the wayleave rental. While they would like to get some standard system for overhead construction which all would approve of, it was difficult to see how that could be done, in view of the rapid development in the contrivance and also in the construction of these lines. Regarding the non-accumulation of snow on overhead aluminium wires when these were kept alive, he heard it suggested the other day that the fact that oxide of aluminium was a non-conductor of electricity might have something to do with it.

Mr. Welbourn, in reply, said the figures referred to by the chairman were necessarily representative of the general case. They were taken from actual existing contracts which represented average conditions. In this particular case the overhead line price included the price of wayleaves, and it was perhaps higher than in the case cited by the chairman, because lead-covered cables were included. The Canadian engineers were emphatic that aluminium did not gather snow, while he knew an aluminium line in this country which collected sleet and snow. It was an electrostatic effect. As to getting rules from the Board of Trade to cover lines for five years, he thought it would be rather unwise, in view of the number of changes taking place, to tie one's hands for five years. In five years they had got away from those frightful contraptions the Board of Trade required, and in five years more they might get away from guard wires altogether. In connection with reinforced concrete poles, so far as he knew these had not been used on high-tension, but he knew of two on low-tension systems.

One of these was in a chemical works where neither wood nor steel would stand, owing to the gases, but the results had not been good. The concrete had started to peel, and water had run down the poles, and they looked very bad indeed. He thought objections would be raised by the post office and railway companies to the earthing of one phase of a three-phase system.

LEGAL.

Marconi v. Helsby Wireless Telegraph Co.

This case was mentioned to Mr. Justice Joyce on Monday, upon an application by the defendants that it should be heard with an assessor.

Mr. Terrell, for the defendants, said the application was made under Sec. 31 Sub-Sec. 1 of the Patents Act, 1907, which provided that "In an action or proceedings for infringement or rectification of a patent the Court may if it think fit and shall at the request of either of the parties call in the aid of an assessor to try the case wholly or partially with his assistance."

His Lordship: Has this ever been done?

Mr. Terrell: On the request from the parties., No. But it has been done by the Court in one case. Counsel added that he doubted whether this case might not prove even more complicated than the one recorded case in which an assessor had been called.

His Lordship: It is quite clear that in this case you must have shorthand notes not only of the evidence but also of the arguments.

Mr. Terrell: I am not prepared on behalf of my clients to pay a share of the costs.

His Lordship: But a patent case like this cannot be tried without.

Mr. J. Hunter Gray, for the plaintiff, opposed the application, saying that for 31 years the Courts had been trying patent cases, and this was the first instance of such an application. Moreover, there was no information before the Court on which it could get a specially qualified assessor.

His Lordship: Who the assessor is to be is a different question, but at present I am only considering whether there is to be one.

Mr. Hunter Gray: My friend is asking you to appoint one now.

His Lordship: I shall order that this case be tried with an assessor. You may now go away and try to agree on one. If you make up your minds that you won't agree to anybody, then I must try to find some one myself, with such assistance as I can get.

Morgan Crucible Co., Ltd., v. Electrical Engineering and Equipment Co., Ltd.

This action, in which judgment in default of appearance by defendants had been given in the previous week, was mentioned again to Mr. Justice Eve in the Chancery Division on February 19th.

Mr. Hunter Gray, for the plaintiffs, said there had been some irregularity of service, and he could not sustain the order.

His Lordship: Very well. The order will not be drawn up.

Crompton & Co., Ltd.

[*The Rights of the Debenture-Holders.*]

In the Chancery Division on Monday, February 23rd, Mr. Justice Warrington heard a motion in the debenture-holders' action brought by Player and another against Crompton & Co., Ltd., and others. The motion asked for the appointment of a Receiver.

Mr. Clauson, K.C., and Mr. J. F. Carr represented the plaintiffs; Mr. Younger, K.C., Mr. Gore Browne, K.C., and Mr. H. E. Wright, were for the defendant company; and Mr. Douglas Hogg appeared for Mr. Ivor Bevan. Mr. Bevan is the trustee of a trust deed to secure the debentures.

His Lordship said the motion was one of an ordinary nature for the appointment of a Receiver. The question raised was whether the plaintiffs were entitled to maintain the action for the realisation of their security. It had been held in defence that the money was not payable because no event had happened such as would put the plaintiffs into a position to be entitled to realise their security. The plaintiffs held debentures issued by Crompton and Co., Ltd., in 1895. These debentures were further secured by a trust deed of January 26th, 1895, the trustee being Mr. Ivor Bevan. Last June Crompton & Co., Ltd., passed a resolution for the voluntary winding up of the company for the purpose of reconstruction. Subsequently the business and assets of the mortgagor company were transferred to the last defendants, who were a company bearing the same name. Since the new company had taken over the old company's assets, the former company had executed a supplementary trust deed giving to the debenture-holders a specific charge on certain assets not included in the original trust deed. What was more material, they created a new floating charge upon the assets of the new company. A very large number—probably the bulk of the debenture-holders—had accepted that arrangement. Plaintiffs were the minority, and some said they were not bound by that arrangement, and the security they originally had was a floating security which had now crystallised. They held that they were now entitled to an order for realisation. The debenture stated that the principal moneys should become immediately payable if the company made default, or if an order was made or any resolution was passed for winding up the company otherwise than for the purpose of reorganisation, reconstruction or amalgamation, or if an order was made appointing a Receiver. In his Lordship's opinion the plaintiffs were entitled immediately to sue and maintain an action and to obtain judgment when the proper time came. Plaintiffs under the circumstances, asked for the appointment of a Receiver. Defendants quite truly said the new company was a prosperous company, and that the arrangement proposed was perfectly honest, and that he ought not, at the instance of plaintiffs and a minority, to appoint a Receiver. They said the appointment might damage the company. His Lordship said the right to the appointment of a Receiver was one of the ordinary rights accruing to a mortgage and especially to an equitable mortgagee who had no means of taking possession and whose security was realisable as one of the steps in the realisation. He thought therefore that plaintiffs were entitled to a Receiver. Inasmuch, however, as the company was a prosperous company, and to immediately put a stranger in possession of the assets might do some damage, his Lordship thought he might quite properly while making an immediate appointment, direct the Receiver not to give security or take possession of the assets until the expiration of a certain period.

Mr. Clauson said he was prepared to accede to a suggestion from the other side. This was to refer it to chambers to appoint a proper person, the order not to be proceeded with for six weeks except by the judge's order or by consent.

His Lordship made the order in those terms.

Metallic Seamless Tube Co. v A. W. Perot.

According to a report in the *Englishman*, this case was before the Calcutta High Court in January before Mr. Justice Chitty, when Mr. Brandt applied on behalf of the plaintiffs for an order for a consent decree. The plaintiff company carry on business in England, while the defendant is an electrical engineer and carries on business in Calcutta as A. W. Perot & Co. The present suit was filed in May, 1912, to recover Rs. 17,340, being the price of goods sold and delivered by the plaintiffs to the defendant. The parties were now agreed that the suit should be compromised and that a consent decree be passed, the defendant having undertaken to pay to the plaintiffs Rs. 6,363 in full satisfaction of their claim.

Mr. J. V. Watkins, having consented on behalf of the defendant, His Lordship granted a consent decree for Rs. 6,363.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

AUSTRALIA.—The Inter-State Commission, to which reference has been made in previous issues of the Electrical Review, have received applications for further tariff assistance in the case of the following, the existing rates for which under the preferential tariff for British goods are quoted:—

Petrol engines	20 % ad val. (no preference).

Applications for reduction of present duties or opposing suggested new duties have been made for the following goods:—

Generators for direct coupling to steam engines—	
Up to capacity of 200 H.P.	20 % ad val.
Over the capacity of 200 H.P. ...	12½ % „
Telephones, telephone switchboards and appliances (opposition to preference)	Free (no preference)
Electric metallic-filament lamps and electric incandescent lamps	10 % ad val.

Application for imposition of duties on iron and steel and other wire now free of duty and applications for the extension of the tariff preference to British goods in the case of the following goods have also been received:—

Engines, superheated steam, semi-stationary and crude oil engines ...	20 % ad val. (no preference)
Electric cable and wire (covered) ...	Free
Iron and steel wire	Free

These applications will be considered in due course.

SOUTH AFRICA.—H.M. Trade Commissioner has forwarded information as to certain further rulings which have been made regarding the new regulations for the declaration on invoices, of the home consumption value of goods imported into South Africa.

The Commissioner of Customs states that, with reference to the production of invoices showing home consumption values, in all cases where such invoices are not presented, deposits will be taken sufficient to cover duty on a 25 per cent. increase of the prices invoiced to the importer, pending the production of invoices showing the required particulars. It is further stated that, in cases of difference between the home and export selling prices, if the home selling value is greater than when for export, the seller must give the price he can obtain when selling for home consumption, which is required of him. Unless, therefore, the manufacturer does give the higher value he obtains in his home market, the importer renders himself liable to a penalty for incorrect declaration, and the possible forfeiture of his goods. It is the intention of the Customs Department to check the accuracy of the declarations by actual inquiries in Europe. With regard to the value of goods on which duty is payable being either that at the place of purchase or free on board, the Customs Department have issued a Regulation to the effect that when a purchase is made by an importer (which includes his agent) *bona fide* inland, the railage to the port of shipment, if shown separately on an invoice or by a separate debit note, may be deducted for the purpose of arriving at the "true current value" as defined by law. The onus of proving the true place of purchase and the correctness of the deductions will rest with the importer. Ordinarily, the place where the invoice is made will be taken to be the place of purchase.

ICELAND.—A new tariff law recently passed provides for a duty of 2 öre per kg. on goods imported into Iceland other than those admitted free of duty or specially referred to in the tariff. This rate will apparently be applicable to electrical and similar goods. The law came into force on January 1st.

100 öre = 1s. 1⅓d.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

3,318. "Trolley heads for electric tramcars, locomotives, rope railways, and the like." L. Johnston and G. W. Green. February 9th.

3,323. "Device for preventing the removal of electric lamps." C. Wharram. February 9th.

3,324. "Incandescent electric lamps." J. F. Newton. February 9th.

3,328. "Securing arrangement for electric cables." St. Helens Cable and Rubber Co., Ltd., and J. C. White. February 9th. (Complete.)

3,336. "Protecting device for use with electric tramway carriages." T. Tiling. February 9th.

3,342. "Incandescent electric lamps." G. Hookham. February 9th.

3,358. "Machine telephone switching systems." Western Electric Co., Ltd. (F. T. Woodward, Belgium.) February 9th.

3,359. "Machine telephone switching systems." Western Electric Co., Ltd. (F. T. Woodward, Belgium.) February 9th.

3,360. "Impulse control systems." Western Electric Co., Ltd. (F. T. Woodward, Belgium.) February 9th.

3,371. "Systems of and apparatus for the wireless electrical operation at distance of a type-printing machine." Franceso de Bernochi. February 9th. (Convention date, March 15th, 1913, Italy.) (Complete.)

3,385. "Switches for controlling electric motors." British Thomson-Houston Co., Ltd., A. P. Young, and E. Garton. February 9th.

3,393. "Dynamos for generating electric currents." D. Suchostawer and J. O. Oxley. February 9th.

3,431. "Devices for preventing disconnection of electric lamps from bayonet-type sockets." E. C. R. Marks. (P. H. Powell, New Zealand.) February 10th.

3,455. "Centrifugally regulated dynamo-electric clutch." W. Morrison. February 10th. (Complete.)

3,458. "Telephone and telegraph recording devices." C. Walton. February 10th.

3,521. "Electrical damping-out or discriminating relays and the like." W J. Healy and P. S. Wentworth. February 11th.

3,530. "Universal electrical switch." L. Beretta. February 11th. (Complete.)

3,538. "Electrically-operated reciprocating apparatus." T. F. Wall. February 11th..

3,552. "Electric train or tram control systems." J. R. Beard and W. L Shand. February 11th. (Complete.)

3,583. "Contact-breaker device for electromagnetic vibrating members." A. H. Maitre and V. H. G. Martin. February 11th. (Convention date, February 20th, 1913, France.) (Complete.)

3,587. "Electric measuring instruments." L. C. Benton. February 11th.

3,589. "Alternating current machines and the like." R. B. Ransford. (Compagnie Universelle de Télégraphie et de Téléphonie sans Fil, France.) February 11th.

3,590. "Alternating-current machines, transformers, and similar apparatus." R. B. Ransford. February 11th. (Compagnie Universelle de Télégraphie et de Téléphonie sans Fil, France.)

3,591. "Method of regulating the length of electric waves in wireless telegraphy and telephony." R. B. Ransford. February 11th. Compagnie Universelle de Télégraphie et de Téléphonie sans Fil, France.)

3,592. "Wireless telegraph or telephone transmitters." R. B. Ransford. February 11th. (Compagnie Universelle de Télégraphie et le Tèlèphonie sans Fil, France.)

3,593. "Wireless telegraph and telephone transmitters." R. B. Ransford. February 11th. (Compagnie Universelle de Télégraphie et de Téléphonie sans Fil, France.)

3,594. "Electric current collectors" Allgemeine Elektricitats Ges. February 11th. (Convention date, February 12th, 1913, Germany.) (Complete.)

3,596. "Current-collecting devices for dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. February 11th.

3,615. "Terminal or attachment fittings of electric conductors." H. Edmonds. February 12th.

3,643. "Construction of electric pocket-lamp dry batteries and outer shell or case containing the aforementioned dry batteries." J. S. Hamilton. February 12th.

3,649. "Electric switches." Igranic Electric Co., Ltd. February 12th. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

3,650. "Electric circuit controlling devices." Igranic Electric Co., Ltd. February 12th. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

3,654. "Electrolytic apparatus." I. H. Levin. February 12th. (Convention date, May 9th, 1913, United States.) (Complete.)

3,658. "Working or controlling electrical machinery." Siemens Bros. Dynamo Works, Ltd. February 12th (Siemens-Schuckertwerke G.m.b.H., Germany.) (Addition to 1,716/10.) (Complete.)

3,696. "Fuse device for electrical circuits." F. [illegible] Schweitzer and N. J. Conrad. February 12th. (Complete.)

3,699. "Electro-magnetic relays. Western Electric Co., Ltd. February 12th. (F. T. Woodward, Belgium.) (Complete.)

3,701. "Rotary electric switches." M. K. Ownbey. February 12th. (Complete.)

3,702. "Incandescent lamp socket." H. Marks and S. Helsel. February 12th. (Complete.)

3,706. "Switches." W. W. Dean. February 12th. (Convention date, February 18th, 1913, United States.) (Complete.)

3,722. "Electrical heating-apparatus." A. F. Berry. February 12th.

3,742. "Relay mechanism for multiplex printer." D. Murray. February 13th.

3,750. "Electrical regulator." F. J. Gray. February 13th.

3,756. "Ignition devices for internal combustion engines." W. Peck. February 13th. (Complete.)

3,763. "Apparatus for drawing wire." E. Buckler, legal representative of E. Buckler, deceased. February 13th.

3,818. "Thermal contact device for electric circuits." B. Jeidel, *née* Hendel. February 13th. (Convention date, December 5th, 1913, Germany.) (Complete.)

3,831. "Systems of electrical distribution. British Thomson-Houston Co., Ltd. February 13th. (General Electric Co., United States.)

3,832. "Brush-holder and plug contact for use with magneto-electric ignition apparatus." Unterberg and Helmle. February 13th. (Convention date, December 4th, 1913, Germany.) (Complete.)

3,835. "Electric furnaces." Soc. Electro-Metallurgique de St. Beron. February 13th. (Convention date, February 20th, 1913, France.) (Complete.)

3,840. "Wireless telegraphy signal-receiving apparatus." W. A. Benton and W. C. Loynes. February 14th.

3,858. "Induction motors." W. Hartnell and D. D. Rayner. February 14th.

3,861. "Signalling-appliance of the electrical type for use in connection with colliery winding-engines." A. J. Routledge. February 14th.

3,881. "Method of and means for effecting adjustment of length in running electric cables." H. S. Hele-Shaw. February 14th.

3,900. "Mounting bracket for switches and the like." A. Heckt. February 14th. (Convention date, February 14th, 1913, Germany.) (Complete.)

3,902. "Circuits for semi-automatic telephone exchanges." Siemens Bros. & Co., Ltd., E. A. Laidlaw, and W. H. Grinsted. February 14th. (Complete.)

3,912. "Arrangements for regulating the phase displacement between the main current and voltage fields of a Ferraris meter. Allgemeine Elektricitäts-Ges. February 14th. (Convention date, February 15th, 1913, Germany.) (Complete.)

PUBLISHED SPECIFICATIONS.

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29,531. Gyrostatically-Controlled Moving Body. J. G. Gray. December 23rd. (Cognate Application, 1,373/13.)

1913.

1,658. Means for Forming Clay Banks Employed in the Manufacture of Insulators and other like Articles. W. Podmore. January 21st.

1,895. Switch for Electric Lighting on a Small Scale. Electromechanische Industrie Ges. & F. Herrmann. January 23rd.

1,915. Manufacture of Tungsten. British Thomson-Houston Co. (General Electric Co.). January 23rd.

1,990. Dynamo Machines for Constant Output at Varying Speeds. W. G. Lee and P. J. Oldfield. January 24th.

2,372. Electric Safety Lamps for Mines and the Like. T. Attwater. January 29th.

2,469. Storage Battery Charging. I. J. Simon, A. F. Roberts, & E. H. Chadwick. January 30th.

2,588. Time Mechanism for Operating Electric Switches, Gas Valves, and the Like. G. O. H. Horstmann, E. H. Horstmann, A. Horstmann, S. A. Horstmann, & W. T. Edgar. January 31st.

2,757. Electrical Switches. William McGeoch & Co. and W. T. Reynolds. February 3rd.

2,918. Transmitting Apparatus for use in Wireless Telegraphy and Telephony. G. Marconi. February 4th.

2,919. Transmitting Apparatus for use in Wireless Telegraphy and Telephony. G. Marconi. February 4th.

3,445. Process for the Manufacture of Iron Particularly Applicable for use in Dynamo Machines, and for Like Purposes. W. Rubel. February 10th.

3,462. Electric Switches. British Thomson-Houston Co. (General Electric Co.). February 10th.

3,684. Electric Motor-Control Systems. British Thomson-Houston Co. (General Electric Co.). February 12th.

4,425. Signalling Apparatus on Tramcars and the Like. R. Heaton. February 21st.

4,472. Electricity Prepayment Meters. British Insulated & Helsby Cables, Ltd., & L. B. Wilson. February 21st.

5,013. Generators of Electric Current for Ignition Purposes. G. A. Vandervell & A. H. Midgley. February 27th.

6,000. Preparation of Acetaldehyde. Consortium für Elektro-Chemische Industries Ges. March 11th. (May 22nd, 1912.)

6,285. Regulation of Dynamo-Electric Machines. British Thomson-Houston Co. (Compagnie Francaise Thomson-Houston). March 13th.

7,137. Manufacture and Production of Soluble Condensation Products of Formaldehyde. J. Y. Johnson (Badische Anilin & Soda Fabrik). March 25th.

7,722. Incandescent Electric Lamps. T. W. Lowden. April 2nd. (Addition to 1,180/12.)

8,267. Track Contact Devices for Electric Tramway and Like Vehicles. A. Helfenstein. April 8th. (April 13th, 1912.)

8,464. Electrically-Driven Clocks. P. A. Bentley. April 10th.

11,960. Electrical Connectors of the Plug and Socket Type. A. P. Lundberg, G. C. Lundberg, P. A. Lundberg & G. Pegg. May 22nd.

12,638. Controlling of Electric Clocks. F. Federico & L. Segalin. May 30th. (May 31st, 1912.)

14,035. Supplying of Energy to Radio-Telegraphic Antennae. E. Girardeau. June 17th. (June 17th, 1912.)

14,799. Starting Devices for Explosion Engines. G. Lecocq & E. Van der Aa. June 26th. (March 8th, 1913.)

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1914 EDITION

NOW READY.

H. ALABASTER, GATEHOUSE & CO.,

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THE I.M.E.A. BILL.

ELSEWHERE in this issue we print the full text of the Bill which is about to be introduced into Parliament on behalf of the Municipal Electrical Association, and which will no doubt be prominently before the electrical world during the next few months. It represents, we believe, the utmost lengths that the Association is prepared to go in the direction of concession and conciliation, in order to establish a lasting peace with the electrical contractors, and to bring to an end the constantly recurring combats between the two parties, both of whom have so much to gain and nothing to lose by making peace. Even with a favourable House of Commons, the Association has hitherto failed to carry the Bill that it would prefer through both Houses to the goal of Royal Assent; now, we rejoice to see, the spirit of compromise has prevailed, and a genuine attempt has been made to arrive at a middle course which will free the hands of the supply engineers without sacrificing the interests of their colleagues—to convert the feud into an honourable alliance.

That is a consummation devoutly wished by all, and by none more than ourselves; we have long urged the contending parties to come to terms and join their forces against their common rivals, and we hope ere long to witness that happy combination. But we have heard only one party to the bond: what will the contractors have to say to the Bill? We understand that as we go to press with these lines, they are deliberating upon the proposals contained in the Bill, and their decision will not be known in time for detailed comment, though, perhaps, we may be able to record it in our "Notes."

It will be seen that the commencement of the Bill is similar to that of last year, but in Clause 4 are introduced a number of provisions intended to meet the case of the Electrical Contractors. The latter are given the right to make use of the municipal showrooms, and to receive the trade discount upon any fittings they may sell on behalf of the municipality [" fittings " here means " fittings, apparatus and appliances for lighting, heating and motive power," &c. (see Clause 1 (1))]; they are to receive commission on other business introduced by them, and are protected against unfair cutting of prices; and the municipal authority is inhibited from executing the wiring of private property except through the agency of the contractors. The supply authorities, on the other hand, are protected against the formation of a ring amongst the contractors to whom they must entrust such work, and both parties are provided with a ready means of resorting to arbitration on any points of disagreement. Most of the other clauses are practically identical with those of last year's Bill, but a new clause is inserted to protect the property of contractors against distraint upon premises where it is let on hire under agreement with the supply authorities.

While the provisions of the Bill are doubtless capable of improvement in detail, it is difficult to see upon what grounds the contractors can take exception to the terms proposed as a whole. That they should claim a monopoly of all transactions other than the bare supply of electrical energy is hardly conceivable, in view of the fact that Parliament has already authorised many local authorities to carry on such business, and has thereby sanctioned it in principle. Indeed, seeing that the local authorities have been encouraged by Parliament to embark upon the business of trading in electricity, it is but reasonable that they should be placed in a position to carry on the business on commercial lines. The grant of powers to let out on hire motors, radiators and cooking apparatus, is a crying need and cannot be withheld. If the contractors were in a position to do this themselves, their opposition might have a better chance of success, but it is notorious that they cannot do it, and, moreover, it is very questionable whether they really wish to do it. Generally speaking, it is to the contractor's advantage to complete a job and be done with it; he does not desire to lock up his capital in motors and cookers as an investment, perhaps a speculation, and, unfortunately, he often has not capital at command to tie up in that way. This branch of the business is certainly better in the hands of the municipality, which by making large contracts can secure terms far better than those obtainable by individual contractors, dividing the business between them. On the other hand, the Bill clearly contemplates that contractors who have the will and the means shall be enabled to enter the hiring field if they wish, in co-operation with the municipality, and they have the power to do it on their own account in any event.

What is there to be said against the Bill? The old and weighty argument at once comes to mind—that rate-aided competition with ratepayers is not just—and that argument cannot be refuted. The local authorities stand to gain extended trading powers in various directions, with the one exception of wiring on "private property"—a phrase which may be construed to exclude public buildings. Provisions are made, no doubt in good faith, to protect the contractor against unfair competition, such as the requirement that the department concerned shall not be run at a loss, and that its accounts shall be separately shown in the published accounts of the undertaking, as well as other provisions referred to above; but he may regard these as illusory and ineffective. On the other hand, the contractor is guaranteed the bulk of the wiring, with which in many cases will go the fixing and maintenance and a large proportion of the sales. He will be brought directly into contact with the consumer, and will have the opportunity of pushing his own business. On such lines as these a *modus vivendi* has been found at St. Marylebone, for instance, and similar understandings have been arrived at in other places where the municipalities possess hiring and wiring powers.

We have always defended the just rights of the contractor; but we are not bigoted in his favour, and we believe he will be consulting his best interests if he endeavours now to arrive at a friendly understanding with the supply engineers—for he may never again have so favourable an opportunity of securing satisfactory terms.

The Copper Market.

The Copper Market has not been in a very cheerful mood lately, being affected not only by unfavourable internal conditions, but also by adverse outside circumstances, which together conspired to produce a feeling of unsettlement among the consuming trades, as well as amongst speculative interests. While generally the statistical position has within the past month tended to improve slightly (at all events the American position seems to have cleared up moderately), it will require some little time before confidence can be re-established as regards the progress of consumption in the United States. This, indeed, is really the key to the entire situation. American takings of copper by consumers have for several months been very seriously curtailed, having, indeed, been so small as to lead to the conclusion being formed in Europe that the copper consuming industries of America had relapsed into a state of practical stagnation, the mail reports received recently speaking in rather disconsolate terms regarding employment in the principal centres of the brass trade there. The phase may be merely a passing one, however, for every market has for some months now been in a rut of depression so far as industrial activity is concerned, which has been reflected probably with the greatest clearness in the iron and steel trades. The last few weeks, however, have witnessed some small improvement here, and there can be no reasonable doubt that if this is so, as seems probable, the United States steel trade is on the threshold of a period of increasing activity, and the stimulus to be derived therefrom will sooner or later be felt with full force in the copper market.

There is no doubt that consumption everywhere is on a reduced scale compared with last year, but even here there is a possibility of matters improving as soon as some of the exceptionally adverse conditions recently ruling have been cleared up, to which end the cheapness of money should be a direct incentive. As regards the external conditions to which reference was made above, one of the principal of these has been the serious rumours regarding the financial standing of a leading French banking house. Happily, the rumours appear to have been very much exaggerated, but they had the effect of quieting the speculative portion of the market, thereby adding to the trials of a position already fraught with considerable difficulty.

The prospects as regards production in North America seem to be favourable enough, and probably the current year will witness a further expansion in output, provided always that no serious labour troubles interfere with the progress of events as was the case during 1913, which indeed was a year of sporadic unrest, more especially in the United States copper refineries. The general outlook as regards prices is not calculated to justify hopes of very much higher figures than those recently witnessed, the tendency indeed being in favour of a gently fluctuating market, but a fresh basis is needed to harmonise with the altered conditions which have been recently put into force. Consumers meantime will probably continue to purchase material as they require it. While demands are slow there is at present no reason to anticipate any serious forcing of material upon the market by the leading American producers. Nevertheless, the protracted abstention of buying by consumers has at last impelled a more yielding attitude on the part of the leading American producers who, this week, have reduced their prices from £68 10s. for electrolytic to about £67, while it is considered likely that they would accept even less if firm business were offered. The European statistics for the last half of February did not disclose much alteration as regards the stocks, and whereas the visible supply has increased about 1,000 tons on the month, it arises entirely from larger quantities being afloat from Chile and Australia. The market is now awaiting with interest the next American returns which are due in a few days.

ELECTRICITY IN MINES.

The general report on Mines and Quarries for 1912, by Mr. Redmayne, Chief Inspector of Mines, contains a report by Mr. Nelson, H.M. Electrical Inspector of Mines, from which it seems that electricity was newly introduced into no fewer than 56 mines, as against 46 in the year 1911, and of these as many as 31 were in Scotland. It is remarkable that the Scottish collieries should lead the way to such an extent; as for the other 25, seven were in the Northern Division, nine in Lancashire, North Wales and Ireland, and nine in South Wales.

The Coal Mines Act of 1911 required a return to be made on January 21st, 1913, of the type and horse-power of electrical apparatus in use above and below ground, and a summary of this return as regards the horse-power is given below :—

	Surface. H.P.	*Underground.* H.P.	*Total.* H.P.
Scotland	19,014	79,343	93,357
Northern	46,333½	64,583	110,916½
York and North Midland ...	42,257½	45,615	87,872½
Lancashire, North Wales and Ireland	8,409¾	17,482¾	25,892½
South Wales	70,911¾	78,481¼	149,393
Midland and Southern ...	7,162	31,162½	38,324½
Total	194,088½	316,667½	510,756

Unfortunately, this table gives no indication of the proportion of electrical H.P. to the total H.P. used at the collieries, but it will be useful to show by comparison with future years the growth or, Mr. Nelson says, decline of the use of electricity in mines. We do not anticipate that there will be any decline; undoubtedly there will be a steady and continuous growth.

As regards accidents, Mr. Nelson reports that there were 12 fatal accidents, causing in all 14 deaths, all of which took place in coal mines. Eleven of these fatal accidents were due to electric shock, while the remaining one was due to an ignition of firedamp by sparks from an electric bell in use for signalling purposes.

In view of the fact that sparks from signalling wires were suggested as being the cause of the Senghenydd disaster, this report is both interesting and important. The accident occurred at Bedwas Colliery, near Newport, South Wales, and three men were fatally burned and nine others were injured by an explosion of firedamp.

> The colliery was a new one, consisting only of communication roads between two shafts and a level, driven about 140 yards in-bye from the upcast shaft. The ventilation was natural, assisted by a fan driven by compressed air, but at the time of the explosion the fan was ventilating only a rise heading, a turning off the main level about 35 yards from the shaft. The in-bye portion of the main level was ventilated by compressed air conveyed in a range of pipes 1 in. in diameter. A small haulage engine, also worked by compressed air, conveyed in a separate range of pipes, was fixed by the side of the main level, at a distance of about 80 yards from the shaft. About 7.15 a.m. four shots for blowing down the roof had been fired about 15 yards out-bye of the haulage engine, and *all the air pipes were broken by the rock blown down.* This destroyed the ventilation of the inner portion of the level. (The italics are ours).
>
> While the work of repairing the pipes was in progress firedamp accumulated at the face of the level, and gradually worked back to the haulage engine. Immediately before the explosion an electric signal bell at the haulage engine was heard to ring. One of the injured men said he was looking towards the bell at the moment, and saw a flash of flame, after which he was burnt, and could remember no more. The ringing of the bell was probably caused by the signalling wires being accidentally brought together by some men who were preparing places for doors further out on the level.
>
> The electric bell was an ordinary one of the trembler pattern, worked by an induction coil and a battery of eight Leclanché cells. Tested after the accident, the battery gave 11½ volts. It was afterwards proved experimentally that sparks from the bell, when supplied with current from the same battery, would ignite an *explosive mixture of coal gas and air*, and this was subsequently fired by sparks caused by rubbing a file across two wires connected to a pair of cells giving only 4 volts pressure. The coroner's jury found that the electric bell was responsible for igniting the firedamp, and there is no reason to differ from that conclusion. So far as I am aware, this is the first recorded case of a colliery explosion caused by sparks from an electric bell. Attention may perhaps be drawn in this connection to one of the General Regulations, which reads :—"In any part of a mine in which inflammable gas, although not normally present, is likely to occur in quantity sufficient to be indicative of danger, the following additional requirements shall be observed —
>
> "(1) All cables, apparatus, signalling wires and signalling instruments shall be constructed, installed, protected, worked and maintained so that in the normal working thereof there shall be no risk of open sparking."
>
> Several manufacturers have placed on the market signalling apparatus which fulfil adequately, I think, the above requirements.

The italics are ours, and in view of the fact that we are of the opinion that *firedamp* cannot be exploded by ordinary signalling apparatus, we may be excused for doubting the accuracy of the assertion that this accident was caused by sparks from an ordinary signalling bell. In the test Mr. Nelson states "coal gas," but it has, we think, been definitely proved that an explosive mixture of coal gas and air is *not* equivalent to firedamp, and what will fire the former will not necessarily fire the latter. We understand this question is being—or has been—fully investigated in connection with the Home Office inquiry into the Senghenydd disaster, and we await the issue of this report with interest. Meantime, however, we beg to differ from Mr. Nelson on his theory as to the cause of this accident.

As regards the electric shock accidents, Mr. Nelson says :—

> Of the 11 electric shock accidents above referred to, four took place on the surface and seven below ground. The two classes of accident will be considered separately, so that any conclusions it may be possible to draw shall have application to surface conditions and to underground conditions respectively. It may be remarked, in passing, that not since the year 1906 has the number of fatal electric shock accidents below ground been less than it was last year. The figures for the preceding five years may be of interest :—
>
> | 1907 | 1908 | 1909 | 1910 | 1911 | 1912 |
> |---|---|---|---|---|---|
> | 10 | 12 | 13 | 15 | 9 | 7 |
>
> When it is remembered that the use of electricity has greatly increased during the last five years, it is satisfactory to note that the number of fatal accidents has begun to show a downward tendency rather than the upward tendency, which appeared constantly until the year 1911. It is less satisfactory to reflect that of the seven fatal electric shock accidents which occurred below ground in 1912, at least *five might have been avoided by greater care in the maintenance of apparatus and stricter regard to the regulations.* (Again the italics are ours.)
>
> 1. *Surface Accidents.*—Of the four surface accidents, three occurred on medium-pressure alternating-current systems, and the fourth on a medium-pressure direct-current system. Two appear to have been due to working improperly on live apparatus with the full knowledge that the apparatus was live.
>
> The other two were due to misadventure in making contact with live parts. In one of the latter cases the victim made accidental contact with a bare trolley wire in boarding a charging machine from the top of a battery of coke ovens. In the other, the victim made accidental contact with a live switch in allowing his hand to rest vaguely on the switchgear controlling a haulage motor, of which he had charge. The latter was the accident which occurred on a medium-pressure direct-current system; the three first described were on medium-pressure alternating-current systems.
>
> (2) *Underground Accidents.*—Of the seven underground accidents, one occurred on a high-pressure three-phase alternating-current system, five on medium-pressure three-phase alternating-current systems, and the remaining one on a medium-pressure direct-current system. The circumstances of each of these accidents have been considered, with the result given by the following table :—
>
> TABLE XLIV.
>
> | | *Accidents.* | *Deaths.* |
> |---|---|---|
> | Due to :—(1) Faults as regards the earthing of outer coverings of apparatus, switchboard frames, &c. :— | | |
> | (*a*) Total absence of any connection to earth ... ... | 3 | 3 |
> | (*b*) Break in continuity of earth connection ... ... | — | — |
> | (*c*) Outer covering earthed, but connection with earth inefficient ... ... | 1 | 1 |
> | (2) Contact, direct or indirect, with live parts of cables :— | | |
> | (*a*) Direct contact with a live cable exposed through abrasion of the insulation ... ... | 1 | 1 |
> | (*b*) Contact with a conductor (a girder) made live by its contact with a live cable exposed through abrasion of the insulation ... ... | 1 | 1 |
> | (3) Accidental contact with uninsulated live parts of apparatus ... ... | 1 | 1 |
> | | 7 | 7 |
>
> The above table may be summarised thus :—

TABLE XLV.

	Accidents.	*Deaths.*
Due to:—(1) Contact with outer coverings of apparatus live through the absence of, or an inefficient earth connection	4	4
(2) Defective insulation of cable system...	2	2
(3) Contact with uninsulated live parts ...	1	1
	7	7

For the period between January 1st, 1905, and December 31st, 1912, that is to say, in eight years, electric shock below ground has been responsible for 69 recorded accidents and 71 deaths. I have carefully considered the available information in regard to all of these accidents (a large proportion were personally investigated by me), and they may, I think, justly be analysed as follows:—

TABLE XLVI.

	Accidents.	*Deaths.*
Due to:—(1) Contact with outer coverings of apparatus live through the absence of, or an inefficient earth connection...	32	34
(2) Defective insulation of cable system...	25	25
(3) Contact with uninsulated live parts...	10	10
(4) Other causes (misadventure)	2	2
	69	71

The above table clearly indicates the importance of maintaining earth connections, in particular, in an effective condition.

TABLE LXVII.—Summary of Fatal Electric Shock Accidents in 1912.

	Accidents.	*Deaths.*
Surface Accidents—		
(*a*) On three-phase systems—		
Low pressure	—	—
Medium pressure	3	3
High pressure	—	—
(*b*) On direct-current systems—		
Low pressure	—	—
Medium pressure	1	1
Underground Accidents—		
(*a*) On three-phase systems—		
Low pressure	—	—
Medium pressure	5	5
High pressure	1	1
(*b*) On direct-current systems—		
Low pressure	—	—
Medium pressure	1	1
	11	11

Of the accidents on the three-phase, nine in all, five accidents were on completely insulated systems and four on systems with the neutral point connected to earth. Of the 11 fatal electric shock accidents three occurred to trained electricians, three to coal-cutter attendants, and one each to a coke-oven attendant, a coal hewer, a fireman, a siding attendant, and a motor-driver.

Mr. Nelson also reports another non-fatal accident due to ignition of firedamp from the sparks of an electric signal bell, as follows:—"At the Caepontpren Colliery, Pontyates, South Wales, on November 1st, a mechanic was testing an electric bell fixed at a point in a slant 1,440 yards from the surface and about 110 yards from the coal face. At the time the test was being made there appears to have been firedamp in the air current, unknown, apparently, to the workmen. The mechanic stated afterwards that having brought the bell wires together, he saw 'flames above his head,' the roadway being, fortunately, about 7 ft. high. Four men who were all standing near the bell, within a few feet of each other, were burnt. The burns were reported to be 'slight' in each case."

Unfortunately, in this case no details of voltage, &c., are given, and it would appear as though all the evidence was accepted as given by the men themselves.

Two underground fires were reported to have been due to electricity in 1912.

The first took place at the Windsor Colliery, Abertridwr, South Wales, on July 30th, but it is reported that no damage was done. The fire was due to the overheating of a resistance grid, which ignited the insulating material on a cable leading to it. The fire was quickly extinguished.

The second fire occurred on October 21st at Bowhill Colliery, Fife, Scotland. In this case, a three-core bitumen-insulated armoured cable "burst into flame" at a joint. Some pit props which had in fact been placed on the cable to protect it during "brushing" of the roof caught fire, and it was some time before the fire was overcome. It was thought that a large stone had previously damaged the joint by falling on it.

Thirty-six non-fatal electric shock accidents causing injury to 36 persons were reported during 1912, 33 in mines under the Coal Mines Act, and three in mines under the Metalliferous Mines Regulation Act. In many cases the accidents were trifling in their results, but in four cases the victim was unconscious for some time. In one instance complete unconsciousness continued for half an hour, and artificial respiration had to be continued for a very long period before the victim fully recovered. A number of instances of successful resuscitation continue to be reported every year.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The B.E.A.M.A.

I enclose copy correspondence between the Secretary of the British Electrical and Allied Manufacturers' Association and this company, and trust that you may find space for it in your issue of next week.

James Gray.
Managing Director,
Electric Construction Co., Ltd.

London, E.C., *February 27th*, 1914.

[COPY.]

D. N. Dunlop, Esq., Secretary,
The British Electrical and Allied Manufacturers' Association,
King's House,
Kingsway, W.C.

Dear Sir.—The following is an excerpt from a letter which we have received this morning from one of our customers:—

"In conversation the other day the writer was told by ———— ————'s representative that he had received special instructions to do all that was possible to stop orders being passed to you, on account of your decision to remain outside the ring."

Similar information having reached us from various sources from time to time, I shall be obliged if you will inform me if the policy indicated is authorised or recognised by your Association towards one of its own members.

Yours very truly,
(Signed) James Gray,
Managing Director,
Electric Construction Co., Ltd.

9, New Broad Street, E.C.,
February 13th, 1914.

[COPY.]

The Electric Construction Co., Ltd.,
Dashwood House,
9, New Broad Street, E.C.

Attention of James Gray, Esq.

Dear Sirs,—I regret the delay which has occurred in answering your letter of the 13th inst., but investigation shows that it will be necessary for you to name (*a*) the town or district in which (*b*) the persons (and their official positions) between whom, and (*c*) the date upon which, the alleged "conversation" took place.

If you desire to refer more particularly to any of the other similar cases, I shall ask you to be kind enough to furnish the like particulars in respect of each of them.

As to the "policy indicated" being authorised or recognised by the Association: it does not appear that the actions of any one or two or half-dozen members afford a reason for assuming that a "policy" (*i.e.*, of the Association) is indicated. The policy of the Association is dictated by its Council; and while the Council is without official knowledge of any policy which might be indicated as above, it is not unsympathetic towards such action amongst members of the Association as, in their view, may lead to ultimate unanimity.

I am, Dear Sirs,
Your obedient servant,
(Signed) D. N. Dunlop,
Secretary,
British Electrical and Allied Manufacturers' Association.

King's House, Kingsway, W.C.,
February 20th, 1914.

[COPY.]

D. N. Dunlop, Esq., Secretary,
The British Electrical and Allied Manufacturers' Association,
King's House, Kingsway, W.C.

Dear Sir,—I duly received your letter of 20th inst. We would have no difficulty in establishing the accuracy of our information, but, in view of your letter, we do not think that any purpose would be served by further inquiries. Although your Committee may have no official knowledge of the practice of which we complain, you admit that "it is not unsympathetic," which means that the practice is at least recognised by the Council.

I need not remind you that the primary object of the Association, when extended two years ago, was to secure fair and reasonable general conditions of contract. It was not suggested that the fixing of minimum prices was to come within its scope, and we informed you why we could not concur in extending the Association's sphere of action in that direction.

The whole position having again been carefully considered by my board, we have come to the conclusion that we cannot remain a member of the Association, and now hereby tender our resignation.

I am sending our correspondence to the Press in order that our friends in the industry may appreciate the reason of our withdrawal.

Yours very truly,
(Signed) James Gray,
Managing Director,
Electric Construction Co., Ltd.

9, New Bond Street, E.C.
February 26th, 1914.

A Query.

In your issue of the 27th ult. I notice three letters in reply to an inquiry by "Ignoramus," on the question of obtaining a single-phase current from a three-phase supply by means of transformers. I also notice that you have yourselves supplied an Editorial note on the same matter.

I do not know whether "Ignoramus" wants the single-phase current for a lamp load, but if this were the case, and if an increase in the frequency did not matter, my frequency changer would, perhaps, meet the case in point, as it does not suffer from the disadvantages applying to the three other methods, viz.: That the loads are not distributed evenly over the three phases of supply, and also that it is necessary to use two or more independent secondary circuits and to keep the loads on these equal.

My arrangement, which uses static transformers, has the advantage that, no matter how severe the load, or what the variation may be in its power factor, it is distributed absolutely equally over the three phases.

A. M. Taylor.

King's Heath, *March 2nd*, 1914.

THE ELECTRIC LIGHTING BILL OF THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

We have received from the hon. secretary of the I.M.E.A., Mr. H. Faraday Proctor, a copy of the draft Bill "To give increased powers to local authorities with regard to electric lighting; and for other purposes connected therewith." The clauses are as follows:—

Powers of Undertakers to Provide Electrical Fittings.

1. (1) Any local authority authorised by Act of Parliament or provisional order to supply electricity (in this Act called "undertakers") may provide, sell, let for hire, and fix, repair, maintain, and remove, but shall not manufacture for the purpose of sale or letting on hire electric lines, fittings, apparatus and appliances for lighting, heating and motive power, and for all other purposes for which electrical energy can or may be used, in this Act called "fittings," and may provide all materials and work necessary or proper in that behalf, and with respect thereto may demand and take such remuneration or rents and charges and make such terms and conditions as may be agreed upon.

(2) Any undertakers may enter into and carry into effect contracts with any person for and in relation to the exercise of any of the powers conferred by this section.

(3) The exercise by any undertakers of the powers conferred upon them by this section shall be subject to the following restrictions:—

(*a*) The said powers shall be restricted to the undertaker's area of supply, and to their consumers or prospective consumers.

(*b*) The undertakers shall so adjust the charges to be made by them for fittings, or for the fixing repairing, maintaining or removal thereof, as to meet in the aggregate any expenditure by them under the powers of this section in connection therewith (including interest upon moneys borrowed for those purposes and all sums applied to sinking fund for repayment of moneys so borrowed).

(*c*) Every sum charged by the undertakers to a consumer in respect of the provision of fittings, or the fixing, repairing, maintaining or removal thereof, shall be separately stated on every demand note delivered by the undertakers to the consumer, unless such sum is included in the price charged by the undertakers for electricity.

(*d*) The total sums expended and received by the undertakers in connection with the purpose in this section mentioned in each year (including interest and sinking fund) shall be separately shown in the published accounts of the electricity undertaking of the undertakers for that year.

(4) With the view to securing co-operation between any undertakers exercising the powers conferred upon them by this section and persons carrying on the business of supplying fittings (in this Act called "Electrical Contractors"), the following provisions shall apply:—

(*a*) When the undertakers provide showrooms for the purpose of selling or letting fittings, they shall, at the request of any electrical contractor whose shop or place of business is situate within the area of supply of such undertakers, give to him when practicable reasonable facilities for enabling his customers whose premises are situate in the said area to attend such showrooms and to inspect the fittings therein.

(*b*) Any electrical contractor who shall, at the request, whether expressed or implied, of any undertakers, sell any fittings on their behalf, shall, subject to any agreement which may be made between them, be entitled to receive out of the purchase money paid to the undertakers, a sum calculated at the rate ordinarily allowed as discount in respect of such fittings by the makers thereof to electrical contractors, and based on the amount actually received by the undertakers in respect thereof.

(*c*) Any undertakers who pay a commission to the persons employed by them in respect of the sale or letting of fittings shall pay a commission at the same rate and under similar conditions to any electrical contractor upon whose introduction any fittings are sold or let by such undertakers.

(*d*) Undertakers shall not in the exercise of the powers of this Section sell any fittings at a less price than the price (if any) which is determined and enforced by the makers of such fittings as the minimum price for the sale thereof to the class of customer to whom such fittings are sold.

(*e*) Undertakers shall not themselves execute the wiring of private property, except between the main of the undertakers and the consumer's meter, but they may enter into contracts for the execution of wiring under Sub-Sec. 2 of this section, provided that:—

1. In making any such contracts for wiring, undertakers shall not in cases where there are more than one electrical contractor whose shop or place of business is situate in their area of supply give any undue preference to any electrical contractors.
2. No undertakers shall be subject to the restrictions contained in this paragraph in any case where there is not effective competition between the electrical contractors carrying on business in the area of supply of such undertakers in regard to the execution of contracts on behalf of the undertakers.

(*f*) Any question which may arise between any undertakers and any electrical contractor under this Sub-Section shall, unless otherwise agreed, be referred to an arbitrator appointed by the President of the Institution of Electrical Engineers, and the provisions of the Arbitration Act, 1889, shall apply to any such reference.

*2. (1) Any company authorised by Act of Parliament or Provisional Order to supply electricity may provide, sell, let for hire and fix, repair, maintain, and remove electric lines, fittings, apparatus, or appliances for lighting, heating, and motive power, and for all other purposes for which electrical energy can or may be used, and may provide all materials and work necessary or proper in that behalf, and with respect thereto may demand and take such remuneration or rents and charges and make such terms and conditions as may be agreed upon: Provided that nothing herein contained shall authorise a company to manufacture any such electric lines, fittings, apparatus, or appliances.

(2) Any electric lines, fittings, apparatus, and appliances provided by or on behalf of any such company on consumers' premises, and any lands, buildings, or works held by them in connection therewith, shall be deemed to form part of the undertaking of such company authorised by the Act or Provisional Order in pursuance of which they supply electricity.

Nothing in this Act shall be deemed to restrict the exercise of any powers possessed by a company by virtue of its memorandum and articles of association or of any Act of Parliament.

*3. Any undertakers may provide and maintain showrooms, promote and hold exhibitions, and exhibit electrical appliances, machinery, apparatus, or fittings, and may, by public advertisement or otherwise, publish and make known any matters connected with or affecting the sale of electricity, and may do all such other as acts they may deem expedient to assist, develop, or promote the use of electricity.

*4. Any undertakers may sell or otherwise dispose of any by-products incidental to the generation and distribution by them of electricity.

*5. Notwithstanding anything contained in the Electric Lighting Acts 1882 to 1909, or any Act of Parliament or Provisional Order authorising an undertaking, the maximum electrical power with which any person shall be entitled to be supplied by any local authority, company, or person authorised by Act of Parliament or Provisional Order to supply electricity in any area shall not include any supply of energy taken only on extraordinary occasions, unless he has agreed with such local authority, company, or person to pay to them such minimum annual sum as will give them a reasonable return on the capital expenditure, and will cover other standing charges incurred by them in order to meet the possible maximum demand for those premises. The sum to be so paid shall be determined in default of agreement by arbitration.

*6. The undertakers may, out of the revenue of their undertaking, pay reasonable subscriptions, whether annual or otherwise, to the funds of any association of local authorities, or of their officers, formed for the purpose of consultation as to their common interests and the discussion of matters relating to the supply of electricity, and may purchase reports of the proceedings of any such conferences or meetings, and may pay any reasonable expenses of the attendance of any members or officers of the local authority, not exceeding in any case four, at conferences or meetings of the said associations or any of them.

*7. In addition to the provisions contained in any Act of Parliament or Provisional Order relating to the application of the revenue received by any undertakers in respect of their undertaking, the undertakers may, if they think fit, instead of carrying the net surplus of such revenue remaining in any year, and the annual proceeds of their reserve fund when amounting to the prescribed limit to the credit of the local rate, apply the whole or any portion thereof to any of the purposes of their undertaking, including the formation of a fund for working capital:

Provided that the fund so formed shall not at any time exceed a sum equivalent to one-half of the gross annual revenue of the undertaking for the time being.

*8. (1) The undertakers may at any time borrow for the purposes of working capital in connection with their undertaking any sums or sums not exceeding in the whole one-tenth of the amount expended by them upon the purchase of lands and the construction of works for the purposes of the undertaking prior to the expiration of the period of three complete years after they have commenced to work the undertaking, or one-tenth of the amount which they shall have been authorised to borrow for the purposes of their undertaking prior to the expiration of that period, whichever amount shall be the larger.

(2) The provisions contained in the Electric Lighting Acts relating to the borrowing of money by local authorities shall apply to the borrowing of money by the undertakers under this section as if they had obtained the consent referred to in Sec. 8 of the Electric Lighting Act, 1882: Provided that—

(*a*) Any money borrowed under this section shall be repaid within 10 years from the date or dates of borrowing:

(*b*) It shall not be obligatory upon the undertakers to commence such repayment by means of a sinking fund or otherwise until the expiration of two years from the date or dates of borrowing.

*9. From and after the passing of this Act the provisions of the Conspiracy and Protection of Property Act, 1875, shall apply as if the words "electrical energy" were inserted in Sec. 4 (breach of contract by persons employed in supply of gas or water) of that Act after the word "gas," wherever that word occurs, and as if the words "electricity works" were therein inserted after the word "gasworks."

*10. (1) Any person who shall hinder an officer appointed by any local authority, company, body, or person from entering any premises in pursuance of Sec. 24 (Power to enter lands or premises for ascertaining quantities of electricity consumed or to remove fittings) of the Electric Lighting Act, 1882, or from exercising the powers contained in that section, shall be liable to a penalty not exceeding £5, and such penalty shall be recoverable in the manner provided by the Summary Jurisdiction Acts.

(2) Where any premises which any local authority, company, body, or person are entitled to enter in pursuance of Sec. 24 of the Electric Lighting Act, 1882, are unoccupied, any local authority, company, body, or person may, after giving not less than 48 hours' notice to the owner thereof, or if he is unknown to such local authority, company, body, or person, by affixing such notice upon a conspicuous part of the premises, forcibly enter the same, doing no unnecessary damage.

11. (1) In this section the word "consumer" means any company, body or person having an agreement with the undertakers for the supply of energy, and the word "contractor" means any company, body or person who has by contract with the undertakers let, or agreed to let, on hire, or disposed of, or agreed to dispose of, on terms of payment by instalments any apparatus and appliances to a consumer.

(2) All apparatus and appliances let on hire or disposed of on terms of payment by instalments by a contractor to a consumer, or which a contractor may have agreed to let on hire, or dispose of as aforesaid, and being in or upon premises to which the undertakers have agreed to give a supply of energy, shall at all times, subject to the terms of the contract between the contractor and the consumer, continue to be the property of the contractor and be removable by the contractor or by the undertakers at the request of the contractor, and, subject as aforesaid, the power to enter premises for the removal of fittings conferred upon the undertakers by Sec. 24 of the Electric Lighting Act, 1882, and the provisions of Sec. 25 of that Act, and of Sec. 16 of the Electric Lighting Act, 1909, shall extend and apply to all such apparatus and appliances so long as they remain the property of the contractor, as if the same were apparatus and appliances let by the undertakers on hire, or belonging to the undertakers within the meaning of such sections or any of them, provided that the distinguishing metal plate or distinguishing brand or mark required by the said Sec. 16, to be affixed to or impressed, or made on such apparatus and appliances sufficiently indicates that the contractor is the actual owner thereof, and that such apparatus and appliances are protected by virtue of this Act.

12. Any undertakers may lay down, take up, alter, relay, repair or renew in, across or along or out of any street, road or path laid out or made, but not dedicated to public use, within their area of supply, such pipes, cables, posts and apparatus as may be requisite or proper for furnishing a supply of electricity within their area of supply, in the same way and to the same extent, and (so far as they are applicable) subject to the same provisions as to the breaking up of streets and the laying down of electric lines, as if such street, road or path had been dedicated to the public use.

*13. The powers contained in Secs. 1, 2 and 3 of this Act may be exercised by any undertakers jointly with any other undertakers, or with any company, body or person.

14. (1) This Act may be cited as the Electric Lighting Act, 1914.

(2) This Act and the Electric Lighting Acts, 1882 to 1909, shall be construed together as one Act, and may be cited as the Electric Lighting Acts, 1882 to 1914.

* Substantially identical with clause in the Bill of 1913.

BUSINESS NOTES.

Book Notices.—*The Insurance* (1911) *Wages Calculator.* Compiled by J. S. Smith. London: St. Stephen's Advertising Agency. Price 2s. 6d.—This "ready reckoner up to date" shows the wages due for any number of hours, from 1 to 100 (including ½ hours), at any rate per hour from 1d. to 1s. 3d., rising by farthings up to 1s. 6d. and afterwards by halfpennies; it also shows the net wages to be paid after deducting the workmen's sickness and unemployment contributions. The arrangement of the book is such that reference to any desired result, with the aid of a thumb-index, is a matter of a few seconds, and there can be no doubt that it will be a most useful and time-saving desk companion to those who employ hands at varying rates and for varying times.

Russian Year-Book, 1914. Compiled and edited by Dr. H. P. Kennard. London: Eyre & Spottiswoode. 10s. 6d. net.—This publication has now reached its fourth year of issue. To those interested in the trade and commerce, natural resources, mining and minerals, finance, tariffs, &c., of Russia, it cannot fail to be of great service, and for all classes of students of this vast Empire, for whatsoever purpose, or those who want information to assist them in connection with visits thereto, there is abundance of information which is not readily accessible in other forms.

Sell's Directory of Registered Telegraphic Addresses. London: Business Directories, Ltd. 25s.—This huge directory has now reached its twenty-ninth year of publication. It is almost unnecessary to say much about it to-day, for it is so well known and so widely used. In business offices it fills an important place, and lest any reader does not know, we may say that it continues to give an alphabetical list of firms in the United Kingdom with their telegraphic addresses and telephonic numbers; an index to telegraphic addresses; a classified trades list for the whole of the United Kingdom, and a list of British Empire overseas and foreign cable addresses. In the Classified Trades List there are more than 3,000 separate trade headings, containing names of 100,000 firms in the United Kingdom and their addresses.

An interesting novelty has been sent us by Mr. J. H. C. Brooking, of the St. Helens Cable and Rubber Co., Ltd., Warrington, in the shape of an *Industrial Character Curves Booklet.* Each page contains a list of items or traits of character, with graduated columns adjoining in which can be recorded the owner's estimate of the degree in which an employé or a colleague possesses each particular quality. By joining up the points thus obtained, a sort of "character curve" is produced. On more intimate or more matured acquaintance with the victim, a new estimate can be made, affording an interesting comparison with previous conclusions. The accuracy of the curves depends upon the user's ability to judge character and his familiarity with the manners and customs of the subject of his appraisement; really a very high degree of psychological skill would be necessary to form a true estimate, and it is not probable that two persons would form the same opinions regarding a third. However, the idea is interesting, and may prove useful. The immense importance of psychological investigations in connection with industry is only gradually being realised. It will become more and more appreciated as time goes on.

The Universal Electrical Directory (*J. A. Berly's*). 1914. London: H. Alabaster, Gatehouse & Co. 21s. post free; "A" edition (which omits the Continental and U.S.A. sections) 12s. post free. The Red Book of the electrical world has just made its thirty-third annual appearance, and in the work of revision every effort has again been made to ensure accuracy and completeness without unnecessary duplication. We are assured we have not tried to count them for ourselves—that there are in all 31,515 names and addresses, and of these approximately 14,000 are in the "British" section, 7,000 in the "Colonial and General" section, 7,500 in the Continental, and 5,700 in the U.S.A. section. Subdivision of the sections into alphabetical and classified departments, a British geographical section of which travellers know the usefulness, financial information relating to British and some foreign electrical companies, full lists of electricity undertakings in the United Kingdom, the British Colonies, and some other countries, with their voltage, current, engineers' names, &c.—these are some of the features to which attention may be directed. The book is of a convenient size for handling, looks well on the shelf, has a thumb index to the sections, and is a most necessary part of the office equipment of any trade or professional man.

The March number of the *Wireless World* contains fully illustrated articles on the new wireless stations in Spain, and the work that is being done on the Labrador Coast. An announcement is made regarding the forthcoming examination in wireless efficiency for Boy Scouts; a complete wireless outfit will be presented to that troop of Scouts to which the most successful competitors belong.

"The Faraday House *Journal*," Vol. V, No. 5, contains notes on the "All-day Efficiency of Static Transformers for Use on Lighting Loads," by R. Crosbie-Hill; an illustrated article on "Switchgear in Relation to Power Schemes," by W. J. P. Orton; and a number of shorter items, in addition to the usual domestic news.

"*Journal* of the Institution of Electrical Engineers." Vol. 52, No. 229. March 2nd. London: E. and F. N. Spon, Ltd. Price 3s. 6d.—This issue contains a paper on "The Electrification of the Atmosphere, Natural and Artificial," by Sir Oliver Lodge.

"The Electric Furnace." By A. Stansfield. Second edition. Price 17s. net. "Electrical Engineering Problems." By F. C. Caldwell. Price 4s. 2d. net. "Problems in Alternating-Current Machinery." By W. V. Lyon. Price 6s. 3d. net. London: Hill Publishing Co., Ltd.

"Answers to Problems in Essentials of Electricity for Wiremen and the Electrical Trades." By W. H. Timbie. London: Chapman and Hall, Ltd. Price 25 cents net.

"The Inventor's and Patentee's Year Book, 1914." By W. H. Taylor. Manchester: Dexter Press, Ltd.

"The Passivity of Metals." General Discussion held by the Faraday Society, November 12th, 1913. London: The Society. Price 7s. 6d.

"Les Surtensions dans les Distributions d'Energie Electrique et les Moyens d'en Prévenir les Inconvénients." By I. van Dam. Paris: Gauthier-Villars. Price 12 fr. 50.

Dissolutions and Liquidations.—Hotton & Co., Ltd.—A compulsory winding-up order having been made, the statutory first meetings of the creditors and shareholders were held on February 27th, at the Carey Street Offices of the Board of Trade, W.C. The Official Receiver reported that the company was registered in October, 1910, as a private company, with a nominal capital of £6,000, divided into 4,500 ordinary and 1,500 preference shares. The object of the company was to acquire a lighting and engineering business carried on at 4, Charterhouse Buildings, E.C., by Mr. Wm. Hotton, under the style of the Hotton Lighting Co. The accounts of Mr. Hotton's business were provisionally investigated, and showed an average profit of £400 or £500 per annum during the three years preceding the transfer of the business to the company. The purchase price was agreed at £100 in cash and £2,396 in shares. Immediately after the incorporation the company took over the management of an agency for the Hotton Malleable Fittings, Ltd., and in order to cope with the extension of the business, they removed to larger premises at 71, Southwark Street, E.C. In August, 1912, Walter Tyler, Ltd., acquired (with two exceptions) all the issued shares of this company from the registered shareholders, in exchange for an allotment of shares in their company, and thus acquired a controlling interest in this company. Between June, 1912, and February, 1913, Walter Tyler, Ltd., advanced £700 to the company, and in the following July £1,082 debentures were issued as security for that and other cash advances. Default having been made in the payment of interest, Mr. F. W. Stephens was appointed Receiver on behalf of the bondholders, and was now carrying on the business. He was of opinion that it was doubtful whether there would be any substantial surplus from the realisation for the benefit of the unsecured creditors. The failure of the company was attributed to mismanagement. A resolution was passed for the liquidation to remain in the hands of the Official Receiver. The following are among the unsecured creditors:—

Adnil Electric Co., Ltd., London	£13
Falk, Stadelmann & Co., Ltd., London	69
General Electric Co., Ltd., London	18
Hart Accumulator Co., Ltd., London	68
Radium Electric Co., Ltd., London	14

The Midland Ignition Co., Ltd.—This company is winding-up voluntarily, with Mr. C. H. McPherson, of 35, Newhall Street, Birmingham, as liquidator. A meeting of creditors is called for March 6th at the Midland Hotel, Birmingham; claims must be sent to the liquidator by April 3rd.

Pioneer Pump Patents, Ltd.—A meeting of creditors is called for March 7th, at 15a, Clifton Street, Notting Hill, W., by the liquidator, Mr. G. H. Smart.

Electromotor Equipment Co., Ltd.—A meeting of creditors is called for March 6th at 59/65 Paul Street, E.C., by the liquidator, Mr. O. Steiner, of 21, Old Broad Street, E.C., to whom claims should be sent forthwith.

W. F. Dennis & Co., engineers and iron and machine merchants and agents, 49, Queen Victoria Street, E.C.—Messrs. F. A. B. Lord, F. W. Dennis and J. E. Hood have dissolved partnership. Debts will be attended to by Messrs. F A B. Lord and J. E. Hood, who will continue the business under the same style.

Harraway Bros., electrical engineers, 116, High Street, Kensington, and 45, King's Road, Chelsea. Messrs. V. J. Harraway and A. J. Cunningham have dissolved partnership as from September 29th, 1913. Debts will be attended to by Messrs. V. J. Harraway and A. J. Cunningham, who will carry on the business in future as Harraway Bros., Ltd.

Grindell Matthews Wireless Telephone Syndicate, Ltd.—First meetings of creditors and contributories will be held on March 10th, at Carey Street, Lincoln's Inn, W.C.

Trade Announcements.—To meet the demand for their fittings in the Northern Counties, Messrs. Galsworthy, Ltd., of Newman Street, W., are opening a branch in Athenian Buildings, 9, Park Lane, Leeds, where showrooms will shortly be ready. Mr. W. B. Clifton, who has for the last six years represented the firm in the provinces and in London, will take over the management of their Leeds branch, and Mr. Wm. A. Maddick will represent them in London and on the South Coast.

Mr. E. Duisberg has severed his connection with Messrs. Goodchild & Macnab as manager of their small tools department, and has started business on his own account at 28, Victoria Street, London, S.W., specialising in twist drills and die castings.

The Electrical Apparatus Co., Ltd., announce that on March 1st Messrs. Brown, Primrose & Smith ceased to represent them in Scotland, and their Scottish business will, in future, be handled by Mr. R. E. Mitchell. At present correspondence should be addressed to him at 3, Caledonian Terrace, Cambuslang, Glasgow; the opening of an office will be announced shortly.

Messrs. Manley & Sandy, Ltd., of King's Cross, N., have removed to new works, Icknield Way, Letchworth, Herts. Telegrams, "Lamps, Letchworth."

Messrs. R. Belfield, Ltd., are moving on March 16th to 65, Victoria Street, London, S.W.

The telephone number of the Record Electrical Co., of Caxton House, S.W., has been changed to "Victoria 6700."

Catalogues and Lists.—The Electrical Co., Ltd., 122, Charing Cross Road, London, W.C.—We have received a bulky volume (price 10s. 6d. net) of close upon 1,000 pages, which is intended to be only representative, not a complete collection, of the manufactures of the company. The foreword informs the reader that if the list were to be made to cover all their manufactures, it would require to be 9½ times its size. As it is, however, it comprises 32 sections of mainly price-list material, though there is also a mine of descriptive material and abundance of half-tone and line illustrations and dimensioned drawings. The first 40 or 50 pages are occupied with pictures of the different departments at the works, electrical regulations relating to factory and mine installations and a tabulated list of British electric supply systems, with kind and voltage of current. The sections deal with the following, among other lines of manufactures:—c.c. and a.c. machines, cinematograph converters, crane motors and controllers and lift equipments; high and low-tension switchgear; fans, small motors, house pumps and tools; measuring instruments, arc lamps and heating and cooking apparatus; carbons, meters and clocks; wires and cables and insulating material; carbon-filament, drawn-wire, miniature and Nernst projector lamps; outdoor fittings, illuminating and electrical advertising material. To touch any of the details of these various sections is, of course, impossible here, but from what we have said the reader can obtain a fair idea of the character of the volume and its contents. We have also received the *E.C. Journal* for February containing illustrated articles on the A.E.G. large machine factory, factory lighting by "Sunshine" arc lamps, electric breast drills, January metal price curves, and single-phase meter construction; stock lists of motors and dynamos are included.

Messrs. Alfred Herbert, Ltd., Coventry.—A new list describing their No. 3 combination turret lathes; also a new edition of their pamphlet describing patent ball-bearing drills.

The Edison & Swan United Electric Ltd., Co., Ltd., Ponder's End.—Advance copies of new price lists relating to the following:—Ediswan meteor patent electric signs, "Majolica" ware fittings, and Ediswan glass shades. Copies of these publications can be obtained on application. Illustrated and priced leaflet relating to "Ultralux" pure white glassware.

Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, E.C.—Reprint (No. 607) of a description of a new push-button control system from an engineering journal.

Messrs. Dryers, Ltd., 53, Victoria Buildings, St. Mary's Gate, Manchester.—Illustrated circular describing Bollinger's dry-air fitters for turbo-generators.

British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—120-page fully-illustrated price list entitled "Everything Electrical for Cinemas, Theatres, &c." Beginning with "Auriga" drawn-wire lamps, the lists proceeds to detail flame and other arc lamps, carbons, various electric light fittings, wall brackets, ceiling bowl fittings, lanterns, &c., number indicators, electric signs, strip lighting, fans, heating apparatus and many sundry lines. The list is intended for architects, contractors nd all connected with the erection and equipment of such emises. Copies will be sent on receipt of trade card.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—24-page illustrated price list of their electric drilling machines, motor grinders, &c.

British Thomson-Houston Co., Ltd., London.—The "Mazda House News" for February has been received. Half-watt lamps are naturally the principal theme for the month.

British Thomson-Houston Co., Ltd., Rugby.—16-page publication (No. 500), containing a number of large full-page photographic reproductions of some of their electrical plant and equipment, including switchboards, motor-driven pumps, winding and haulage plant in use in coalmines.

Waltham Manufacturing Co., 2, Jackson Road, Holloway, London, N.—Illustrated price leaflets of electric projection arc lamps and Waltham arc lamps.

Wholesale Fittings Co., Ltd., 23-27, Commercial Street, London, E.—108-page illustrated catalogue of electrical accessories, lamps, conduits, bells, telephones, and a large variety of fittings for interior and exterior lighting.

Messrs. Quilliam Bros., Cleggs Court, Chapel Street, Salford.—Catalogue F, illustrating and describing the latest pattern Collins patent automatic point turners for overhead trolley or conduit tramways. In the new pattern box an inner lid is provided which, owing to the "diving bell" joint, renders it impossible for water to enter the interior, even if the outer gasket joint is defective. The mercury sealed stuffing box to the shaft, between the inner and outer chambers, is retained in the new pattern.

Fire Prevention.—The British Fire Prevention Committee, whose recent standard specifications and reports on the construction of portable chemical fire extinguishers have met with a gratifying reception at the hands of the various public bodies concerned, have decided to extend their investigations into the relative effects of the various liquids and chemicals, which are being generally used in this class of first-aid appliance, and into certain questions relating to the pressure generated in such extinguishers under varying conditions. A further detailed report on the subject of extinguishers will be issued in due course. The Committee now issue their standard specification for chemical fire extinguishers, free to inquirers upon written application (with return postage enclosed), addressed to the Registrar, B.F.P.C. Offices, 8, Waterloo Place, London, S.W. The Committee has also set up a Special Research Sub-Committee on non-liquid first-aid appliances.

Henley's Cables.—Messrs. W. T. Henley's Telegraph Works Co., Ltd., have issued an illustrated folder informing the user of cables and wires how he may easily ascertain that he is getting their Association grade or Non-Association class cables and wires. All that it is necessary to do is to strip back the tape around the core, as the firm's name appears on the tape of every coil sent from the works. Association cables bear the wording: "Association cable made by a member of the Cable-Makers' Association—Henley's"; and Non-Association: "Henley's Non-Association cable."

Fuel Economy.—Referring to the statements in the report of the directors of the Metropolitan Railway Co., published in our issue of February 13th, to the effect that considerable economy has been effected by the installation of special grates under the boilers at the Neasden generating station, a matter of importance in view of the high price of coal, Messrs. Ed. Bennis and Co., Ltd., ask us to point out that the new grates were installed by them. These grates were described and illustrated in our issue of July 18th last year.

G.E.C. Lantern Slides.—The General Electric Co., of Witton and London, have prepared a series of slides which represent their latest practice in electrical work, to meet the large number of demands made for sets of lantern slides to illustrate lectures on electrical subjects. A description of each slide has been prepared and accompanies the set, which the company will be pleased to lend to any responsible engineer. Applications should be made to the company's advertising department, 67, Queen Victoria Street, London, E.C.

Cable Manufacture in the Netherlands.—H.M. Consul-General at Rotterdam reports that a company has been formed in the Netherlands, with a capital of about £166,700, for the purpose of erecting a factory for the manufacture of cables for electric light, power, telegraph and telephone purposes. The cost of installation will be about £40,400. The name and address of the company may be obtained at the Commercial Intelligence Branch of the Board of Trade in London.

Long-lived Carbon Lamps.—The carbon filament is not dead yet. The Edison & Swan United Electric Light Co., Ltd., inform us that a "Royal Ediswan" railway signalling lamp on a northern railway has been burning for 22,607 hours. A batch of similar lamps on a large travelling crane lasted for over 5,000 hours, and half-a-dozen of them were still sound when replaced by new lamps.

Bankruptcy Proceedings. — Frederick Isaac Behrens (trading as Fred. Burns), electrical engineer, 16, Market Street, Barnsley. Receiving order made February 23rd on debtor's own petition. First meeting, March 9th. Public examination, March 26th. Both at County Court Hall, Regent Street, Barnsley.

LIGHTING and POWER NOTES.

Accrington.—Street Lighting.—A scheme is to be prepared for electrically lighting main roads by lamps fixed to the tramway standards, instead of as at present, using lamps suspended from the overhead wires.

Alton.—Proposed E.L.—The U.D.C. has instructed the surveyor to visit other towns having an electricity supply with overhead distribution, and obtain complete information as to the cost, &c.

Argentina. — The total output of the Compania Allmana Transatlantica de Electriadad for 1913 was approximately 71 million units for lighting, an increase over the previous year of 14 millions, 27 million units for power, and 61 million units for traction.—*Review of the River Plate.*

Atherton.—The Lancashire United Tramways Co. has renewed its agreement with the Atherton U.D.C., its largest customer for electricity supply, for another ten years.

Australia.—The N.S.W. Railways Department is erecting a power house at Newcastle, to provide electricity for Walsh Island workshops and the coal-loading cranes; it is expected that eventually power from this source will be supplied to the tramways, which are shortly to be electrified. An order has been placed with the Australian General Electric Co. for a 2,500-kw. Curtis turbine and a G.E. alternator. Babcock & Wilcox boilers will be installed, but no order has been placed, as the department has some in stock.—*Tenders.*

Bacup.—Street Lighting. — The Electricity and Tramways Committee has passed a resolution that it is prepared to undertake the wiring and maintenance of the installations for the E.L. of the main roads, and the Finance Committee is applying to the L.G.B. for sanction to borrow £1,000 for the purpose.

The Cemetery and Lighting Committee has resolved to include in the estimates for next year a provision for the substitution of electric light for gas in several roads, by fixing one lamp on each tramway span-wire.

Barrow-in-Furness.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £8,000 for the following purposes:—Mains, £6,500; services, £750; public lighting, £600; and balancer and switchgear, £150.

Bingley. — Electric Supply Inaugurated. — On Saturday last the electricity undertaking was inaugurated by the chairman of the Electricity and Tramways Committee. The supply is obtained by overhead wires from the Keighley T.C. at a pressure of 6,600 volts, and is transformed down to 400 and 230 volts for power and lighting respectively. The current for the Bingley section of the new tramway to Bingley from Bradford is supplied by the Bingley Council. The sub-station plant has been supplied by the British Westinghouse Co.

Blackpool.—Proposed Loan.—The Finance Committee has decided to apply to the L.G.B. for permission to borrow £15,000 for the electricity department, for cable extensions.

Blackrock (Co. Dublin).—Proposed E.L.—The U.D.C. has decided to appoint a consulting electrical engineer to report on five suggested schemes for the electrical lighting of the town. (1) A power station and installation for the district; (2) the supply of current in bulk from the Dublin Corporation; (3) a joint scheme with Kingstown and Dalkey; (4) an arrangement with the Dublin Southern District Electrical Supply Co.; and (5) a supply of current in bulk from the Pembroke U.D.C.

Bolton.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £1,810 in respect of sidings and other works in connection with the new generating station.

Brighton.—Proposed Loan.—The Lighting Committee has recommended the T.C. to obtain a loan of £16,250, including mains, £5,000; services, £4,250; motors for hire, £3,000; heating and cooking apparatus, £2,500; and office extensions, £1,500.

Burnley.—Year's Working.—The income of the electricity undertaking for the past year was £34,400. The electricity department proposes to apply £5,500 to the relief of rates, to reduce the charge to the tramways department, to increase the discount for lighting and power from 5 per cent. to 10 per cent., and to reduce the charge for domestic purposes other than lighting, from 1½d. to 1d. per unit.

Cambridge.—New Plant.—The University Building Syndicate recommends that it be authorised to spend £3,000 in providing and equipping an electric power station in connection with the engineering workshops.

Canada.—The Montreal Council has authorised a loan of $2,000,000 to establish an electrical plant in connection with the enlargement of the aqueduct. It is proposed to developed 10,000 h.p., 6,000 h.p. for pumping water and the remaining for lighting.—*Canadian Electrical News.*

Chorley.—Prov. Order.—The T.C. has decided to support the granting of a prov. order to the Lancashire E.P. Co. for the supply of electricity for lighting purposes within the borough area.

Clayton (Lancs.).—The Accrington Electricity Committee has decided to extend its mains in Clayton-le-Moors, at an estimated cost of £410.

Clogheen (Co. Tipperary).—Street Lighting.—At a meeting of the D.C., notice of motion was given that the Council should consider the desirability of lighting the streets by electricity, in place of the present oil lamps.

Clonakilty (Co. Cork).—Proposed E.L.—Steps are being taken to have the town lighted by electricity. The services of an electrical engineer are being sought by the promoters for the purpose of planning and supervising a scheme which will include the lighting and wiring of private houses.

Colne.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £1,000 for the purchase of motors to be let out on hire, and £250 for a motor-driven booster for the Keighley Road cable.

Colwyn Bay.—Proposed New Station.—The U.D.C. is considering the erection of a new electricity generating station. Mr. A. R. Tudman, the electrical engineer, recently reported on a scheme for removing the generating station to a new site adjoining the proposed destructor. The new station, as designed, will cost £21,000, including laying feeder cables to the Ivy Street site, from which the current will be distributed. It is understood the Council will approve the scheme at its next meeting.

Continental Notes.—Denmark.—Plans are being prepared for a central station at Boeslunde, near Korsor, for the supply of electricity in the town and district.

Germany.—A generating station of 60,000-h.p. capacity is in course of construction at Laufenburg, for the Kraftwerk Laufenburg Gesellschaft. It is intended to utilise the fall of the Rhine between Allbruck and the Schaffingen, below Laufenburg. The plant will comprise 10 turbines, each of from 5,000 to 6,000 h.p.; of the A.E.G. three-phase generators, which will be coupled direct, three will have outputs of 5,200 kw., the other seven being of 6,150-kw. capacity, at 6,000-6,600 volts, and a speed of 107 revs. per min. The energy will be transmitted partly at this voltage and partly transformed up to 47,000 volts.

Servia.—The new port, which the Government proposes to construct at Prachovo on the Danube, will be equipped with the latest appliances for loading and unloading goods. These are to be worked by electricity, to be generated at a power station, which is also to be erected at the port.

Spain.—An electric lighting and power transmission plant is to be installed at the State Power and Explosive Works at Granada.

Norway.—Extensions are to be undertaken at the Drammen municipal electricity works, the 20,000-volt transmission between the power station and town being replaced by one of 50,000 volts. New power and sub-stations are to be built, and the expenditure is expected to reach £22,500.

Dartford.—The L.G.B., in regard to the proposed h.t. extension of the supply, has raised the question of the sufficiency of stand-by plant in the event of a breakdown occurring; otherwise it is prepared to sanction the loans required. The E.L. Committee recommends that Mr. Snell be appointed to report upon the matter raised by the Board. The electrical engineer is authorised to supply 23 houses with energy for lighting at a fixed charge per lamp per week.

Derby.—Proposed Plant Extensions.—The T.C. is applying for a loan of £12,540, to be expended as follows:—Turbine, £7,290; foundations and flooring, £400; piping, £250; condensing water screen, £300; boiler, piping, &c., £2,400; and motor-generator, £1,900.

Dundalk.—The U.D.C. has instructed the engineer to prepare plans for the carrying out of the agreement with the G.N. Railway Co. of Ireland, for an electrical installation in the town. A deputation is to wait on the L.G.B. in connection with the application for a loan.

Eccles.—The T.C. has requested the local Member of Parliament to support the I.M.E.A. Bill.

Edinburgh.—Public Lighting.—The Corporation Gas Commissioners have been inquiring into the question of high-pressure gas lighting for the streets, and have considered a report by Mr. Herring and Mr. Masterton, which suggests that allowing for all costs of a high-pressure gas installation, the Commissioners would be justified in offering such lamps of "guaranteed" 600 c.p., including lighting and maintenance, at £7 per lamp per annum, which compares with £9 for the existing arc lamps. The report refers to high-pressure lighting in London and Berlin, but presumably the Manchester tests have been omitted.

Elgin.—Proposed E.L.—The T.C. has remitted the question of an electricity supply scheme for the town to a committee for consideration. It was stated that an E.L. scheme would cost £7,000, and to extend the gas works, more than that sum.

Goole.—The Electrical Distribution of Yorkshire, Ltd., has given notice of its intention to lay cables from Snaith and Rawcliffe to Goole immediately.

Halifax.—Proposed Loan.—The Tramways and Electricity Committee has resolved that application be made to the L.G.B. for sanction to the borrowing of £7,000 for the purchase of a water-tube boiler with mechanical stokers and a 1,000-kw. 50-cycle rotary converter and switchgear for the electricity works.

Hanley.—Street Lighting.—The Stoke T.C. has decided to experiment with 500-c.p. metal-filament lamps for street lighting in Liverpool Road.

Huntingdonshire.—Electric Police Lamps.—The Chief Constable of Huntingdonshire has decided to periodically replace all the police oil lamps with electric lamps.

Ilford.—The U.D.C. has approved the L.G.B.'s amended scheme, to cost an additional £2,200, for the erection of a sub-station at Goodmayes.

Japan.—Fire at Electricity Works.—The power station of the Fukui Electric Co., which supplies electricity to a large number of silk weaving establishments, was recently burnt down. The plant was restarted after about five weeks' delay.

Lancaster.—The E.L. Committee reports a balance of £208 on the past year's working, which will be placed to the reserve fund. A decrease in price has led to increased consumption.

Limerick.—Annual Report.—The report of the borough electrical engineer shows that there was a substantial profit in the working of the electricity undertaking during the year ended March 31st last. The loss per annum has previously averaged £1,600.

Lisnaskea.—Street Lighting.—A petition against the proposed granting of urban powers for the purpose of the lighting of the streets by electricity has been forwarded to the L.G.B.

Listowel (Co. Kerry).—Electric Pumping.—The Waterworks Committee has asked the Listowel E.L. and P. Co. for estimates of the cost of an electric pumping plant at the waterworks, as an alternative to expensive renewals of the present steam plant. It is estimated that electric pumping will cost £247 per annum, as against the present cost, £500.

London.—Bethnal Green.—The Electricity Committee of the B C. recommends sealing the agreement with Stepney for a supply of electricity in bulk, and the control, management and maintenance of the supply within the borough; and that application be made to the L C.C. for sanction to a loan of £24,470 for the inauguration of the undertaking.

Stepney.—The B.C. has been recommended by its Finance Committee to apply to the L.C.C. for a loan of £15,000 for mains extensions.

The Electricity Committee has recommended the B.C. to apply to the B. of T. for its approval of the agreement between Stepney and Bethnal Green, by which the former is to supply electricity in bulk to the latter.

Malton.—Street Lighting.—The U.D.C. has decided to invite tenders for public lighting for three years. The present contract is held by the Northern Counties E.S. Co., and expires on May 31st.

Middleton.—E.L. Scheme.—The consent of the R.D.C. has been obtained for the E.L. scheme promoted by Messrs. Best & Pullen, of Bradford. It is proposed to form a company, with a capital of £1,500, and if water-power is not available suction gas plant will be used. The charge for current will be 6d. per unit, and the R.D.C. will have the option of purchasing the undertaking.

Morecambe.—New Plant.—The T.C. has decided to install an evaporative condenser at the electricity works, at an estimated cost of £1,544, and to apply to the B. of T. for permission to supply current outside the borough boundary on the same terms as are in force within the borough.

New Zealand.—The Corporation of Invercargill has obtained authority to raise a loan of £42,400 for, among other things, the extension of the electric lighting, power and fire-alarm systems.—*B. of T. Journal.*

Oban.—Street Lighting.—The Council is to apply to the L.G.B. for authority to the expenditure of £1,173 for the purpose of converting the street lighting from gas to electricity.

The engineer reported that the equivalent of over 1,450 30-watt lamps had been connected during the past year to the electricity department's mains.

Penistone.—Workhouse Lighting.—The B. of G. has appointed a committee to inquire into the question of the substitution of electricity for gas for the lighting of the workhouse; it was suggested that a saving in cost of almost 50 per cent. could be effected.

Portrush.—Prov. Order Extension.—On the recommendation of the L G B, the U.D.C. is applying for an extension of its prov. order to cover the whole of its area.

Preston.—Suggested E.L. Extensions.—The Finance Committee will consider at its next meeting the question of additional provision being made for the supply of electricity in the town

Scarborough.—Workhouse Lighting.—The B. of G. is to spend £6,252 on a scheme for heating and lighting the workhouse.

South Africa. — The ratepayers of Knysna, Cape Province, have sanctioned the expenditure of £15,000 on new water and electric lighting schemes.

Southport.—In regard to the proposed revision of electricity charges, it has now been decided to form a special committee of members of the Gas and Electricity Committees to draft a new scheme of charges for submission to the Finance Committee.

Reigate.—Price Reduction.—The T.C. has reduced the price of electricity for power from 2d. to 1½d. per unit, and adopted a new rate of 1d. per unit for heating and cooking. Meter rents are to be abolished, except where accounts do not reach 10s. per quarter, in which case 2s. per quarter is to be charged.

Sheffield. — The Corporation Electricity Committee has engaged Mr. Sydney O. Cooke to deliver a series of public lectures on "The Art of Correct Illumination."

Tunbridge Wells.—A letter has been received by the T.C. from the Southborough U.D.C., inquiring upon what terms it would supply the latter with electricity in bulk.

U.S.A.—The State of New York is about to imitate the Hydro-Electric policy of Ontario. The fact is particularly interesting because about a year ago an alleged expert from New York State published a book to show what a horrible mistake Ontario had made.

The Conservation Commission of New York State proposes to conserve new and develop all the water powers. The scheme involves further use of the Niagara Falls on the American side, the use of the Long Sault Falls on the St. Lawrence, the Genessee Falls, and the surplus water of the large canal between Troy and Schenectady, N.Y. The proposition is being resisted by the private corporations, but the Commission is most hopeful, and bases its chief argument in favour of conservation, on the success which has attended the work of the Hydro-Electric Commission in Ontario.

Warrington.—Proposed Loan.—Application is to be made to the L.G.B. for sanction to the borrowing of £3,000, to cover the cost of extension of mains during the next three years, £2,000 for services, and £1,950 for a rotary converter.

West Yorkshire.—E.L. Proposals.—At a meeting of the Guiseley D.C. last week, Mr. W. B. Woodhouse attended to explain the Power Co.'s scheme. He observed that a great many misconceptions of the scheme had arisen during the period in which it had been under consideration. A motion in favour of the scheme was ultimately carried.

TRAMWAY and RAILWAY NOTES.

Accrington.—Rate Relief.—The Tramways and Electricity Committee has voted £2,000 out of last year's profits of the tramways undertaking to the relief of the rates.

Argentina.—As soon as the electrification of the Santa Fé tramways is completed, it is probable that electric tramways will be laid in Esperanza.

Construction of the electric tramways in Paraná was commenced last month, and the work is expected to be finished about the middle of 1916.—*Review of the River Plate.*

Annual Returns.—The published returns for 1913 give the receipts of the Buenos Ayres tramways companies at $40,286,240, an increase of $2,515,077 over the preceding year. Approximately 410 million passengers were carried, an increase of about 28 millions. The length of the lines is 715 km., an increase of 20 km.

The gross receipts of the Rosario electric tramways for 1913 were $2,718,156, and 27,181,607 passengers were carried. 130 km. of line are open.

Arnold.—Tramway Extensions.—The U.D.C. has provisionally accepted an offer of the Nottingham T.C. to extend the electric tramways to the Free Library, and the T.C. is to be asked to carry the extension beyond the point named to Spout Lane.

Australia.—A report of the Victorian Parliamentary Standing Committee on Railways recommends the construction of an electric street railway from Sandringham Station to Black Rock, a distance of about 2½ miles. The estimated cost of the work is £43,400, of which £29,000 is for track and overhead construction, £4,200 for motor-generators, feeder cables and car-shed, and £6,000 for five motor coaches. To extend the line to Beaumaris and provide the necessary additional rolling stock would involve a further outlay of £38,500. *Board of Trade Journal.*

Automatic Signalling.—Mr. Fitzpatrick, chairman of the Victorian Railway Commissioners, who recently visited Europe and America in connection with the selection of an automatic signalling system for the Melbourne suburban railways, now being electrified, reports that, after discussing the matter with Mr. Merz and his staff, it was unanimously agreed that a system controlled by A.C. track circuits with automatic stops, similar to that in use on some of the London underground railways, was the most suitable.

Bristol.—Lock-Out.—The *Westminster Gazette* states that, owing to their refusal to sign the new rules of the Bristol Tramway Co., 200 men engaged in the motor construction department were locked out on Monday.

Continental Notes.—Italy.—Steps have been taken to secure a concession from the Ministero dei Lavori Pubblici for the construction of an electric railway from the Provinces of Udine and Bellona to connect with the line from Villasantina to Sappada (alto Cadore).

Poland. — The Lodz Fabrik Eisenbahn has commenced the construction of an electric tramway from Ozorkoff to Zgierz *viâ* Lenczyca.—*Board of Trade Journal.*

Russia.—The municipal authorities of Riga have approved of the scheme of the Société des Tramways et Electricité en Russie for the extension of the electric tramways in the town.

Coventry.—Loan Sanction.—The B. of T. has sanctioned the borrowing of £10,000 for the purchase of 10 new tramway cars.

Dearne Valley.—Light Railway Inquiry. — The hearing was commenced last week by the Light Railway Commissioners of an application by several U.D.C.'s for powers to carry out the Dearne Valley light railway scheme. It is proposed to construct about 18 miles of tramways, at an estimated cost of £151,891, including £21,650 for generating stations. The proposed routes run from Barnsley and Thurnscoe to Mexboro', and connect with the Rotherham tramways. The scheme is being strongly opposed by the railway companies with lines in the area and by a large number of property owners.

Ilford.—Electric Tower Wagon.—What is stated to be the first electric tower wagon in this country has been put in service by Mr. L. E. Harvey, the manager of the tramways department. The vehicle, which was built to Mr. Harvey's designs, is fitted with a 225 ampere-hour battery of Edison accumulators.

Japan.—Work is well in hand on the electrification of the railway between Tokio and Yokohama, and it is expected that electric trains will be in use by the end of August next. The generating station is being established at Yobuki, on the River Rokugo.

London.—The City Corporation has refused consent to the proposed extension of the L.C.C. tramways along Aldgate, and has only consented to the extension to Ludgate Circus, on the Council undertaking not to obtain powers to cross the Circus and to widen a portion of Farringdon Road at considerable cost.

North London Railway Electrification.—At the annual meeting of the above company last week, the chairman said that it was hoped that the new works and rolling stock would be ready early next year for a through service of electric trains from Watford to Broad Street.

Manchester.—Tramway Accident.—During a fog on Wednesday morning, last week, a Corporation tramcar left the rails on the curve at the corner of High Street and Upper Brook Street, and overturned on the footpath. Twenty persons were injured. At the B. of T. inquiry, conducted by Lieut.-Col. Von Donop last Friday, the driver stated that owing to the fog, he was on the points before he saw them, and was travelling at from 10 to 12 miles per hour.

Rochdale.—New Workshop and Equipment.—The Tramways Committee has approved the plans of the proposed new workshop, which is estimated to cost £12,000, and has also agreed to purchase, at about £3,000, new equipment, including machinery, lighting, rails, &c.

Salford.—Reduction of Fares.—The Tramways Committee has agreed upon a new scale of fares, to come into operation on April 1st, involving a reduction in revenue of about £10,000 or £11,000 a year.

South - Western Railway Electrification. — The chairman of the above company stated at the annual meeting last week that it was pressing forward the work on the Waterloo-Kingston-Twickenham-Richmond-Waterloo circular route, the Hounslow loop and the Wimbledon line, *viâ* Southfields, and hoped to have one ready for electric traction this year. The Shepperton line and the Hampton Court branch line are also to be electrified. The whole of the work has been placed with British firms.

Stalybridge.—The Stalybridge Joint Tramways Board has decided to issue a precept for £1,475 on each of the four Corporations concerned, to meet the deficiency on the year's working. Ever since the inception of the undertaking in 1903 there has been a deficit in the tramways account, but this is the lowest precept that has been issued.

Tilbury Railway Electrification. — At the recent annual meeting of the Midland Railway Co., the chairman pointed out that in preparation for the electrification of the Tilbury and Southend line, it would be necessary to carry out widenings at Stepney and between Barking and Upminster, at a cost of £900,000. This would ultimately have been necessary in any case in view of the increasing traffic.

U.S.A.—According to the *Canadian Electrical News*, Messrs. Norton Griffiths & Co., of London, have offered, in conjunction with Messrs. W. H. Brown & Co., of New York, to organise an operating company, with $25,000,000 capital, to build a system of underground railways in Chicago. The fare is not to exceed 5 cents. The surplus profits are to be divided—55 per cent. to the city and 45 per cent. to the company.

Westhoughton.—A deputation from the U.D.C. was informed by the manager of the South Lancashire Tramways Co. that his directors were unfavourable to the proposed tramway extension through Hindley and Westhoughton, and unless an indemnity to cover possible loss was offered by the Councils, he could not hold out any hope of the scheme being carried out.

York.—Light Railway Inquiry.—The Light Railway Commissioners held an inquiry, on February 25th, into an application of the Corporation for powers to construct a tramway from Nessgate to Hull Road, and a short extension of the Haxby Road route. There was a good deal of opposition from the local architectural and archæological societies, lest some of the structures should be interfered with, but the town clerk assured them that the proposals did not involve danger to any structure of interest.

Rate Relief.—The auditors, in their report on the accounts for 1912-13, state that they note with regret that the Finance Committee has not considered it necessary either to recognise the claims of depreciation or to discontinue the contribution in relief of rates. They point out that the amount provided for depreciation and sinking fund by 95 of the principal tramway undertakings in the kingdom during 1912 averaged £2·62 per £100 of capital, whereas the figures of the York undertaking were £1·26 in 1912 and £1·31 in 1913.

TELEGRAPH and TELEPHONE NOTES.

China.—It is reported that an agreement has been entered into with the British Marconi Co. to install a series of stations with a minimum range of 2,000 miles. The stations will be worked by the company, which will also lend the necessary capital.

Germany.—An extraordinary credit of M. 39,000,000 for telephone purposes has been voted by the Reichstag, to be spent partly on transforming the overhead service to underground, as poles are found to be unable to support the large number of wires now required, and partly on new stations and extensions of networks. In the matter of the number of stations and of local networks, it is claimed for Germany that she stands at the head of all European States, while in the rapidity of the growth of traffic she surpasses even the United States.

The new Postmaster-General, Mr. Hobhouse, and Sir Henry Norman on Monday inspected the wireless station at Nauen, under the guidance of Count Arco.

Hull.—On Tuesday last week an inquiry was held by Mr. T. C. Ekin, on behalf of the L.G.B., into the application of the Hull Corporation for sanction to a loan of £192,423 for the purchase from the Government of the plant of the National Telephone Co. It was stated that the population of the area was 287,032, and that the rates were 9s. 2d. to 9s. 6d in the £. If the loan were repaid in 22 years, the annual payment would be £14,426, equal to a rate of 2·7d. Mr. T. Holme, manager of the Corporation telephone undertaking, stated that the National Telephone Co.'s plant in Hull had been brought up to date on account of the competition, and was better than the average throughout the country. The original cost of the Corporation undertaking was £22 per station, and the purchase price of the National the same apart from the "omnibus" subscribers, or £19 with them.

Imperial Wireless Chain.—A statement was made in the House of Commons on Monday by Capt. Norton to the effect that the English station had been begun at Leafield, in Oxfordshire; a change had been made in the Egyptian station, which would be a three-way instead of a two-way station, and the East African station had been abandoned, as it was impossible to secure a suitable site for a three-way station there. The third station would, therefore, be in India, near Poona. A station would be necessary in East Africa to link up with South Africa, and sites for both these stations had been chosen. Parliamentary sanction was not required for the changes in the plans.

Norway.—The Government proposes to expend a sum of £55,000 on the erection of a new automatic telephone exchange at Christiania. This forms part of a scheme, which comprises the erection of one main exchange, and two sub-exchanges in the western and northern parts of the town. The total number of subscribers is now about 20,000, and the population is about 250,000.

Spain.—The Compania Nacional de Telegrafia sin Hilos has constructed two new towers at its Puntales Station, near Cadiz, with a view to coping with its increasing business.

Telephone Hints.—The Postmaster-General has issued a leaflet giving hints to users of the telephone to assist them in preventing overcharges for calls on the measured-rate system.

Telephones in Mines.—The Home Office Regulation which provides that where electricity is used for signalling in mines, the pressure shall not exceed 25 volts, has been misunderstood by some inspectors and mine owners, who have recently stipulated that the voltage of magneto generators used in connection with watertight telephones shall not exceed 25 volts. This being commercially impossible, the Telephone Manufacturers Association has communicated with the Home Office and obtained the assurance that the rules in question (No. 15 (*a*) of the Electricity Special Rules under the Metalliferous Mines Act, and No 134 (*a*) of the General Regulations, Coal Mines Act) relate only to signalling and not to telephonic communication.

Wireless and Fires on Board Ship.—In a letter to the *Times* of February 27th, Mr. G. Sharpe draws attention to the occurrence of sparks 3 in. or 4 in. long about the heads of cargo derricks, along chains and wire guys, &c., on board ships equipped with wireless telegraphy, and while deprecating undue alarm, suggests that investigation into the matter is desirable.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—March 12th. Electrical goods for a year for the Powell Duffryn Steam Coal Co., Ltd. Stores Manager.

Australia.—Newcastle.—April 29th. P.M.G. Electrically-controlled clocks at Post Office, Newcastle, N.S.W. Schedule No. 361. See "Official Notices" to-day.

Melbourne. — April 7th. P.M.G. Accumulator batteries for radio-telegraph stations. Relays, non-polarised. Stores Schedule 996. See "Official Notices" February 27th.

April 21st. P.M.G. Telephone switchboards. Schedule No. 1,005. See "Official Notices" to-day.

March 24th. P.M.G. Automatic switchboard apparatus for Geelong. Schedule No. 1,016. See "Official Notices" February 27th.

Adelaide.—April 8th. P.M.G. Switchboards, various. Schedule No. 315. See "Official Notices" February 27th.

Austria.—March 19th. The Austrian State Railway authorities in Vienna are inviting tenders for an installation of electric lighting at the railway station at Amstetten.

Aylesbury. — March 7th. U.D.C. Contract 2. Two 100-kw. Diesel oil engine d.c. generating sets, with static balancers, battery boosters and accessories. See "Official Notices" February 13th.

Barnes.—March 9th. U.D.C. Distributor cables. See "Official Notices" February 20th.

Belfast.—March 11th. 36 cwt. of electric copper wire for the Harbour Commissioners. See "Official Notices" Feb. 27th.

March 16th. Corporation. Renewal and reconstruction of permanent way for 12 months, for the Tramways and Electricity Committee. Forms of tenders (£1 1s.) from the City Surveyor.

Belgium.—March 11th. The municipal authorities of Liége are inviting tenders for a new steam engine and dynamo, 600 kw., at the central electricity generating station.

Brussels.—March 17th. For electrical equipment of the overhead line between Ghent and Lochristy, of the Vicinal Railway. Particulars from the Société National des Chemins de Fer Vicinaux, 14, Rue de la Science.

March 31st. The Société Nationale des Chemins de fer Vicinaux, of Brussels (14, Rue de la Science). Overhead electric equipment of the extension of the Namur (station), Namur (Citadelle) light electric railway to La Plante. Specifications of the work can be obtained for 1 fr. from the address given.

Burton-upon-Trent.—March 14th. Corporation. One 1,250-kw. three-phase turbine-alternator and condenser, pipe-work, valves and accessories. Extensions to high-tension switchboard. See "Official Notices" February 13th.

Carshalton (Surrey).—March 11th. Motor-generator, switchgear, battery-charging board and connections, &c., at the Queen Mary's Hospital, for Metropolitan Asylums Board. See "Official Notices" February 27th.

Dover.—March 10th. Electric cables and electrical sundries for a year for the Harbour Board. Mr. Martyn Mowll Registrar, Castle Street (2/6 each schedule).

Dundalk.—March 10th. U.D.C. Twelve months' supply of stores for the electricity department. See "Official Notices" February 27th.

Edinburgh.—March 9th. Corporation. Maintaining house telephone and electric bell installations. Forms of tender from Superintendent of Works, City Road.

March 9th. Corporation. Twelve months' supply of electrical and insulating material. Specification from the Resident Electrical Engineer, Dewar Place.

Farnworth.—March 18th. U.D.C. 500-KW. rotary converter, transformer, switchgear and cables. See "Official Notices" to-day.

Gillingham.—March 6th. Corporation. Twelve months' supply of meters, cables and other stores. See "Official Notices" February 20th.

Greece.—PIRAEUS.—March 15th to 28th. The Hellenic Ministry of the Interior for the Port of Piraeus. A 10-ton and a 6-ton crane, with a 75-K.V.A. transformer, 25 periods, 5,000/500 v., with the needed transmission lines to the cranes. Deposit 10,000 lire.

Heston and Isleworth.—March 7th. U.D.C. Twelve months' supply of stores, including cables, meters, &c., for the electricity works. See "Official Notices" February 20th.

Ilford.—March 14th. Stores for the tramways department of the U.D.C. for a year. Mr. L. E. Harvey, Tramways Manager, Ley Street.

Italy.—SAVONA.—March 17th. Two-ton crane for the railway depôt at Savona. Particulars of the Direzione Generale delle Ferrovie dello Stato, Savona.

TURIN.—March 17th. Twenty-eight electric motors for the Officine di Torino. Particulars of the Direzione Generale delle Ferrovie dello Stato, Turin.

Liverpool.—March 9th. Electrical fittings for a year, for B.G. Mr. G. W. Coster, Clerk, Parish Offices.

London.—L.C.C. March 18th. Electrical installation at the Upper Marylebone Street Elementary School, Gt. Portland Street, W. (148 points, 200 lights). See "Official Notices" Feb. 27th.

March 12th. Bellhangers' work to buildings in the London district during three years. See "Official Notices" February 20th.

The Highways Committee recommends that tenders be invited for an electrically-driven pump for draining water from deep cable manholes and for the reconstruction and rewinding of two 50-KW. generators for use at the Greenwich generating station.

LAMBETH.—March 17th. B. of G. Internal telephone system at the Infirmary, Brook Street, Kennington, S.E. See "Official Notices" to-day.

It is proposed to install electric lifts at the Infirmary in Brook Street, and at the Workhouse, Renfrew Road.

WESTMINSTER.—March 11th. Guardians. 12 months' supply of electric lamps, fittings, &c. Mr. W. J. Lickley, Clerk, Prince's Row, Buckingham Palace Road, S.W.

Londonderry.—March 14th. Corporation. Meters and cables for the Electric Light Department. Specifications from the City Electrical Engineer.

Macclesfield.—March 11th. Electrical goods for one year for the Cheshire County Asylum, Parkside, Macclesfield. Forms from Mr. W. Tingay, Clerk of Asylum.

Manchester.—March 17th. Corporation. (*a*) Tramway rail bonds, (*b*) hard drawn copper trolley wire (*c*), span wire brackets for tramway poles. Specifications for (*c*), 21s. (returnable) from Mr. G. M. McElroy, General Manager, 55, Piccadilly, Manchester.

March 18th. Education Committee. Electric lighting installation at Heald Place Municipal School, Rusholme. Specifications (£1 1s.) from the Secretary, Education Committee, Deansgate, Manchester.

Merthyr Tydfil.—March 10th. Electrical accessories for a year, for the B. of G. The Workhouse Master.

Millstreet (Co. Cork).—New Hibernian Hall. The Secretary.

Newport (Mon.).—Corporation. Rails, tie bars, fishplates, and special track work, for the Electricity and Tramways Department. Specifications from Mr. A. Nichols Moore, Borough Electrical Engineer, Town Hall.

New Zealand.—BOROUGH OF TAURANGA.—May 11th. Hydro-electric and sub-station plant. Specifications (£2 deposit) from H. W. Climie & Son.—*N.Z. Shipping and Commerce.*

Plymouth.—March 19th. Corporation. Registering punches for tramways system. Town Clerk.

Rochdale.—March 12th. Stores for the Tramways Department. Form of tender, &c. (5s.) from Mr. G. Webster, General Manager, Mellor Street.

Rotherham.—March 12th. Corporation. One 2,000-KW. high-pressure turbo-alternator with condensing plant, switchgear, steam and exhaust piping and accessories; one 1,000-KW. rotary converter, transformer and switchgear; one 20-ton overhead crane. See "Official Notices" February 20th.

Southampton.—March 9th. Corporation. For supply of rotary converter, balancer, and direct-current meters. Specification from the Borough Electrical Engineer.

Spain.—The municipal authorities of Santa Marta (province of Badajoz) are at present inviting tenders for the concession for the electric lighting of the town during a period of ten years.

March 13th.—Tenders are being invited by the municipal authorities of Monturque (province of Cordoba) for the concession for the electric lighting of the town until the end of 1933.

April 22nd. Tenders for the concession of an electric tramway in Madrid. Proposals to be accompanied by a deposit of 1,274 pesetas (about £47), which is to be paid into the "Caja General de Depositos.—*Board of Trade Journal.*

MADRID.—Tenders are invited for the supply of wireless telegraph stations for the Royal Dockyards of Cartagena and Ferrol. Full particulars from the Ministry of Marine, Madrid, Negociado 5 de la Seccion Ejecutiva (Material) del Estado Mayor Central. Detailed advertisements appeared in the *Times* of March 3rd.

Swansea.—March 13th. Corporation. Cable ducts, cables, pilot and telephone wires, joint boxes, &c. See "Official Notices" February 27th.

Swindon.—March 7th. Corporation. Twelve months' supply of stores for electricity and tramways departments. See "Official Notices" February 18th.

March 18th. Corporation. Cooling tower. See "Official Notices" to-day.

Swinton and Pendlebury.—March 26th. U.D.C. 12 months' supply of cable, joint boxes, joint-box compound, bitumen, &c. See "Official Notices" to-day.

Warrington.—March 14th. Corporation Gas Committee. Dynamo, 220 volts direct-current, 30 KW. Particulars from Mr. W. S. Haddock, General Manager, Gas Offices.

March 31st. 750-KW. rotary converter, E.H.T. switchboard panel, for Electricity and Tramways Committee. See "Official Notices" to-day.

Wimbledon. — March 6th. Corporation. Twelve months' supply of stores for electricity department. See "Official Notices" February 20th.

Worle (Somerset).—March 19th. Street lighting for the Parish Council. Mr. Robert K. Clay, Clerk, Virginia Villa, Worle.

CLOSED.

Accrington.—The Electricity Committee has accepted the following tenders :—

National Gas Engine Co.—Generating plant, including two 1,000-H.P. gas engines, £10,750.
Bruce Peebles & Co.—Alternator and dynamos, £2,550.
Power Gas Corporation.—Gas-making plant, £11,000.
Brush Electrical Engineering Co.—Three single-deck cars, £2,823, and two double-deck cars, £2,092, complete with electrical equipment by Dick, Kerr & Co., Ltd., and Westinghouse magnetic brakes.

Admiralty.—The Walsall Electrical Co., Ltd., has received a contract for 62 meters from H.M. Admiralty.

Bath.—The tender of Messrs. Kendall has been accepted for installing the electric light at All Saints' Church, Weston.

Belgium.—Ten concerns, eight German and one each Belgian and French, submitted tenders to the municipal authorities of Ixelles, last week, for the supply of a quantity of low-tension electricity supply cables, the lowest offer being that of the Société A.E.G. Union Electrique, of Brussels.

Blackpool.—The Corporation is to be asked to seal a contract with the Magneta Time Co., for the installation of a municipal time service and automatic clocks on the tram routes.

Bolton.—The Tramways Committee has accepted the tender of Messrs. Hadfield's for tramway points and crossings.

Bristol.—The Docks Committee has accepted the tender of the Electric Construction Co., Ltd., for a 12-H.P. motor.

Croydon. — The Borough Council has adopted the Gamewell system of fire-alarms, as recommended on Monday by the General Purposes Committee, at a cost of £3,736.

Derby.—The T.C. has accepted the tender of Messrs. C. A. Parsons & Co., Ltd., for an additional turbine, at £7,017.

Glasgow.—The Clyde Navigation Trustees have considered tenders for material for the traverser authorised by the Granary Committee to be made at Renfrew workshops for the tramways at Meadowside Granary, and have agreed to accept those of Estler Bros. for overhead gear, at £21 10s., the Igranic Electric Co., Ltd., for control apparatus, at £92, and Laurence, Scott & Co., Ltd., for the motor, at £58. The offer by Mr. George Uril for switches and crossing required for tramway purposes (£156) has been accepted, as well as the following :—

Cab tire cable for traverser.—St. Helen's Cable Co.
Cast steel gear and trod wheels for traverser.—Springfield Steel Co.

The T.C.'s Tramways Committee has recommended acceptance of the following tenders :—

Armature coils.—Manchester Armature Repair Co.
Scrap for disposal.—Pegler Bros. & Co., R. M. Easdale & Co., Trainer and Allison, and Ballardie, Holden & Co.
Special trackwork.—Hadfields, Ltd.
E.H.T. rubber cable.—B.I. & Helsby Cables, Ltd.
Tinned iron and zinc sheets.—P. & W. M'Lellan, Ltd.
Wood surface planing machine.—John M'Dowall & Sons.
Metal-filament lamps.—W. C. Yuille & Co., Ltd.

Government Contract.—A contract for cables for the new Board of Agriculture has been placed with the Liverpool Electric Cable Co., Ltd.

Grimsby.—The tender of Messrs. E. Bannister & Co., Ltd., has been accepted for a nine months' supply of Sherwood slack to the Electricity Works, at 16s. 4½d. per ton.

Halifax.—The Corporation Education Committee has accepted the tender of Messrs. Charles Boll, Bradford, for the electric lighting installation at West House, King Cross Street, Halifax.

Ipswich.—Messrs. H. W. Butler & Co. have secured the order for the Corporation's cable requirements, for high and low-tension extensions, on behalf of their principals, the A.C.E.N.E. Cable Works, Jeumont, France.

Launceston.—For installing the electric light at the new Constitutional Club, the following tenders were received :—

Lord & Shand	(accepted)	£38
Alger & Son	.. ..	40
Mr. T. L. Chapman	.. ..	45

Leyton.—The U.D.C. has accepted the following tenders :—

Oliver Arc Lamp Co.—Arc lamp carbons, £2 16s. 6d. per 1,000 pairs.
Johnson & Phillips, Ltd.—Do., £3 7s. 6d. per 1,000 pairs.
C. C. Wakefield & Co.—Oils.
R. R. Todd.—Annual supply of the following cables on the basis prices mentioned :—$\frac{7}{14}$, £64 ; $\frac{7}{16}$, £46 10s. ; $\frac{7}{18}$, £32 ; $\frac{3}{18}$, £20 7s. 6d. ; twin $\frac{3}{18}$, £48 5s.

Liverpool.—The T.C. Tramways and Electricity Committee has accepted the following, among other, tenders for annual supplies :—

Rubber goods, &c.—L. Andrew & Co., Avon India-Rubber Co., Ltd., Geo. MacLellan & Co., North British Rubber Co., Ltd.
Lubricating oils and greases.—Dee Oil Co., Ltd., Joshua Rea & Sons, Ltd., Vacuum Oil Co., Ltd.
Steel gears and pinions.—R. W. Blackwell & Co., Ltd., F. W. Rowlands and Co.
Wrought-iron lamp standards, brackets, &c.—A. B. Dalzell & Co., Ashmore and Co., Killick & Cochran.
Cast-iron lamp columns and plugs.—Newton Chambers & Co., Ltd., Killick and Cochran.

The following tenders have also been accepted :—

S. H. Heywood & Co., Ltd., 15-ton, 43 ft. 6 in. span, three-motor electrically-driven overhead travelling crane, with 100-ft. gantry conductors.
Pulford Bros., Ltd.—Installation of electric light at new nurses' home and extension of Parkhill Hospital.

London.—L.C.C. The Stores and Contracts Committee reports that tenders were invited for the supply of metal filament lamps (with filaments other than drawn) under items 8 to 27, schedule No. 17, from 46 firms, the tenderers being requested to state whether they proposed to supply British or foreign-made lamps. The lowest tender was for lamps of foreign make, which were not satisfactory. The next lowest, that of the Electric Lamp Supply Co., was also for lamps of foreign make. The Committee recommends the acceptance of the tender of Pope's Electric Lamp Co., being the lowest tender for British-made lamps (the prices average about 11 per cent. above those of the Electric Lamp Supply Co.'s tender). Both companies' lamps have been tested with satisfactory results. Mr. Lewis is to move an amendment that the Electric Lamp Supply Co.'s tender be accepted.

ISLINGTON.—The B.C. has accepted the following tenders for annual supplies to the Lighting Department :—

Meters, &c.—Chamberlain & Hookham, Ltd.
Cables.—B.I. and Helsby Cables, Ltd.
Electrical sundries.—The Electrical Co., Ltd. ; Cryselco, Ltd. ; General Electric Co., Ltd. ; I.-R., G.-P. and T.W. Co., Ltd. ; American Hard Rubber Co. ; Heap & Johnson ; A. Round.
Service and network boxes.—Callender's Cable Co., Ltd. ; W. Lucy and Co. ; B.I. and Helsby Cables, Ltd. ; Sykes & Sugden, Ltd. ; J. Gibb and Co., Ltd. ; Dussek Bitumen Co., Ltd.
Earthenware pipes, insulators, troughs and fireclay.—Young & Son ; J. Knowles & Co., Ltd. ; J. H. Turner & Lisney, Ltd. ; Doulton & Co., Ltd. ; The Leeds Fireclay Co., Ltd.
Transformers and c.i. tanks.—British Electric Transformer Co., Ltd. ; Johnson & Phillips, Ltd.
Arc lamp carbons.—Sloan Electrical Co., Ltd. ; Ship Carbons, Ltd.
Arc lamp globes.—Falk, Stadelmann & Co., Ltd.
Oil and lubricants.—Vacuum Oil Co., Ltd. ; First Anglo-Russian Oil Co., Ltd.

STEPNEY.—The Electricity Committee recommends the acceptance of the offer of the Shipping and Coal Co., Ltd., of a barge of Northumberland nuts, at 14s. 11d. per ton, and a barge of Yorkshire "Meteor" screened washed nuts, at 17s. per ton, for trial purposes.

Newcastle-on-Tyne. The T.C. on February 25th accepted the tender of Hadfields Steel Foundry Co., Ltd., for a tramway junction, at £1,355, and a cross-over, at £312.

Northampton.—The T.C. has accepted the tender of Messrs. J. B. Pearse & Co., at £297 for a supply of tramway uniforms.

Plymouth.—Messrs. Johnson & Phillips have received an order from the Corporation for an eight-panel H.T. steel cubicle type switchboard.

Salford.—The following tenders have been accepted by the T.C. :—

Musgrave & Co., Ltd.—Induced-draught plant for heating car shed at central car depôt, Pendleton, £71 18s. 6d.
Ferguson, Pailin & Co.—Switchgear, for Ordsall transformer sub-station, £608.
Ferranti, Ltd.—Two three-phase oil-insulated self-cooled power transformers, £866.
Lancashire Dynamo and Motor Co., Ltd.—40-H.P. slow-speed motor, to drive air compressor, £131 10s.
T. Wragge & Sons, Ltd.—1 500 yards of three-way stoneware conduits, 1s. 11¾d. per piece 2 ft. 6 in. in length.

Southampton.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a supply of alternating-current meters, as well as those of Doulton & Co., Ltd., for pipes, troughs and covers, and Oates & Green, Ltd., for conduits.

Sunderland.—The River Wear Commissioners have accepted the offer of Messrs. Peter Pilkington, Ltd., for the supply of air-compressing plant and pneumatic hammer, and the offer of the Corporation Electricity Department to equip a 125-KW. sub-station at the Commissioners' works for the delivery of electricity to operate the air-compressing plant.

Warrington.—The T.C. has accepted the tender of Messrs. Walter Scott, Ltd., for girder tram rails, at £7 10s. per ton ; fishplates, at 10s. 10d. per ton ; and bolts, at 4d. each.

FORTHCOMING EVENTS.

Greenock Electrical Society.—Friday, March 6th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Paper on "Power Transmission," by Mr. A. Zoller.

Junior Institution of Engineers.—Friday, March 6th. At 8 p.m. At 39, Victoria Street. Paper on "Maihak Indicator and Battcher's Power Counter," by Mr. F. E. Rainey.

Friday, March 13th. At 8 p.m. At 39, Victoria Street, S.W. Paper on "Lightning Conductors and their Tests," by Mr. F. H. Taylor.

Saturday, March 14th. North-Western Section Visit, Oil Tank Steamer at Mode Wheel on the Manchester Ship Canal.

Nottingham Society of Engineers.—Friday, March 6th. At 7.30 p.m. At Welbeck Hotel, Milton Street. Annual Dinner.

Wednesday, March 11th. At Welbeck Hotel. Paper on "The Utilisation of Exhaust Steam and the Approximate Cost of Producing Electrical Energy therefrom," by Mr. W. C. Mountain.

Batti-Wallahs' Society.—Monday, March 9th. Annual General Meeting.

Institute of Marine Engineers.—Monday, March 9th. At 8 p.m. Paper on "Liquid Fuel," by Mr. J. Veitch Wilson.

Institution of Mechanical Engineers (Graduates' Association).—Monday, March 9th. At 8 p.m. At Storey's Gate, S.W. Paper on "Condensing Plants," by Mr. Ralph Jackson.

Institution of Post Office Electrical Engineers.—Monday, March 9th At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "Machine Telegraphs," by Mr. A. C. Booth.

Institution of Civil Engineers—Tuesday, March 10th. At 8 p.m. At Great George Street, S.W. Resumed discussion on "Rail-Steels for Electric Railways," and "Rail Corrugation and its Causes."

Association of Engineers-in-Charge.—Wednesday, March 11th. At 8 p.m. At St. Bride's Institute. Paper on "The Storage of Coal, with some Applications of Reinforced Concrete," by Mr. Henry Adams.

Royal Society of Arts.—Wednesday, March 11th. At 8 p.m. At John Street, Adelphi. Ordinary meeting.

Institution of Electrical Engineers.—Thursday, March 12th. At 8 p.m. At Victoria Embankment. Paper on "The Design of Rolling Stock for Electric Railways," by Mr. H. E. O'Brien.

(Newcastle Students' Section).—Monday, March 9th. At 7.30 p.m. At Armstrong College. Paper on "Circuit Breakers, Automatic and Otherwise," by Mr. J. Young.

(Manchester Local Section).—Tuesday, March 10th. At 7.30 p.m. At University, Physical Laboratory. Paper on "Motor and Control Equipments for Electric Locomotives," by Mr. F. Lydall.

(Scottish Local Section).—Tuesday, March 10th. At 8 p.m. At 207, Bath Street, Glasgow. Discussion on "Methods of Improving the Power Factor in Alternating-Current Circuits."

(Yorkshire Local Section).—Wednesday, March 11th. At 7.15. p.m. At Philosophical Hall, Leeds. Paper on "Textile Driving," by Mr. J. E. Schofield.

Royal Institution of Great Britain.—Thursday March 12th. At 3 p.m. At Albemarle Street, W. Paper on "Heat and Cold," by Prof. C. F. Jenkin.

March 14th. At 3 p.m. Paper on "Recent Discoveries in Physical Science," by Prof. Sir J. J. Thomson, F.R.S.

Physical Society of London.—Friday, March 13th. At 8 p.m. At Imperial College of Science, South Kensington. Ordinary meeting. Papers on "Time Measurements of Magnetic Disturbances and their Interpretations," by Dr. C. Chree, F.R.S.; "The Asymmetric Distribution of the Secondary Electronic Radiation produced by X-Radiation," by Mr. A. J. Philpot.

Manchester Association of Engineers.—Saturday, March 14th. At Grand Hotel, Aytoun Street. Topical Discussion Evening.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week:—

Monday, March 9th.—"A" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Tuesday, March 10th.—"B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Wednesday, March 11th.—Recruits only. Infantry drill, 7 to 9 p.m. Rating examination for all Companies, 7 to 10 p.m.

Thursday, March 12th.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Friday, March 13th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Saturday, March 14th.—Headquarters will be opened for the transaction of regimental business only from 10 a.m. till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

The Batti-Wallahs' Dinner.—We are informed that about 100 members and their ladies attended the ninth annual dinner of the Batti-Wallahs' Society on Saturday last. The President, Mr. J. Snow Huddleston, was in the chair, in spite of the fact that he had been in a motor accident the day before, and injured his knee. After the usual loyal toast and a pianoforte solo, Mr. Ashley P. Pope proposed the toast of "The Society." The President responded, and pointed out that the Society had made very satisfactory progress since the last annual dinner, there having been a 20 per cent. increase in membership. Mr. Wansbrough proposed the toast of "The Ladies and Visitors," and Mr. S. Horner suitably responded, and pointed out that since there was a "Pope" (Ashley P. Pope) and a "Bishop" (Mr. Bishop, of Henley's) present, he was sure the Batti-Wallahs were strictly proper people. One of the most appreciated items in the entertainment was given by Mr. H. Hewson-Brown, a Batti-Wallah who entertained with character sketches from Dickens. Mr. Charles James sang "A Slave of the Lamp," the Batti-Wallahs' own song. The President thanked Mr. Pooley, the hon. secretary, and Mr. A. J. Greenly, hon. entertainment secretary, for their work in connection with the dinner. During the evening a further issue of the "Batti-Wallah Journal" was distributed.

Electric Vehicle Committee.—At the last meeting of the above Committee, Mr. J. S. Highfield took his seat as the representative of the Incorporated Association of Electric Power Companies; Mr. J. A. Phillips (British Thomson-Houston Co., Ltd.), and Mr. R. A. R. Bolton (Siemens Bros. Dynamo Works, Ltd.) have been elected as representatives on the Committee of the B.E.A.M.A.'s motor and switchgear sections respectively. It has been decided that the 150-ampere size of concentric plug and receptacle, recently standardised by the Electric Vehicle Association of America, should be adopted as the standard for Great Britain; and that where a plug of somewhat larger capacity is required, the contact pieces should be lengthened in proportion to the greater carrying capacity. It was not considered necessary or desirable that, in the design of the plug, any provision should be made for earthing. The Engineering Standards Committee are to be asked to consider the adoption of the design as the British Engineering Standard charging plug. A drawing of this standard plug appeared in our issue of February 20th: it is at present being manufactured by the Albert and J. M. Anderson Manufacturing Co., of Boston, Mass., U.S.A.

As the most suitable type of flexible cable to use in conjunction with the plug, it is suggested that "cab-tire" sheathed flexible twin cable should always be employed.

In regard to International standardisation, arrangements have been completed whereby the Committee obtain the active help and co-operation in this work of the International Electrotechnical Commission.

Standardisation in the British Isles will be undertaken by the British Engineering Standards Committee, the Electric Vehicle Committee co-operating. Mr. Frank Ayton, the hon. secretary, has been co-opted as a member of one of the panels of the British Engineering Standards Sub-Committee on Electrical Plant.

The Commercial Sub-Committee presented a report on tariffs, in consequence of which it was decided to circularise electric supply authorities in order to ascertain at what minimum prices they would be willing to supply electric energy for charging the batteries of electric vehicles. In drafting this letter, the secretary was directed to point to the desirability of making the prices as low as possible.

The Committee, realising the necessity of electric supply authorities themselves adopting the use of electric vehicles, if proper progress is to be made, have been in communication with Mr. John Burns, the late President of the L G.B.

Mr. Burns was asked whether, in order to facilitate the purchase of vehicles by municipal authorities, his department would be willing to sanction loans for the purpose. In reply, the L.G.B. states that it is "prepared to entertain applications from local authorities for sanction to borrow money for the purchase of vehicles which they are authorised to provide in connection with the exercise of their statutory powers."

The secretary mentioned that, in his letter to Mr. Burns, he had suggested 10 years as the proper period for loans for this purpose. The secretary was directed to send a copy of the Board's letter to all municipal electric supply undertakings.

As to the rates for insuring electric vehicles, the Committee, for some time, have been in touch with the Central Organisation of the Tariff Offices, and also with one of the Non-Tariff Offices on this matter. At the request of both, the Committee obtained certain information on insurance matters for them from the United States. So far the Tariff Offices have not come to any decision, but the managing director of the Car and General Insurance Co., Ltd., states that as a preliminary measure, his company will be pleased to allow a reduction of 15 per cent. off the rates quoted for certain policies in the case of satisfactory vehicles propelled wholly by electric current derived from storage batteries. He further believes it will be possible to increase this reduction up to 20 per cent. in certain cases, and, on the other hand, it may be necessary, in a few instances, to reduce such reduction to 10 per cent. His company intend to give electrically-propelled vehicles beneficial treatment, and to get out a special electrically-propelled motor vehicle prospectus.

Messrs. Heenan & Froude, Ltd., of 4, Chapel Walks, Manchester, have a very complete collection of lantern slides illustrating the different types and makes of electric vehicles which they will be pleased to loan to any engineer who is arranging lectures in connection with this matter.

The next meeting of the Committee was fixed for March 20th.

Chain Driving in Textile Mills.—At a meeting of the Scottish Section of the Textile Institute, held at Edinburgh, Mr. H. T. Hildage read a paper on "Chain Driving in Textile Mills."

The Author said that chain drives, in his opinion, furnished a very convenient means of transmission from electric motors to line-shafts in spinning factories; their high efficiency, positiveness, and the quietness and absence of vibration with which they operated, went a long way towards obviating the necessity for the direct-coupled motor. The limit of power could be taken at about 250 h.p., and the limiting speed ratio at about 1 : 6. The motor speed permissible varied with the power. It was very easy and convenient in the case of electrically-driven weaving sheds to connect the motors to the line-shafts by chains. Practically every machine which could be driven by an individual motor could advantageously be connected thereto by a chain drive.

Chain gearing was at least equally efficient, under parallel conditions, with any other form of gearing, and much more efficient, under bad conditions, than any other form of gearing. Its high efficiency was maintained until it was worn out. It was a positive transmission, with enough elasticity to prevent serious vibration, and withal was rigid enough to transmit perfectly uniform turning.

In existing mills which were to be electrified, chain transmission enabled the engineer to make his conversion without any change in the existing structure of the mill, and usually without any stoppage of any part of the machinery. Lighter motors could be used if the transmission was by chain.

In new mills that were to be electrically driven under the group system, the availability of chain gearing for the drive from the motor to the line-shaft gave increased latitude for arranging the mill purely and simply from a production point of view.

From the millowner's point of view, it was hardly worth while to use well-made and well-fitted bearings, or to go to considerable expense in the alignment of shafting and careful erection of gearing, if this refinement was at once nullified and liable to be quickly destroyed by the defects and faults of the instruments of transmission, viz., tight belts, tight ropes and rough-cast gearing. With the use of chain gearing, however, many refinements throughout the mill became, not merely possible, but profitable.

Physical Exercises for Engineers.—On Monday last, by the courtesy of Mr. A. Hugh Seabrook, general manager of the St. Marylebone electricity supply, we were enabled to witness a special demonstration of the Müller system of physical exercises, given by Lieut. Müller himself before the staff of Messrs. Selfridge and Co., Ltd., and the St. Marylebone Electricity Department, at the establishment of the former. Mr. H. G. Selfridge occupied the chair, and was supported by the Mayor of St. Marylebone, Mr. John Fettes (chairman of the Electricity Committee), and other gentlemen interested in the subject of physical training, and there was a large attendance.

The demonstration was most interesting, and made it perfectly clear that, without the aid of any appliances whatever other than those found in every household, it is possible to attain and maintain a condition of sound bodily health and vigour, at a cost of 15 minutes a day. We strongly commend the system to the attention of our readers.

Electrical Ship Propulsion.—A vessel now being built in Sweden for the "Swedish Steamship Co." is to be propelled by the "Paragon" three-phase current reduction system; it is of approximately 1,000 s h.p., with a steam turbine running at 7.000 r.p.m., and generating 116-cycle current. A mechanical gear is to be placed between the induction motor and the propeller shaft, in order to reduce the diameter of the motor and allow it to be placed well aft. Mr. Durtnall, who recently inspected the motors near Stockholm, states that Swedish engineers are very much interested in this first application of the system in Scandinavia. Owing to the special construction of the turbine (Ljungström system) and the high speed and blade velocity satisfactorily obtained with this prime mover, a great reduction in fuel consumption is confidently expected in this vessel, as compared with sister ships driven by the old-fashioned reciprocating engine or geared turbines.

Institution and Lecture Notes.—Junior Institution of Engineers.—On Saturday last the thirtieth annual dinner of the Institution was held at the Holborn Restaurant. The President, Sir Boverton Redwood, was in the chair, and the company numbered about 140; amongst the guests were Sir Oliver Lodge, Sir Frederick Black, Sir John Forsey, Prof. R. Meldola, Prof. J. Cadman, Dr. Messel, Mr. Bedford McNeill, and other prominent gentlemen.

After the loyal toasts, Sir Oliver Lodge, proposing "The Petroleum Industry," said that engineering was the science of moving things about; it was divided into two branches—the static, in which they moved things and left them there, and the kinetic, in which they kept things moving. The latter was the science of locomotion, and grew more and more dependent upon the petroleum industry, with which engineers of the future would be more closely associated. Hence, the choice for president of Sir Boverton Redwood, in whom the industry was personified. The Admiralty, he said, depended very greatly upon engineers, and he sometimes regretted the vast amount of work and genius that was bestowed upon engines of death and destruction, but which, if expended in scientific research, would result in discoveries of immense importance. The country which allowed itself to get behindhand in scientific progress would take a back seat, and at present they were in danger of being eclipsed by other nations. The importance of the oil industry was recognised by the Government, which had made use of Prof. Cadman, the head of the department of mining engineering in Birmingham University, to carry out investigations abroad. The Oil-Well Engineering Co. had presented to the University a plant for experimental boring. Responding, the President said that he had grown up with the petroleum industry, and recalled the chief events in the history of the industry, from the drilling of the first well in Pennsylvania in 1859 by Col. Drake. He showed that British engineers had always played a prominent part in the development of the oil industry in all parts of the world, but it had been most difficult to secure good trained men capable of supporting their leaders. The University of Birmingham, in instituting a special curriculum in oil engineering, had performed a service of national importance.

Prof. Meldola proposed "The Junior Institution of Engineers," expressing admiration for the camaraderie and mutual helpfulness of engineers, which were so well exemplified in the Institution; he felt envy, too, for the products of engineering appealed to the eye of the people, while the achievements of chemists produced no impression on the public. He said that the objects of the Institution were set forth in an admirable paper by Mr. King, the chairman, and the advantages of membership were many and varied. The teaching of chemistry to engineers was often criticised, and the chemists would be glad of a conference that would give them hints as to what was required. Mr. E. King, in his reply, said that though the Institution came into being 30 years ago, the members were still "juniors" in spirit, and that spirit dominated their policy. Special provision was made for the younger members, such as informal meetings for discussions, a register for employment, which last year found 102 situations for members, and so on. Only 6 out of 1,272 members were now out of employment. During the five months of the new session 101 new members had been enrolled, compared with 35 in the whole of the previous year. They had decided to form local sections, of which two were in being at Birmingham and Manchester, and a third had just been inaugurated at Sheffield on February 21st. A proposal was under consideration to form one at Melbourne.

The President next gave the traditional toast, to "Absent Members," after which Mr. W. T. Dunn proposed "The Guests," drawing attention to the intimate relationship existing between engineers and chemists, and to the presence of eminent representatives of the Admiralty. In replying, Sir F. Black said that "Deeds not Words" was the motto of the Navy, and reminded the audience that the celebrated engineer Archimedes was so absorbed in his work that he failed to notice that his country had been captured by the enemy. The same enthusiastic spirit still inspired engineers.

Mr. J. N. Boot proposed "The President," explaining that it was the practice of the Institution to seek for its president an eminent representative of the branch of engineering or industry that was most prominent at the moment; the petroleum industry being the one complying with the conditions, the election of Sir Boverton Redwood was the obvious consequence. The President briefly replied, expressing the high opinion that he had formed of the Institution, and proposed the health of the secretary, Mr. A. Clifford Swales, who suitably acknowledged the compliment.

An excellent musical programme was provided by Messrs. J. Humphreys, C. Leggett, C. Corner, E. Clare and Signor Ceci, under the direction of Mr. G. T. Bullock; the accompanist was Mr. R. Cooper.

Institution of Electrical Engineers (Manchester Local Section).—The thirteenth annual dinner in connection with the Manchester Section of the Institution was held on Friday evening last, the chairman of the Local Section, Prof. E. W. Marchant, presiding. There were 162 members and friends present, including the Mayor of Salford, Mr. W. Duddell, President of the Institution, Prof. Petavel, and Mr. C. Vernier, chairman of the Newcastle Section.

After the loyal toasts had been duly honoured, Mr. A. B. Anderson proposed "The Corporations of Manchester and Salford." He congratulated the Manchester Corporation upon the able management and success of the electricity department. He had also noticed that Salford had at last recognised that the increased cost of living, the Insurance Act, and the death duties affected electrical engineers as well as other people, and he was glad to see from the advertisements in the Press that they were willing to pay a respectable salary for the post of electrical engineer to the Salford Corporation. The Mayor of Salford responded to the toast and in an amusing speech said that electricity had been the bane of the existence of the members of the Salford Council. They had had a terrible time. They had tried all manner of things. They had changed their dynamos. They had changed their boilers. They had changed their committee. They had sought advice and not followed it. As a last resort they had offered a salary of four figures for a new engineer. A short time ago they blew up part of their works, which happily were insured. Their only regret was that they had not made a job of it and blown the whole lot up, so that they could have had a fresh start.

Mr. Alderman Walker proposed "The Institution of Electrical Engineers," and made an appeal for the appointment of a committee with representatives from the railway companies, the Local Government Board, and the Board of Trade to report on the best system for the electrification of railways. Mr. W. Duddell, the President, responded and said that whilst he was in sympathy with the sentiments expressed by Alderman Walker, the present moment was inopportune, and it would not be advisable to decide upon any one particular system until experiments, which at the present time were being undertaken, had been completed. He hoped that the suggested meeting-house and library for the various technical societies of Manchester would be proceeded with. The chairman (Prof. E. W. Marchant) also responded, and said that at the present time the danger was that the work of the Local Section Committee and chairman was becoming too easy. If local papers were not forthcoming they simply applied to London. Personally, he preferred the arrangement suggested last year, viz., that half the papers read at the Local Section meetings should be of local origin. In Manchester the experience was that the members took far more interest in local papers than they did in other papers, possibly of greater merit. This local spirit should be encouraged, for it stimulated interest and aroused enthusiasm as nothing else could.

Dr. E. Rosenberg proposed "The Visitors," and remarked that he did not at all agree with the remarks of Mr. Alderman Walker. No one was more in sympathy with organisation and standardisation than he was, but before you could standardise anything, it must exist. It would be far better for railway electrification generally that each company should experiment in its own way and on its own system and learn by its failures. Then possibly in a few years they could determine which was the best system. It would pay better eventually to scrap the wrong systems than to wait until the right one came along.

Mr. J. F. C. Snell and Mr. C. Vernier responded to the toast.

Calcutta Local Section.—On January 29th the annual general meeting and annual dinner of the Section took place, Mr. R. E. Winkfield presiding. Proposing the toast of the "Local Section," the chairman stated that the membership was 80, and the Section was firmly established. The Hon. Treasurer presented the statement of accounts, which, with the report, was adopted, and Mr. W. H. Everett was elected chairman in succession to Mr. Winkfield. Mr. E. M. Hughman was re-elected hon. secretary.

On February 6th, Mr. C. T. Williams read a paper on the new Central Telegraph Office at Calcutta, and the standard fitting and equipment of telegraph offices in India generally.—*The Englishman.*

Royal Society.—Mr. John Dewrance has presented £2,000 to the Donation Fund of the Society, the income arising from which is applied in promoting experimental researches.

Society of Engineers (Inc.).—On the 2nd inst. a paper entitled "Esperanto: An International Language for Engineers," was read by Mr. T. J. Gueritte.

Ipswich Engineering Society.—An interesting paper on "Electric Automobiles" was recently read before the Society by Mr. G. L. Garton, of the Corporation electricity department. In the discussion, Mr. F. Ayton stated that Messrs. Liberty's found they could run their ½-ton vehicles 270 to 320 miles a week, at a working cost of 9s. 6d. each, a figure unapproachable with petrol.

Institute of Marine Engineers.—The twenty-fifth annual meeting of the Institute was held on February 26th, Mr. Thomas L. Devitt presiding. The annual report showed that the membership at the close of the financial year stood at 1,408, a net increase of 58 during the session. The City premises fund amounted to £8,193. The *Titanic* Engineering Staff Memorial Fund had realised the sum of £2,940. The total income from all sources during the year was £1,430. There was a credit balance of £339, and after adding entrance fees, a total of £451 was added to the revenue account during the year, that account now standing at £4,279. Sir Archibald Denny was elected president for the session 1914-15.

Metropolitan Association of Electric Tramways Managers.—A meeting of the members of this Association was held on Friday, February 27th, at the Municipal and County Club, Whitehall Court, S.W., at which the following were present:—Messrs. Ullmann (East Ham), Coveney (Erith), Schofield (Leyton), Harvey (Ilford), Moffet (West Ham), Hammond (Metropolitan Electric), Mason (South Metropolitan) and Goodyer (Croydon), hon. secretary.

Surface Combustion.—In the course of a paper on this subject read before the Royal Institution on Friday last, Prof. W. A. Bone stated that the boiler equipped with this system was invented and developed in Leeds by a group of British chemists, all University trained, and he protested against the attempts of the German technical Press to claim it as in part a German invention.

Ghent Exhibition.—As indicated in a previous article, the engineering exhibits in the Post Office Gallery at Ghent proved one of the principal attractions in the British Section. They secured the highest possible awards in their classes. The exhibit, as a whole, was awarded the Grand Prix in Class 26, Telegraphy and Telephony, while a similar honour was paid to Messrs. Sullivan for the Hay fault locater designed by the Research Section, Post Office Engineering Department. Messrs. Siemens Bros. were awarded a Grand Prix in each of the following classes: 24, 26 and 27. The Western Electric Co. secured a Grand Prix in Class 23, Group 5, Mechanical Production and Utilisation of Electricity, and also one in Class 26 in the same group. Messrs. Gell secured the Diploma of Honour and a Gold Medal for their perforator. Messrs. Burt, Boulton & Haywood secured a Diploma of Honour in Class 50, Gold Medals in Classes 26 and 28, and a Silver Medal in Class 22. Gold Medals were awarded to the following manufacturers:—

Messrs. The British Insulated and Helsby Cables for the telegram cord carrier.
Messrs. The Peel-Conner Co. for the telephone demonstration board.
Messrs. Lamson & Co. for their "Pick-up" carrier.
Messrs. Gent & Co. for water level apparatus.
Messrs. The Oliver Typewriter Co. for their typewriter adapted for telegraphic purposes.
Messrs. The Silent Electric Clock Co.,

while Silver Medals were awarded to

Messrs. Gent & Co.
Messrs. Sauvee & Co.'s model of a facing table.

The Post Office stand during the whole period was the rendezvous of the telegraph and telephone engineers, many of whom availed themselves of the opportunity to study the Wheatstone automatic system, which, it is understood, has recently been introduced into the Belgian Post Office.

Early in June a special tour of inspection was made to the P.O. Court by the King of Belgium and his suite. During his Majesty's visit a message of greeting from the Postmaster-General was dispatched, and the various processes through which a telegraphic message might have to pass greatly interested the distinguished visitors. The presidents and members of the various electrical institutions throughout Europe also took keen interest in the department's exhibit.

It may interest readers to know how exhibitions are organised and what part the P.O. engineering department plays. The Board of Trade Exhibitions Branch invites firms to rent space in the British Section, whilst the Government departments likely to take part are offered space in the galleries, and the cost of their exhibits is borne by the Board; thus the P.O. as a department is put to no expense. A P.O. exhibit without the engineering department would be more in the nature of a museum. An up-to-date exhibit must necessarily include working apparatus of all kinds. The writer, who was responsible for the arrangement of the P.O. exhibit, and who has had considerable experience in exhibition work, in conjunction with the technical experts prepared a plan covering an area of about 80 ft. by 40 ft., but the extremely interesting nature of the engineering department's exhibit alone caused it soon to overflow this small space, and ultimately the Board of Trade officials agreed to build a special court to accommodate the display. Firms from whom the department purchases its apparatus were invited to send samples of their wares as at present in use in the P.O., and as will be seen by the list of awards were very successful in the competition.

The department's factories set to work to construct pneumatic tubes, jointing chambers, examples of the method employed in jointing underground cables to aerial wires, terminating wires and protecting from lightning, and a variety of other devices peculiar to the department. The Controller of Stores set apart samples of his best goods for display and placed the services of one of his experts at this department's disposal. The result was, as the Press reports state, the finest P.O. exhibit ever brought together.

An incident which might have caused the destruction of the British Section occurred shortly after the Exhibition was opened. Fire originated in a refreshment pavilion immediately opposite the British Section, and had the decorative arch situated midway between the burning building and the British Pavilion caught fire, nothing could have prevented disaster, for the high wind was already carrying quantities of burning material on to the roof, and, in fact, in several places the velurium was burned. Thanks, however, to the presence of an abundant supply of water, the architect and his men saved the building.

In designing the British Pavilion every precaution was taken against fire. The walls were almost entirely composed of cement blocks, and the floor boards were packed up with earth, so as to prevent a current of air causing a fire to spread.

During the month of October a number of technical officers from the various administrations in Europe visited the Post Office Court in connection with the reconstruction of some of their postal and telegraph appliances. M. Hubar, the Directeur de Service des Postes, took particulars of the department's latest appliances for dealing with mails, while M. Pierre Pasquier, who, it is understood, made a special journey from China to Europe in connection with the equipment of a new line of railways in China with Morse apparatus, was directed to the Post Office Gallery.

The official closing day of the Exhibition was fixed for November 3rd, but owing to the great demand from the residents of Ghent and others to acquire the exhibits, the authorities decided to keep the sections open until November 10th. Numerous applications were made to the officer in charge of the Post Office Gallery during this period with reference to the various exhibits.

Post Office Engineering Department.—The annual dinner of the Department was held on February 10th at the Criterion Restaurant; Mr. Slingo, Engineer-in-Chief, presided, and amongst the guests were Mr. Herbert Samuel, M.P. (Postmaster-General), Sir H. Norman, M.P., Mr. R. Elliott Cooper, Dr. Glazebrook, Mr. W. Duddell, Rear-Admiral Charlton, Prof. Fleming, Mr. F. Gill, Mr. Hugo Hirst, Mr. A. M. Ogilvie, Sir John Gavey, Mr. W. M. Mordey and Mr. A. B. Walkley.

Proposing the toast of "The Engineering Department," Mr. Samuel said that it had been impossible to have simultaneously a reorganisation and a rapid growth of the telephone system. The new tariff was completed, and would bring to the telephone system a very large number of additional subscribers. Four years ago the Department was spending 2 million pounds a year; next year it would be spending 8 millions, and this last year it had spent nearly 6 millions; this showed the enormous increase in the work thrown upon the Engineering Department. The recent improvement in communication between Liverpool and Manchester, and the transfer of 5,000 subscribers from the old to the new Victoria Exchange, were achievements highly creditable to the staff, as well as the new Anglo-Irish telephone cable. The use of machine telegraphy and of automatic telephone exchanges was being extended, the Imperial wireless chain was in course of construction, and the Post Office tube railway had received Parliamentary sanction; in these respects this country led the whole world. Mr. Slingo, in reply, expressed the willingness and ability of the department to spend eight millions a year, or even more, and referring to the Holt scheme, said that the longer it was studied by the men, the more satisfied they would be with it.

Mr. A. J. Stubbs proposed "The Visitors," to which Mr. Walkley, Mr. Duddell and Sir Henry Norman responded. Mr. Moir proposed the health of "The Chairman," who briefly replied.

Fatalities.—Whilst repairing an overhead electric wire at the United Electric Car Co.'s works on February 26th, Henry Pye, 32, over-balanced and fell. He received internal injuries from which he died later.

The inquest was held at Preston on Monday. The *Manchester Guardian* says that the evidence showed that whilst repairing an overhead electric wire Pye ascended a tower wagon 17 ft. high. A dead wire snapped, and a hook in it caught the workman's jacket, knocking him off the tower. The jury expressed the opinion that the platform of the tower wagon was too small, and recommended that it should be fenced by a rail at least 4 ft. high.

Ball.—The annual staff ball of Messrs. Bruce Peebles & Co., Ltd., Edinburgh, was held last Friday evening, the place of meeting being, as in former years, the North British Station Hotel. A number of invited guests were present, and the total attendance was well over a hundred. The dancing programme was divided into two halves, the intervening interval being taken up by the supper. The usual toasts were proposed and responded to. The honours of the evening were shared by the joint managers of the company, Messrs. S. E. Bastow and J. H. Bunting, the former, with Mrs. Bastow, holding a reception at the beginning of the evening, and the latter presiding over the supper.

Annual Dinners.—The Lancashire Electric Power Co. held the annual works dinner at the Ram's Head Hotel, Radcliffe, on February 25th. The resident engineer (Mr. M. H. Adams) occupied the chair. The health of the chairman was proposed by Mr. Harrison (British Thomson-Houston Co., Ltd.). The musical programme was contributed to by Messrs. W. Walsh, T. Heaton, A. Foden, J. Mack, F. W. Irvine, R. E. Hickton and A. Hill.

Educational Notes.—South-Western Polytechnic Institute, Chelsea.—On March 27th, at 8 o'clock p.m., Lord Chelmsford, G.C.M.G., will present the prizes and certificates to students of the evening classes and day college. The laboratories and workshops will be open to public inspection about 9.15 p.m. Tickets of admission may be obtained on application at the Institute.

Club Concert.—The thirteenth annual smoking concert of the St. James's Electric Athletic Club is to be held on Saturday, March 21st, at 7.30 p.m., at the Wellington Hall, Eyre Arms Hotel, St. John's Wood, N.W.

Appointments Vacant.—The Colne Town Council has decided to advertise for a tramways manager, at a commencing salary of £225 per year; switchboard attendant, for Stoke-on-Trent (27s. 6d.). Particulars are given in our advertisement pages.

Inquiry.—Makers of "Acme" insulating tape are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Establishment Committee of Leyton U.D.C. has decided to grant increases in the salaries of the undermentioned employés in the Tramways and Electricity Departments: Mr. F. Harman Lewis, engineer and manager, to £700 per annum, by two annual increments of £25; Mr. L. O. Cox, distributing engineer, maximum to be fixed at £220, subject to such increase being regarded as personal, and not as attaching to the appointment; Messrs. Carter, Jones and Heather, charge engineers, to £168 per annum each, rising at the expiration of 12 months, to a minimum of £180 per annum; Mr. J. H. Quicke, draughtsman, to £160 per annum, rising by annual increments of £10, to a maximum of £180 per annum; Messrs. Sawford and Blackburn, junior charge engineers, to 37s. 6d. per week, rising at the expiration of 12 months to a maximum of 40s. per week; Mr. E. Edwards, tramways chief inspector, to £3 per week, as from April 1st next.

The Warrington T.C. Electricity Committee proposes to appoint Mr. J. A. Phipps, of Barnsley, to the post of shift engineer, rendered vacant owing to the resignation of Mr. E. Fenton. The Committee also proposes to increase the salary of Mr. E. Rathbone, shift engineer, to £2 7s. 6d. per week.

The Stoke-on-Trent T.C. has increased the salary of Mr. A. M. Walker, electricity and general assistant at the Hanley works, from £155 to £165 per annum. It has also appointed Mr. Herbert Wood, of Doncaster, to succeed Mr. F. W. Lawton, who has been appointed in connection with the new power house for Greater Birmingham, as mechanical and engineering draughtsman in the electrical engineer's office.

Mr. F. Nicholls, assistant engineer at the Heston and Isleworth electricity works, has been appointed engineer-in-charge, at a salary of £102 per annum, in lieu of Mr. Sadler, resigned.

The Haslingden Town Council has resolved that the sum of £50 be paid to Mr. S. J. Watson, consulting electrical engineer, for his services during the past year.

Proposed increases in the salaries of officials under the Manchester Corporation include the following:—Electricity department: Mr. J. A. Cookson, mains surveyor, £400 to £425; Mr. W. E. Foden, accountant, £425 to £450; Mr. F. E. Hughes, secretary, £475 to £500; and Mr. E. Bolton, sub-stations engineer, £375 to £400. Tramways department: Mr. J. Wood, now financial superintendent, to be appointed assistant manager, and salary to be advanced from £500 to £600 by four annual instalments; Mr. D. G. Mallalieu, permanent-way superintendent, £300 to £350 by two annual increments; Mr. J. T. Oakes, traffic superintendent, £475 to £500.

Of the increases in salaries amounting to £6,094, recommended by various Corporation committees at Edinburgh, the electric lighting department receives £350.

The Tramways and Electricity Committee has recommended the Halifax Town Council to increase the salary of the electrical engineer (Mr. W. M. Rogerson) from £600 to £700 per annum as from April 1st next.

Mr. A. S. Barnard, electrical engineer to the Walsall Corporation, has, after a service of about seven years, tendered his resignation to the Electricity Committee. Prior to going to Walsall, Mr. Barnard was for four years electrical adviser to the Government of Ceylon and the Municipality of Colombo.

Tramway Officials.—Mr. J. W. Dugdale, general manager of the Oldham Corporation Tramways, is confined to his bed and, although making satisfactory progress, it was intimated at a meeting of the Tramways Committee last week that it would be some weeks, or perhaps months, before he would be able to resume his work. The Committee expressed sympathy and hopes for a speedy recovery.

The Haslingden T.C. has decided to increase the salary of the tramway manager, Mr. B. Kay, by £13 per annum.

General.—Mr. Marconi, who is about to commence a series of experiments in the Mediterranean, gave a lecture on radio-telegraphy before the King of Italy on Monday last.

The name of Mr. J. E. Kingsbury appears in the list of elections to membership of the Royal Institution at last Monday's meeting.

The Newcastle City Council, on a proposition by the Lord Mayor, is considering the desirability of presenting the honorary freedom of the city to Sir J. Wilson Swan and to Sir Charles A. Parsons.

According to the *Canadian Electrical News*, Mr. Julian C. Smith, manager and chief engineer of the Shawinigan Water and Power Co., Montreal, has been awarded the Gzowski Medal by the Canadian Society of Civil Engineers for his paper on "High-Voltage Transmission Lines."

Mr. J. W. Meares, electrical adviser to the Government of India, is officiating as controller of patents, in addition to his own duties, for nine months. His address is Patent Office, Calcutta, till November, 1914.

Mr. A. T. Young has been appointed general manager of the British Electric Plant Co., Ltd. Mr. Young was, until the end of January, manager of the company's London office.

Mr. W. Smith has now joined the Liverpool staff of Messrs. Simplex Conduits, Ltd., and all communications should be addressed to him at 1, Dawson Street, Liverpool.

Mr. Anthony Hodgson, late of Burnley, has been selected as chief superintendent of the Eastern Telegraph Co., at Gibraltar. Mr. Hodgson has had an extended and varied service in many foreign countries.

As we go to press we are informed that the Marquis of Winchester and Sir David Salomons, Bart., have been appointed directors of the City of London Electric Lighting Co., Ltd.

According to the *South African Mining Journal*, Mr. J. N. Bulkley has resigned from the position of consulting electrical engineer to the General Mining and Finance Corporation, and is returning to the United States.

Obituary.—The death is announced of Mr. F. W. Jones, for many years chairman of the Montevideo Telephone Co., managing director of the United River Plate Telephone Co., &c. Due to bad health Mr. Jones retired from active business several years ago and returned to his home in the United States.—*Review of the River Plate.*

NEW COMPANIES REGISTERED.

Pyrene Co., Ltd. (134,210).—This company was registered on February 25th, with a capital of £5,000 in £1 shares, to carry on the business of manufacturers of and dealers in Pyrene and other fire extinguishers and apparatus, roofing, damp course, siding, building, sheathing, insulating and wrapping papers, decorating materials, chemical and electrical compounds, oils, colours, &c., and to adopt an agreement with the Pyrene Manufacturing Co., of the State of New York. The subscribers (with one share each) are:—W. B. Phillips, 29a, Charing Cross Road, W.C., civil engineer; W. E. Stratton, 29a, Charing Cross Road, W.C., company director; E. H. Wiley, 80, Duke Street, St. James's, S.W., solicitor. Private company. The number of directors is not to be less than three or more than nine; the first are W. B. Phillips (chairman), W. E. Stratton, E. H. Wiley, D. R. James, E. A. Clapp and E. J. Waring; qualificaton, one share; remuneration as fixed by the company. Registered office, 29a, Charing Cross Road, W.C.

Lighting Supplies, Ltd. (134,200).—This company was registered on February 25th, with a capital of £2,000 in £1 shares, to carry on the business of wholesale and retail dealers in, and suppliers of, lighting appliances and accessories, accumulators and lamps, electricians, &c. The subscribers (with one share each) are:—H. A. Jacoby, 101, Iverna Court, Kensington, W., electrical engineer; G. Krause, 1, Leinster Gardens, W., merchant. Private company. The number of directors is not to be less than two or more than three; the first are H. A. Jacoby (chairman) and G. Krause; remuneration of H. A. Jacoby, £50 per annum. Registered office, 36, Commercial Road, E.

Carlton Metal Works, Ltd. (134,186).—This company was registered on February 25th, with a capital of £1,000 in £1 shares, to take over the business carried on at 14, Lonsdale Road, West Kilburn, as "Springthorpe & Co.," and to carry on the business of electricians, electrical engineers, generators and storers of electricity, &c. The subscribers (with one share each) are:—C. A. J. Springthorpe, 14, Lonsdale Road, West Kilburn, N.W., metal worker; J. E. Arnall, 158, Hanover Road, Willesden, N.W., builder. Private company. The first directors are not named; J. E. Arnall, 158, Hanover Road, Willesden, N.W., is the first secretary.

J. Christopher & Sons, Ltd. (134,198).—This company was registered on February 25th, with a capital of £4,000 in £1 shares, to carry on the business of mill furnishers, makers of lifts, cranes and hoists, electrical and mechanical engineers, &c., and to adopt an agreement with J. Christopher. The subscribers (with one share each) are:—J. Christopher, 39, Clerkenwell Road, E.C., engineer; C. R. Barry, 44, Westbourne Park Villas, Bayswater, W., engineer. Private company. The number of directors is not to be less than two or more than three; the first are J. Christopher and C. R. Barry (both permanent joint managing directors). Remuneration as fixed by the company. Registered office, 39-43, Clerkenwell Road, E.C.

Grindlay, Ross & Co., Ltd. (8,993).—This company was registered in Edinburgh on February 20th, with a capital of £10,000, in 7,500 ordinary and 2,500 preference shares of £1 each, to carry on business as electrical engineers, &c. The subscribers (with one share each) are:—J. Grindlay, 14, Darnley Road, Glasgow, electrical engineer; J. S. Paul, 81, St. Vincent Street, Glasgow, solicitor; J. Mair, jun., 8, Crown Mansions, Glasgow, accountant. Private company. The number of directors is not to be less than three or more than four; the first are J. Grindlay, J. Mair, jun., and J. S. Paul; qualification, 100 ordinary shares. Registered office, 47, Waterloo Street, Glasgow.

Naylor Battery Co., Ltd. (134,246).—This company was registered on February 27th, with a capital of £12,000 in £1 shares, to take over the business of a metallurgist, electrician and manufacturer, and regenerator of electric batteries and accumulators, carried on by E. H. Naylor at 1, Lammermoor Road, Balham, and the patents granted to him. The subscribers (with one share each) are:—G. H. Pauling, 7, Fig Tree Court, Temple, E.C., barrister; E. H. Naylor, 1, Lammermoor Road, Balham, S.W., electrician. Private company. The number of directors is not to be less than three; the first are G. H. Pauling, Sir Sidney O'Brien Hoare, Bart., and E. H. Naylor; qualification, £50. Solicitor, P. R. Christie, 6, Stone Buildings, Lincoln's Inn, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Opel Motors, Ltd.—Particulars of £3,500 debentures, created August 11th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,500. Property charged: The company's undertaking and property, present and future, including uncalled capital; no trustees.

Indian Electric Supply and Traction Co., Ltd.—Issue on February 19th, 1914, of £5,000 debentures, part of a series of which particulars have already been filed.

Electromobile Co., Ltd.—Issue on February 9th, 1914, of of £455 12s. 6d. debs., part of a series of which particulars have already been filed.

Anglo-Argentine Tramways Co., Ltd.—Acknowledgment of indebtedness, dated February 6th, 1914 (supplemental to trust deed dated June 15th, 1910), to secure £1,500,000 deb. stock, ranking *pari passu* with £4,500,000 similar stock, secured by principal deed. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to prior charges. Trustees: Law Debenture Corporation, Ltd., 41, Threadneedle Street, E.C.

City of Oxford and District Tramways Co., Ltd.—A memorandum of satisfaction in full on December 31st, 1908, of mortgages and debs. dated January 1st, 1901, securing £10,000, has been filed.

Church Stretton Electric Supply Co., Ltd.—Particulars of £4,000 debs., created February 19th, 1914, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital, land, with erections thereon, at Church Stretton, Salop, and a provisional order granted to the company. Trustees: Rev. A. H. Johnson and E. Bond.

Pontelec Welding Patents, Ltd. (107,935).—Capital, £30,000 in £1 shares (10,000 preference). Return dated January 2nd, 1914, 20,000 ordinary and 5,000 preference shares taken up, £5,000 paid on the preference, £20,000 considered as paid on the ordinary. Mortgage and charges: £1,900.

Electrical Installations, Ltd.—A memorandum of satisfaction to the extent of £200 on February 18th, 1914, of debentures dated June 12th, 1908, securing £2,000, has been filed.

Gresham Export Co., Ltd.—Debenture dated February 20th, 1914, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: Mrs. B. A. Durrant, Stapledale, Russell Hill, Purley, Surrey.

Urban Electric Supply Co., Ltd.—Deed of acknowledgment of indebtedness dated January 31st, 1914, creating £15,000 further deb. stock, making with £475,000 already created a total of £490,000 deb. stock, and supplemental to trust deeds and acknowledgments of indebtedness dated from July 28th, 1904, to January 4th, 1911. Property charged: Electric lighting and tramway undertakings, lands, buildings, materials, rolling stock, plant, freehold and leasehold hereditaments, shares, purchase moneys, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Merchants' Trust, Ltd., 4, Crosby Square, E.C.

Hong Kong Tramway Co., Ltd.—A memorandum of satisfaction to the extent of £4,500 on February 13th, 1914, of trust deed dated July 1st, 1903, securing £195,000, has been filed.

CITY NOTES.

Hove Electric Lighting Co., Ltd.

The directors in their report for the year ended December, 1913, give the following figures:—

Year.	Houses.	Equivalent in 35-watt lamps.	Units sold.	Gross revenue.	Net revenue.
1911	2,128	138,200	1,139,328	£24,840	£14,457
1912	2,276	141,919	1,1[illegible]9,003	£25,220	£14,630
1913	2,464	147,392	1,127,125	£24,169	£14,029

There has been a reduction in gross revenue of £1,051, but as the working costs have been also reduced, the actual reduction of net revenue is only £601.

With the addition of the balance £348, brought forward, and bank interest, the amount to the credit of net revenue account is £14,390. Deducting the dividend on the preference shares (£588), the interim dividend on the ordinary shares at the rate of 8 per cent. per annum (£2,825), and provision for debenture interest and other items, there is a surplus of £8,365 now available. Preference dividend to December requires £588, and a final dividend for the six months is recommended on the ordinary shares at the rate of 10 per cent. per annum, making 9 per cent. for the year. The amount carried forward, after providing for the directors' extra remuneration of £285, is £3,960. The expenditure during the year on capital account amounted to £936. By agreement with the Hove Corporation the amount to be paid to the company for the undertaking, is to be £175,500 in respect to capital expenditure up to 31st December, 1912, plus £936 expended during the past year, and any further capital outlay properly incurred by the company up to the date of purchase. The Hove Corporation have notified the company that the purchase money will be paid in about three or four weeks.

The meeting is called for March 10th.

Fife Tramway, Light and Power Co.

Mr. William Low, chairman, at the annual meeting, said that the earnings from the Dunfermline and District Tramways Co. during the year, paid over to the company as dividend and management fees, amounted to £15,020, compared with £12,200 for 1912. There was, he said, a steady growth in traffic on all lines, and on certain sections, if the increase continued, it would be desirable to consider doubling certain portions of the track in order to take full advantage of the increased traffic offering, and to speed up the service. The Power Co. had made substantial progress during the year, the total consumers connected being 515, and the total receipts £17,750, compared with £12,200 the previous year. During the year cables had been extended towards Buckhaven, Methil and Leven, and a duplicate transmission line erected from the power station, connecting with Lochgelly, in order to give a duplicate supply to this point. The boiler capacity at the power station was approximately doubled during the year, and the generating station building considerably extended, ready to receive additional generating plant, which would be installed during the current year. When these additions were completed the Power Co. would be able to sell about double the maximum output of last year before requiring any serious additions to the plant at the station.

Mr. G. Balfour, London, seconded the chairman's motion for the adoption of the report and accounts.

It was agreed to increase the capital from £300,000 to £400,000 by the creation of an additional 50,000 preference shares and 50,000 ordinary shares.

Stolz Electrophone Co. (London), Ltd.—A meeting of the shareholders was held at Winchester House, E.C., on February 27th, at which the liquidator, Mr. A. F. Whinney, made a statement concerning the position of the company. Among his other remarks was one to the effect that there had been duplication of shares. A resolution was passed expressing appreciation of the liquidator's manner of conducting the inquiries into the affairs of the company, supporting his proposal for reconstruction on fair and equitable lines, and pledging itself to support him if it became necessary to proceed with legal proceedings that he had mentioned. Another resolution, also passed, expressed the opinion that the closest investigation should be made into the affairs of the company and the conduct of its business.

Chelsea Electricity Supply Co., Ltd.

The directors' report for 1913 states that the profit was £37,551 plus £2,833 brought forward and £2,251 for interest, making £42,634. After deducting interest on debenture stock £7,875, interim dividend on preference shares (6 per cent. per annum) £900, and interim dividend on ordinary shares (4 per cent. per annum) £4,944, there remains £28,915, which it is proposed to appropriate as follows:—Reserve for renewals, depreciation and contingencies £14,041, debenture stock premium redemption fund £704, written off cost of extinction of founders' shares £1,089, written off cost of investments £2,000, final dividend on the preference shares, making 6 per cent. for the year, £900, final dividend on ordinary shares (6 per cent. per annum) making 5 per cent. for the year, £7,415, carrying forward £2,766. The number of 8-c.p. lamp equivalents connected on December 31st, 1913, was 306,422, an addition of 12,449 during the year, and the total number of units sold was 4,451,165, being 267,093 more than that for the previous year.

The meeting takes place on March 16th.

Newcastle and District Electric Lighting Co., Ltd.—The annual meeting was held in Newcastle-on-Tyne on February 27th, Dr. J. B. Simpson presiding. The Chairman, in moving the adoption of the report (see Electrical Review, page 368), said the share capital remained practically the same as in the previous year, as did the first debenture stock. Of second mortgage debentures £2,200 had been redeemed during the year. The item of £1,900 credited to second debenture redemption fund to December 31st, 1912, appeared in the balance sheet for the first time, and with the £2,011 to be transferred out of last year's profits, made £3,911 in the fund at December 31st, 1913. There had been an increase of capital expenditure of £10,772 during the year, a large portion of this being for plant on which a rental was paid. The gross profit for the year was £30,824, an increase of £4,362 over the previous year, and the amount available for division was £19,489. After providing for second mortgage debentures redemption fund they were enabled to make a return to the shareholders of 4 per cent. and carry forward £10,075. Mr. H. I. Brackenbury seconded the resolution, which was carried. A resolution was adopted extending the directors' borrowing powers by £50,000. Mr. F. B. Atkinson, of Gallowhill, Morpeth, has been elected to a seat on the board.

Crossley Bros., Ltd.—Sir Kenneth Crossley, presiding at the annual meeting held at Manchester on February 25th, said that the year's trading showed considerable improvement. Wages were higher, raw materials were high, and competition was plentiful. They had spent a great deal of time and money on the new gas engines, and were now completing similar improvements in oil engines—Crossley, not Diesel. They had sold a large number of gas plants for situations where coal-gas and oil fuel were either unavailable or too costly. They had taken out valuable patents in connection with the use of lower grade fuels, and their gas plant trade all over the world had already improved. They regretted that there was no ordinary dividend, but they were strengthening their position for the future and to meet competition.

Bastian Meter Co., Ltd.—The directors' report for 1913 states that there was a slight decrease in the net trading results as compared with the previous year. The export trade has fallen off, but happily the home trade has improved. £500 having been written off patents and goodwill, the net amount of profit for the past year is £283, plus £345 brought forward, making £628, as compared with £863 for the previous year. The directors recommend the 6 per cent. dividend on the cumulative preference shares, amounting to £121, and a 2½ per cent. dividend on the ordinary shares, amounting to £248, for the year, leaving £260 to be carried forward.

Stock Exchange Notices.—Application has been made to the Committee to appoint special settling days and to give quotations in the following:—

Auckland (City of)—Scrip fully paid for £224,500 electric power additional loan 4½ per cent. debentures.

Cleveland and Durham Electric Power, Ltd.—£130,000 5 per cent. first mortgage debentures of £100.

And for official quotations in:—

Crompton & Co., Ltd.—85,007 ordinary shares of £1 fully paid, Nos. 1 to 85,007; and 136,000 preference shares of £1 fully paid, Nos. 1 to 136,000.

British Insulated and Helsby Cables, Ltd.—The directors announce a final dividend on the ordinary shares, bringing up the total distribution for the year to 13 per cent. This compares with 10 per cent. for the year 1912. Approximately the same amount as for the previous year is put to depreciation and reserve (£90,000), and £93,000 is carried forward, as compared to £74,231.

Constantinople Telephones.—The *Financial Times* understands that underwriters of the £200,000 6 per cent. bonds in the Constantinople Telephone Co. have had to take up 66 per cent.

John Spencer & Sons, Ltd.—An interim dividend on the ordinary shares of 5 per cent. per annum for the past half-year is announced.

Halifax and Bermudas Cable Co., Ltd.—An interim dividend of 3 per cent. is announced.

Lancashire United Tramways, Ltd.

The annual meeting was held on February 27th, at Winchester House, E.C., the Hon. Arthur Stanley, M.P., presiding.

In proposing the adoption of the report (see Elec. Rev., page 371), the Chairman said it would be seen that the working of the combined undertaking had produced a profit of £27,653, this being an increase of £8,187 over 1912. If they referred to the accounts for the year 1907—the first full year of operation after the reconstruction—they would find that the profit amounted to £12,850, so that they had more than doubled their earnings in six years. The increase in receipts over the previous year included £10,143 from passengers and parcels, £1,072 from the sale of electrical energy, and £105 from rents and interest. Against these there was a slight decrease in advertising amounting to £155. The traffic earnings per car mile showed a satisfactory increase from 8.21d. to 9.01d. The increase of £3,278 in expenditure was chiefly due to the cost of working the new extensions, the increased amount of electrical energy generated for outside consumers, the further increased price of coal, and the holidays with payment they had granted to workmen. The electrical energy generated and sold to outside consumers for the year was 1,413,527 units, as against 1,025,470 units in the previous year, being an increase of 388,057 units. Although they had earned £27,653, they did not think it would be advisable to make any payment of interest on the Second Mortgage Debenture stock, and therefore they had only transferred from the operating companies sufficient revenue to enable the company to meet the interest on the Prior Lien Debenture stock and working expenses. The balance, amounting to £14,994, had been retained in the operating companies, the bulk of it being placed to the credit of renewals account, and the remainder carried forward. He would point out that heavy track renewals would have to be borne by the operating companies, and the funds must be built up in those companies to enable such expenditure to be made from time to time. At December 31st last the depreciation and renewal accounts and amounts carried forward in the combined companies amounted to £29,290. The new turbine had been installed during the year, and was put on load on November 16th. This addition to the plant would enable them to cope with any expansion they expected in the supply of electrical energy. They would be pleased to know that the agreement with the Atherton Urban District Council—their largest customer for electrical energy—had been extended for a further ten years. During the year the company constructed the extensions of 2½ miles in the districts of Little Hulton and Farnworth, and these were opened to traffic on August 28th last. The results had come fully up to anticipations, and there was no doubt the line was also proving a valuable feeder to the connecting tramways. As they would have seen from the Press, the question of carriage of goods by tramways in Lancashire had been discussed lately, and the Liverpool Corporation was now considering a report by its general manager on the proposal. They had also had the matter under consideration, and had promised to co-operate in every possible way, but until the Liverpool Corporation and the Mersey Docks and Harbour Board made a definite move they could do very little in the matter themselves except to help on the negotiations.

Sir Joseph Beecham seconded the motion.

Replying to a shareholder, the Chairman said they had not fixed any figure for the renewal fund before they commenced to distribute something on the Second Debentures; in view, however, of heavy renewals that would have to be undertaken, they would have to get that fund considerably larger than it was at present before they could declare a dividend.

The report was adopted.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The directors report that the connections to the system at the end of 1913 amounted to 203,668 h.p., which, compared with the previous year's figure of 174,327 h.p., show an increase of 29,341 h.p. The profit for the year is £141,140 (as compared with £120,989), plus £6,768 brought forward, making £147,909 (as compared with £125,597), against which has been charged interest on Debenture stocks, loans, etc., amounting to £42,632, leaving £105,276. There is recommended a dividend of 2½ per cent. on the Preference shares, making 5 per cent. for the year, £34,375; a dividend of 3 per cent. on the Ordinary shares, making, with 5½ per cent for the year, £39,312; transfer to depreciation account, £15,000; transfer to reserve account, £10,000; carrying forward to 1914 £6,589. The reserve account at December 31st, 1912, stood at £10,405, which will be increased by the proposed transfer out of profits of £10,000 to £20,405, out of which the directors propose to write off part of the cost of the issue of Second Mortgage Debenture stock, £20,000, leaving in reserve account a balance of £405. The unappropriated depreciation account, which at the end of 1912 stood at £118,900, will be increased by the transfer of £15,000, which is in addition to the items of £170,000 and £8,600 specifically allocated as shown in the balance-sheet. The additions to capital expenditure account for the year amount to £174,271, and represent part of the cost of extensions now in progress at the Dunston power station, of general extensions to the distribution system of the company, and assets acquired from the Durham Collieries Electric Power Co., Ltd. In order to meet the existing and prospective expenditure on capital account, an issue of £100,000 5 per cent. Second Mortgage Debenture stock was made in October last. The purchase of the undertaking of the Durham Collieries Electric Power Co., Ltd. (which included the shares of the Houghton-le-Spring and District Lighting Co., Ltd.) was completed in October last, and 10,000 Ordinary shares of £5 each, fully paid, of the company have been allotted as part consideration, the balance of consideration being satisfied by the release by the company of certain debts and the cancellation of debentures and bonds which this company held in the Durham Collieries Electric Power Co. The boards of this company and the County of Durham Electrical Power Distribution Co., Ltd., have for some time had in view the advantages of a closer union of interests between the two companies, and after due consideration they have come to the conclusion that this will best be attained by the Newcastle Co. acquiring by exchange the shares of the Durham Co. This company already holds 9,415 Ordinary shares and 10 Preference shares of the Durham Co., and the board recommends that the company should offer to acquire the remaining shares in the Durham Co. upon terms set out in a memorandum, and a resolution to this effect will be submitted at the meeting to-day (Friday). The proposed scheme, if carried through, will involve an increase of this company's capital. The directors recommend that the existing £5 shares in the company should be sub-divided into five shares of £1 each. If the necessary resolution is passed by the required majority, an extraordinary general meeting of the company will be subsequently convened for the purpose of confirming such resolution as a special resolution, and if the proposed exchange of shares meets with a satisfactory response from the Durham Co.'s shareholders, a resolution for increasing the capital will be put before the shareholders at the same meeting. Mr. D. Cunliffe resigned his seat on the board during the year, and the Hon. R. H. Brand, C.M.G., was appointed to fill the vacancy.

W. T. Henley's Telegraph Works Co., Ltd.

For the year 1913 the directors report a profit of £112,509. After deducting directors' and auditors' fees, Debenture interest, income tax, and amount written off for depreciation on buildings and machinery, £26,844, there remains £85,665, plus £45,017 brought forward, making a total of £130,683. From this the following are deducted: To reserve in respect of depreciation of Consols and other trustee securities, £5,284; transfer to reserve account, £15,000; dividend on Preference shares to December 31st, 1913, £9,000; interim dividend on Ordinary shares, £10,000; leaving an available balance of £91,399. The directors recommend a dividend on the Ordinary shares of 15 per cent., free of income tax, including the interim dividend of 5 per cent. already paid; and also, consequent on the success of the company's "Why Not" golf balls, a bonus of 5s. per share, free of income tax; this will require £30,000; income tax on total Ordinary dividend and bonus, £2,333; leaving to be carried forward £59,065. The dividend warrants on the Ordinary shares will be posted on March 6th. The directors regret that, owing to advancing years and ill-health, Mr. Frederick Newton has resigned his seat on the board. The shareholders are reminded that Mr. Newton joined the board on the formation of the company in the year 1880, and the directors desire to place on record their appreciation of the long and valuable services rendered by Mr. Newton to the company. Mr. William Joseph Potter, who has been for many years in the service of the company, has been elected a director. The meeting is being held to-day.

South Metropolitan Electric Light and Power Co., Ltd.

The annual meeting was held on February 25th, at Winchester House, E.C., Mr. H. St. John Winkworth in the chair.

In proposing the adoption of the report (see Elec. Rev., page 319), the Chairman said that the net revenue had increased from £33,933 for 1912 to £41,569 for 1913, an increase of £7,616, the largest increase they had had. The improvement had been general throughout the whole area; there had been no abnormal revenue, but a steady increase in the demand for lighting, heating, and power. The units sold were 6,662,842, an increase of more than 20 per cent.; 625 new consumers were added during the year, as compared with 566 for the previous year; while 607 extension orders were received from existing consumers, and the 35-watt equivalents increased 30,833 (equal to 880 K.W.), all of which were record figures. The sales of electricity produced £61,098, an increase of £8,609, or 16.5 per cent. The total gross revenue showed an increase of £9,031. Coal cost £890 more, which showed that the large increase in the demand had been economically dealt with. The business done at the company's show-rooms had been well maintained; the number of transactions had increased from 4,080 for 1912 to 4,180 for 1913, and the sales showed another increase over the previous year. The total expenditure amounted to £24,061, or £1,394 more than last year, and represented 36.6 per cent. of the gross receipts, as compared with 40 per cent. for the previous year. The cost per unit sold had decreased from .99d. to .86d., which was a creditable achievement, especially in view of the increased price paid for coal, and showed that the additional unit of plant which was working for about nine months last year, was producing satisfactory results. The net revenue amounted to £41,569, which brought the return on their average capital expenditure up to 6.8 per cent. As the business had developed, the return on the capital employed had shown a steady increase, having improved from 4.91 per cent. in 1910 to 6.8 per cent. for last year. They brought forward from last year £5,470, making a total to be dealt with of £47,039. The Chairman having stated how this was to be allocated (see the directors' report), he added that the balance available, after providing for Debenture interest and Preference dividend, amounted to £15,102, which, after placing £5,000 to depreciation account, represented 8 per cent. on the Ordinary shares; but the Debenture trust deed provided that before any dividend was paid on the Ordinary shares a sum equivalent to 2½ per cent. on the average capital expenditure had to be set aside to a special reserve fund for depreciation, etc., which amounted to £14,882 for the year. This obligation upon the company might be disappointing to some of the Ordinary shareholders, but on the other hand the retention of the profits in the business increased the real value of the property, and should benefit the company and the holders of the Ordinary shares in the long run, as it would provide the capital necessary for the ordinary development of the business, such as short extensions of mains, new services, meters, etc., and only make it necessary for fresh capital to be raised for any important or special business which might offer and be advantageous for the company. Now that the earnings covered the full sum required to be set aside by the trust deed, the surplus profits would, as he understood it, be available for dividends on the Ordinary shares. In this connection it might be interesting to refer to the tabulated figures in the report, in which they would see that the net revenue, which in 1910 amounted to £27,009, increased to £41,569 for 1913, an improvement of £14,560, or more than 50 per cent. in the three years. If the same progress was made in the next three years as in the past three years, the profits would then suffice to pay a dividend of about 10 per cent. on the Ordinary shares. Of course, it was impossible to say whether this result would be realised or exceeded, but without attempting to prophesy, he thought he might say that as far as could be seen at present there was no reason why the progress they were at present making should not continue. The capital expenditure exceeded the capital receipts by about £25,000, which had been provided by a loan from the company's bankers. In order to deal with this and provide for the development of the business, the directors had under consideration a new issue of capital. The form which the issue would take had not yet been decided upon, but it was proposed to offer the same to the shareholders and Debenture stockholders. The business of the West Kent Electric Co. was being actively developed, extra high-tension mains having been laid through Bromley to Hayes, with a spur to West Wickham, where supply became available in December last. This formed part of a ring main to give supply to Keston, Farnborough, Orpington, and The Crays, which would be extended from time to time as profitable business offered. In regard to the references in the Press to the London Electric Supply Bill, which was being promoted in the name of the County of London Co., they would all like an extension of tenure, and if this could be arranged and a definite basis could be agreed as to the terms upon which capital expenditure was to be repaid by the L.C.C. in the event of their purchase of all the companies, he thought it would be to the advantage of both the Council and the companies, and it would benefit consumers by enabling the companies to provide an efficient supply for London under up-to-date conditions. As the Bill took power to alter the Act of 1908, which gave the companies valuable rights and defined the terms upon which the L.C.C. could ultimately purchase the undertakings of all the London companies at one and the same time, they felt it to be essential in the interests of the company to preserve the right to be heard on any change that might be proposed. They had therefore taken steps to obtain a hearing, and had joined with other companies with this object. Some well-known financial houses had approached the companies with a scheme under which they desired, by the aid of this Bill and by the formation of a large holding company, to amalgamate all the London electric companies. As the scheme was under consideration by a committee, he could express no opinion as to its merits, but as regarded the South Metropolitan Co. the proposal in its present form was not acceptable, as it failed to acknowledge or value the present position and future prospects of the undertaking. He would therefore ask them to rely upon the board to protect their interests in this respect. Should any scheme be presented to them which the board considered satisfactory and in the interests of the company, they would at once call them together and lay it before them. The prospects for the future were very encouraging. The increase in lamp connections for the first six weeks of this year compared favourably with the previous year, while there were several important orders both for light and power—among others, two large hospitals, which were now being prepared for connection. The revenue for the present year would materially benefit by the record connections of last year, so that he thought they might look for a substantial improvement in the revenue for the current year, and as the increased load was being economically dealt with at the power house, he believed the company was now earning sufficient to provide the full reserve required by the Debenture trust deed with a fair margin for dividend upon the Ordinary shares, which they would hope to increase from time to time as the business of the company was developed.

Mr. H. W. Bowden (managing director and engineer-in-chief), in seconding the motion, said that on previous occasions he had referred to the importance of low operating costs where the power load was an important feature of the undertaking. These units represented more than one-half of the year's output in their company. The new turbo plant had resulted in a considerable saving of fuel. Considerable extensions had been made to their distributing cable system, and the "efficiency of distribution" had again increased, *viz.*, from 77.67 per cent. to 78.71 per cent., which showed that the losses were few, notwithstanding the extensive network of their system having regard to the wide area covered (approximately 30 square miles). The output on feeders at the power house had shown an exceptionally large increase, *viz.*, from 7.06 millions to 8.46 million units, or 20 per cent.; while the units sold had increased from 5.48 millions to 6.66 millions, or 21 per cent., raising the efficiency by 1.04 per cent. The maximum load had risen from 4,000 to 4,700 K.W. Those figures represented their largest increase, both in maximum load and units, with the result that the coal cost had been further reduced from .37d. to .34d., notwithstanding the increased price of fuel; the works costs were reduced from .59d. to .51d., and the total costs were reduced from .99d. to .86d. The year's progress and the results obtained were the best on record.

Mr. H. L. Cripps said he hoped the chairman would not consider him out of order if he referred at some length to the question of the proposed Bill for a bulk supply for London. He had the honour to submit a somewhat similar proposal to the companies some years ago, which was carefully considered. His proposal was based on the impossibility of the directors and engineers of the electric companies in London at the present time doing real justice to their undertakings or really getting the best out of them because of the difficulties which arose from the allotment of different small areas in London among many companies and local bodies. It was found impossible among the companies as a whole to come into any concerted scheme, and therefore after the companies had considered the matter for some time the suggestions were quietly pigeon-holed in the belief that the difficulties in carrying them out were insuperable. A good deal had happened since that time, and now the County of London Company had taken their papers out of the pigeon-hole and had taken further advice, and had recognised the importance of some more unified system of management and were introducing a Bill into Parliament. He was thoroughly familiar with all the circumstances surrounding the question, and he felt very strongly convinced that when the Bill was thoroughly considered and understood it would be found to be one which made a very considerable advance in regard to the electrical industry in London in the solution of pressing problems. He entirely agreed with the policy of the directors of that company in presenting a petition against the Bill, for, of course, it was difficult to say how it might turn out, and it was important that the directors should have taken the step they had along with other companies in securing the right to be heard in order to see that it did not pass except in some form agreeable to themselves. The scheme was so large and the interests involved were so widespread that unless some general consensus of opinion could be obtained on the matter he was afraid it would not do any real good. The L.C.C. must have great influence in settling the matter, and unless they could see not only benefit to the shareholders in the various companies, but also benefit to the users of electricity and to London generally, they could not expect the Council to assent to any scheme. Failing their assent, he felt it would be almost hopeless to persevere with anything of the kind, for there was no doubt that the policy of the House of Commons would be very largely influenced by the L.C.C. His view was that not only would the scheme be advantageous to the shareholders of the companies by giving them an extended concession, but it would also be advantageous to London as a whole from the consumers' point of view. We were notoriously behind in this country in regard to electrical enterprise. Electrical industries, manufactures, big machinery works, etc., did not occupy that position in London which they ought, having regard to London's position, and he thought that the discussion of this Bill, whatever might be the ultimate result of the measure, would tend to throw a great deal of light upon the subject generally and, he hoped, would put London and this country generally in a better position in regard to the electrical industry.

The Chairman remarked that he was glad Mr. Cripps approved the attitude which the directors were taking in regard to the County of London Bill, but, as he had stated in his opening remarks, he was precluded from giving his opinion upon the matter as it was in the hands of a committee.

The report was adopted.

Direct Spanish Telegraph Co., Ltd.—A dividend at the rate of 4 per cent. per annum on the ordinary shares for the half-year ended December, 1913, is announced.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. for the three months ending 31st inst. on the 6 per cent. cumulative preference shares.

(*Continued on page* 409.)

New Type of Electric Locomotive for the Rhaetian Railway.

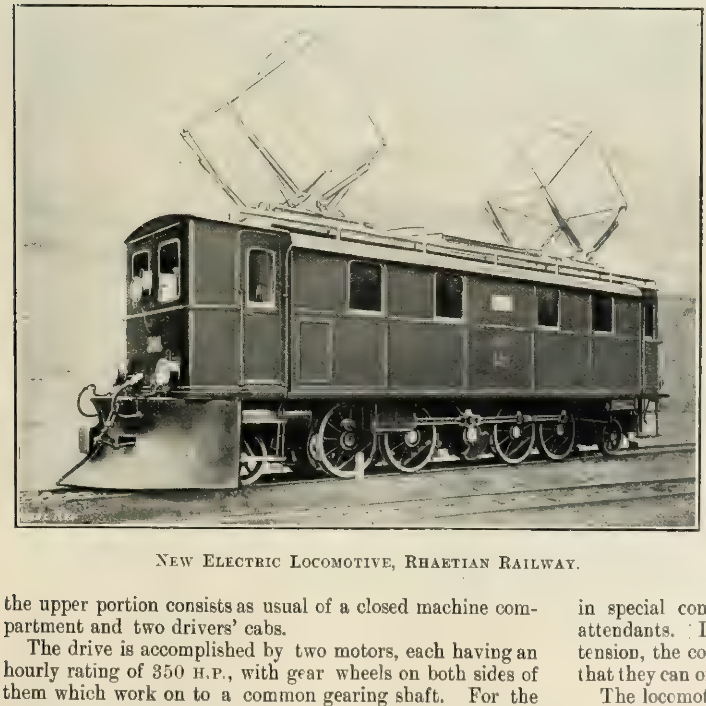
BY OUR BERLIN CORRESPONDENT.

A NEW type of electrical locomotive has been constructed for the St. Moritz-Schuls mountain line, which, with a branch to Samaden-Pontresina, is known as the Rhaetian Railway.

The locomotive is to be employed on a line having a 1-metre gauge, with maximum gradients of 1 in 10 and a minimum curve radius of 160 metres. It is operated by single-phase current at a pressure of 10,000-11,000 volts, $16\frac{2}{3}$ cycles. It was specified that the locomotive must be capable of drawing a train having a total maximum weight of 200 tons. It was also particularly specified that a train having a total weight of 180 tons must be able to start on the gradient of 1 in 40 and attain a speed of 28 km. per hour in 52 seconds; further, that these trains must travel backwards and forwards over the entire line from St. Moritz to Schuls four times consecutively, *i.e.*, a total distance of 454 km., without the electrical equipment becoming excessively heated. The maximum speed is 45 km. per hour. The type of brake specified was the Hardy vacuum brake.

ELECTRIC TRAIN ON VIADUCT IN LOWER ENGADINE, RHAETIAN RAILWAY.

The locomotive is designed to run easily on curves in accordance with the nature of the track. It has two fixed and two movable coupling axles, and two Bissel bogie trucks; the upper portion consists as usual of a closed machine compartment and two drivers' cabs.



NEW ELECTRIC LOCOMOTIVE, RHAETIAN RAILWAY.

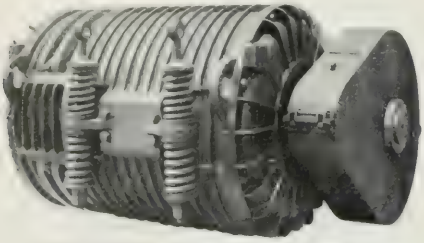
The drive is accomplished by two motors, each having an hourly rating of 350 H.P., with gear wheels on both sides of them which work on to a common gearing shaft. For the purpose of equalising the pressure, each of the gear wheels mounted on one shaft is provided with teeth set at an angle, this angle being opposite on each wheel. The gearing shaft drives the jack shaft lying between the third and fourth axles by means of coupling rods also set at an angle, and the jack shaft in turn drives the coupled axles.

The two motors are connected up in accordance with a method known as the double-feed system; on starting up the rotor is short-circuited. The control is effected by electro-magnetic contactors operated from the controller which, similarly to the reversing controller for the motors, is fed with alternating current at 300 volts. Owing to the fine pressure graduation of the current led to the motors, starting and speed regulation while running can be carried out smoothly and without any shock. Each motor can be separated from the other electrically in a very simple manner, so that in the event of one motor becoming defective, the locomotive can be run with the other alone.

The electrical equipment further comprises two pantograph current collectors, an electro-pneumatically operated high-tension oil switch, oil-cooled transformers, a motor compressor which generates the compressed air required for raising the current collectors and for the operation of the oil switch, the sand strewer and the signal whistles, and a converter which provides the direct current for the lighting and oil switch releases. Finally, the equipment for the vacuum brake consisting of a motor pump and two brake controllers combined with air valves, should be mentioned. The energy for heating the trains is taken directly from the transformer; 100 KW. can be supplied for this purpose.

All current-carrying parts are enclosed in special compartments, thus ensuring the safety of the attendants. In all cases where the apparatus is under high tension, the compartments are interlocked in such a manner that they can only be opened when the current has been cut off.

The locomotive has covered a total distance of, approximately, 14,000 km. during the first three months in which it has been running, without developing any appreciable defects. No wear of the commutators has been noticed, and the wear of the brushes has been very slight. Similarly, the contactors have not required any overhauling whatever.

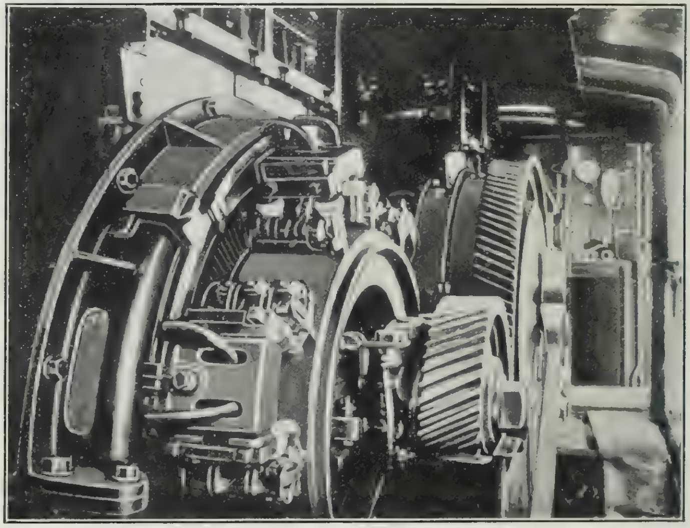


90-H.P. DERI MOTOR FOR PASSENGER CAR, MARTIGNY-ORSIERES RAILWAY.

At the trial runs the locomotive complied with all the specified conditions.

THE MARTIGNY-ORSIERES ELECTRIC RAILWAY.

THE cross-valleys of Lower Valais, with their surpassing scenery, have been opened up to railway traffic during the last few years, and nearly every station of the Simplon line between Villeneuve and Martigny is now the starting point of some side line. To the north, the mountain railway leads up to the sunny, health-giving plateaus of Leysin, Gryon and Villars; on the opposite side of the valley it has linked up to world-traffic the favourite health resort of Champéry, and has established a connection from Martigny across Châtelard with Chamonix at the foot of Mont Blanc. The same Martigny has recently become the starting point of another railway leading to Orsières and opening up Val d'Entremont, the valley of the river Drance. Though this valley has lost its economic importance as an approach to the Great St. Bernard, since the Simplon road, and more recently the Simplon railway, deviated into other channels the international traffic from Switzerland to Italy, it is thought that the new era of engineering development will afford it an economic compensation by the utilisation of its enormous water powers. Plans have been made for the installation of huge industrial undertakings for consuming the hydraulic energy on the spot, and the new possibilities of export and import offered by the railway will allow these projects to be carried into practice.



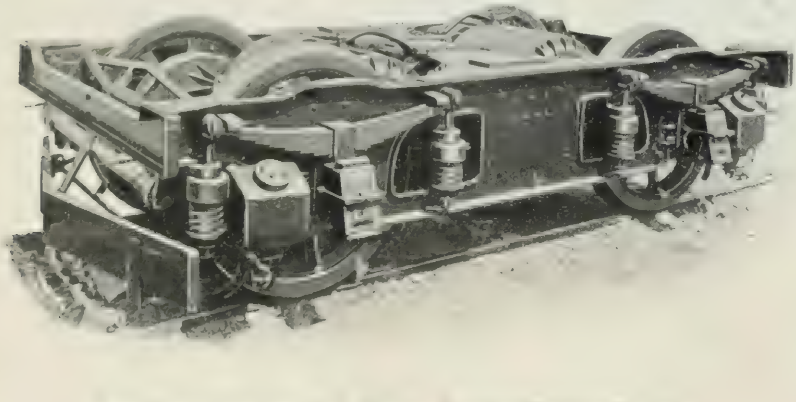
INTERIOR OF ELECTRIC LOCOMOTIVE, RHAETIAN RAILWAY.

The new line is, at Martigny, connected up to the Swiss Federal railways and passes through a number of intermediary stations (Martigny-Ville, Martigny-Bourg, Martigny-Combe, Bovernier and Sembrancher) to Orsières. It is a normal-gauge railway about 19·3 km. in length, the maximum gradient (nearly continuous in the upper section) being 35 per cent.

It was decided at the outset to operate the railway by electricity, each passenger train (of about 70 tons total weight), consisting of a motor-car and one or two trailers, accommodating about 100 passengers, and travelling at a speed of 30-45 km. per hour, according to the gradient. Each goods train was to consist of a goods motor-car, conveying goods wagons of 80 tons total weight (resulting in a total train weight of about 130 tons) at a speed of 15-25 km. per hour. Provision was, however, to be made for the goods motor-cars, with a reduced trailer weight of 20 tons, to attain the travelling speed of passenger trains, so as to be used, in cases of emergency, in place of the passenger motor-cars. Six pairs of passenger trains and two pairs of goods trains were to be run each day.

As regards the electrical system adopted, it was realised that only one using a high contact-line voltage would provide for an economical distribution of energy. After considering for some time the use of high-tension continuous current (2,400 volts between rails and contact wire), a single-phase alternating current at 8,000 volts was chosen, the frequency adopted, in accordance with regulations by the Swiss Railway Department, being 15 cycles. Messrs. Brown, Boveri & Co., of Baden, Switzerland, were entrusted with the supply of the whole of the electrical equipment.

One of the most interesting features of this railway is the use of single-phase commutator motors on the Brown-Boveri system, with Déri connections. These motors, which are briefly referred to as Déri motors, are typical repulsion motors and comprise a single-wound stator without compensating winding, fed at a constant voltage between terminals, and a rotor independent of the line, separated from the stator and only communicating with it through magnetic flux

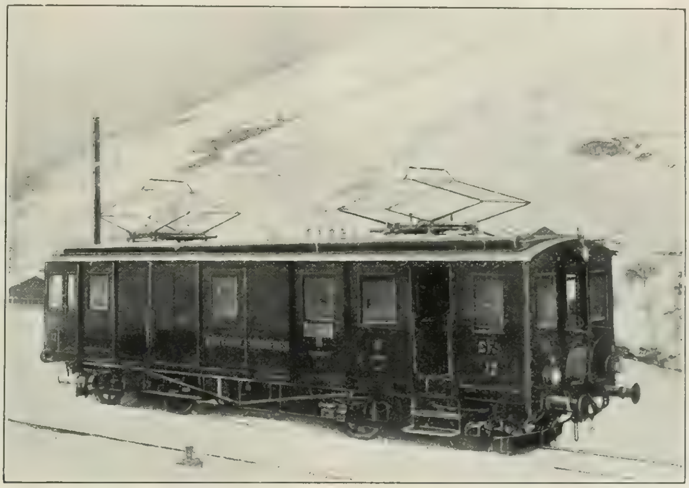


MOTOR BOGIE WITH TWO DERI MOTORS, MARTIGNY ORSIERES RAILWAY.

linking. The rotor carries two sets of brushes, viz., a stationary one in the axis of the stator field, and one free to rotate round the commutator. Each stationary brush is connected with a rotary brush by a flexible cable. When the motor is at rest, the rotary brushes are placed in the axis of the stator field, *i.e.*, close to the stationary brushes. The rotation of the motor is started by shifting the brushes out of this position. The rotation occurs in a direction opposite to the shifting of the brushes, at a speed augmenting as the angle of brush displacement increases.

Each motor-car is equipped with four Déri single-phase motors, each developing 90 H.P. during an hour, and coupled to the axles through a reduction gear. Speed regulation, as well as starting and reversing, is merely effected by shifting the brushes; the controller consists simply of a switch for the motor stator and a mechanical transmission gear acting on the movable brushes. The motors work at a pressure of 750 volts, the pressure in the contact line (8,000 volts) being reduced to 750 volts (for operating the motors) by two static transformers, which also feed the air compressor motor, a 5-H.P. Déri motor. Two pneumatically-operated bow collectors, mounted on pantograph supports, serve to take the current off the overhead contact line. A special transformer feeds the lighting and heating plant of the whole train; the compressor supplies air for operating the Westinghouse brake. The electrical equipment of the passenger and goods motor-cars is largely identical, the only difference being in the reduction ratio of the gearing and the extension of the lighting plant.

Contact Line at Martigny-Bourg Station, with Section Switch and Signalling Device.



Goods Motor-Car, Martigny-Orsieres Railway.

Electric Passenger and Goods Motor-Cars.

The contact line, throughout the length of the railway, is of circular copper wire, [illegible] mm. in diameter. Its suspension generally is simple, and the wire is only carried by steel tube brackets fixed to impregnated wooden poles at road crossings. In the case of simple suspension, the wire is fixed to brackets suspended by means of small insulators from steel tube jibs; in those sections for which catenary suspension has been adopted, the brackets carry heavy double insulators to which the carrying cable (an iron cable 35 mm. in diameter) has been fixed. The suspensions of the contact wire each consist of a steel wire 2 mm. in diameter, and are arranged at 3 m. apart. At each station there are provided section insulators, by means of which the current can be switched off without interrupting the current in the line. Electrically bonded rails serve as return conductors.

The electrical energy for operating the railway is derived from a power house of Société d'Electrochimie, of Martigny-Croix, where a Pelton wheel, operating a Brown-Boveri single-phase generator (6,000 KW., 8,000 volts, 15 cycles, 450 R.P.M.), with exciter and switchgear, have been installed.

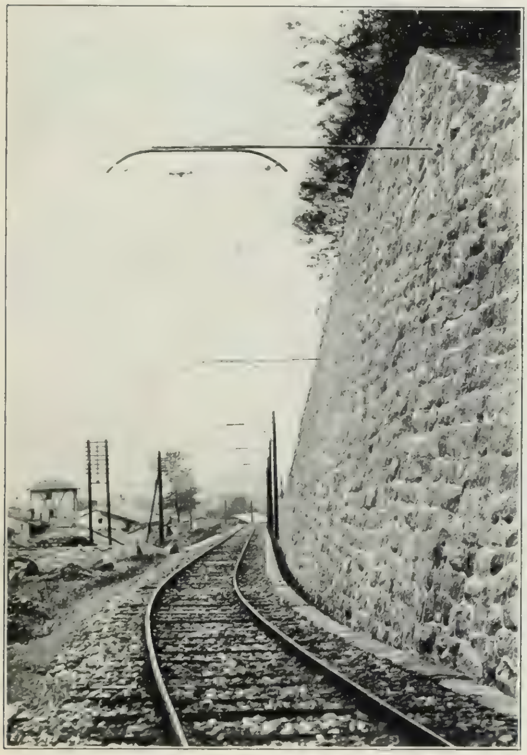
New York's Oldest Private Plant.—The oldest private electric generating plant in New York City is an installation of Edison dynamos driven by "Safety" steam engines in Broad Street. This plant, which is still in daily operation, was installed in 1883, only four years after Edison's invention of the incandescent electric lamp. The three 25-KW. Edison generators have been in continuous daily service for 31 years, although the plant has since been supplemented by the addition of a 75-KW., a 100-KW. and a 160-KW. unit made necessary by the increased demand for artificial illumination in the Mills Building, as the height of surrounding structures has increased.—*Electrical World.*

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

In British Columbia a dam is to be constructed across the Similkameen River, in order to develop about 18,000 H.P. with a 60-ft. head.

The Alberta water powers have been investigated by the Dominion Government, and the report thereon shows that four water-power sites, capable of yielding 40,000 H.P., could be economically developed on the Bow River alone, within 50 miles of Calgary. The Calgary Power Co. has a power station at Horse Shoe Falls, which has a maximum output of 18,000 H.P., and at Kananaskis Falls there will be another 11,000 H.P. available shortly.



Bracket Overhead Construction.

Lighting Transformer at Station.

The Martigny-Orsieres Railway (see page 406).

At Medicine Hat, Alberta, $10,000 is to be spent on a high-tension distributing system, $20,000 on street lighting, and the generating station capacity will be increased by 1,500 KW.

In Manitoba, the city of Winnipeg is arranging to construct another high-tension transmission line, and the city of Brandon, as well as other places, is trying to secure a supply of power from the first-named though, owing to the distance and the comparative smallness of the demand, it is doubtful whether this would pay.

In Ontario a good deal of work is going on. The Welland, Lake Erie and Niagara Railway Co. has decided to construct an electric line running from Welland to Port Calborne, and along the shore of Lake Erie to Fort Erie, thence along the Niagara River to the Falls.

The City of Brantford is to issue debentures for $70,000 for hydroelectric and waterworks purposes.

The Hydroelectric Power Commission of Ontario is being besieged with requests for surveys and estimates of proposed electric railways. Since this question was taken up last summer by the Commission, great interest has been shown by every town in the south-western portion of the Province, and already 600 miles of line have been surveyed, and several tentative schemes have been submitted.

It is expected that a definite scheme, comprising a section of line some 70 miles in length will shortly be proposed to the municipalities interested, and with them rests the final decision as to whether the line shall be built or not, since each is expected to bear a proportionate share of the cost of the line. If this project goes through, as seems not unlikely, actual construction will be commenced in a few months' time, and there is little doubt that other lines will soon follow.

The operations of the H.E.P. Commission seem destined to grow indefinitely for many years to come, as the supply of power to farmers, the building and running of electric railways, the inspection of *all* electrical work throughout the Province, and the development of water-powers far removed from the original source of power, viz., Niagara, are all at present being undertaken or considered, and each of them is capable of growing to very large proportions.

The Commission, although on the whole very successful and steadily gaining in popularity, has its troubles. In these notes was related last summer the story of a series of interruptions which occurred, due to the breakdown of insulators on the 110,000-volt lines, and only a fortnight ago an interruption of about eight hours occurred on a Saturday evening, due to the breakage of overhead lines in a storm. Two wires broke owing to ice and wind loads, and these, unfortunately, fell across the others, causing a short-circuit. As this occurred on the double-circuit line (and interrupted both circuits) between Niagara Falls and the main switching station at Dundas, the whole of the Commission's system was shut down for the period named. Saturday evening, fortunately, was not the worst time at which such a mishap might have occurred, as it did not affect the manufacturers, though it upset the calculations of shopkeepers and others, and tied up trains on two electric railways which obtain their power from the H.E.P. Commission.

To prevent a similar occurrence in future, another double-circuit line is to be built as soon as possible.

CITY NOTES.—*Continued from page 401.*

Continued from page 401.

Tramways, Light and Power Co., Ltd.

THE directors' report to December 31st, 1913, states that the receipts for the year were £11,756, and after providing for administration, loan and debenture interest, the profit was £10,127.

The directors after paying the dividend on the preference shares for the half-year to December, 1913, at the rate of 6 per cent. per annum, absorbing £9,000, recommend that £1,127 be carried forward. In December last £200,000 of five per cent. debenture stock was issued to provide for the Co.'s capital requirements, including the acquisition of the whole share capital of the Midland Electric Light and Power Co., Ltd. The year was largely occupied in construction works for the Derbyshire and Nottinghamshire Electric Power Co., the Nottinghamshire and Derbyshire Tramways Co., and the Leicestershire and Warwickshire Electric Power Co., and the directors are satisfied with the earnings of these undertakings during the period. The earnings of the Leamington and Warwick Electrical Co., Ltd., and the Midland Electric Light and Power Co., Ltd., were entirely satisfactory. The power station plant of the Derbyshire and Nottinghamshire Electric Power Co. had been largely increased and cables were laid to connect up several new districts. New consumers were being obtained at a satisfactory rate.

VISCOUNT CHILSTON presided over the first ordinary general meeting, held on February 26th, at 66, Queen Street, E.C.

In moving the adoption of the above report he said the shareholders would remember that the earnings of the Co. were derived first from the Derbyshire and Nottinghamshire Electric Power Co., from the Nottinghamshire and Derbyshire Tramways Co., Leicestershire and Warwickshire Electric Power Co., the Leamington and Warwick Electrical Co., Ltd., and the Midland Electric Power Co. The company was formed in December, 1902, and made its first issue of shares during that month, when 300,000 6 per cent. accumulative preference shares at £1 were offered to the public. Those shares became fully paid on the 31st March, 1913, and the preference dividend became accumulative from the 1st July last. When the prospectus was issued offering the preference shares in December, 1912, it stated that approximately £150,000 would be required for the completion of the acquisition of the properties and the construction of works which would be made by the debenture issue. It was gratifying to the directors to report that the figures of capital requirement had proved substantially correct. During the year a favourable opportunity occurred for acquiring the share capital of the Midland Electric Light and Power Co., who controlled the Leamington electric light undertaking, for £45,000. The total requirements with the addition of the purchase of this property amounted therefore to £195,000. An issue was made of £200,000 5 per cent. debenture stock in December last, and, notwithstanding the dear money which entailed a rather higher underwriting commission than was forecasted, the proceeds of the issue were sufficient to meet the capital obligations. During the year additional generating plant had been installed in the Derbyshire and Nottingham power station, and cables were laid to tap many districts. The electricity for the Nottinghamshire and Derbyshire Tramways Co. was supplied from the Power Co.'s generating station. The supply cables of the undertaking were now laid and consumers were connected in many new districts and many applications for a supply were being received. The net revenue should be more than double this year. The Nottingham and district tramways, extending from the boundary from the city of Nottingham to Ripley, were constructed during the year and were open for traffic during August. Under the terms of the Act of Parliament a connecting line of 1¼ miles in length had to be built by the city authorities, and when built, leased to their company for a term of 42 years, the company paying 5 per cent. to the city of Nottingham on the capital outlay to cover interest and sinking fund. This line was, unfortunately, not laid for traffic until January 1st of this year, and consequently it was only possible to obtain a comparatively small revenue from the tramway for the 4½ months during which the cars were run. The directors were satisfied with the winter earnings of the tramways and looked forward to doing an exceedingly heavy business during the summer months by carrying pleasure traffic to and from the city of Nottingham. With regard to the Leicestershire and Warwickshire Electric Power Co. this was developing an entirely new district that had not hitherto been supplied by a power company. Notwithstanding this fact, during the year this undertaking succeeded in showing a small credit balance and it was anticipated that during the current year a moderate profit would be earned. He should mention that when the company was formed, the board did not calculate on deriving any benefit from the company for two years at least and they were consequently very pleased with the developments of the property up to date. Since the company acquired their interests in the Leamington and Warwickshire Electric Co. various economies had been effected and the net earnings were quite satisfactory to the board. It was intended to remodel the plant in this station as and when opportunity offered, and so effect considerable additional economies. Regarding the Midland Electric Light and Power Co., recently acquired by them, the board were glad to say that the net earnings were equal to expectations. He should mention that the area of the Midland Electric Light and Power Co. was co-terminus with the area of the Leamington and Warwick Electrical Co. for the purpose of electrical supply, and for that reason it was obvious that many economies could be ultimately effected which would still further improve their profits. The board had had under consideration the question of the acquisition of further properties, but the shareholders could rest assured that they would only be acquired provided the cash yield was satisfactory at the date of acquisition and that there was a considerable prospect of an increasing yield with a very small outlay. After paying the company the interest and dividend shown in the profit and loss account the various subsidiary companies had balances carried forward amounting to nearly £1,000. Regarding the outlook for the present year the directors were satisfied with the progress made in the development of the various undertakings and, with normal trade conditions, they had reason to believe the shareholders would be quite satisfied with the earnings of the current year.

MR. GEORGE BALFOUR, in seconding the motion, remarked that in companies of that nature the most difficult and anxious period was the first 6 or 12 months, because however ably they might be administered and whatever care was given to them, until the accounts for the first year were produced it was very difficult for anyone to make forecasts. The report was quite satisfactory, and speaking with a certain amount of expert knowledge, he had every reason to believe that the accounts for the present year would be equally to their satisfaction.

The report was adopted.

Electrical and Industrial Investment Co., Ltd.

THE second ordinary general meeting was held on February 26th, at the Electrical Federation Offices, Kingsway, Mr. Emile Garcke presiding.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 320), said the past year was not a favourable one for financial operations. It was all right for those who had capital to invest, but not for those who wished to realise investments at a profit. Money was dear, and relatively high interest had to be paid on loans, and the values of securities generally were exceedingly depressed, so that a very few opportunities presented themselves of making profits on sales. Nevertheless, they had done fairly well, and they were encouraged to believe that now that the general conditions had changed they would be able to show still better results. The company was formed in May, 1912, to take over the investments of the City of Birmingham Tramways Co. The first seven months' working showed a profit of £1,618 per month, and they had at the end of 1912 a reserve of £23,195. For the past twelve months they had made a profit of £1,783 a month, an increase of more than 10 per cent., and they finished off with a reserve of £24,223. During the past year they had allotted a further £85,237 4½ per cent. Debenture stock and £12,955 5½ per cent. Debenture stock, and they had now issued £100,000 of all classes of stocks. They had been granted a quotation for their 4½ per cent. Debenture stock on the Stock Exchange. That was a first-class stock. The interest charge was £4,500 per annum, and the available profits were over £21,000 besides the carry forward of £7,200, so as to security of capital the stock was covered about five times. With regard to the distribution of the profits for the past year, they had £16,373 available after paying interest on both Debenture stocks. They proposed to write off £3,090, the cost of issuing further Debenture stock during the year, and to pay 6 per cent. dividend on the Preference shares and to carry forward £7,282, as compared with £3,314 brought into the account from the preceding year. The shareholders had already approved the policy recommended by the directors of putting the company into a thoroughly strong position before commencing to pay dividends on the Ordinary shares. The directors proposed that the Ordinary shares should be divided into half Preferred Ordinary shares entitled to a preferential dividend of 7 per cent. out of the profits of each year and to priority of capital, and into half Deferred Ordinary shares entitled to all the surplus profits and assets. He saw no reason whatever why they should not count upon the company being able to pay the full dividend of 7 per cent. per annum on the Preferred Ordinary shares from the date of their creation; and as to the Deferred Ordinary, he believed they would become very valuable in course of time. At the end of the year they held 208 investments of the book value of £588,430, and the classification and distribution of those investments was quite satisfactory. A large proportion of the investments were in electrical securities, but they did not confine their operations to that category. An important matter for the shareholders was the principle on which the accounts were made up and how the securities were valued. The directors had adopted the principle of adding to reserve the profits made on sale of investments and of charging losses on realisation against the reserve, the profit and loss account only being credited with interest on investments, fees for financial services, and other like profits, but not with any profits derived from the appreciation of investments. On the other hand, profit and loss was not debited with any losses resulting from depreciation of investments. Their policy was to keep the capital account distinct from the revenue account, to enter all investments at their actual cost, and not to write them either up or down. The valuation of the assets at the end of the year showed a deficiency of £1,868 to provide for the whole of the capital, or a depreciation equal to 1¼ per cent. on the quoted securities. That was not at all surprising, considering that the fall in securities generally since the formation of the company in 1912 until the end of December, 1913, was equal to about 7½ per cent. There was, however, nothing to worry about in their little deficiency at the end of the year, for the appreciation in values since the beginning of the year to the date of the report showed a surplus of £8,000, instead of a shortage of £4,000.

Mr. C. Shirreff Hilton seconded the motion, and the report was adopted.

Subsequently an extraordinary general meeting was held, at which resolutions were passed dividing up the Ordinary shares in the manner outlined by the Chairman, and altering certain of the Articles of Association.

Metropolitan Railway Co.

Lord Aberconway presided on February 26th at the offices, Baker Street Station, over a largely attended Wharncliffe meeting of the shareholders of the Metropolitan Co. to consider the Bill in Parliament to incorporate and confer powers upon a joint committee of the Metropolitan and Great Northern Companies; to provide for, among other matters, the leasing to the committee of the Great Northern and City Railway undertaking of the Metropolitan Company.

The Chairman, in moving the resolution, said, the meeting had been called in order that the stockholders might give their sanction to a Bill which was being promoted jointly by the Metropolitan Co. and the Great Northern Railway Co. during the present session. Last year when they were seeking by their Bill to acquire the Great Northern and City Railway, the Great Northern Co. were at first among their most vigorous opponents. During the progress of the Bill through Parliament the Great Northern Co. approached them to see whether some arrangement could not be made favourable to both parties, and in the result they agreed to promote the joint Bill which was now before the stockholders. On the faith of this agreement, the Great Northern Co. withdrew their opposition. The board came to the conclusion that it was in the interests of the company that they should be friends rather than opponents of the Great Northern Co. Though they might lose some of the profits they would otherwise make by entering into partnership with another company, they thought they would be more than compensated by the increased traffic which would result from friendly relations and a thorough connection with their system to which the agreement would give effect. The Great Northern Co. were prepared at their own expense to construct a line at Drayton Park to join up the two systems. The company's general manager, Mr. R. H. Selby, was strongly in favour of the arrangement. The board did not object to fair criticism, but they felt that some of the criticisms that had been levelled at them passed the limit.

Mr. C. de W. Kitcat, the solicitor, explained the Bill.

Mr. Paul Speak seconded the resolution.

A long discussion followed, in the course of which Mr. Pownall strongly opposed the scheme, but not, as he explained, because he had any objection to the junction acquired for the Great Northern Railway at Drayton Park, but because he considered the other sections of the scheme speculative.

Other speakers included Sir Adolph Tuck, Mr. Walford, and Mr. Sanger. Eventually on a show of hands the resolution was declared carried by 50 votes to 33.

Mr. Pownall consequently demanded a poll, the result of which was that there were 178,150 votes in favour of the resolution as against 41,876.

The resolution was therefore carried by the requisite majority.

Northampton Electric Light and Power Co., Ltd.

The annual meeting was held at Northampton on February 26th. Mr. F. H. Thornton presided, and in moving the adoption of the report he said that the year had been one of steady progress right through. They had increased the mains and the capacity of the station. The number of lamps and motors taken by the public had also greatly increased. The units sold increased from 3,108,113 to 3,468,981, an advance of 11½ per cent. They had put in during the year a new Westinghouse turbine set of 1,000 K.W., the previous largest plant installed being 600 K.W. They had also put in a Babcock boiler and a water-cooling tower. They contemplated further developments and improvements during the year. They had received £24,113 by the sale of current, against £22,443 last year. The other items of receipts were very much the same as last year. They had set aside £1,500 to the reserve fund, which now amounted to £6,000, and the depreciation account had been raised to £28,991. They could therefore consider that the finances of the company were in an assured and safe position. They were raising £50,000 more capital, but not all at once, and they felt it would be readily subscribed. £10,000 would be issued during the year, and he advised shareholders to take up their quota, as it was being offered at a price under which shares would be readily saleable in the market.

Mr. Tomes seconded the motion. Referring to the extension of business, he said they had not only gone to the extremes of the town, but were supplying outside, a source of revenue which would be increased.

The report was unanimously adopted.

The Chairman paid a tribute to Mr. Jackson, the company's engineer.

The remuneration of the Directors was fixed at £300, and a vote of thanks was accorded the engineer and staff.

At an extraordinary meeting which followed, it was agreed that the capital of the company be increased by £50,000 to £150,000, the price of issue to be 21s. 6d. for Ordinary shares and 20s. 6d. for 5 per cent. Preference shares.

London Electric Supply Corporation, Ltd.

The annual general meeting of this company was held on February 26th, at Winchester House, E.C., Mr. R. H. Benson presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev., page 321), said that the past year had established three new records—in units sold, gross receipts, and cost of generation. The gross receipts had risen from £146,567 to £162,854—an increase of over £16,000; and the net profits from £68,670 to £71,752. This had enabled them to increase the dividend from 2½ to 3 per cent; to place £3,000 to contingencies account, as against £1,000 last year; and to carry forward £5,097, as against £4,705. And what was more, this was after putting aside a large sinking fund for the redemption of the whole of the Debenture stock in 1931, when the option of the L.C.C. to purchase the undertaking began. This sinking fund was a big reserve fund. The number of units sold showed an increase of about 25 per cent., and amounted to 35,336,223. The cost of generation had dropped from .66d. per unit sold to .62d. That these very satisfactory results had not to a greater extent been reflected in the dividend was due to the price of coal. The average price per ton paid by them last year was 15s. 2¼d., as compared with 11s. 8½d. in the preceding year—a rise of 30 per cent. Their annual coal consumption now amounted to 62,435 tons. Had the price remained at the level of the year before, they would be in the happy position of having something like another £10,000 additional profit, or rather more than the amount of the existing Ordinary dividend. Since the beginning of the year there had already been a drop of over a shilling a ton from the high prices they had been compelled to pay; and the tendency now appeared to be downward, which should be of good omen for the current year. The capital account was overspent by £102,332. This expenditure had been incurred in connection with the extensions of the Brighton Railway contract. The past year was unpropitious for the finding of fresh money for any purpose, and the board decided to postpone the question of issue of any fresh capital until more favourable times. He told them last year that they had reason to expect a demand from the Brighton Railway Co., in connection with the complete electrification of their suburban system, for a number of units which might amount to four or five times as many as they were now supplying to them; it was obvious that a contract of these dimensions involved large capital outlay, and they had to see their way clear not only to find the sum required, but to repay it. This would be simple enough with a sinking fund spread over 40 years, but they were liable to be taken over by the L.C.C. in 1931, and should therefore, in ordinary circumstances, have to provide for the extinction of any fresh debt within that period. It was obvious that to raise the money on a 15 years' sinking fund would impose an unfair burden on revenue—a burden, in fact, which it could not bear. The matter was one of public importance, and applied equally to all the London electrical undertakings as and when they required fresh capital to meet the increasing demand of the public for power and light. He ventured to think that Parliament, when it enacted a purchase clause in the interest of the public, and gave the option of purchase to the L.C.C., never intended to cripple the credit of the electrical industry and force the companies to run an inferior service in order to buy them up cheap. The root of the trouble—that which had retarded and still retarded the business of electrical supply in London—was the uncertainty of tenure: the doubt about the purchase price in 1931. It was the first axiom of good finance, if they were making securities, to make good ones, eliminating speculative factors as far as was humanly possible. By so doing they commanded good credit. Credit abhorred uncertainty. The policy which protracted uncertainty tended literally to discredit. Look at the speculation and the lawsuits that arose over the purchase of the tramways and the telephones. They were a warning against similar procedure with the electrical supply companies. If he was right in saying that the root of the trouble was the uncertainty, there was a way of curing it: agree upon a valuation *now* instead of waiting till 1931, and let the option of purchase by the L.C.C. mature as now in 1931 (or later if mutually agreed), but at a known price instead of at an unknown price. That would lay a foundation of certainty instead of uncertainty—a foundation which could be built upon for the benefit of the public. The next step would be to agree upon capital expenditures henceforward, all agreed capital expenditures to be added to the purchase price. This fundamental question needed to be lifted up above party considerations. In order to focus it and elicit a widespread and wholesome public opinion, the assistance of the Press was needed. There were precedents to be found for the solution of the problem in detail in the relations of sundry municipalities to electrical producers in America and on the Continent; but for an elementary principle, namely, a settlement now instead of in 1931, one might appeal to higher authority. "Agree with thine adversary quickly while thou art in the way with him." Such a settlement did not require an Act of Parliament, but depended on the initiative of the L.C.C. and mutual give and take. He hoped that when they next met he might be able to announce that a satisfactory solution of the difficulty had been found. The whole question was closely bound up with another matter, and this was a question affecting equally the whole electrical industry of London and the general public. He alluded to the Bill now being promoted in Parliament by the County of London Co. for the establishment of one huge bulk supply of electricity for London, with the assistance of any or all of the existing undertakers, and, of course, of the County Council, whose consent to an extension of the existing period for purchase would be necessary. Broadly speaking, the scheme, as he understood it, was to establish, with the co-operation of the existing companies, the bulk of whose generating machinery would be scrapped, one huge station for the supply of the whole of London. The date of purchase by the L.C.C. would, of course, have to be postponed beyond 1931, and an enormous fresh capital outlay would be necessary. It was evident that the promotion of this Bill raised a question of the deepest importance to them as well as to all the other electricity companies of London. They approved the principle underlying it. The opportunity for co-operation between the companies for more economic working was given in the Act of 1908, and they had availed themselves of the Act in association with two other neighbouring companies. They were of opinion that the principle should be carried further, viz., that there should be more co-operation, more association, even consolidation, between different producers, in the interest of consumers themselves. The necessity for a postponement of the date of purchase was equally self-evident if the whole industry was to be progressive *pari passu* with the needs of the public, and not brought to a standstill for want of fresh capital. So far they were at one with the promoters of the Bill, but it had other aspects which were less satisfactory. They, in common with the other London companies, had had opportunities of conferring with the financial group interested in the scheme and learning something of its details. It was still under consideration by a conference of the companies; but careful technical investigation by a committee of engineers made them doubt whether the scheme in its present form would either result in the economies or realise the profits that it anticipated. Although, in their judgment, the principle was sound, all the London companies had felt that they had no option but to oppose the scheme as it stood. They had taken this course because they felt that, apart from the technical objections to the scheme, there were reasons why, on general grounds, they could not give it their support in its present form. For instance, they thought that the supply of electricity in such an immense area could not safely be provided from one station only, and would not be permitted; and that certain of the existing stations, equipped with modern machinery, might usefully be employed as stand-bys against risk of breakdown from *force majeure*. It was a pity that for all these years the thirteen companies had never succeeded in evolving for themselves a scheme of joint working; and they recognised that the unification of supply, both economic and financial, might have to come from outside, subject to the willing co-operation of the companies; but it was their business to see that any such comprehensive scheme of amalgamation should be developed on lines likely to secure a due advantage to the undertakings which for 25 years had borne the burden and heat of the day. Further, it was essential for the success of any such scheme that it should be introduced with the "backing" and full co-operation of the L.C.C.; but they also were opposed to the present Bill. He counted it gain, however, that the question should be ventilated. The same sort of difficulty arose abroad—the difficulty how far articles of public utility such as power and light should be confined to private enterprise or to municipal enterprise, and how far private enterprise should be "regulated," to use the euphemistic term. The Act of 1908 was passed to encourage them to associate. It had been proved outside these islands, especially in America, that cheap power came from a monopoly, like the telephone, for instance, and not from competition; and the problem was how to regulate the monopoly in the interest of the public, allowing, for instance, an increasing return upon the capital invested, *pari passu* with a reduction in the cost of power. It was really a problem in co-operation, and ought not to be insoluble here, though they had taken a long time about it. It was, however, only in 1908 that the L.C.C. was installed as the ultimate purchasing authority in or after 1931, and the question was only now becoming acute. He thought they must look to the L.C.C. for some initiative. The Chairman concluded by referring to the death of Sir William Preece.

Mr. R. Stewart Bain, in seconding the motion, pointed out that the capital expenditure during the year had been £26,000, of which £12,000 was for plant and machinery, £6,300 for mains, and £3,220 for electrical instruments. The plant and machinery was primarily a new battery and boilers. They had laid about 3½ miles of new mains, bringing the total length of mains laid to 200 miles. Dealing with the cost of production and energy, and the price at which the company sold it, Mr. Bain said the electrical companies of London were too modest as regards the price at which they were giving power. Speaking at the Charing Cross Co.'s meeting that day, Mr. Fladgate, the chairman, said that the average rate in London was lower than in any city in Europe or America, except Chicago. He confirmed the statement, but went further, and would not make an exception of Chicago. He had ascertained that the average selling price in Chicago was 1·08d. per unit, and the average cost 0.708d., whereas the average selling price of their company was 1·04d. per unit and the average cost 0.618d. Whilst centralisation of the electric supply of London might be helpful in some respects, he was of opinion that it would not assist consumers to get a cheaper supply. The chief engineer informed him as he came into the room, that, for the first time in the history of the company, their weekly output—for the week ending at 12 o'clock that day—was 1,000,000.

Mr. Cripps spoke at considerable length on the future of the electric supply companies in London, and suggested that they did not want to postpone the date of purchase, but rather to get rid of the idea of purchase. He was sure the London County Council would consider the subject with the best interests of London before them. Personally he would like the whole matter referred to a joint committee of both Houses of Parliament.

The report was adopted.

Charing Cross, West End and City Electricity Supply Co., Ltd.

Mr. W. F. Fladgate presided on February 26th, at the offices, 66, St. Martin's Lane, W.C., over the annual meeting of the above company.

The Chairman in moving the adoption of the report (see Elec. Rev. p. 321), having referred to the election of Mr. John D. Laurie as a director in place of Mr. H. C. Pulley, complimented the shareholders on the very satisfactory result of the working for the last few years and upon the position which they had attained, which justified them this year in increasing the dividend by 1 per cent. He might say that they had thought of doing this last year, but perhaps more prudent counsels prevailed. The past year's results showed a genuine and a by no means unsatisfactory progress throughout the whole of their districts, and the increase was greater in motive power and heating than for lighting purposes. Dealing first of all with the West End business, the proceeds of the sales of current had amounted during the year to £146,241, and their total receipts, bringing in various other items, had amounted to £151,239, being some £4,500 in excess of those of last year. That was very satisfactory, and they had been able to produce these increased receipts at an expense which was for all practical purposes the same as last year. With regard to the accounts of the West End undertaking, the capital account called for a little explanation because from it there appeared to have been an expenditure during the year 1913, whereas, as a matter of fact, it was a credit item. The facts were these. Some few years ago His Majesty's Office of Works wished them to erect a sub-station in St. James's Park, which they did, and last year they opened up negotiations and expressed the desire of buying this sub-station from the company, and the result was that they sold it to them upon terms which were quite satisfactory. The result was that upon the one hand there was an expenditure which amounted altogether to £8,422, and there were receipts on account of the sub-station of £12,485, so that they were left with a credit to capital account of the sum of £4,063 in respect thereto. The speaker gave particulars as to the proportions of current which was now applied to heating and power and to lighting in the West End. No less than one-third of the whole supply, or 36 per cent., was used for power, while only two-thirds, or 64 per cent., was applied to lighting. Turning to the City undertaking, the progress again had been considerable. It was true that the gross earnings had not increased to the same extent as in the West End undertaking, but although they had not very greatly increased, the expenditure in the City had decreased by some £3,000 as compared with last year, the amount being £84,958 last year as compared with only £80,638 this year, so the result was that they showed net earnings nearly £6,000 greater. In the case of the City undertaking they were applying there the same policy as hitherto, only paying the interest on their loans and debentures and the dividend upon the preference shares, and were carrying forward £18,000, which was the balance and which was a reserve to income account, or to carry forward for the next year, and which was the amount of their preference dividend; they then carried £20,327 to the general reserve income account, which now amounted to £73,473. In the City the increases in the sales relative to power purposes and to heating and lighting had been more marked in proportion than even in the West End. The expenditure upon capital account in the City had only amounted to £6,393, and he did not think that there were any serious commitments which they were likely to have to deal with in the near future. After dealing with the question of depreciation, the chairman reminded the shareholders that the City undertaking was liable to be purchased by the Corporation in the ensuing year, or in any future year up to 1927, and it seemed likely that within the current year they would know the intentions of the City, because under the Provisional Order held by the City of London Co., unless the City Corporation exercised their right within the year, the right of purchase of the City Co. ceased, and the London County Council became the prospective purchasers of the undertaking of the City of London Electric Lighting Co. In that case the probability of the City of London purchasing their undertaking would appear remote indeed. The chairman referred to the most recent attempt to deal with the supposed requirements of London in the matter of bulk supply. He said "supposed" because he, for one, repudiated with considerable warmth the suggestions made from time to time in the Press that this great city was badly supplied with electrical energy. He claimed, at any rate in the districts which they served, there was an ample supply of energy for all purposes, whether for light, heat, or motive power, and the price for each supply was moderate. When he reminded them that the average price which they obtained for energy for all purposes was only 2.348d., and that this price, as well as the average price in London, was lower than that obtained in any continental or American city, except Chicago, he was, he thought, justified in making such a statement. Let them, however, for a moment assume the existence of the evil and consider the remedy suggested. The promoters of the Bill to which reference was made, intended to form a holding company, or, in other words, a company formed to acquire and hold shares in their and other electric light companies, and by means of such holding in effect to gain the control of the electric lighting industry in London. With that in view, an offer would be made to them to transfer their holdings in their company to the holding company in exchange for their shares or debentures, and when that offer was made, this board would issue a statement of their views as to the expediency of such proposed exchange, and until the shareholders received this statement, he strongly advised them to refrain from committing themselves in any way to the promoters. If the promoters were successful in thus acquiring the necessary control of the industry, it was their intention to scrap the whole, or, at any rate, the greater part, of the existing plant of the various companies, and to replace it by a large power station, or a series of power stations, at Barking, laying all necessary connecting mains so as to supply the whole of London from one centre. There might be separate stations and separate sets of mains, but the main generating plant was, he believed, to be at one single place. For many reasons, in his opinion, this was not desirable, and he for one should want very much stronger evidence than he had as yet heard to induce him to support any scheme which provided in effect only one main station for the supply of the needs of London. It might be economical, but economy might be purchased at the expense of safety and efficiency. It was claimed, however, that by means of these proposals there would be great decrease in cost and great increase of profit. Such a scheme would naturally involve a large expenditure, estimated at some 4½ millions. In addition to this, the promoters naturally looked to a profit for themselves, and in the financial arrangements, they had provided for this profit to the tune of well over a million—the promoters, as they would notice, thought only in large figures. The promoters claimed that the economies they would be able to effect in generation would more than justify the proposed expenditure—would, in other words, show a handsome profit to all those who joined the scheme. The estimates of revenue, however, were based on the assumption that the price obtained from the sale of current would be maintained at the existing average figure of to-day, and therefore it was obvious that the general public at any rate would not be invited to share in this hypothetical profit. For himself he did not consider any bulk scheme could be sound which did not assume a decrease in price consequent on its operation. If there was to be a large increase in the amount of energy consumed in London, it could only be by a large increase in the use of electricity for motive power purposes, and the larger the proportion of motor units to total units the smaller must be the average price obtained. They considered therefore that in making their revenue estimates on the basis of the present average price, the promoters had fallen into a serious and palpable error. As to their engineering estimates, neither their board nor the boards of the London electric lighting companies generally felt competent to express a definite opinion, and the question had accordingly been referred by the companies jointly to a committee of experts under the chairmanship of Sir Alexander Kennedy; and that committee was still conferring with the engineers of the promoters. He did not think for the present he need further criticise this particular scheme, though it might be necessary for him to revert to it at some future date; still he would venture to trespass on their patience a little longer and to outline to them as briefly as he could, what he considered the real requirements of London to-day. As he had already indicated, he considered the promoters of the various power bills which had from time to time been put forward, had greatly exaggerated the future requirements of London, while the capacity of the existing companies effectively and cheaply to deal with the increasing demand for electrical energy, had been greatly under-estimated. In saying this he did not mean that nothing could be done to improve the present position of the companies, or to improve the position of the London County Council, when, if ever, it took over the functions and obligations of the existing companies. But such an improvement should be made, and in his opinion should only be made, by slow degrees, and by a scheme which would ensure that all future developments should be on converging lines, that the duplication of work and of plant hitherto rendered inevitable by the original policy of Parliament should now cease, and that to the benefits of competition should succeed the advantages of a regulated monopoly. In his opinion, and in that of the board, all this could be done gradually and at a comparatively small cost by giving the existing companies the necessary powers, facilities, and inducements. He need hardly remind them of the Parliamentary struggles in which they were for many years engaged in endeavouring to solve this problem; and these culminated in the Act of 1908; and for himself he believed that if the Bill which the companies had then originally promoted had been passed in its entirety, this difficult question would have been practically solved. The Government, however, insisted upon cutting out of that Bill the important provisions under which it was proposed to constitute a statutory committee consisting of representatives of the companies and the local authorities to deal with the whole question of generation of electricity, and this was the really important part of the measure. The Act as passed was one of some value. It contained clauses allowing companies to associate themselves for mutual benefit, which had been taken advantage of by some companies, but which at present had not been of any use to them. It further provided that the power of purchase of the several undertakings of the London companies should no longer be vested in the various local authorities, the London County Council being constituted the purchasing authority of all, but with the necessity imposed upon them to acquire all at the same time. This was a very important step forward, and any attempt to vary this provision should be strongly opposed. This power was exerciseable in the year 1931, and in any succeeding tenth year. That was in 1908, but since then little had been done; nor, so far as this company was concerned, did they as a board consider that there was any need of immediate action for their protection. In conclusion the chairman said that his view was that they should go slowly. In his opinion, the advantages which were sought could be arrived at by agreement amongst the interested parties themselves much better and more economically than by throwing the industry into the melting pot and calling in the aid of the millions of the financier.

Mr. John D. Laurie seconded the resolution, which was unanimously agreed to without discussion.

Oxford Electric Co., Ltd.

The directors' report for 1913 states that the revenue account shows a profit (including £846 brought forward) of £15,312. After providing £2,000 for Debenture interest and writing off £829 on account of hire-purchase installations, the balance is £12,482. It is proposed to pay 7 per cent. per annum on the Ordinary shares (whereof 3 per cent. was paid in September), £7,000; 5 per cent. per annum on the Preference share capital (whereof 2½ per cent. was paid in September), £2,500; to put to reserve and renewal of plant £2,000; and to carry forward £982. Reserve and renewal of plant account has been charged with the cost of plant replaced. The lighting, heating, and motive power connections continue to increase satisfactorily, and have more than compensated for the extended use of lamps of low candle-power and high efficiency. The supply mains of the company have been extended in Bainton, Botley, Fairacres, and Kingston Roads. The whole of the authorised capital having been issued, the directors, in order to provide additional capital for the extension of the undertaking, have resolved to increase the capital by the creation of 5,000 Cumulative 5 per cent. Preference shares of £5 each, which will as occasion requires be offered in the first instance to the shareholders.

Telegraph Construction and Maintenance Co., Ltd.

The fiftieth ordinary general meeting of this company was held on February 26th at the offices, 38, Old Broad Street, E.C., the Earl of Selborne, K.G., presiding.

The Chairman, in proposing the adoption of the report, (see Elec. Rev. p. 371), said that in 1913 there were several very dramatic incidents connected with wireless telegraphy with which they must all be familiar. He did not think that in either of the cases of which he was thinking submarine telegraphy could have done what wireless did, and that led him to the observation that without attempting to prophesy as to the future developments on either side of those great branches of telegraphy, it did seem as if the two were going to have separate spheres of action. At any rate in the great boom which had been going on for the last year or two, it would have been disquieting if the property in which the capital of that company was invested had not received a fair amount of employment, and he was glad to be able to repeat what he said last year, viz., that the year had again been one of steady and interesting work. The variations were only variations of the sort with which they were familiar. With regard to the accounts, last year there was a smaller stock in hand and a larger cash balance at the bankers; this year the stocks were larger and the cash balance was smaller. They proposed to add another £20,000 to the reserve fund. That was the fiftieth annual general meeting, and he felt he was justified in saying that the record of those fifty years was a most remarkable one. For six years the company prospered and paid dividends which, he believed, never exceeded 10 per cent. In the year 1870 £8 was repaid in respect of each share, and ever since that time the dividend had never sunk below 15 per cent., and on about half of the occasions it had been the same as they were distributing this year. That was a very remarkable record, and for it they had to thank the directors in times past, and the staff who had worked under them both in the office and at the works, and the officers and crews on board their ships. Sir Daniel Gooch, Admiral Sir George Richards, Sir R. Herbert and Mr. Shuter were his predecessors in the chair to whom the company owed much. The first was one of the great engineers and captains of industry of the nineteenth century; the second was a distinguished naval officer; the third was one of the best known civil servants who had ever served the Crown; and the fourth was trained in the company's own service. There were still in the offices and works men who had been there the whole of the fifty years' existence of the company, and, as showing what the company had done for the world, he might say that there were more than 235,000 miles of its cables at the bottom of the ocean, enough he believed to girdle the equator more than ten times, and still leave a considerable stock in hand.

Sir James Pender, Bart., seconded the resolution, which was carried unanimously.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

Colonel R. E. Crompton, C.B., presided on February 25th at the offices, Brompton Road, over the annual general meeting.

Before moving the adoption of the report (see Elec. Rev. p. 321), the Chairman referred to the loss the company had sustained in the death of Mr. Erskine, who was its first secretary. It was nearly 30 years since Mr. Erskine and Mr. Miller agreed to join him in forming the working staff of the Kensington Court Co., which afterwards developed into the the present company. They were the pioneer company of electric distribution in this country, and it was perhaps difficult for their present shareholders to realise the initial difficulties experienced by them before they were able to show results which would justify extensions of their capital on the lines they had since followed. They had filled Mr. Erskine's place by the appointment of Mr. Britton, who had been in their office for a long time as assistant secretary. Turning to the accounts, he said that they proposed to pay the same dividend as last year, but they were able to carry forward an increased sum of £774. The balance that they had taken from revenue account and placed to the credit of renewals and reserve fund, was reduced by £1,969 on account of special expenditure on the replacing and renewals of accumulators. The total, however, now standing to the credit of the renewal and reserve fund, £122,139, might be considered as a substantial and satisfactory sum. Their revenue for the sale of electricity had during the year increased from £75,847 to £77,810, which was as much as they could reasonably expect, particularly as they had only had the benefit of the small increase of prices which was due to the readjustment of discount for a part of the year. They had an increase of working expenses of £1,155, principally due to the increase in the cost of coal. This increase in coal costs would have told more heavily against working expenses if it had not been for increased economy in its use. Still the net increase was a substantial one, for if coal now stood at the same price as in 1910, and if they had had the benefit of the economies which they had since realized, they would have reduced their working costs by a sum sufficient to increase their dividend on their ordinary share capital by at least 1 per cent. He had referred to the expenditure they had made in the re-arrangement and, to some extent, the reconstruction of the accumulator station in Cheval Place. This special expenditure would not be repeated and could hardly be debited to the working costs of the year, and for this reason they had considered that part should come out of their renewal fund. Apart from this, the chief expenditure and upkeep of their plant had been normal, and had been amply sufficient to maintain it in first-class condition and repair. In regard to the bill that had been promoted in Parliament, called the London Electric Supply Bill, which had for its object an attempt to revise the conditions of purchase of all the electrical companies, and to obtain some extension of their lives, of course shareholders in this company in common with the shareholders in other companies were naturally desirous of extending its life, but they must carefully watch the terms on which this extension was proposed. At the same time they had been approached by a financial group, which proposed to arrange for the amalgamation in some form or other of the existing companies, and the two matters of the Bill and amalgamation must therefore be taken together, and they were receiving the careful and most anxious consideration of the directors. For obvious reasons he could not say anything further than that the proposals made to the company appeared to recognise that it occupied a strong and well secured position, but as soon as they were in a position to understand the direction in which the negotiations were tending, they would certainly call the shareholders together and lay the scheme before them.

Sir Henry W. Bliss, K.C.I.E., seconded the motion.

Mr. Hedges, referring to the amalgamation scheme, said it was a big affair, and he thought it would require some considerable consideration before anything was done. If they joined a scheme of this kind, he took it it would be a kind of Trust in which all the companies would be united, but they would lose their individuality and be simply in the hands of those who dominated the Trust. If they were a non-progressive company they would no doubt like to see something which would give more market value to their friends and greater scope as an investment, but they were very comfortably placed. The dividends came very regularly, and the board seemed to handle things well with an efficient staff, and he really could not see what advantage there was for the so-called chance of extension by putting themselves in the hands of people whom they knew nothing about.

The Chairman said he thought Mr. Hedges had put the position of the shareholders very fairly, and the directors were taking up identically that position. They wanted to know really what advantage the shareholders of the company would reap from this bill or from the amalgamation, and it was only fair to tell them that so far as the negotiations had gone, they were not yet clear themselves what the position would be. Their position was almost identical with that of the St. James's Co. and the Westminster Co. They were not so large, but their steady earnings and the nature of the districts they served, made their future resemble very closely that of the companies he had named. Naturally, they were not moving without consultation with them, and so far as he had been able to gather from the reports of the speeches at the meetings of those companies, they were not much clearer at the present moment than he was as to the nature of these proposals. It would be absurd for him to give it them, and it would be no good for him to point out what they believed would be a weak point in the proposal. He thought it ought to be sufficient for the shareholders to know that they were certainly aware of the dangers which might accrue from amalgamating their interests with interests at the other end of London, which were entirely different to theirs and governed by an entirely different set of affairs. Industrial London was one thing and residential London another, and they were in residential London. One other point of interest which he omitted from his address was as to the extended uses of electricity to purposes other than lighting during the year. He was glad to say there had been a considerable increase for electricity for heating, cooking, and motor power. This year the units sold for such purposes amounted to nearly one million, which was a very great advance, and it was a direction in which their energies were turned to increase the output of the company.

The motion was then carried.

Westminster Electric Supply Corporation, Ltd.

Mr. J. Browne Martin presided on February 25th at the offices, Eccleston Place, Westminster, over the annual meeting of the company.

In moving the adoption of the report (see Elec. Rev. p. 321), the Chairman referred to the continued steady progress of the business. They sold 1,624,000 more units than in 1912. Their costs were £3,500, and their revenue £4,900, more than in 1912, so that on balance they were £1,400 to the good. They would probably have done better but for the exceptionally bright weather during the last half of the year. In the balance sheet investments were entered at their cost price of £338,800, and a note stated their market value on 31st December to be £37,000 less. The directors did not think it was necessary to write down the value, for the market fluctuated, and to-day the depreciation would be considerably less. When they wished to realise there might be no loss at all. It was satisfactory that they had not found it necessary to increase their prices during the period of reduction in revenue caused by the metal lamp. This period was now over, and, while maintaining their dividends, they had been able to allow the whole of the benefit of the more economical lamp to go to their consumers, which must have the effect of increasing their sales for lighting. But so far as they could see, the use of electricity for lighting would be largely exceeded in the future by its use for power, heating and cooking. The units sold for these purposes had increased by 75 per cent. during the last five years, and something like four-fifths of all new business was now of this nature. They sold this current at 1d. per unit, which was considerably less than the price charged in the principal towns in America and on the continent, and less than the rates proposed by the promoters of the big power bills of 1905, 6, 7, and 8. The question of dealing with the supply of electricity in London was full of difficulty and complexity. There were rumours of big schemes of amalgamation of the electric supply companies and statements of the benefits which would accrue to shareholders and to the public if they were carried out. A bill had been deposited by one of the companies, but so far as they could see, the promoters' proposals would not have the beneficial effect they claimed, and they had consequently joined with other companies in petitioning against it. Those who thought that a heavy additional capital expenditure would enable prices to be reduced and increased dividends to be paid were, he was convinced, mistaken. Apart from the railway companies, there were three bodies concerned in the supply of electricity in London. These were the present supply companies, the local authorities with electric undertakings, and the L.C.C. The L.C.C. was the ultimate purchaser of the companies. Any scheme brought forward by one of these three bodies alone in its own interests would probably be opposed by the other two, and therefore unless the three bodies could be brought together and a joint scheme be devised between them, litigation, with its consequent expenditure, would go on. In the meantime they had to take it that their concession would come to an end in 1931, and they must work with that end in view. They were in a sound position, and consequently any capital required for the increase of their business could be obtained without difficulty. Extensions of plant would be made mostly at the Grove Road station of the Central Co., which was, as they knew, owned jointly by the St. James's Co. and this company. They had looked ahead a good many years and had arranged to meet the capital expenditure which would be required there by an increase in the sum allowed annually for depreciation. For their own area they had, first, the sum they set aside each year for depreciation, say, £30,000 a year, and secondly, the investments they had made outside the business. The latter, if gradually brought into the business between now and 1931, would give them another £18,000 to £20,000 a year, so that they had available something like £50,000 per annum for extensions of mains and other capital expenditure without raising any fresh capital. He mentioned these points as an answer to the arguments which they had doubtless seen in the papers that "something must be done soon with regard to the supply of Electricity in London, because the companies would be unable to raise capital to fulfil their obligations as the year 1931 approached." In their case, this statement was quite incorrect, their rates of charge were reasonable, and their financial position was thoroughly sound. Thanks were due to the staff for their conduct of the business during the year.

Mr. Hayes Fisher, M.P., seconded the motion.

Mr. W. J. Fisher said the chairman had made a brief reference to the scheme of coalescing the whole of the electric supply companies of London, and he would like some further information. In common with other shareholders, he had heard a great deal about it, and certainly what he had heard did not induce him to show much favour towards it. He had been told on good authority that part of the proposed scheme was to add to the colossal undertaking something like £1,000,000, which was known in the City as watered capital. Doubtless the lips of the directors were more or less sealed, but if a little more light could be thrown on the scheme, it might possibly be of considerable advantage to the company.

Capt. Bax said that Sir. Alex. Kennedy was appointed chairman of the engineers to go into this matter on behalf of most of the electric supply companies, and he had many interviews with the promoters, and gave them a report on the technical side of the question, and perhaps Sir Alexander would explain as much as he felt at liberty to do.

Sir Alex. Kennedy said he thought he knew most of the figures concerned. It amounted to something like this. The present capital of the companies was about £15,000,000. The proposed further capital was a matter of £4,000,000 or £5,000,000 (but they thought it ought to be a great deal more for the erection of a new station and new plant), and £4,000,000 additional for the purposes Mr. Fisher had suggested and for other purposes. That was a matter of £8,000,000 additional capital, or practically 50 per cent. of the united capital of the whole of the companies. He thought without going any further into it he might just say this, because it was a matter of common sense, and open to everybody who looked at the accounts, if they looked into the accounts of their own company and those of the Central, and he thought practically almost any other company, they would find that the costs of an electric supply undertaking such as theirs were divided into three parts. About 25 per cent. of the whole was the cost of generation; about 25 per cent. distribution, managements, rates, taxes and insurance, and that sort of thing; and the remaining 50 per cent. was capital charges. Therefore the additional 50 per cent. to their capital, especially when some £1,000,000 of plant was to be scrapped, meant an enormous addition which could not possibly be balanced by saving in generation, as the total cost of generation was only about half the total capital charges of the companies. In fact, if anyone had the curiosity to examine the generating accounts of the companies in London for the last ten years, they would find that they fluctuated between about £440,000 to £460,000 per annum. That was they had practically remained nearly stationary during ten years although 80,000,000 more units had been generated. The points about the proposals of the promoters were as mentioned. It was a proposal to add enormously to the capital expenditure of the companies without, so far as their directors or any other directors had been able to see, any corresponding probability or possibility of increased dividends to the shareholders.

Mr. W. J. Fisher said he understood that the proposal was that the shareholders in the companies should receive stock to the extent of £5 of stock for every 5 per cent. paid. That was to say, as the shareholders of the Westminster Co. were receiving 10 per cent., they would get £10 of stock.

Sir Alex. Kennedy said it was much more complicated than that, and it was a matter he could not explain briefly.

The motion was then carried.

The Chairman proposed that a dividend at the rate of 10 per cent. per annum be declared, and this was seconded by Lord Kinnaird, and adopted.

City of London Electric Lighting Co., Ltd.

In their report for 1913 the directors state that the capital expenditure on additions, extensions and replacements during the year was £47,456, making it £2,560,874. The amount written off prior to 31st December, 1912, was £513,094, and there is a further amount written off in respect of buildings, plant and other works dismantled during 1913, £53,890, leaving the net expenditure as at 31st December, 1913, £1,993,890, showing a net deduction from capital account during the year 1913 of £6,434. The directors have credited the first debenture stock premium redemption account with £1,511 from revenue for interest, raising the amount at the credit of the redemption account to £64,472. They have also transferred £50,000 from net revenue account to reserve account. The balances at credit of the reserve funds stand as follows:—Reserve account £142,987, first debenture stock premium redemption account £64,472, leasehold redemption account £4,800, standing reserve for doubtful debts £2,155, in addition to which there will be the amount to be carried forward to 1914 £27,837, making the total £242,251. The total revenue for the year (£311,822), including interest on investments and discounts £2,492, was £314,314, from which must be deducted the following:—Expenses of generation and distribution £73,434, repairs and maintenance of buildings, machinery, plant, mains and other works £10,056, rent, rates, taxes, management expenses and special charges £56,234, leaving £174,590, plus £24,333 brought forward, making a total available revenue of £198,924. Of this sum the following amounts have been distributed or provided for:—Interest on loan from bankers, consumers' deposits, etc. £2,995, interest on first and second debenture stock for year ended £31,546, interest transferred to debenture stock premium redemption account £1,511, leasehold redemption account, interest and appropriation £278, contributions to employees' provident funds and under National Insurance Act, £2,113, stores, written down £919, transfer to reserve account £50,000, leaving available £109,561, plus the balance standing to the credit of dividend equalization account £7,352, making a total of £116,913. The directors recommend dividends of 6 per cent. on the preference shares and 10 per cent. on the ordinary, as compared with 9 per cent. a year ago, the total dividends for the year amounting to £89,077. There is to be carried forward £27,837.

The following tables show the position of the company as it was at the end of 1913 and 1912.

	1912.	1913.	Increase.
Gross revenue from all sources ...	£300,619	£314,313	£13,694
Net revenue	163,681	174,590	10,909
Distribution on Ordinary shares	9 per cent.	10 per cent.	

PRIVATE SUPPLY: AVERAGE PRICES PER UNIT OBTAINED.

In 1912, 2.37d. In 1913, 2.33d.

	1912.	1913.	Increase.
Number of customers	14,729	15,083	354
K.W. connected (including power and heating)	41,151	43,703	2,552

On February 18th, 1914, there were 44,941 K.W. applied for, out of which 44,074 were connected, and the customers numbered 15,146.

TOTAL UNITS GENERATED, SOLD, UTILISED ON WORKS, &c.

(Including Public Street Lighting.)

	1912.	1913.
Generated	32,220,338	33,542,870
Sold	27,488,860	29,112,618
Metered and used by the company	1,429,784	1,490,078
Expended in distribution, etc.	3,301,694	2,940,174
Maximum supply demanded	18,510 K.W.	19,433 K.W.

The total units sold during 1913 show an increase of 1,623,758 over the quantity sold during 1912.

The power and heating supplies continue to show a steady increase, the total units sold for these purposes in 1913 being as follows:—Power, 10,797,552 units; heating, 1,818,654 units; total 12,616,206 units; together being equal to 45.1 per cent. of the total units sold for private supply. By the London Electric Supply Bill, 1914, the promoters purport to seek powers to empower the County of London Co. and any other London company to enter into agreements with the L.C.C. for a postponement of the date and variation of the terms of purchase of their undertakings, and thus to alter or repeal the provisions of the London Electric Supply Acts, 1908 and 1910. The company has lodged a petition against the Bill as a precautionary measure. The meeting takes place on March 11th.

Waste Heat and Gas Electrical Generating Stations, Ltd.

The annual meeting was held on February 27th, in Newcastle-on-Tyne, Dr. J. B. Simpson presiding.

In moving the adoption of the report and balance-sheet (see Elec. Rev., p. 367), the Chairman said that the reserve and depreciation account had been increased by the transfer of £9,500 out of the year's profit, that was £500 more than in the previous year, and the fund now amounted to £42,850. They had also made the necessary sinking fund allowances in respect of plant that was let out on hire or hire-purchase. Capital expenditure on buildings, generating plant and machinery had been increased by £30,933, which represented certain retention moneys which had been paid on existing generating stations and the cost of two new installations at Horden and Shotton, where waste heat from the Horden Collieries, Ltd., was utilised for the generating of electrical power. Regarding their investments, they had taken up £45,100 second mortgage debentures in Cleveland and Durham Electric Power, Ltd. During the past year the Cleveland Co.'s first and second mortgage debentures fell due for repayment, and by the issue of two new series of debentures for a period of 30 years they had put their financial position on a sound and permanent basis, which was, of course, a satisfaction to this company, as the Cleveland Co. operated and maintained a considerable number of the waste heat generating stations. The debentures they had acquired carried interest at the rate of 6 per cent, and were repayable in from 25 to 30 years by means of a sinking fund. Their profits showed an increase over the previous year of over £2,200, part of which had been allocated towards an increase in the amount transferred to reserve and the balance went to the carry forward. All the stations had operated satisfactorily during the year, and the new stations at Shotton and Horden, which were only acquired during the latter part of 1913, should produce an increase in the revenue during the coming year. He thought they could congratulate themselves that they were a useful company in that they supplied a very large amount of cheap power to the electrical power companies, in addition to which they had during the past year paid something over £10,000 to ironmasters and coal-owners in the district for energy which was previously entirely wasted, and, of course, so large a revenue could not have been obtained by them, except through the Waste Heat Co. as an intermediary between them and the power companies. They were considering proposals for the erection of one or two more generating stations, and he thought it possible that next year they might be able to report that those had been satisfactorily concluded, and that the works were well in hand.

The report was seconded by Mr. E. Lloyd Pease, and carried unanimously.

Metropolitan Electric Supply Co. Ltd.

The directors report that the capital expenditure has now reached a total of £2,172,336, being an increase during the year of £68,340. A further £11,368 3½ per cent. mortgage debenture stock was issued during the year. The gross revenue amounted to £217,605, an increase of £15,422. The working expenses amounted to £111,317, an increase of £12,230. The balance at the credit of the revenue account, before providing for depreciation, is £106,289. The directors have set aside £22,000 as an addition to the depreciation and reserve fund, which now amounts to £319,355, carrying to the credit of the net revenue account (No. 5) £84,289, plus balance brought forward, interest and dividends on investments, and other receipts, making a total of £97,475. After deducting interest on debenture stocks and loans, dividend on preference shares and other charges, there remains £47,653. An interim dividend of 2s. per share (4 per cent. per annum) on the ordinary share capital, amounting to £20,000, was paid on August 13th, and the directors recommend a further dividend of 2s. 6d. (5 per cent. per annum), making a total for the year of 4s. 6d., or 4½ per cent. This will absorb a further £25,000 and leave a balance of £2,653 to be carried forward. During the year new connections representing the equivalent of 58,526 8-c.p. (30-watt) lamps, equal to 1,756 kw. were added to the company's system, making a total connection at the end of the year of 1,086,830 lamps. The Kingsway property of the company has been let on a building lease for 98 years. The stations, machinery and plant have been maintained in a satisfactory condition.

The meeting takes place on March 10th.

Davis & Timmins, Ltd.—The directors report that the net profit for the year ended December, 1913, including £15,210 brought forward, after allowing for depreciation and commission to manager, was £37,083. The interim dividend on the preference shares absorbed £1,800, that on the ordinary shares at the rate of 6 per cent. per annum £1,410, and there has been placed to general reserve account £9,000, leaving £24,873 to be dealt with. This the directors propose to appropriate as follows:—Final dividend on the preference shares, making 6 per cent. per annum for the year, £1,800; a balance dividend at the rate of 10 per cent. per annum on the ordinary shares for the December half-year, making 8 per cent. for the year, £2,350; a bonus of 12 per cent. out of profits, £5,640; carrying forward £15,083.

The meeting is called for March 12th.

North Metropolitan Electric Power Supply Co.—An extraordinary general meeting was held on Monday at Electrical Federation Offices, Kingsway, Mr. C. G. Tegetmeier presiding, at which a resolution was unanimously adopted, authorising the company in exercise of the powers contained in the North Metropolitan Electric Power Supply Act 1909, to raise the sum of £100,000, being a further portion of the additional capital authorised by that Act, by the issue of preference stock ranking *pari passu* with the existing preference stock of the company. The chairman, in submitting the resolution, which was seconded by Mr. A. L. Madgen, remarked that it was a purely formal matter. The additional capital, he added, was required for the general purposes of the company.

British L. M. Ericsson Manufacturing Co., Ltd.—The directors report that the business shows an increase in all departments for 1913. After charging £10,503 for depreciation, and £2,500 for debenture interest, the net profit amounts to £23,809, plus £5,940 brought forward, making an available balance of £29,749. After payment of the preference dividend amounting to £5,999, it is proposed to pay 8 per cent. (free of income-tax) to the ordinary shareholders, requiring £8,001, writing off balance of preliminary expenses £4,340, placing to reserve account £5,000, carrying forward £6,409. The meeting is called for March 18th.

Company Restored to the Register.—The British Power, Traction and Lighting Co., Ltd.—Mr. Justice Joyce, in the Chancery Division on January 20th, made an order restoring this company to the Register of Companies.

Madras Electric Tramways (1904), Ltd.—A dividend of 5 per cent. per annum on the ordinary shares is announced for 1913.

Western Telegraph Co., Ltd.—A second quarterly interim dividend 3s. per share is announced payable March 25th.

Held Over.—Owing to heavy pressure upon our space, reports of several companies are held over until next week.

STOCKS AND SHARES.

Tuesday Evening.

Money and Mexico maintain their supremacy as the dominant factors in the Stock Exchange for the time being. Money has grown less of a bugbear, Mexico is still a grave *bête noire*, and the tone of markets as a whole is none too satisfactory. It can hardly be said that business has returned to any great extent, but a recovery in the price of Consols induced a better feeling, and had the effect of bracing up prices in many parts of the House, a subsequent wave of depression being so much the more disappointing.

The meetings of the various London electric supply companies held during the past week or so provide particularly interesting reading, in view of the remarks made by the different chairmen on the subject of the proposed amalgamation of interests through the medium of a holding company. Mr. Fladgate, of the Charing Cross Company, made certain references to the scheme which drew from Messrs. Slaughter & May, the solicitors, a reply evoking further answer; and the fusillade, as we write, is still going on. There are times when the echo would fain become the voice. The temptation, for instance, is strong to take sides in the controversy now proceeding around the question of the super-company, instead of being hemmed in by the necessities of playing the part of record to the Stock Exchange gramophone.

The market for the various companies' shares halts between two opinions—(1) that the prices are cheap, having regard to the dividends which are being paid, and (2) the uncertainty as to the progress of the County of London's Bill, now before Parliament. If the Bill should not go through, the sentimental effect might be to put prices down a little. But this would probably be a temporary affair only, for in any period of cheap money the claims of electric lighting shares as high-yielding investments can scarcely be overlooked.

The City of London Company, we are told, has been strengthened by the addition to the board of the Marquis of Winchester, who, as chairman of the Victoria Falls and Transvaal Power Supply Company, has had experience of supply work. Publication of an excellent report had no effect upon the price. County Ordinary and Preference shares have reacted a little, several simultaneous sellers coming in. South Londons again lost ⅛. South Metropolitan Second Preference hardened to 18s. 9d., and a rise of 3 lifted the 4½ per cent. Debenture stock to 98½.

The Mexican outlook is now bounded by the various sidelights that are allowed to come through from Mexico—or which are evolved from the imaginations of Yankee journalists—respecting the death of Mr. Benton. There was a rumour current in the Stock Exchange last week to the effect that General Huerta had promised to assist President Wilson's policy in pacifying the country and then offering his resignation. The story, tall as it was, found some little credence; and the prices of Mexican things moved on erratic planes.

The main drop of the week has been in Pachuca 5 per cent. Debentures, which slumped to 67½, these bonds being guaranteed by the Mexican Light and Power Company. The next coupon is due for payment on April 1st. Mexican Light and Power issues themselves have been dull, and Mexican Electric 5 per cent. bonds also gave way. No movement occurred in Monterey Debentures.

Mexico Trams fluctuated in consonance with the news, and, after being flat, they recovered substantially; the price is 2 points higher on balance. River Plate Ordinary stock moved up 18 points on the issue of a circular to the shareholders apprising them of negotiations for sale of part of the property at a good price. Montreal Light and Power Common stock gained 5, anticipation looking for an increase in the dividend.

Brazilian Traction shares advanced on the cessation of selling from the Continent, and upon the attention called to the pace at which net earnings are piling up. In spite of the difficulties that are besetting most things connected with Brazil, the Traction Company appears to be doing well, and maintenance of the 6 per cent. dividends would appear to be in no danger, so far as can be seen at present. Calcutta Trams rose to 6½. The British Columbia Electric group is rather duller, and amongst Anglo-Argentine issues the only movement is a fall of $\frac{1}{16}$ in the First Preference shares. The new Debenture stock, however, is rather firmer at ¼ premium.

Protest and indignation have been aroused by the proposal to suspend payment of the dividend on Bath Tramways Preference shares for a period of four years, in order to provide the company with sufficient working capital to carry on its business. The concern is doing fairly well, but wants more money; and as such support would have to be paid for on fairly stiff terms—the company's 4½ per cent. Debenture stock is quoted 72½ middle—the directors propose the suspension of the Preference dividends for four years. Much interest attaches to the outcome of the suggestion, but conceivably the directors assured themselves of sufficient assistance before they put the matter before their fellow-proprietors.

The Railway market is dullish. Prices have been moving within narrow margins, and the majority of Preference stocks are now quoted *ex* dividend. Metropolitan Consolidated at 42¾ is 1 lower on the week, the Pownall agitation having its effect upon the price of the stock. Districts are ½ down, but Underground Electric Railways £10 shares recovered part of their previous drop. The Company's 6 per cent. Income bonds are just quoted *ex* the £3 interest—which, by the way, is paid net, without deduction of income-tax.

Telegraph stocks and shares are very quiet. Direct United States Cables lost ⅛, but beyond this the movements have been few and insignificant. Marconis revived a little after their sharp fall, but again reacted, and the Preference regained ⅛ to lose it later; the shares of the subsidiaries have also been tending to the duller side. Reuter's shares at 8¾ are 5s. lower, and the reason for the continual fall is difficult to define. Were it the subject of a guessing competition, one of the entrants would certainly put down a possible reduction in the dividend as amongst the likely causes of the decline.

In the Manufacturing group, General Electrics continue to harden; the preference at 10⅜ are ⅛ higher, but the Debenture stock has gone back to 88, a fall of 2½. Telegraph Constructions rose to 40½, a gain of the fraction, upon the maintenance of the dividend at the regular 20 per cent. British Insulated shares put on 15s., the price rising to 9⅜ on the declaration of a dividend, making 13 per cent. for 1913. This is an increase of 3 per cent., and the figures are exceedingly good. Of the lower-priced varieties, British Aluminium Ordinary are the turn better. Rubber shares are alternately firm and dull. The price of the raw material keeps in the neighbourhood of 2s. 4½d., with occasional variations of ¼d. or ½d. per lb. that serve to tilt the scales against bull or bear, as the case may be, in the Stock Exchange market. Activity has completely died away for the time being.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Feb. 25	2,923	+ 217	8	5,594	— 11	..	..
Blackpool-Fleetw'd	„ 28	1,186	+ 62	8	2,891	+ 90	8	..
Bristol	„ 27	29,504	+ 3,365	9	60,696	+ 4,044	80·5	..
Brit. Elec. Trac. Co.	„ 20	200,169	+ 8,078	..	..	..	429·8	1·25
Chatham and Dist.	„ 26	8,268	+ 100	8	6,474	- 294	14·98	..
Cork	„ 26	1,759	+ 110	8	3,575	+ 19	9·89	..
Dublin	„ 27	21,262	— 105	9	42,703	— 2,298	54·25	..
Hastings	„ 26	2,879	+ 164	8	5,464	- 136	19·3	..
Lancashire United	„ 25	6,176	+ 914	8	12,272	+ 1,674	42	8
Llandudno-Col. Bay	„ 20	605	+ 13	12	1,776	+ 6	6·5	..
London United ..	„ 27	21,988	+ 1,349	9	44,282	+ 678	..	..
Tyneside	„ 25	1,917	+ 51	8	3,607	+ 124	11	..
Anglo-Argentine ..	„ 25	227,208	+ 8,643	8	455,119	+ 17,384	..	..
Auckland	„ 13	28,552	+ 3,436	32	159,090	— 489	25·42	1·81
Calcutta	„ 28	18,066	+ 1,302	..	..	+ 1,957	..	..
Kalgoorlie, W.A. ..	Dec.	2,907	..	52	34,510	..	20·5	..
Madras	Jan. 31	3,876	+ 334	4	3,876	+ 334	15·25	..
Montevideo ..	Feb.	35,805	+ 1,437	17	187,901	+ 1,366	..	..
Cen. London Rly.	Feb. 28	20,188	— 1,822	9	46,630	- 3,035	6·78	·4
City & S. Lon. Rly.	„ 28	11,092	— 936	9	25,724	— 1,904	7·26	..
Dublin-Lucan Rly.	„ 27	458	+ 18	8	925	— 16	7	..
L'pool Overh'd Rly.	Mar. 1	6,430	+ 194	9	14,887	+ 514	6·6	..
London Elec. Ry. Co.	Feb. 28	57,645	+ 175	9	181,885	- 495	21·25	..
Mersey Railway ..	„ 28	9,126	+ 101	9	20,464	+ 65	4·5	..
Metropolitan Rly.	Mar. 1	70,805	+ 6,478	8	161,408	+ 18,962	29·25	8·5
Met. District Rly.	Feb. 23	53,104	+ 788	9	119,058	+ 8	25	..

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, March 4th.

CHEMICALS, &c.		Latest Price.	Fortn'ght's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2⅞d.	⅛d. dec.
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£22 10	..
a Lead, Nitrate	„	£30 10	..
a „ White Sugar	„	£28	..
a „ Peroxide	„	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %) ..	per ton	[illegible] 10	..
a „ Chlorate	per lb.	3¼d.	..
a „ Perchlorate	„	3¾d.	⅜d. dec.
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	75/-	7s. dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10	5s. dec.
a „ Chlorate	per lb.	3⅜d.	..
a „ Crystals	per ton	£2 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..

METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£86	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£112	..
b „ Sheet, in ton lots ..	„	£112	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¼d.	⅛d. dec.
c „ Tube (brazed)	„	9⅝d.	..
c „ „ (solid drawn) ..	„	8½d.	¼d. dec.
c „ Wire, basis	„	7⅜d.	¼d. dec.
c Copper Tubes (brazed)	„	10½d.	⅛d. dec.
c „ „ (solid drawn) ..	„	10½d.	⅛d. dec.
g „ Bars (best selected) ..	per ton	£81	£2 dec.
g „ Sheet	„	£81	£2 dec.
g „ Rod	„	£81	£2 dec.
d „ (Electrolytic) Bars ..	„	£67 10	£1 dec.
d „ „ Sheets ..	„	£85 10	£1 dec.
d „ „ Rods ..	„	£78	£1 dec.
d „ „ H.C. Wire	per lb.	8⅜d.	⅛d. dec.
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/-	..
h India-rubber, Para fine	„	2 4	9d. dec.
l Iron Pig (Cleveland warrants) ..	per ton	51 6	8d. dec.
„ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£20 5	7s. 6d. inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/3	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10⅜d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£173 15 to £174 15	£7 15 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/4	1d. dec.
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Tyneside Electrical Development Co., Ltd.—The directors' report for the year ended January 31st last, states (according to the *Financial Times*) that the profits amount to £3,046, plus £2,601 brought forward. The directors propose a final dividend, making 15 per cent. for the year, transferring to general reserve account £1,000 (making £7,000), and leaving to be carried forward £3,047. The investments have yielded a satisfactory return during the year, and show an increase in value. The development of the business of the Electro-Flex Steel Co., Ltd., which was formed to manufacture steel castings by means of an electric furnace, has taken longer than was anticipated, and further capital has also been required. The company's investment has not yet yielded any return, but more satisfactory progress is now being made.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations March 3rd.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	$\frac{3}{16}$ — $\frac{5}{16}$	..	Nil
Do. 5 % Pref.	1	5	5	½ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	16 — 18	..	..
Do. Do. Deferred	100	..	..	7 — 9	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	90 — 93	..	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	3	..	57 — 60	..	5 0 0
Do. 5 % Perp. Deb.	100	5	5	94 — 97	+ ½	5 3 0
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 82	—1	5 9 9
Central London Railway, Ord.	100	3	3	57 — 62 xd	..	4 16 9
Do. Gtd. Assented	100	..	4	81 — 83 xd	..	4 16 5
Do. Pref.	100	4	4	68 — 73 xd	..	5 9 7
Do. Gtd. Assented	100	..	4	82 — 84 xd	..	4 15 8
Do. Def.	100	2	2	57 — 62 xd	..	3 4 6
Do. Gtd. Assented	100	..	4	80 — 82 xd	..	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97 xd	..	5 3 1
Do. Do. 1896	100	5	5	95 — 97 xd	..	5 3 1
Do. Do. 1901	100	5	5	93 — 95 xd	..	5 5 3
Do. Do. 1903	100	5	5	91 — 93 xd	..	5 7 6
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	67 — 72	..	6 5 0
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 3
Lancashire United, 5 % Deb.	100	5	5	85 — 87	..	5 15 0
London and Suburban, Ord.	1	..	..	¼ — $\frac{5}{16}$	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	½ — ¾	..	6 13 4
Do. Do. 4½ % 1st Deb.	100	4½	4½	79 — 84	..	5 7 2

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations March 3rd.	Rise + or Fall	Present Yield p.c.
	*					£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	63 — 67		[illegible]
Metropolitan Railway Consol.	100	1⅝	1⅝	42½ — 43 xd	—1	3 15 7
Do. Surplus Lands	100	2¾	2¾†	63 — [illegible] xd	+ ½	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — [illegible]	..	3 19 7
Do. 3½ % Pref.	100	3½	3½	82 — 84 xd	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82 xd	..	4 5 4
Metropolitan District Ord.	100	Nil	..	30½ — 30¾	— ½	Nil
Do. 6 % Deb.	100	6	6	138 — 141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	86 — 89 xd	..	5 1 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	—1	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	93 — 96	..	4 13 9
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Potteries, Ord.	1	3½	..	¼ — ½	..	..
Do. 5 % Pref.	1	5	5	[illegible]	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 [illegible] 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	3 — 3½	+ ⅛	Nil
Do. "A"	1/-	..	..	⅜ — $\frac{7}{16}$	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	113 — 115 xd	..	5 4 4
Do. 4½ % Bonds	100	4½	4½	99 — 101	..	4 9 0
Do. 6 % Income	100	6	6	90 — 91 xd	— ½	6 11 10
Yorkshire (West Riding). Ord.	5	Nil	..	$\frac{5}{16}$ — $\frac{9}{16}$	..	Nil
Do. 6 % Pref.	5	3	4	3⅞ — 4⅜	..	4 11 5
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations March 3rd.	Rise + or Fall	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4$\frac{13}{16}$ — 5$\frac{1}{16}$	—$\frac{1}{16}$	5 8 7
Do. 2nd Pref.	5	5½	5½	$\frac{5}{16}$ — $\frac{9}{16}$	..	6 0 7
Do. 4 % Deb.	100	4	4	93 — 95	+ ½	4 4 3
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	103 — 106	..	4 14 3
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 — 100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	88½ — 90½	+ ½	6 12 7
Brisbane Trams Invt., Ord.	5	8	8	7⅝ — 8⅛	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 — 101	—1	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	119 — 123	—1	6 10 1
Do. Pref. Ord.	100	6	6	106 — 110	—1	5 9 1
Do. 5 % Pref.	100	5	5	103 — 106	— ½	4 14 4
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	96 — 98	..	4 6 9
Calcutta Trams, Ord.	5	7½	5†	6¼ — 6¾	+ ¼	5 11 1
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5¼ — 5½ xd	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	95½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	N	..	0 — $\frac{1}{16}$	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations March 3rd.	Rise + or Fall	Present Yield p.c.
La Plata Elec. Trams, Ord.	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4⅜d.	6	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	$\frac{15}{16}$ — 1$\frac{3}{16}$	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	5 — 5⅜	..	5 11 7
„ Elec. Tr. (1904), Deb.	100	5	5	101 — 103	..	4 17 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 — 100	..	5 0 0
Mexico Trams Com	$100	7	7	71 — 74	+2	..
Do. Gen. Con. 5 % Bonds	..	5	5	78½ — 82½ xd	+2½	6 1 3
Do. 6 % Bonds	100	6	6	81 — 85	..	7 1 2
Para Elec. Rlys. & Lt., Ord.	5	10	10†	4⅞ — 5⅜	..	9 6 0
Do. 6 % Pref.	5	6	6	4½ — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	93 — 95	..	5 5 3
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	100 — 102	..	4 18 0
Do. 5 % Mort. Bonds	100	5	5	92 — 94	..	5 6 5
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	100 — 103	..	4 17 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96½ — 98½	— ½	5 1 6
Un. Elec. Trams Monte Video	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	94 — 97	..	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations March 3rd.	Rise + or Fall	Present Yield p.c.
Bournemouth & Poole, Ord.	10	6	7	9½ — 10½	..	6 13 4
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord.	5	10	10†	9⅛ — 9⅝	..	5 4 0
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 9⅛	..	3 16 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	6	4¾ — 5¼	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅞	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10	18 — 19	..	5 5 3
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	99 — 102	..	4 8 1
County of London, Ord.	10	6	7	12½ — 13	— ⅛	5 7 8
Do. 6 % Pref.	10	6	6	11⅞ — 12⅛	— ⅛	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	101½ — 103½	..	4 7 0
Do. 4½ % Second Deb.	Stock	4½	4½	100 — 103	..	4 7 5
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4⅛	..	7 5 5
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	92 — 94	+1	4 15 9

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations March 3rd.	Rise + or Fall	Present Yield p.c.
Hove	5	8	8†	8¾ — 9¼	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 8 xd	..	5 12 6
Do 4 % Deb.	Stock	4	4	90 — 92	+1	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1½ — 2	..	4 10 0
Do. 6 % Pref.	5	6	6	5 — 5⅜	..	5 11 7
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4¼	4½	3⅝ — 4⅛	..	5 9 1
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford	5	7	7†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord.	5	10	12	9½ — 10 xd	..	6 0 0
Do. 7 % Pref	5	7	7	6½ — 7 xd	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5½	5½	3 — 3⅜	— ⅛	6 1[illegible] 4
Do. 5 % First Mort. Deb.	100	5	5	98 — 101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1$\frac{1}{16}$ — 1$\frac{3}{16}$ xd	..	5 18 6
Do 4½ % First Deb. Stock	100	4½	4½	100 — 97	+3	4 10 0
Urban, Ord.	£3	Nil	..	⅜ — ⅝	..	
Do. 5 % Cum Pref.	5	3‡	..	2⅞ — 3⅛	..	4 12 0
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 3
Westminster, Ord.	5	10	10	8¾ — 9¼ xd	..	5 9 7
Do. 4½ % Cum Pref.	5	4½	4½	5$\frac{1}{16}$ — 5$\frac{5}{16}$	..	4 4 8

* Unless otherwise stated all shares are fully paid. † Interim Dividend. ‡ 3s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 3rd.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5 — 5½ xd	..	5 14 3
Calcutta, Ord.	5	8½	5†	7⅝— 8	..	5 6 3
Do. 5 % Pref.	5	5	5	4 15/16— 5 1/16 xd	..	4 16 5
Calgary Power, 1st Mort. Bds. ..	100	5	5	90 — 92	..	5 8 8
Canadian Gen. El. Com.	$100	7	8	113 —117	+1	6 16 9
Do. 7 % Pref.	$100	7	7	123 —128	..	5 9 5
Cordoba Lt., Power and T., Ord.	1	5	..	7/16— ⅜	..	7 12 0
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88 — 90	+ ½	6 13 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95 xd	+ ½	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛— 5/32		Nil
Do. 6 % Pref.	1	6	6†	15/32— 17/32	+ 1/32	10 11 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1¼— 1¾	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103 —108	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	65 — 70	+2½	7 2 10
Mexican Lt. & Power, Common	$100	4	4†	42 — 45	—1	..
Do. 7 % Cum. Pref.	$100	7	7	79 — 84	—1	8 6 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	77 — 81	+1	6 3 5
Do. 5 % 2nd Mort. Bonds ..	100	5	5	64 — 68	..	7 7 1

NAME.	Stock or Share.	Dividends for		Closing Quotations March 3rd.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	54 — 59	..	..
Montreal, Lt., H. and Power ..	$100	9	10†	233 —238	+5	4 4 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	225 —235	+18	4 5 1
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	103 —108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	102 —104	..	4 6 7
Shawinigan Water, Capital ..	$100	5½	6†	144 —148	..	4 1 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 —108	..	4 12 7
Do. 4½ % Per. Deb.	Stock	4½	4½	98 —101	..	4 9 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	96 — 99	+1	4 11 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Victoria Falls Power, Pref. ..	1	6	6	¾— 13/16	..	7 7 8
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	100 —102 xd	..	5 17 8

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 3rd.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	11/16— 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	¾— ⅞	..	6 17 2
Babcock & Wilcox	1	16	14†	3⅛— 3¼	..	5 18 6
Do. Pref.	1	6	6	1 5/16— 1 7/16	..	4 8 6
British Aluminium, Ord. ..	1	..	..	1 3/32— 1 7/32	+ 1/32	..
Do. 6 % Cum. Pref.	1	6	6	13/16— 15/16	..	6 8 0
Do. 5 % Prior Liens Debs. ..	100	5	5	96 — 99	..	5 1 0
Do. Deb. Stk.	100	5	5	88 — 93	—1	5 7 6
B.I. & Helsby Cables	5	10	13	9⅝— 10⅛	+ ⅜	4 19 1
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
British Thomson-Houston, Deb.	100	4½	4½	90 — 93 xd	..	4 16 9
British Westinghouse, Pref. ..	2	Nil	..	1 7/16— 1 9/16	..	Nil
Do. Deb.	100	4	4	68 — 71	..	5 12 8
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	37 — 41 xd	..	10 19 6
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	11½— 12½	..	6 2 4
Do. Pref.	5	5	5	4 15/16— 5 3/16	..	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	22½	2¾ — 2⅞	..	..
Do. Deb.	100	4½	4½	103 —106	..	4 5 1

NAME.	Stock or Share.	Dividends for		Closing Quotations March 3rd.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	5/16— 9/16	..	..
Do. Pref.	1	6	6	23/32— 27/32	..	7 2 2
Edison & Swan, A, £2 paid ..	5	Nil	..	1/16— 3/16	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	9/16— 11/16	..	7 5 6
Do. Pref.	1	7	7	15/16— 1 1/16	..	6 11 7
Greenwood & Batley, Pref. ..	10	7	7	6¾— 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref. ..	10	6	6	10¼— 10¾	..	5 14 8
Do. Deb.	100	4	4	86 — 90	—2½	4 9 0
Henley's, Ord.	5	15	20	14 — 15	..	6 13 4
Do. Pref.	5	4½	4½	4⅞— 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	7½	11 — 12	..	6 5 0
Do. Pref.	10	5	5	8¾— 9¼	..	5 5 8
Telegraph Construction	12	20	20	39½— 41½	+ ½	5 15 7
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref. ..	100	..	..	50 — 55	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 3rd.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	6½— 6¾	..	6 18 4
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 —126	..	6 7 0
Do. Collat. Trust	$1000	4	4	92 — 95	..	4 4 3
Anglo-American Telegraph ..	Stock	3	3	65 — 68	..	4 8 3
Do. 6 % Pref.	Do.	6	6	108¾—109¾	..	5 9 4
Do. Def.	Do.	30/-	30/-	24⅛— 24⅜	..	6 1 10
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104 xd	..	4 16 2
Chili Telephone	5	8	..	7⅜— 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	81½— 83½	..	4 16 0
Cuba Telegraph	10	6	6†	8¾— 9¾	..	6 8 1
Do. 10 % Pref.	10	10	10	15¾— 16¾	..	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3½— 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	..	7½— 8	..	6 5 0
Direct United States Cable ..	10	4	4†	6¾— 7¼	— ⅛	5 10 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	133 —136	—1	5 3 0
Do. 3½ % Pref. Stock	Do.	3½	3½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	..	4 2 4
Eastern Extension	10	7	7	12⅜— 12⅞	..	5 8 9
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust ..	10	6	6†	11⅜— 11⅞	..	5 1 1
Do. 6 % Pref.	10	6	6	12½— 13	..	4 12 4
Great Northern Telegraph ..	10	20	5†	32½— 34½	..	5 16 0
Indo-European Telegraph ..	25	13	5†	58 — 60	..	5 8 4
Mackay Companies Common ..	$100	5	5	86 — 90	..	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7

NAME.	Stock or Share.	Dividends for		Closing Quotations March 3rd.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph ..	1	20	20	3½— 3⅝	— 1/16	5 10 6
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2⅞— 3⅛	..	5 8 7
Monte Video Telephone, Ord. ..	1	6	6	13/16— 15/16	..	6 8 0
Do. 5 % Pref.	1	5	5	¾— ⅞	..	5 14 8
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101	..	4 9 0
Oriental Telep. and Elec. ..	1	10	10†	1 15/16— 2 3/16	..	4 11 4
Do. 6 % Cum. Pref.	1	6	6	1⅛— 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½— 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	8½— 9½	— ½	10 16 2
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½— 98½	..	4 11 5
United River Plate Telephone	5	8	6†	6⅜— 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5⅛— 5⅝	..	4 9 0
West Coast of America	2½	2½	..	1 5/16— 1 7/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	1½	2 7/16— 2 11/16	..	4 18 0
Do. 6 % Cum. 1st Pref. ..	10	6	6	9¾— 10¼	..	5 17 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd. ..	10	7†	7	13⅛— 13⅝	..	5 2 8
Do. 4 % Debs.	Stock	4	4	95 — 97	..	4 2 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 — 98	..	4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

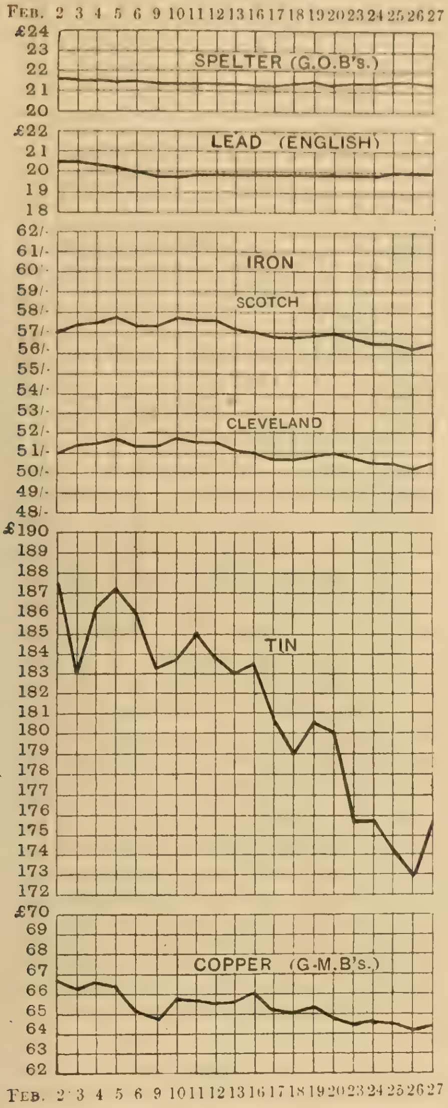
Glasgow Contractors' Concert.—The Electrical Contractors' Association of Scotland, Glasgow Branch, held their annual whist drive and concert on February 25th, in the Burlington House, Glasgow. A most enjoyable evening was spent. The chairman of the branch, during the interval, said that nearly all the *bona fide* electrical contractors in the Glasgow district were now members, and that the Association's efforts to secure first-class work being done by its members was being more fully recognised by architects and engineers. The special cable rebate to members was due from the C.M.A. manufacturers on completion of members' returns. The rules for workmen had been recently signed on behalf of masters and men after many lengthy meetings of representatives. The wages question had been settled for the next 12 months, and a system for increase and reduction thereafter agreed upon. The Edinburgh and Aberdeen Branches had also settled the rules and wages question with their men.

The Channel Tunnel.—At a meeting in the City of London on Thursday last week, a resolution was passed supporting the proposal to proceed with the construction of a tunnel between England and France.

The London Goods Clearing-House Scheme.—On Monday last, Mr. A. W. Gattie, by invitation of the South-Eastern and Chatham Railway Research Association, read a paper on the advantages of economic transport to railway employés, before the members of the Association. He pointed out the disadvantages and costliness of the methods of goods transport at present in vogue, and explained how, by the adoption of the clearing-house scheme of the New Transport Co., an immense saving of time, and a saving in money estimated at 40 millions sterling per annum, could be effected. A discussion followed the lecture.

METAL MARKET.

Fluctuations in February.



Walking Race.—The Hackney Walking Club held a very successful 20 miles scratch walking race and yacht handicap on Saturday last, over an ideal stretch of road—Edmonton to Hoddesden and back again. Twelve entered, nine started, and eight finished, Haynes, of Associated Fire Alarms, Ltd., retiring at 12 miles. A. R. Edwards (the London to Southend record holder), after leading for 13 miles, was overtaken by S. H. Smith (winner of the Boxing Day 20 miles race), who held a decided lead right up to the finish, the result being:—S. H. Smith (Hornsey), 3 hrs. 20 min., first; A. R. Edwards, 3 hrs. 26 min. 20 sec., second; C. H. Malivoire (Crypto Electrical Co.), 3 hrs. 28 min. 30 sec., third; W. L. Dawson (Crouch End), 3 hrs. 29 min., fourth; H. V. Wallington (Harringay), 3 hrs. 29 min. 30 sec., fifth; H. Gregory (Crypto Electrical Co.), 3 hrs. 32 min., sixth; J. Tippetts (Woolwich), 3 hrs. 38 min. 25 sec., seventh; L. G. Short (Stratford), 4 hrs. 23 min. 30 sec., eighth. The yacht handicap was won by Wallington with 40 min. allowance, Dawson being second with an allowance of 37 min. 30 sec. For the 100 miles race at Easter eight actual entries have been received and as many more promises. We are asked to say that as several members of the club are in the electrical trade, if a gentleman, or firm, would care to offer a special prize for the 100 for the first electrical trade employé to finish, the club will be pleased to announce the same for competition. The loan of motor-cars for the event is also asked for, and the Hon. Secretary, Mr. S. C. Haynes, 20, Pendra Road, Clapton Park, N.E., will be pleased to forward all particulars.

THE GRADING OF ELECTRICIANS.

By H. R. Taunton.

(*Concluded from page 377.*)

The arguments that apply to wiremen do not at all apply to mates. The supply of mates is relatively unlimited, and the number employable at the minimum rate will always be in excess of the demand. There is no compensatory motive why an employer should pay more for one mate than another, though a proved better man; for the simple reason that a good wireman can work with a mate fit for little else than to hand up the pliers, while the best of mates cannot help a bad wireman to turn out a good job.

Minute grading of the mates, therefore, is not practicable. Two grades might be possible; the upper grade to consist of men who had completed half a qualifying term under certain conditions, and able to command an extra ½d. an hour, above the minimum rate of 7½d. an hour for a fifty-hour week. The difference in quality between a young mate just beginning to learn his business, and an older, steadier man, almost qualified to work as wireman, would be sufficiently marked to make it worth an employer's while to engage tne latter, at the higher rate, for the better class of work. The qualifying term might be ten years, during which the mate would have to show that he had been employed for a minimum of, say, forty weeks in each year, thus weeding out the inefficient. These conditions fulfilled, a man would have the option of registering himself as a wireman at 10d. an hour, becoming subject to the larger scheme. If, on the other hand, he had not confidence in his ability to obtain adequate employment as a wireman, he could elect to remain a mate at 8d. an hour, for as long as he might think desirable. The present rules restricting the proportion of mates to wiremen employed on a job would, of course, be rigorously enforced.

A strong central authority might be able to impose some test, practical and theoretical, on mates desirous of registering as wiremen, if such a course were considered necessary to keep out the incompetent. One can imagine the opposite case of the wireman, handicapped by increasing years or some physical defect, who might decided that he would be better off with lower wages but more continuous employment: it should be open to him to register formally as a mate. All electricians would be registered as either wiremen or mates, according to their actual grade, each being required to give notice of any alteration in his grade.

Assume the scheme acceptable to the trade, and that it comes into operation on a definite date. Every worker would then have his present rate advanced by ½d. an hour: the 9½d. man would become the 10d. minimum man, and the charge-hands and foremen, who now command more than the trade union minimum, would have a corresponding increase, thus furnishing the nucleus of the proposed higher grades. Certain machinery would obviously be necessary in order to authenticate the grading of each man. The simplest—indeed, almost the only practicable—method would be an adaptation of the stamped cards made familiar by the Insurance Act.

Stout cards would be provided for each man bearing his name and address, and his personal signature as a protection against impersonation. These cards would be about the size of Insurance cards, but single, and eyeletted so that a number might be fastened together; and provided with dated spaces for fifty-two stamps, Insurance size, on each side. Each card would thus serve as a record for two years, and a man might easily carry about with him the record of a lifetime. The current cards would remain with the employer until the man took his discharge, and each week, as the wages were paid, a stamp would be fixed in the proper space. As it is, two stamps have to be fixed on Insurance cards every pay-day, and the extra trouble of stamping another card would be relatively insignificant. The stamps would bear a suitable design in varying colours for the different grades, with a space for a plain number distinguishing each particular firm. This number might with advantage be the firm's telephone number. Thus a man's card would show at a glance his grade and the length of time he had worked with each firm; and thus, also, provide the necessary evidence of his qualifying periods. It would, in fact, subsitute a complete and accurate record of his career, and by inference his quality, for the loose and not readily verifiable statements one has usually to be satisfied with. Any firm who had stamped the card could, if desired, be applied to for further particulars (hence the suggestion of the telephone number); but the card itself would, as a rule, provide all the testimonial that was necessary.

Firms would not employ men who could not produce cards, and, conversely, men would not work for firms who did not stamp them, as obviously they would be losing whatever benefit had hitherto accrued to them from the system. Men would not necessarily have to belong to the trade union; but, on the other hand, the whole scheme would fall to the ground unless the majority of the reputable firms in the trade were subscribers to it. The stamps would only be obtainable from a central organisation—the Electrical Contractors' Association, for example—who would issue definite quantities to requisition, printing the blanks with the index number of the firm requisitioning them. Subscribing firms would pay a certain sum for the stamps: say, for the sake of argument, a penny each, irrespective of grade. The contribution of each firm to the organisation would thus be directly proportional to the labour they were employing. The small firm would, generally speaking, pay a relatively smaller contribution than the large firm which would have more occasion to make use of the various services of the organisation. This penny per man would be contributed entirely by the employer, and would in no way be a charge on the men's wages. It would also be the employer's only contribution to the organisation—let us say, for the sake of simplicity, it would be his contribution to the Electrical Contractors' Association.

This contribution would go to pay for the standing charges and working expenses of the central authority, who would add to their present not very marked activities the management of the suggested register of all workers in the trade, and its corollary, a central labour exchange. Members would not engage men at their own offices, but would make a point of telephoning their requirements to the central office, where all unemployed men would put down their names. Jobs would be given out in rotation, according to the grades required, men actually in attendance being given the first chance; or weight might be given to an employer's expressed preference for men who had worked for him before. Such an exchange, it need scarcely be pointed out, would be as great a convenience to the men as to the employers.

Further, the members' contributions might also go towards a combined insurance policy for all the members of the organisation. Instead of each firm, as at present, taking out small policies for Employers' Liability, Third Party risks, and so on, the central authority would take out one policy for all the members, covering all the usual risks. Actuarially, the combined policy (for the large number of firms who, by hypothesis, would then be members of the Electrical Contractors' Association) would be considerably less than the sum total of all the small policies taken out by the individual members. Moreover, for so large a policy the competition among the insurance companies would have the effect of still further reducing the premium. It is probable that if such a combined policy were made part of the programme of the organisation, the money now paid by individual firms as premiums on their various insurance policies, would not only provide the same benefits of insurance, but pay the whole cost of working the grading scheme, and its accompanying register and labour exchange, on the equitable principle of proportional contribution, effected simply by means of stamps. The amount of labour employed by a contractor is, except in extraordinary instances, a direct measure of his activities and of the risks against which he requires insurance.

An increase in the unit of contribution per man would, of course, yield a surplus, which might be applied to a hundred uses, for the benefit of the subscribers and their employees. It is outside the scope of this article to enlarge upon the manifold advantages to the trade that would spring from a powerful and wealthy association of the employers, with an imaginative and progressive policy.

A good scheme of grading, controlled only by the employers, would tend to weaken the hold of the Electrical Trades Union on its members. This, whatever some employers may think, is undesirable. It is to the wider interests of the trade that it should possess a trade union strong enough to represent the men against minor injustices, and to check the rapacity of unscrupulous firms. (One can even imagine a broad-minded and far-seeing association of employers making a contribution to the funds of a weak trade union to keep it from declining into impotent decay). Although, therefore, the concurrence of the trade union is not—at least, in the electrical contracting trade—essential to the establishment of such a scheme of grading as that outlined above, provided always that it meets with the approval of the majority of the men, the Electrical Trades Union would be acting in its truest interests by adopting it whole-heartedly. With the Union's assistance its working would be facilitated, and its universal acceptance accelerated, with advantage to all Union members. Under such a scheme none of them would be worse off, and many of them would be much better off; while the employers would be the gainers by a strengthened organisation, and a satisfied, efficient, and accurately graded body of labour.

THE DESIGN AND MAINTENANCE OF MINERS' ELECTRIC LAMPS.

By F. J. TURQUAND, A.M.I.E.E.

(*Abstract of paper read before the* Association of Mining Electrical Engineers (London Branch) *February 6th*, 1914.)

There are now on the market some dozen or so miners' electric lamps, each with its particular merits. The body of the lamp may suitably be constructed of wood, iron or steel, or aluminium alloy. Iron or steel is used by several makers in the form of pressed cases; the well-known Sussmann lamp, that has served a dozen years of practical work in the pit, has a square metal case to which fastening devices are attached. Aluminium alloys are used with success by several manufacturers. They do not rust, and the products of corrosion are not so injurious to the battery. A thick casting does not dent or distort as easily as steel, and can be remelted if required. The alloys are not hard enough to provide friction surfaces or fastenings, but brass, gun-metal, iron or steel pieces can be cast in them and will remain tightly fixed owing to the relative contraction of the various metals.

Battery cases should be provided with a pad of resilient material to minimise the transmission of shock from the case to the battery, and should also fit loosely around the battery for the same reason.

The incandescent bulb is a comparatively fragile article, and must be protected as far as possible from vibration and mechanical shock. The surrounding glass should be as thick and strong as possible consistent with minimum light loss, and preferably of the smallest dimensions to present the smallest surface to an obstacle. The dome-shaped glasses very generally used have the advantages of strength and of leaving only one edge to seal against leakage. When using blown glasses of this description, purchasers should be careful to have thoroughly annealed glass, as only when this is properly done can the glass be safe to use.

It has been proved that the current passing through a two-volt electric bulb when broken or short-circuited may fire methane by either the cooling lag of the filament or a make-and-break spark at the short-circuit, and as comparative immunity from risk of these happenings is an important factor deciding the suitability of an electric lamp for miners' work, various devices are extant with this end in view. The point is so to place the bulb in the lamp that in the event of the outer glass breaking from any cause the electric current shall be automatically cut off before the bulb can itself be damaged. The makers of the Ceag lamp hold the bulb down on to its electric contact by a spiral spring between the inside of the dome glass and the top of the bulb, so that when the spring is displaced by the moving or breaking of the dome the bulb rises from the contact springs. In the G.E.C. lamp this difficulty is overcome by fixing the outer glass itself in such a way that displacement or breakage releases a contact pin in a gas-tight chamber on the centre terminal of the battery instantaneously. This arrangement is a perfectly safe break in a gaseous mixture, even if the outer glass itself is not hermetically sealed. Other designers arrange that the chamber formed by the outer glass shall be more or less filled with compressed air or other gas that will rush out immediately the hermetic seal is broken, as well as open the electrical circuit. This method has the added advantage of temporarily preventing (by an outgoing draught of air) ingress of the outer atmosphere, and of prolonging the interval between the displacement or fracture of the outer glass and the actual inrush of gas upon the bulb, intact or broken.

The simpler and smaller the switch between the bulb and the battery the better. The type that appears to have found most favour is simply a screw, the head of which is outside and the point inside a flame-proof chamber. Screwing down on to a contact closes the circuit, and it seems difficult to improve on the idea. Another class of switch where the lamp-top turns upon the battery outer case, however, is as effective and a somewhat easier form to manipulate when the fingers are large or cold. The switch is more for the purpose of economy in the event of underground disaster than convenience under ordinary conditions.

To avoid accidental sparking outside the lamp, in designing the switch it is important that the external portion, if of metal, shall be permanently connected to the outer case of the lamp if the case is utilised as a conductor, but insulated from it if the case is not so used.

The makers of nearly every portable lamp primary battery with which the writer is acquainted employ metallic zinc as the anode, and carbon as the cathode, with chromic acid as the depolariser. A lamp of this type is the Float rescue lamp, which has passed the Home Office tests. The difficulty of the wasteful consumption of active material is overcome by inverting the battery when not in use, and by this means a lamp for rescue purposes can be kept ready for immediate use. The makers estimate the cost of maintenance at 2d. per lamp per shift, and that the prime cost of installing such lamps would be less than that of accumulator lamps.

For miners' electric lamps all the accumulators with which the writer is acquainted are constructed on the pasted principle, to secure greatest capacity with least weight.

Each manufacturer has his own method of separating the electrodes, one using perforated celluloid, another prepared wood, a porous jar, a porcelain slab or glass wool. Many makers use glass wool not only to separate the electrodes but to form thereby a semi-dry accumulator from which the liquid will not run out in any position, owing to its being held in suspension amongst the glass wool. Other makers use vegetable fibre of more highly absorbent properties than glass wool, losing somewhat less capacity compared with the wet cell than users of glass wool. After completion of charge the battery may be drained of free liquid and can then remain permanently in any position during use without spilling of acid. The disadvantages of this method are the decreased capacity of the battery, weight for weight, and the greater possibility of sulphating of the plates.

Most electric lamp makers are satisfied with a battery designed for use in the upright position, but which when inverted for a short period will not emit liquid. Some makers simply hermetically seal the battery with a screwed plug during the discharge period, and this method—when the container case is strong enough and the battery elements in such condition that very little gas is given off—is quite satisfactory.

The writer's experience emphasises the importance of providing a substantial base to the cell in types of lamp where the cell is removed from the outer case for charging, and also the use of resilient material for supporting the electrodes in the cell rather than the celluloid or ebonite feet frequently employed.

One of the greatest difficulties in designing a lead battery for miners' electric lamps is to prevent spilling and creeping of acid over the terminals of the battery itself.

A new edition of the Stach lamp is fitted with an auxiliary flame lamp for detecting CH_4 and CO_2; the flame is protected from the outer atmosphere by a gauze in the usual way.

The claims for the alkaline cell in practice are as follows:—(*a*) A long life of at least 2,000 charges and discharges before serious deterioration occurs; (*b*) a strong case made of metal instead of celluloid or ebonite, making more permanent non-leaking terminals possible; (*c*) inappreciable gassing on discharge, allowing the cell to be hermetically sealed without danger of its bursting; (*d*) small liability to deterioration through irregular charging and discharging, consequently less margin for depreciation required, and less weight for given capacity than with the lead cell. Alkaline battery miners' lamps of four makers are on the market.

The main points in erecting a miner's electric lamp charging and repair installation are:—(*a*) An electric supply at constant voltage supplied through a circuit the insulation resistance of which is high and without liability to leaks; (*b*) absolutely accurate circuit and testing voltmeters and ampere meters, including a main-circuit recording volt and ampere meter which should be recalibrated periodically, and have frequent sub-section fuses with the minimum of margin; (*c*) strong benches and charging racks, completely covered with stout lead or glass sheet; (*d*) facility for washing down with a hose, and quick drainage.

Lamps should be handed to the hewer with the light switched on and with instructions not to switch it off except in emergency. This practice ensures a predetermined discharge and also tends to lengthen the active life of the filament (which is less fragile when alight).

One of the largest items on the list of renewals will be bulb replacements, and the efficiency must not be high enough to shorten the useful life of the bulb by fracture of the filament or undue blackening of the glass, or low enough to discharge the battery at too high a rate. Experience shows that the average life of 2-volt bulbs is 600 burning hours—say, when working four shifts per week, three months—and that it is desirable to test all the bulbs individually through a long-scale ammeter and use only bulbs of the required efficiency.

In view of the Home Office Regulations for the use of electric hand lamps in coal mines, requiring all lamps to show a spherical illuminating power of not less than 1 C.P. after nine hours' continuous burning, it is desirable to install a photometer of reliable design and manufacture, and periodically test batches of lamps for C.P. and voltage on closed circuit at the expiration of an ordinary shift, noting any lamps that show a diminishing efficiency, to ascertain whether the bulb or the battery is at fault. The percentage of reported failures in the pit can be materially reduced thereby and the reputation of the installation kept up to standard. Batteries decreasing in discharge capacity should be immediately placed in hospital and replaced by others known to be in good condition; and bulbs whose filaments, when examined through a magnifying lens, reveal thin or irregular sections, should be at once rejected.

Quoting from a report on Gray-Sussmann lamps (of which there are about 20,000 in use), published by Mr. W. E. Gray, one learns that:—" . . . . A liberal estimate of the cost of working, based on nearly three years' experience, including all material required for repairs and renewals, current for charging at 1½d. per unit, all wages, and including giving out the lamps and 10 per cent. depreciation on first cost, was under 3½d. per lamp per week, as compared with 1½d. or 1¾d., which he supposed would be considered the usual cost of working oil lamps; in other words, they were really getting nearly three times the light at about double the cost. . . ."

The "Ceag" Co. have handed to the writer a letter from one of the first collieries to install their lamps in any quantity in this country, in which it is stated that "The cost of upkeep works out at under ½d. per lamp per shift, including all labour, repairs, acid, &c. The men and boys are very proud of the lamps, and no cases of nystagmus have occurred."

It is only by the strictest attention to, and accurate records of the details of the daily life of each individual lamp that the highest commercial efficiency can be secured and maintained.

MOTOR AND CONTROL EQUIPMENTS FOR ELECTRIC LOCOMOTIVES.

By F. LYDALL, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *February 26th*, 1914.)

Motors for locomotives may be divided into two classes, viz., geared and gearless motors. The sphere of utility of the geared motor is practically confined to locomotives of moderate speed, as, for instance, locomotives whose maximum speed never exceeds 60 to 65 miles per hour; whereas for express passenger locomotives, with which speeds up to 80 or 85 miles per hour may be reached, the gearless motor practically holds the field.

A narrow gauge hampers the designer very seriously. If the space available is insufficient to accommodate a motor of the required capacity, the only alternatives are to increase the wheel diameter or to adopt some other form of transmission.

The restrictions of gauge are of less importance in a locomotive in which gearless motors are used mounted in the body of the locomotive and driving by connecting rods and jack shafts. With this construction the motor can be made as large in diameter as desired consistent with the limits of armature peripheral velocity, but in an axial direction it is limited by the distance between the centres of the crank-pins at the ends of the jack shaft.

For the same capacity a high-tension D.C. motor will be larger and heavier than a low-tension motor.

For D.C. motors of moderate capacity, there seems no difficulty in raising the supply voltage to 2,400, as in the case of the locomotives for the Butte and Anaconda Railroad. A step in advance of this is being tested on the Lancashire and Yorkshire Railway, where motor-coach equipments are being supplied by Messrs. Dick, Kerr & Co., each consisting of four 250-H.P. 1,650-volt single-reduction single-geared motors with driving wheels of 44-in. diameter, the supply voltage being 3,300. These equipments are said to work perfectly satisfactorily.

In considering A.C. systems, the question of frequency is important. For three-phase locomotive motors, especially those operating in cascade, a low frequency is desirable.

So far as capacity in relation to weight and bulk is concerned, polyphase induction motors make a very good showing. It must be remembered, however, in comparing induction motors with motors having series characteristics, whether D.C. or single-phase A.C., that the induction motor is rated at its maximum speed, whereas the series motor is rated on the basis of a speed which may be, and often is, not more than half the maximum. In practice, the single-phase motor, even at the low frequency adopted as the standard on the Continent (16⅔ or 15) is undoubtedly more bulky than the continuous-current motor. As an illustration of this, the 2,000-H.P. 600-volt motor of the Pennsylvania Railroad locomotives may be compared with the 800-H.P. single-phase motor of the Lötschberg locomotive equipped by the Allgemeine Elektricitäts Gesellschaft. The comparison is shown in fig. 1, the two motors being drawn to the same scale.

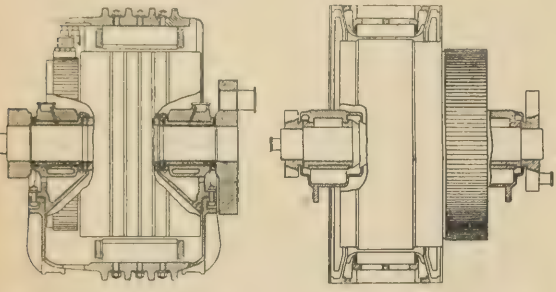


FIG. 1.—2,000-H.P. D.C. MOTOR. 800-H.P. SINGLE-PHASE MOTOR.

The advantage of forced ventilation in increasing the continuous capacity is so great that it is becoming general to introduce it in locomotives of all classes except small industrial locomotives. The complication of apparatus involved in the provision of the blowers is not great, and no trouble in regard to maintenance need be anticipated, as the blowers and their motore can be fixed in the interior of the locomotive where they can be inspected at any time. An electric locomotive differs essentially from a motor-coach both as to its function and as to its constitution. A motor-coach equipment is usually designed to enable the train to be started with a high acceleration, and the weight of the motor-coach is kept down to the lowest limit consistent with strength and the requisite capacity. In the design of an electric locomotive, on the other hand, the weight is arbitrarily chosen; the principal deciding factors are the adhesion necessary to enable the required tractive effort to be exerted, and the speed of travel. In many cases locomotives are ballasted in order to bring up the total weight to the required value. In the second place, electric locomotives are not usually intended for service in which high acceleration is required. Rapid starting is not a matter of great importance for freight trains or for long-distance passenger trains. In consequence the proportion of the weight on the driving wheels to the total weight of the train in the case of freight trains might perhaps be as low as 1 to 20; whereas for multiple-unit trains it would seldom be less than 1 to 2½, or 1 to 3. This difference in the ratio of adhesion weight to total weight has a marked influence on the control system.

The weight on a pair of driving wheels is generally not far from the maximum permissible weight, as determined by the strength of the track, bridges, &c., and a locomotive is utilised to the greatest advantage when it is coupled to the heaviest train with which it is able to deal; that is, haul at the regulation speed on the line selected, start on the steepest rising gradient, and stop on the maximum falling gradient.

The variations of the tractive effort exerted by the motors during the progress of the controller depend on the number of steps in which the controlling resistances are switched out with the motors in series and in parallel. Whatever the variation may be, the current on each position of the controller must be allowed to fall so far that when the next step of resistance is switched out the current does not increase beyond the value corresponding to the maximum permissible tractive effort. If the load behind the locomotive when travelling up the specified gradient is too great, the current will never fall sufficiently to permit the controller to progress without causing the wheels to slip. If, therefore, the load is excessive, the locomotive will be unable to start the train and gather speed on the gradient, although it may be perfectly capable of maintaining full speed up the gradient if the train has already been started on the level or on an easier gradient.

If the maximum theoretical load is attached to the locomotive, the acceleration varies from a fairly high value down to almost zero on each position of the controller. In practice, therefore, the load must be limited to something less than the theoretical maximum value. The only safe way is to estimate the tractive resistance on the high side and allow a margin beyond the calculated value to ensure that the starting period is not unduly prolonged.

The number of steps in the control system will depend on the characteristics of the motor in question. If the magnetic circuit of the motor is not highly saturated on that part of its range which is used during starting, and if the resistance of the motor is relatively high, the number of steps necessary to keep the torque variation within moderate limits is not likely to be excessive. The greater the saturation, and the lower the internal resistance, the greater will be the number of steps.

In a general way one may say that the bigger the motors the lower will be the internal resistance, and therefore the greater the number of steps.

The question of self-induction in the motor windings does not enter into the consideration of the problem. On the other hand, there are two factors which make for some uncertainty as to the precise fluctuations of the torque during the accelerating period, viz., the variation of the supply voltage and the variations in the resistance values of the controlling resistances due to the rise in temperature. The first of these tends to reduce the fluctuations, as the supply voltage will generally fall slightly as more current flows through the motors. The second is very uncertain, depending on the working conditions, &c.

To a certain extent the same problem is met with when A.C. motors are employed, either with rheostattic control or with voltage control obtained by drawing current from successive tappings of a transformer. The actual variation of motor torque from step to step will, however, depend upon the effect of the self-induction of the motor windings on the motor characteristics. This effect, so far as the speed-current curve is concerned, is similar to that of a large increase in the internal resistance of the motor, and, therefore, greatly reduces the fluctuation of the torque for any given number of steps.

It is evident that the irregularity of the effort exerted by the motor equipment of an electric locomotive is a disadvantage which, under certain circumstances, reduces the usefulness of the locomotive. It may be compared with a very similar characteristic of the steam locomotive, the tractive effort of which varies with the positions of the cranks. There is, however, this difference between the two cases: the tractive effort of the steam locomotive fluctuates under all conditions, whereas that of the electric locomotive is uniform on any single step of the controller, whether intermediate or final, so long as the speed remains constant, and, therefore, at the worst, fluctuates only during the actual starting period.

For continuous-current equipments variable voltage might be obtained by some form of motor-generator, but this method is open to the great objection that the motor-generator is practically a sub-station installed in the locomotive, and is extremely bulky and expensive, and costly to maintain.

The case is quite different with large locomotives equipped on the single-phase alternating-current system. Voltage variation can be very conveniently provided without using rotating machinery, simply by providing taps on the secondary winding of the step-down transformer. However, it is not practicable to go very far in the direction of fine graduation. In practice, owing to the requirements of single-phase motor design, the voltage even at full speed is seldom more than about 300. It is also customary to employ large motors for these locomotives, and consequently the motor current which must be dealt with by the controlling contactors may be very heavy.

The alternative is to use an induction regulator or variable transformer, this method has the great advantage of simplicity, as it entirely eliminates the contactors and the tappings on the low-tension side of the main transformer. It, however, also has the serious disadvantage of introducing into the locomotive a bulky and heavy additional piece of apparatus which adversely affects the efficiency and the power factor of the equipment.

An alternative method, which is in reality a combination of the contactor system and the induction-regulator system, was worked out by the writer about eight years ago, and has been adopted on several of the single-phase locomotives equipped by Messrs. Siemens-Schuckert for the Prussian State Railways.

This method consists in the employment of a small induction regulator combined with a number of contactors which control the connections from the motors to the tappings of the low-tension winding of the main transformer. The function of the regulator is to increase the voltage at the terminals of the main motor or motors as gradually as may be required until the voltage corresponding to the next higher tapping of the transformer is reached. At this point a change is made in the circuit connections by closing a fresh contactor and opening the one previously closed, which operation can be effected without giving rise to any local short-circuits or serious sparking or difficulties of any kind. If the number of contactors employed is, for example, four, the capacity of the regulator is reduced to one-fourth; if six, it is reduced to one-sixth. Whatever the number and the consequent reduction in size, however, it is possible and easy to ensure that the voltage variation shall be as gradual as may be desired.

There are various ways of carrying out this method, but probably the simplest is shown, quite diagrammatically, in fig. 2. In this diagram six tappings and six contactors are shown. The voltage of the secondary winding of the regulator through which the main current flows is exactly equal to the voltage between any two adjacent tappings. Current passes into the secondary winding at either end according to which end is connected to a closed contactor and passes out from the middle point to the motors. The tappings are connected through the contactors alternately to two leads, X and Y; 1, 3 and 5 being connected to X, and 2, 4 and 6 to Y. The ends of the regulator secondary are permanently connected to these leads X and Y. For the minimum voltage, contactor 1 is closed, the primary of the regulator being in such a position that the voltage induced in the secondary opposes the voltage of the main transformer. To increase the voltage, the regulator is turned round until the voltage induced in its secondary is added to the voltage of the main transformer. At this point contactor 2 is closed, and contactor 1 opened, and the circuit is in this way rearranged so that the regulator voltage opposes the main transformer voltage corresponding to the second tapping. The regulator is then turned round again as before and the process repeated until the full voltage is reached.

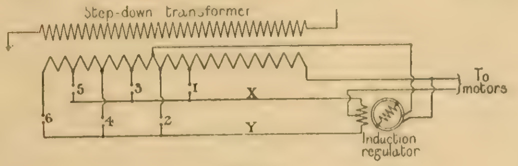


Fig. 2.

Referring once more to continuous-current locomotives, the importance of avoiding shocks also has its influence on the control equipment. During the starting period there are at least two occasions when shocks of greater or less severity are possible and are to be avoided, so far as may be, in the interest of the couplings between wagons. The first occasion is when the current is first switched on to the driving motors. The control equipment must therefore be arranged so that the tractive effort on the first notch or step of the controller is relatively quite small. It should also be remembered that if the starting acceleration of the locomotive when working light is too great, it may be difficult for the locomotive driver and his mate to keep their feet.

The other occasion of which a shock is to be avoided is during the transition in the grouping of the motors from series to parallel. This can be effected by employing the well-known bridge system of control, in which the full torque is maintained by the driving motors right through the transition stage, subject of course to the fluctuations that occur to the same extent during the whole of the starting period.

Dealing now with the arrangement of the controlling resistances, it is to be observed that in order to keep the fluctuations within given limits, it is necessary to provide more steps for cutting out resistance in the series grouping than in the parallel. This can be done most conveniently, and without involving the provision of any more contactors, by arranging the equipment on the bridge system, in which each motor or group of motors has its own set of resistances and contactors for cutting out these resistances in steps, and by cutting out one section of resistance from each of the two sets alternately while operating in series and cutting out the same sections simultaneously when operating in parallel.

The material most generally used for the main controlling resistances in continuous-current locomotives is cast-iron. This can be either plain grey cast-iron, or an alloy which contains certain ingredients giving qualities of elasticity and high resistance. There is no difficulty in obtaining grids having a specific resistance of about 80×10^{-6} ohms per cubic centimetre, and capable of carrying intermittently currents from 30 amperes to 400 amperes or higher still if necessary. The grids are usually left plain without any rust preventive.

The determination of the resistance values in any particular case is not very difficult if the motor characteristics are known. On the other hand, it is extremely difficult to decide on the capacity of the resistances for a locomotive unless the conditions of service are very precisely stated. As a general rule it is impossible to lay down a set of conditions such as can easily be given for multiple-unit trains in urban or suburban service. A locomotive can be most irregular in its working.

The only rule which will provide for perfect security against overheating is to make the resistances so large that continuous running on any step of the controller is possible without giving rise to excessive temperatures. There is no difficulty in meeting this condition in the case of a low-power locomotive, and there is everything in its favour.

For high-power locomotives it is practically impossible to attain to this ideal on account of the space required. For such locomotives the only thing to be done is to examine each case separately and insert as much resistance as can be conveniently disposed in the space available. It may also be necessary to take into consideration the question of forced ventilation for the resistances.

On the Continent liquid rheostats have been used in one or two cases, principally for three-phase locomotives. For continuous-current locomotives it would be difficult to utilise such an arrangement, and for single-phase locomotives a rheostat finds no place.

With regard to control apparatus proper, whereas in equipments for motor coaches the designs are practically determined by the requirements of multiple-unit working, no such condition necessarily applies to locomotive control-apparatus. There are, of course, cases in which this provision cannot be dispensed with, for example on the freight locomotives for the Kiruna-Riksgraensen line in the North of Sweden. These locomotives are intended for hauling mineral trains weighing 2,000 tons, there being one double locomotive in front and another at the rear of the train. Under these conditions it is important that the two locomotives should not work independently otherwise there would be frequent cases of breakage of couplings. The control equipments are therefore specially designed so that both can be operated absolutely synchronously from the master controller in the leading locomotive, electrical connections being provided by a control cable with the usual couplers from front to back of the train.

This condition is, however, up to the present somewhat exceptional, the more usual arrangement being that the electric locomotive is a single unit suitable for hauling trains of specified weights in the same way as steam locomotives. In many cases advantage can be taken of this to arrange the main circuit-breaker and perhaps the reversers for hand operation by means of levers, hand wheels and geared shafts. Several of the single-phase locomotives built on the Continent have been designed on this principle.

Turning now to a rather more detailed consideration of locomotive control-apparatus, it must be admitted that in many cases there is nothing to distinguish the various items in the equipment from similar items in the control equipments of multiple-unit trains except size and quantity. The contactors are more numerous and are larger to deal with the higher current. The circuit-breakers, fuses, &c., are designed on well-known lines, merely adapted to altered conditions. Reversers are commonly eliminated and replaced by the necessary number of contactors.

Circuit-breakers for D.C. locomotives do not call for any special remark except that on high-voltage systems the circuit-breaker must not only be substantial, but should also be allowed plenty of room in which the arc may spread. Where the high-voltage continuous-current supply is distributed by means of an overhead line, it is advisable that the arc formed on breaking a heavy overload or a short-circuit should not be violently disrupted by means of a strong magnetic blow-out, otherwise there is a liability for surges to be set up in the overhead line. On A.C. locomotives the circuit-breakers are usually oil switches similar to those used in generating stations, but adapted to fit into the locomotive.

For locomotives, especially freight locomotives, there can be no question as to the benefits to be gained from taking the regulation of the tractive effort at starting out of the hands of the driver. So far as the author is aware, the only cases where automatic control is employed are on the three-phase locomotives for the Simplon Tunnel and the Italian railways. The author is strongly of the opinion that if the limit switches are adjustable, and if the control equipment can be changed over without difficulty or complication from automatic to hand control whenever circumstances require such a change, there is everything to be gained by relieving the driver of the necessity of watching the ammeter, and setting him free to attend to the signals and to his other duties.

Coming to induction regulators for controlling single-phase railway motors, the main point to which attention may be drawn is the necessity for very substantial construction. Except when the relative positions of the primary and secondary windings are such that the mutual induction is zero, there is a very considerable torque produced by the action of the magnetic field and the current in the secondary winding. A fairly powerful motor is needed to operate the regulator, and the reduction gearing between the motor and the regulator must be of a very substantial nature. Some trouble has been experienced with regulators of this type, due to breakage of the gears, which were designed before the effect of the powerful fluctuating torque was fully realised. Any sudden overload or short-circuit in the main motors is bound to set up a tremendous force in the induction regulator, and the whole of this is transmitted to the teeth of the gear-wheel.

On the Continent the general tendency seems now to be setting towards the use of contactors exclusively for locomotives however large. This has been the practice all along in the United States, and has much to recommend it. The action of a contactor may be regarded as practically instantaneous, and in case of momentary failure of the supply all the contactors will open, and the control system can easily be arranged in such a way that they will not close again except by notching up from the first position of the master controller. In this way protection is provided against sudden rushes of current. With the induction regulator, or indeed with any other controlling mechanism operated by an auxiliary motor, such as, for example, the drum-type controller of the new Lötschberg single-phase locomotive, similar protection can be provided, but the process is comparatively slow and cumbersome.

On the other hand, the induction regulator undoubtedly possesses the advantage already mentioned of fine graduation in the regulation of the speed and tractive effort of the locomotive, which can only be obtained with contactors by multiplying the number of contactors and operating circuits and by enlarging the master controller.

Most engineers will agree that the fewer auxiliary motors there are in a locomotive the better. So far as single-phase locomotives are concerned, the supply of current at a voltage suitable for small motors is quite a simple matter, as there is usually an auxiliary transformer which can be tapped as required. With continuous-current locomotives, however, especially when the supply voltage is higher than 600 volts, the auxiliary motors must be fed either from the main supply direct, or from the motor-generator. In either case the voltage is probably inconveniently high for small motors. There is no great difficulty in insulating master controllers and contactor-operating coils for 600 or 750 volts, or in reducing the voltage on each coil by means of control rheostats.

It would be a mistake, however, to press forward too much in the direction of a rigid standardisation until the general requirements of electric locomotives and their operating conditions are better known.

DISCUSSION IN LONDON.

MR. ROGER SMITH, in opening the discussion, referred to the fact that dear fuel and the physical conditions arising from smoke, &c., accounted for the electrification of Continental main lines and tunnel and terminal railways in America. In this country fuel was cheap and electrification was not required on that account. There was special cases in colliery districts where the conditions favoured the use of electric locomotives, which would weigh less than the steam locomotive. Looking at the performance curves of direct-current motors and controllers, given by the author, he could not help being struck by some of the disadvantages of the D.C. motor as compared with the single-phase commutator motor. With the latter every notch was a running notch, and the driver could continue on one until conditions changed, and then pass on to the next. With D.C. traction the contact steps might be too great and overstep the adhesion. Unless the Ward-Leonard or other system was used in a D.C. locomotive, it seemed difficult for the latter to compete with a locomotive equipped with the A.C. commutator motor for varied services. On the North-Eastern Railway electric trains, automatic controllers were in use—the controller notching itself up after the handle was moved. This had proved a great advantage during the recent strike, when many new men were put on to drive without special training in the use of the equipment.

MR. F. W. CARTER discussed a previous paper by the author, not circulated at the meeting; his remarks dealt more particularly with the unsatisfactory features of past electric locomotives, which he thought the author might have referred to. He said that the Westinghouse (U.S.A.) view of the case was that only those locomotives using the Scotch yoke arrangement were successful on the Continent, and no doubt side rods had given much trouble. There were racking forces in the coupling rods, which were not found in steam locomotives and which constituted a serious obstacle to success.

MR. J. BOWDEN said that apart from gauge limitations of electric locomotives there were many mechanical features in question and suitability of design really affected the cost of operation. Electric locomotives in the States were originally developed by electrical engineers, but the railways then took the matter up and side rods were introduced and appeared to be successful. The Metropolitan Railway had electric locomotives in service developing 1,000-1,200 H.P. He understood that reversers had given trouble, and the latest Lancashire and Yorkshire Railway equipments had contactor reversing.

MR. J. B. SPARKS pointed out that with the H.T.-D.C. system much smaller currents had to be dealt with, and therefore if more contacts were required, they might still not be so expensive as in the case of single-phase control. Direct-current locomotives had been supplied in the States, costing between £60 and £70 per ton, but single-phase locomotives were much more expensive.

DR. S. P. SMITH thought the comparison between the two motors illustrated in fig. 1 was scarcely fair. The D.C. motor gave 2,000 H.P. on a short-hour rating, and should be normally rated at 1,200 H.P.; it weighed 19 tons, and ran at 200 R.P.M. The 800-H.P. A.C. motor was of a comparatively heavy type, and a simple series motor would weigh less, but its weight was 14 tons, and its speed 160 R.P.M. A H.T. direct-current motor would be roughly the same weight as the single-phase commutator motor.

The AUTHOR, in briefly replying, said that field control had been adopted on some of the Pennsylvania locomotive motors, but he had not heard of any motor-generator control system in use.

DISCUSSION IN BIRMINGHAM.

DR. C. C. GARRARD asked whether there was any possibility of the series system being applied to electric traction. He was surprised that automatic control had not been used on electric locomotives, as it would leave the driver more time to watch the signals, &c. He thought that liquid controllers could have been used in locomotive work with success. For electric winding machinery liquid controllers were universally used, and this was a more difficult problem, as the winder had, perhaps, to be stopped and started once or twice a minute. He asked whether any action had yet been taken with a view to standardising electric traction on the railways in this country, as it seemed desirable that something should be attempted in this direction.

DR. T. F. WALL said that the conclusion drawn from the remarks of Mr. Roger Smith and Mr. Lydall was that, for fast passenger service, the continuous-current series motor was at a disadvantage as compared with the steam locomotive, because the characteristic of the ordinary series motor was such that the torque diminished too rapidly with the speed—the torque at low speeds being limited by the strength of the draw-gear. It seemed to the speaker, however, that by the use of a diverter to the field coils the torque at the high speeds might be increased at will. If the supply pressure was constant, the armature current at any given speed would be greater when a diverter was used than when one was not used, whilst for a given speed the flux per pole would be practically the same whether a diverter was used or not. Consequently, the use of a diverter would enable the motor to exert a larger torque at a given speed.

MR. E. C. POULTNEY asked whether any system of air filtering was used in the case of electric locomotives which were fitted with fans to cool the motors, as he supposed dust drawn in and blown into the machines would be detrimental to their working. He also asked what these large electric locomotives, some of them of 2,000 H.P., weighed per H.P., what was their approximate cost per ton, and what were the operating costs per mile, that is, maintenance and running costs. Steam locomotives working with saturated steam developed about 9·5 I.H.P. per ton of total weight (engine and tender) and locomotives working with superheated steam developed about 11·5 I.H.P. per ton of total weight at speeds of from 55 to 60 M.P.H., or about 220 R.P.M. A steam locomotive fitted with a superheater designed to develop continuously 2,500 I.H.P. would weigh with tender about 200 tons, and the boiler would have to contain at least 4,000 sq. ft. of heating surface. £55 per ton was the cost given for a modern express locomotive, and the operating costs were, for maintenance, from 2s. 6d. to 5s. 7d. per mile, while running costs varied from 7s. 8d. to 10s. 1d. per mile, and total costs, maintenance and running, varied from 11s. 3d. to 15s. 2d. per train-mile.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

B.T.H. Lightning Arresters.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, have forwarded us particulars of their new compression chamber multi-gap lightning arresters for alternating currents, which are being supplied to meet the demand for an arrester which will give good protection at low cost.

The large discharge capacity is evidenced by the fact that it is only necessary to employ a resistance of about 40 ohms in series with the 2,200-volt arrester unit. Our view, fig. 1, is of one of these arresters broken away to show the interior

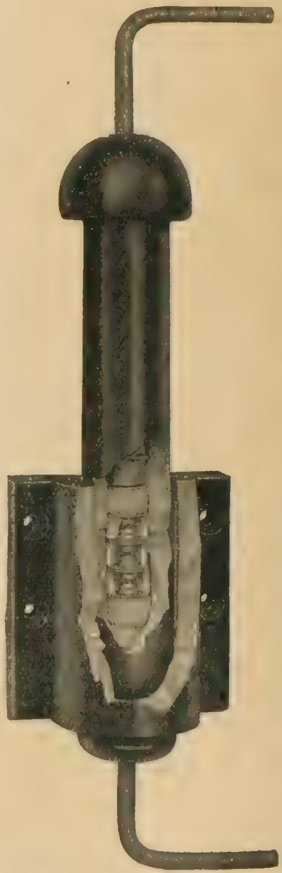


FIG. 1.—COMPRESSION CHAMBER MULTI-GAP LIGHTNING ARRESTER, WITH PORCELAIN BROKEN AWAY TO SHOW INTERIOR.

The upper line lead is connected to a carborundum resistance rod, the bottom end of which makes contact with the upper electrode of a series; these electrodes are spaced equal distances apart by means of porcelain separators, and together with the resistance, are enclosed in a porcelain tube—the construction being shown in our view.

Outside the lower portion of the tube are placed the antennæ, consisting of metal strips lying parallel with the spark gap—which are connected to the earth lead at the bottom and to the lower electrode. The antennæ are enclosed in a porcelain box, filled in with compound.

The antennæ modify the capacity between each electrode and earth, reducing the discharge voltage without reducing the power of the device to open the circuit after a heavy discharge.

New B.T.H. Half-watt Fittings.

We have received particulars from the British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, E.C., of two semi-indirect fittings with Alba and Calla glass bowls respectively. From what has been said of the high intrinsic brilliancy of the half-watt lamp, it is obvious that for interior lighting these lamps must be adequately screened from view, either by means of fairly dense diffusing glassware, or of opaque bowls.

In the present fittings, which are shown in figs. 2 and 3, dense white glass bowls are employed, which agreeably diffuse and effectively distribute the light of the lamps. The characteristics of Alba and Calla glassware are sufficiently well known, and there is no need to describe them here. Those who desire to see the illuminating results obtained are advised to call at Mazda House.

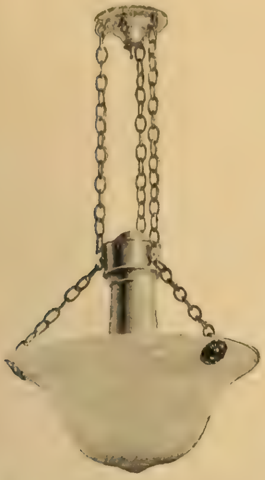


Fig. 2.—B.T.H. Semi-indirect Fitting with Alba Glass Bowl, specially designed to take Mazda Half-watt Lamp.

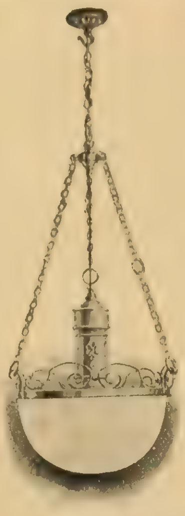


Fig. 3.—B.T.H. Semi-indirect Fitting with Calla Glass Bowl, specially designed to take Mazda Half-watt Lamp.

The British Thomson-Houston Co., Ltd., in their "Half-Watt" Price List (No. 11,000), show five different patterns of Goliath Edison screw holders suitable for half-watt lamps. These include brass and porcelain holders, fitted with cord grip, suspension hook, or drilled and threaded top. All are substantially constructed, and have an ample margin of safety in the matter of carrying capacity.

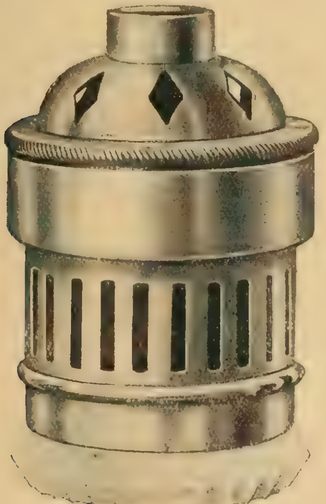


Fig. 4.—New Type of Ventilated Half-Watt Lampholder.

The disadvantage of the ordinary Goliath holder lies in the fact that it is a Goliath holder, and is somewhat unsightly because of its size. A new holder has now been introduced by the B.T.H. Co. which is of normal size, with graceful lines and of neat design. The holder is made of brass, and the case is ventilated by vertical aperatures around the lower part, and lozenge-shaped apertures around the top. Ventilation between the cap of the lamp and the interior of the holder is secured by means of a vertical channel cut across the thread of the holder.

Since Mazda half-watt lamps are being extensively used for interior lighting, the importance of this new holder development will be realised.

The new B.T.H. holder (Catalogue No. A298) can be seen and purchased at Mazda House.

New Glassware.

The Edison & Swan United Electric Light Co., Ltd., of Ponder's End, Middlesex, have recently placed on the market Ediswan "Ultralux," a new scientific glassware for electric light fittings. It is pure white, of even thickness, and is provided with a standard 1½-in. hole, thereby dispensing with galleries. It is made in two types, concentrating and distributing, as shown in figs. 5 and 6.

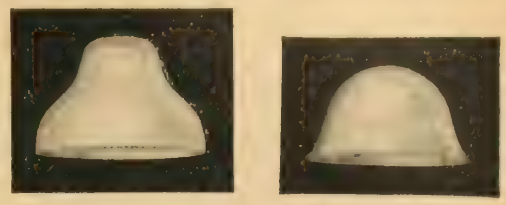


Fig. 5.—Concentrating Type. Fig. 6.—Distributing Type. Ediswan "Ultralux" Glassware.

Artistic Fittings for Wotan Half-Watt Lamps.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, send us particulars of two fittings suitable for use with Wotan half-watt lamps.

One of these is made up for use with holophane reflector bowls, and is especially suitable for the lighting of large halls, stores and high-class business establishments. This fitting can be arranged for either 1,000 or 2,000 c.p. Wotan half-watt lamps, and it is claimed that no more efficient lighting unit can be obtained when used in conjunction with half-watt lamps.

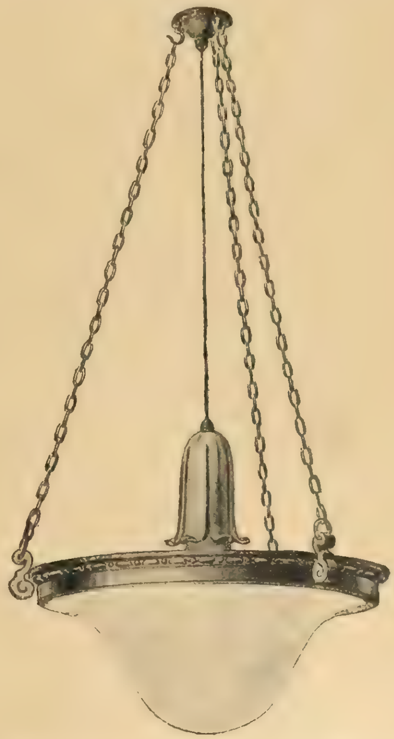


Fig. 7.—Siemens Fitting for Half-Watt Indirect Lighting.

The other fitting enables Wotan half-watt lamps to be adapted for indirect lighting, and in this case a deep opal bulb is used. The indirect lighting system has been to some extent handicapped owing to the loss of efficiency through the absorption of light by the reflecting surfaces. As half-watt lamps make it possible to double the candle-power of the lighting unit, indirect lighting schemes can be arranged at a reduced cost and far more successfully than hitherto. The fitting illustrated in fig. 7 can be arranged for 1,000 and 2,000-c.p. Wotan half-watt lamps in bowls 14 in. and 16 in. diameter respectively.

A price list will shortly be issued embodying these designs.

Artificial Daylight.

Various methods of obtaining artificial illumination of daylight quality have been invented, but they were mostly unfitted for use in picture galleries or studios, either by reason of their cost or the difficulty of adapting them to this particular purpose.

At a meeting of the Illuminating Engineering Society, on February 20th, Dr. Silvanus Thompson gave a very interesting demonstration of a method which is claimed to be successful from any point of view. The method is simple in the extreme—all that is necessary being a standard Mazda lamp, dipped in a special daylight varnish, supplied by the British Thomson-Houston Co., Ltd.

A Pump Governor.

We have received from Messrs. Ronald Trist & Co., Ltd., of 1, Lloyd's Avenue, E.C., some particulars of their Thermofeed Differential Pump Governor for automatically controlling the working of steam pumps by opening or shutting-off the steam supply.

The principle on which the device operates is as follows:—Water pressure from the pump discharge actuates a piston in the top of the governor through the intermediary of a column of oil; the piston in turn operates a small pilot valve, admitting steam to small cylinder, the piston in which moves down, and, by means of its piston rod, closes a double-beat valve in the steam supply pipe.

By means of a trigger device the pilot valve is held until the pressure in the oil cylinder at the top of the governor falls; the trigger is then released, and the small pilot steam valve moves up (by spring control) to its normal position. This puts the control cylinder below to atmosphere, and the piston and attached double beat valve are raised by spring action, allowing steam to pass to the pump.

A fully illustrated description of the device can be obtained on application to the firm.

Electric Drills and Grinders.

We have received from Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, particulars of a range of electric drilling machines and motor grinders, which they are placing on the market, including portable bench and pillar drilling machines, and lathe and hand operated grinding motors. The machines are fitted with ball bearings throughout, and have been designed to meet the special requirements of engineering works and shipyards, the motors being of ample rating to withstand the rough usage met with in ordinary working.

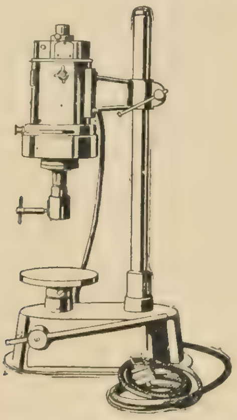


Fig. 8.—Simplex Electric Bench Drill.

We illustrate, in fig. 8, a workshop drill with a wide range of utility, taking drills from $\frac{1}{16}$ to $\frac{1}{4}$ in., with two-speed pulley; the consumption of the motor varies from 75 to 110 watts.

Terminals for Small Wires.

We have received from Messrs. Ross, Courtney & Co., of Ashbrook Road, Upper Holloway, N., particulars of their patent terminals which have found considerable use for a variety of purposes such as fuse wires, motor-car ignition and lighting work, telephone leads, electric elevator connections, &c.

A new pattern has now been introduced to meet the special needs of telephone wiring of a neat finish to the leads. It is a development of the older pattern consisting of a serrated disk of soft copper, in which the bared loop formed at the end of the wire is inserted, a small washer placed over it, and the points of the serrations then bent over to hold the washer in place; a small serrated projecting piece is now left on one side by means of which the last $\frac{1}{2}$ in. or so of the wire leading to the terminal can be enclosed, thus giving an improved finish to the wire. The firm invite inquiries as to terminals of this class for special purposes.

Patent Restored.—The following letters patent has been restored:—W. Reid—"Improvements in railway signalling mechanism and the like," No. 14,495 of 1906.

LEGAL.

Vere v. Mackenzie.

On February 26th, in the West London County Court, before his Honour Sir W. Lucius Selfe, a claim for £37 16s. for work done and materials supplied was made by C. H. Vere, electrical engineer, Church End, Finchley, against James Mackenzie, of 1, Stanley Gardens, Notting Hill. Mackenzie counterclaimed for £50 damages caused by delay in finishing the work.

It appeared from the evidence that plaintiff, in August last, gave an estimate for fitting up an electric light installation at 1, Stanley Gardens, which the defendant was converting from an old-fashioned mansion to modern flats. His estimate was accepted at £56, with a discount of £2 10s. if the work was completed in a month—September 30th—it being also a condition that £25 would be paid when two-thirds of the contract was completed, and the balance on completion. Owing to a scarcity of electrical engineers in the labour market, the plaintiff was delayed in his operations, and two-thirds of the work was not finished by the date expected, so that when he applied for the instalment it was declined, and he had to struggle on, the contract not being at an end till well into October.

Defendant now claimed that he intended the flats for letting at the December quarter, and this he was unable to carry out, the rents of the five flats ranging from £100 to £120 each.

Plaintiff's excuse for non-completion was that the laying down of a composite floor delayed the wiring, and the plaster work being neglected he could not fix the switches.

In the result his Honour gave judgment for the plaintiff for £31 18s. 6d. and costs on the higher scale, and for the defendant for £15 and costs on his counterclaim.

Howe and Howe v. Newcastle-on-Tyne Corporation.

At Newcastle-on-Tyne Assizes on February 25th, before Mr. Justice Ridley and a special jury, the hearing was commenced of an action for damages for personal injuries. The plaintiffs were John Howe, a miner, and his wife, Isabella Eleanor Howe, who reside at Cross Cottage, Ryton-on-Tyne, and the defendants were the Newcastle-on-Tyne Corporation. The claim set out that on January 4th, 1913, the plaintiffs boarded a tramcar at the Cattle Market, Newcastle, and as Mrs. Howe was ascending the steps of the car, with her infant on her left arm, the car was negligently and without warning, started with a jerk. Mrs. Howe was, in consequence, thrown backwards from the steps, with the result that she sustained serious injury to her back and spine and severe shock, which was still continued and likely to be permanent. The defence filed was a denial that the car was started with a jerk or without due warning, and that Mrs. Howe was given a reasonable opportunity of reaching a safe position before the car was started. In the alternative the defence was set up that Mrs. Howe was guilty of contributory negligence in ascending the steps of the car with an infant in her arms, and in not holding, or making proper use of, the side rails provided for the use of passengers.

Considerable evidence was given on both sides, and the hearing was resumed on February 26th, when the jury found for the plaintiffs for £250 damages for pain and suffering, and an additional £50 for special damages.

An application for a stay of execution, on the ground that the legal aspect of the case was not presented to the jury, was refused.

Judgment was accordingly entered for the plaintiffs for £300 with costs.

Osram Lamp Works, Ltd., v. The Gabriel Lamp Co. and George Davis.

Mr. Justice Eve gave judgment in the Chancery Division on Friday, February 26th, in the summons taken out by plaintiffs in this case.

The summons, his Lordship said, was for an order for better answers by the defendants to two interrogatories. The action was for an injunction to restrain alleged infringement of letters patent, of which the plaintiffs were the registered owners. The subject matter of these related to improvements in the manufacture of incandescent electric lamps and metallic bodies for electric glow lamps. Plaintiffs were claiming on the ground of a sale by the defendants in October, 1912, of 150 lamps, the issue by the defendants of circulars, and the publishing of advertisements. Liberty was given to the plaintiffs to deliver seven interrogatories to the defendants. Of these the first, the fifth and the sixth were referred to in that summons. The first was: Did the defendants sell on or about October 9th, 1912, or some other date, to Messrs. Maxwell Butcher & Co. 150 lamps, or what number of lamps? The fifth was: Were the said lamps manufactured wholly or in part by the Compagnie Générale d'Electricité, of Paris?; and the sixth: Were the said lamps supplied to the defendants whole or in part by the said company? The first interrogatory was answered in the affirmative. The fifth was objected to on the ground that it was irrelevant, and was not put *bona fide* for the purposes of the action. With regard to the sixth, the defendants said the lamps were supplied to them, but they objected to say by whom, for the same reasons as before. Plaintiffs asked that the defendants be ordered to give further answers to these two latter interrogatories. They (plaintiffs) said that the defendants themselves, being, as they had stated, ignorant of the process of manufacture, the plaintiffs ought to be allowed to obtain from the defendants particulars of the source from which the lamps came, as they would thereby be able to ascertain the process of manufacture. He (the Judge) did not think it was proper matter for an interrogatory. No doubt the information would be of material assistance, and would save the plaintiffs trouble and expense. It was legitimate to save expense by means of interrogatories, but it was not legitimate where the items set related simply to facts which it was not incumbent upon the interrogating party to prove, but which, if proved, might assist in proving the facts. The question he had to decide was whether the information asked for was the proper subject of interrogatories, and he did not think it was. The point was, therefore, decided in favour of the defendants.

On the application of Mr. Hunter Gray for the plaintiffs, his Lordship gave leave to appeal.

SOME RAILWAY CONDITIONS GOVERNING ELECTRIFICATION.

(*For abstract of paper by* Mr. Roger T. Smith, *before the* Institution of Electrical Engineers, *see* Electrical Review, *page* 335.)

Discussion at Birmingham.

Mr. A. M. Taylor said that Mr. Roger Smith's curves emphasised the point that at the high speeds suitable for fast passenger traffic, electric locomotives, as hitherto constructed, had been deficient in pull as compared with the steam locomotives. It was well known that the continuous-current series motor, though it had excellent characteristics as regarded the initial stages of acceleration which rendered it highly suitable for local suburban lines, fell off considerably in its pull as it reached a steady running speed corresponding to that in which all the resistance was taken out. What was wanted appeared to be an electric locomotive which for a given expenditure in copper and iron would give a very high pull at high speeds, and this might be obtained apparently at the expense of diminished accelerative pull at the low speeds, though, on the other hand, there was a large margin of pull available at the lower speeds for acceleration on account of the fact that the pull ran up at the ⅝ power of the speed. Now that Mr. Roger Smith had propounded the conditions, it would not be long before designers were able to comply with them. The cost of the locomotive itself depended largely upon designs being standardised and a number of locomotives being built. The initial cost, however, must necessarily be very heavy. As regarded the cost of running, Mr. Roger Smith hinted that the railway companies did not care to undertake the generation of current for railway work on a large scale. If this was the attitude of the railway companies, the suppliers of electric power on a large scale would not be backward in assisting them; but, of course, the railway companies must not expect them to undertake the supply of current at prices which were unremunerative in order merely to introduce electric traction. Mr. Roger Smith talked about getting current at ½d. per unit; he did not think there was any probability of his obtaining that happy result at present. Mr. Roger Smith had made out a good case for the electric goods locomotive, and he could see no reason why, if this were so, electrical engineers should not concentrate their energies on getting electric locomotives in for this work, which would appear to be the thin end of the wedge for long-distance work, and would probably bear the cost of the electrification of the line, which need not then be debited to the high-speed passenger service when electric locomotives for this purpose were introduced.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"H. L. A." writes :—"A feeder cable has been laid under a public footpath which is a right-of-way through private property; the consent of the owner was not obtained, although notices were given to the various local authorities interested. The cable has been laid for about two years. The property has lately been sold, and the purchaser of same now claims to be able to make a wayleave charge. Can this be enforced, seeing that the purchaser had notice previous to purchase that the cable was there, and that no wayleave charges had been made?"

⁂ It is plain that pipes can only be laid in the ground with the consent of the owner. To lay pipes under land without consent is a trespass; and if after the pipes have been laid, the land changes hands, the new owner can sue the owner of the pipes in trespass. (See Holmes *v.* Wilson (1839) 10 Ad. and El. 503.) The right to sue for trespass would, of course, be barred after the lapse of six years. That is to say if the landowner were to stand by and allow the trespass to continue for that period, he could not then enforce his remedy. The fact that the purchaser had notice that the cable was *in situ* when he bought the property, has no bearing on the question.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

BRAZIL.—The Brazilian Budget Law for 1914 provides that glass imported in the form of bulbs or tubes for the manufacture of electric lamps is to pay a duty of 300 reis per kg. Any tariff changes introduced by the Budget Law are not to take effect until four months after the publication of the law; goods included in a bill of lading dated before the date on which tariff changes are to take effect will be subject to the duties in force on the date of the bill of lading. The levy of a 2 per cent. surtax on goods imported into Rio Janeiro, Recife, Bahia, Rio Grande do Sul, Maranhao, Ceara, Rio Grande do Norte, Parahyba, Espiritu Santo, Panama, Santa Catherina, Matto Grosso, Alagoas, Parnahyba and Aracaju for port works is continued. The Government is also authorised to levy a tax of from 1 to 5 reis per kg. on merchandise loaded or discharged at Brazilian ports, according to the value of the goods, when proceeding from or destined for other ports. The provisions of the Budget Law for 1913 respecting the proportion of import duties to be paid in gold is continued. The regulation that consignees shall present the original Consular invoice within 90 days is altered to provide for an extension of the time for 45 days if the invoice is not forthcoming at the end of the first period.

DENMARK.—The Customs authorities have decided that cases for electric pocket lamps made partly of black lacquered iron plate, less than 1 mm. thick, with copper lid and bottom, and containing a lampholder of nickel-plated brass and a glass lens fixed in the lid, are to be dutiable at the rate of 20 öre per kg. Electric heating stoves consisting of a case of perforated black lacquered iron plate screwed securely to a cast-iron base, the sides of the casing having two contacts fixed, one to break the contact and the other to light a red electric incandescent lamp to illuminate the inside of the casing, are to be dutiable at the rate of 7½ per cent. *ad val.*

Note.—100 öre = 1s. 1⅓d.

AUSTRALIA.—The Commonwealth Customs authorities have decided that electric soldering irons are to be dutiable at the rate of 10 per cent. *ad. val.* if of British origin, and 17½ per cent. *ad val.* if of foreign origin.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

3,925. "Electric transmission and clutch for motor vehicles and the like." E. F. Roydhouse and A. H. Cheeseman. February 16th.

3,963. "Apparatus for generating high-frequency oscillations for wireless telegraphy or telephony." J. A. Fleming. February 16th.

3,965: "Printing telegraph systems." Western Electric Co., Ltd. (F. T. Woodward, Belgium). February 16th. (Complete.)

3,967. "Advertising on road vehicles by means of cinematography or slides obtained by electric, acetylene, or any illuminant and projected on to a screen." G. Pearson and G. Robertson Pearson. February 16th.

3,986. "Electro-magnetic shaking feeds or jiggers." Maschinenbau-Anstalt Humboldt. February 16th. (Convention date, February 18th, 1913, Germany.)

3,991. "Electrical lamp for cycles, motor-cars and the like." B. Pordes. February 16th.

3,992. "Portable electric battery lamps." B. Pordes. February 16th. (Complete.)

4,006. "Electric switches for use in connection with illuminated advertising or other purposes." J. Tabrar. February 16th.

4,017. "Electric heaters." J. R. Quain. February 16th.

4,025. "Connections between the parts of electrical and other accessories." J. N. Mollett and E. Mollett. February 16th.

4,057. "Contact-breaker for ignition magnetos and the like." H. J. Howard and Wessex Engineering Co., Ltd. February 17th.

4,067. "Electric light reflectors." T. W. Fairlie. February 17th.

4,082. "Selecting keys." R. C. M. Hastings. February 17th. (Complete.) (Divided Application on 9,986/13.)

4,101. "Production and condensation of metallic vapours." Helfenstein Elektro Ofen G.m.b.H. February 17th. (Complete.) (Convention date, February 18th, 1913, Austria.)

4,107. "Duplex and like telegraphy." J. D. Reid and Eastern Telegraph Co., Ltd. February 17th.

4,131. "Train electric control systems." B. Starie. February 17th.

4,133. "Protective devices for electric distribution systems. British Thomson Houston Co., Ltd. (General Electric Co., United States.) February 17th.

4,157. "Electric hoists." J. H. Gee. February 18th.

4,167. "Means for supporting resistance wire and the like. Credenda Conduits Co., Ltd., and V. Summerhayes. February 18th.

4,184. "Method of manufacture of heat conductors for thermic telephones from platinum or the like wires treated by the Wollastone process." P. de Lange. February 18th. (Convention date, May 8th, 1913, Germany.) (Complete.)

4,203. "Method of manufacture of heat conductors for thermic telephones from platinum or the like wires treated by the Wollastone process." P. de Lange. February 18th. (Addition to 4,184/14. Convention date, June 3rd, 1913, Germany.) (Complete.)

4,211. "Means for regulating the reversal of electric motors, particularly applicable for use in connection with elevators." Otis Elevator Co., Ltd. (Otis Elevator Co., Inc. United States.) (Complete.) February 18th.

4,215. "Construction and operation of electrical condensers of the ring type." Hartmann & Braun Akt Ges. February 18th. (Convention date, February 20th, 1913, Germany.) (Complete.)

4,218. "Ships' compasses." Hon. L. W. P. Chetwynd and C. H. Johnson. February 18th.

4,220. "Support for the heat conductor of thermic telephones, and a method for its manufacture." P. de Lange and O. Fischer. February 18th (Addition to 4,184/14. Convention date, September 8th, 1913, Germany.) (Complete.)

4,223. "Signalling apparatus for mines." Sterling Telephone & Electric Co., Ltd. (Telephon-fabrik. Akt-Ges. vorm. J. Berliner, Germany.) February 18th.

4,225. "Electro-magnetic clamp." H. Sefton-Jones. (L. Schulwe, Firm of, Germany.) February 18th. (Complete.)

4,227. "Electric lighting lamps and switches." V. Bridgman. February 18th.

4,230. "Method of lighting intense current arcs by means of less intensity and high frequency." A. Korn. February 18th. (Complete.)

4,233. "Electrically-driven vehicles." K. von Kando. February 18th (Addition to 963/14.)

4,235. "Electric conductors." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) February 18th. (Complete.)

4,236. "Electric lifts." M. D. Scott. February 18th.

4,237. "Operation of weak-current electrical installations." Elektrizitats Akt-Ges. Hydrawerke. (Convention date, February 19th, 1913, Germany.) (Complete.) February 18th.

4,249. "Electric circuits and motors." R. Haddan. (David A. Marks, United States.) February 18th. (Complete.)

4,258. "Manufacture of incandescent electric lamps." H. A. Gearing. February 19th.

4,261. "Electric chiming and striking gear." H. Wilson. February 19th.

4,268. "Invertible electric battery." R. Latham. February 19th.

4,276. "Radio-telegraphic time-piece." F. H. Spicer. February 19th.

4,294. "Electric hoists, cranes, winches and the like." D. Wilson. February 19th. (Complete.)

4,308. "Controlling electric motors for ship propulsion and means therefor." Siemens-Schuckertwerke G.m.b.H. and F. Hulss. February 19th. (Divided Application on 13,148/13. June 6th.) (Complete.)

4,309. "Controlling electric motors for ship propulsion and means therefor." Siemens-Schuckertwerke G.m.b.H. and F. Hulss. February 19th. (Divided Application on 13,148/13. June 6th.) (Complete.)

4,321. "Exercising and electrical curative apparatus." E. R. Smith and A. Turner. February 19th. (Complete.)

4,323. "Electric tele-motors for producing synchronising movements at a distance." W. H. Scott. February 19th.

4,324. "Electric steering-gear or apparatus requiring similar movements." W. H. Scott. February 19th.

4,329. "Electric incandescent lamps." Edison and Swan United Electric Light Co., & W. C. Cooke. February 19th.

4,343. "Incandescent electric lamps." G. A. Puente. February 19th.

4,344. "Dynamo-electric machines." E. C. Ketchum and D. H. Andrews. February 19th. (Complete.)

4,345. "Transformation of frequency of high-frequency alternating current for wireless telegraphy and telephony." Soc Marius Latour et Cie. February 19th. (Convention date, February 20th, 1913, France.) (Complete.)

4,347. "Electrolytic process for the production of iron tubes, sheets, and the like, with a non-corrosive surface." S. O. Cowper Coles. February 19th.

4,356. "Watt-hour indicating magnet motor meter." Allgemeine Elektricitats Ges. February 19th. (Convention date, March 11th, 1913, Germany.) (Complete.)

4,358. "Control of electrically-propelled vehicles." C. S. Schultz and C. C. A. Hardie. February 19th.

4,359. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. and F. P. Whitaker. February 19th.

4,368. "Air-filters for electric generators." Heenan & Froude, Ltd. and W. Wheal. February 20th.

4,397. "Hygienic attachments for mouthpieces of telephones, speaking-tubes, and the like." W. C. Hickmutt. February 20th. (Complete.)

4,414. "Variable resistances for electrical circuits." H. Cooch. February 20th.

4,432. "Electric heating-apparatus." •H. Hurst and C. H. Archer. February 20th.

4,436. "Apparatus for underground electrical signalling in collieries." E. Edwards. February 20th. (Complete.)

4,447. "Throw-over switches." T. Jessen. February 20th. (Convention date, February 24th, 1913, Germany.) (Complete.)

4,448. "Starters for alternating-current single-phase induction-motors." M W. Woods. February 20th.

4,461. "Electric incandescence lamps." A. Heller. February 20th.

4,469. "Controlling-device for electrical motors, more particularly applicable to motors used in driving planing and the like machines where a reciprocatory or other movement is attained." G. W. Robinson and H. D. Staniar. February 20th.

4,470. "Cases or holders especially intended for carrying electrical batteries upon motor-cycles." A. S. West. February 20th.

4,471. "Contact-breaker device for electro-magnetic vibrating members." A. H. Maitre and V. H. G. Martin. February 20th. (Complete.)

4,472. "Thermo-electric regulators." British Thomson-Houston Co., Ltd. February 20th. (General Electric Co., United States.)

4,489. "Machine-switching telephone-exchange systems." Western Electric Co., Ltd. February 21st. (F. T. Woodward, Belgium.) (Complete.)

4,506. "Electric lamps for cycles and other vehicles." A. Spencer. February 21st.

4,523. "Suspension and tension arrangements for electric trolley-wires or contact-lines." Siemens-Schuckertwerke G.m.b.H. February 21st. (Convention date, March 20th, 1913, Germany.) (Complete.)

4,525. "Devices or jointings for tubes carrying electrical conductors." H. H. Longbottom and T. Farrar, trading as Steel Tubes and Conduits Co. February 21st.

4,526. "Telephones particularly for use in collieries and the like." A. Dootson. February 21st.

4,534. "Fixation of electric conductors." E. M. Wildey. February 21st.

4,542. "Electric pendulums." E. E. Greville. February 21st. (Addition to 11,274/13.)

4,554. "Electric motor control systems." British Thomson-Houston Co., Ltd. February 21st. (General Electric Co., United States.)

4,562. "Ignition magneto-generators." H. C. Mueller. February 21st. (Convention date, July 17th, 1913, United States.) (Complete.)

4,565. "Electric conductors." A. R. Muller. February 21st.

4,577. "Electric heating apparatus." B. T. Lang. February 21st.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

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2,418. Electric Controllers. British Thomson-Houston Co. (General Electric Co.) January 29th.

2,758. Electrical Switches. W. McGeoch & Co., and W. McGeoch. February 3rd.

2,836. Lanterns or Enclosures for Lamps Used for Projecting a Beam of Light. H. Ayrton. February 4th. (Cognate Application, 17,865/13.)

3,046. Magnetic Separators. Bowes, Scott & Western, Ltd., & I. S. Galgleish. February 5th.

3,110. Electric Measuring Instruments of the Thermal Type. E. I. Everett & K. Edgcumbe. February 6th.

3,250. Electric Motors Particularly Adapted for Hoisting Purposes. Otis Elevator Co. (Otis Elevator Co.) February 7th.

3,370. Apparatus for Heating Liquids Electrically. K. P. H. Syndicate, Ltd., & C. Kratt. February 10th.

4,926. Magazine Arc Lamps. J. Brockie, and Johnson & Phillips, Ltd. February 26th.

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5,063. Combination Connection Adaptor for Electrical Fittings and the like. A. Milham. February 28th.

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5,482. Thermostatic Apparatus. C. Kratt and J. Aikman. March 5th.

6,982. Sealing Means for Boxes Containing the Electrical Operating Mechanism of Tramway or Railway Points, Switches, and the like. S. T. Quilliam. March 22nd.

8,173. Mode and Apparatus for Sending and Reproducing Telegraphic Signs. H. Kaehler and P. Kaehler. April 7th. (April 6th, 1912.)

8,301. Electric Arc Lamps. Engineering & Arc Lamps, Ltd., and A. T. Dowdell. April 9th. (Addition to 16,678/11.)

8,711. Electric Apparatus for Moving Advertisements. E. Oberlander, P. Kazvinczky and I. Gross. April 14th.

8,746. Electro-Pneumatic Systems and Apparatus for Railway Signalling and for Operating Points. E. C. Irving and British Pneumatic Railway Signal Co. April 14th.

10,100. Electric Clocks. T. Rushton. April 29th.

15,728. Apparatus for Recording Different Measurements or Values. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.) July 8th.

15,760. Electrical Fuses of the Plug Type. H. T. Paiste. July 8th.

15,975. Insulating or Like Slabs. J. A. Torpey. July 11th. (Cognate Application, 21,501/13.)

16,067. Emergency Controlling Devices for Motor Vehicles. A. J. Olsen, J. E. Von Mehren and J. C. M. Ditlevsen. July 11th.

16,566. Magneto-Electric Ignition Apparatus Adapted for Use in Connection with Internal Combustion Engines. G. G. M. Hardingham. (Mafam Motor Apparate Ges.). July 18th.

16,890. Interlocking Mechanism such for Instance as Used in Railway Signalling. Siemens Bros. & Co., and W. E. Scourfield. July 23rd.

17,502. Electric Head Lamps for Motor Vehicles. E. Aron & H. Aron. July 30th.

18,517. Method of Insulating Electrical Conductors. J. A. Heany. August 14th.

18,568. Locking Apparatus for Locking Electric Light Glow Lamps to Holders. S. Davies and W. J. Bodell. August 15th.

18,751. Setting of any Apparatus from a Distance. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.) August 18th. (Addition to 30,292/10.)

18,975. Electrical High-Tension Indicator. J. Stephenson. August 21st.

19,277. Process and Apparatus for the Subsequent Treatment of Drawn or Rolled Wires. W. Frese. August 25th.

19,857. Anti-Vibration Device for Electric Lamps. F. H. Reeves. September 2nd.

20,179. Telephone Transmission Circuits. Western Electric Co. (Woodward, acting for Western Electric Co.). September 6th.

20,482. Devices for Producing Discharges in Rontgen Ray Tubes. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). September 10th.

22,527. Magneto Electric Ignition Machines for Internal Combustion Engines. M. Anschutz. (December 12th, 1912). October 6th.

22,816. Discharge Tube with Incandescent Cathode and Enclosed Vapour Forming Body. Allgemeine Elektricitats Ges. October 9th. (October 14th, 1913).

23,110. Electrical Regulating Switches. L. Hulbert. October 13th.

24,943. Electric Torches. G. Hitzelberger & New British Ever Ready Co. November 1st.

25,506. Mariner's Compasses. E. Farkas, V. R. Von Klarwill & S. Scheer. November 7th. (November 7th, 1912).

26,600. Devices for Attaching Electric, Telegraphic and Telephonic Cables or Wires to Insulators. H. Parra. November 20th. (November 25th, 1912).

27,641. Electric Fuses. H. W. Young. December 1st. (December 14th, 1912).

27,877. Electricity Meters. Korting & Mathiesen Akt. Ges. December 4th.

28,267. Sparking Plugs. M. Pognon. December 8th. (December 31st, 1912).

28,634. Electric Fuses for Blasting Purposes. Bickford Smith & Co., and W. N. Bickford Smith. December 11th.

29,241. Transmitter of Electric Writing Telegraphs. E. H. Widegren & K. A. Widegren. December 18th. (December 30th, 1912.)

29,389. Apparatus for Perforating Tape for Automatic Telegraph Transmitters and the like. A. C. Baronio and K. L. Wood. December 20th. (Divided Application on 29,416/12, December 20th).

International Electrical Congress, 1915.—In connection with the above Congress, which is to be held from September 15th to 18th, 1915, at San Francisco, during the Panama-Pacific Exposition, the following prominent British engineers have been appointed honorary members of the International Committee on Congress organisation:—Mr. W. Duddell, Mr. Alex. Siemens, Dr. R. T. Glazebrook, Colonel R. E. Crompton, Mr. C. le Maistre, Lord Rayleigh, Dr. Gisbert Kapp, Sir J. J. Thomson, Dr. S. P. Thompson, Mr. W. M. Mordey, Prof. J. A. Fleming, Sir Charles Parsons, Sir Oliver Lodge, and Mr. S. Z. de Ferranti.

The honorary members representing France are Messrs. R. de Baillehache, A. Blondel, J. Blondin, Paul Boucherot, E. Brylinski, Paul Janet, F. Laporte, M. Latour, M. Leblanc, N. Mazen, R. V Picou, General H. Sebert, and Mr. A. S. Garfield.

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LONDON LABOUR DISPUTES.

DURING this week conflicting reports have appeared in the Press regarding the prospects for an early termination of the dispute in the London building trades. It is stated that the masters have taken steps in the direction of conciliation, and we believe that among the best of the workmen there is a growing recognition that they must be prepared to give a reasonable guarantee that they will not in future break agreements. The determination of the employers to have this matter definitely settled has been interpreted by the men as an act of war on the Trade Unions; but, at the time of writing, it is stated that representatives of the Unions have been invited to a conference. Apparently efforts have been made to arrive at some substitute which shall effectively take the place of the penalty clause that the men refuse to sign, but these have failed, and the conference now proposed will make another attempt. The employers' organisation was credited with taking steps to widen the area of the dispute, in the hope of more speedily ending it, but such measures, at least, stand deferred for the present. The Unions, with that same weakness for failing to keep their word which the masters want to remove for the future, are failing to comply with their resolutions to support each other, and the London District Committee has decided to expel from the Federation the Unions that have refused to comply with those resolutions by withdrawing their labour from firms presenting the obnoxious penalty document.

The dispute possesses electrical interest solely because the electrical workers, through their Union, are pledged to give their support. It has, of course, its larger bearing as a national industrial question, for in days when we seem, we hope temporarily, to have forgotten our proud boast that "an Englishman's word is his bond," all employers are asking that there shall be some greater certainty that understandings when signed shall be faithfully acted upon. The Unions as organisations are obviously at loggerheads between themselves, and if we do not seriously mistake, the members of the individual Unions are far from unanimous. It is easy for agitators to use strong language, and to persuade unthinking hearers, while together in the mass, that the day of the capitalist is past for ever, but the individual member of a union seldom seriously thinks when he is alone that that is the case. And hearing as one sometimes does of what goes on behind the scenes, it is plain that the bold policy advocated, and the bold front shown, by the "leader," have only been approved by a majority. We are merely giving away a secret divulged to us by a very talkative agitator when we say that we believe the recent fighting policy of the Electrical Trades Union was only carried by silencing some who were favourably disposed toward less militant measures. Indeed the Union's own organiser a few weeks ago denounced some present at the Memorial Hall meeting because they would not consistently hang together. There is obviously an element in the Union that does not want "war." Further, we have before us a report of what is called a "straight talk to Sheffield electrical workers." The speaker was the general president of the Union, and he castigated his audience because they had not done their duty. "The arrears of contributions of the Sheffield district were a disgrace. Other branches were in arrears, but Sheffield was worse than the majority. In the event of a strike those in arrears would know where they were when they didn't get strike benefit." And this is the strong organisation whose spokesmen tickled the A.E.S.E. meeting with promises of the great financial resources that would be at their backs if they only agreed to act co-operatively at the given signal! We congratulate the A.E.S.E. upon its resolves to continue untramelled by unionist ties, and we wish it every success in its worthy efforts.

The London Electrical Masters' Association has issued a new schedule, which we reprint on a following page. It is willing to agree to certain increases in wages and alterations in conditions. It is anxious to raise the status and efficiency of the worker and the quality of the work done, and to that end it stipulates that before a man can be regarded as a fully-fledged wireman he must have qualified either by apprenticeship or by experience. Many points are covered in these rules, which we hope will receive fair and dispassionate consideration from all interested, but few of the rules are of such deep concern as that which preserves the right to the employer to employ either Union or non-union labour, and to the worker to work unhindered and unmolested if he elect to remain outside the Union.

The electrical workers have their own questions to settle, and while of course electrical contracting work must necessarily be somewhat hindered if building work is at a standstill, they will be acting in their own bread-and-butter interests if they adopt a conciliatory tone and do not place too much faith in the support that may be looked for from non-electrical unions. The E.T.U. will be well advised to sit down and consider the L.E.M.A. proposals seriously, and not to reject them as summarily as is said to be likely.

Lead.

The tangled skein in Mexico is the cause of the lead position being still unsettled, and it looks as if the threads were for the time being inextricably mixed up. But for the suspension of supplies from this country, there is little doubt that lead would have responded to the influences which have held sway with other metals, and that prices would have been now on a much lower basis than is actually the case to-day. There, however, seems to be not the least chance of better things in the near future as regards the supplies which are coming forward. A week or two ago it was reported that things were improving, especially in the northern parts of the country, and that some of the smelting plants there were getting back to work, including the Chihuahua smelter, but even if this were correct the situation in the southern districts is so much worse, that the general position cannot be said to have improved at all. At Torreon, for instance, there has been fierce fighting, and with the district in the hands of guerilla bands which have been terrorising the countryside, it is too much to hope for any resumption of normal industrial conditions yet awhile. Lead, indeed, depends upon the Mexican position as much now as it did a few months ago, and unless and until Mexico improves, it is hopeless to anticipate any material relaxation in prices. Supplies from the producing countries, apart from Mexico, are very limited, and show a singular lack of response to the high prices at which the metal stands. With the Far East taking lead more freely, as seems to be the case from the much larger sales made to Japan, China and India, so far this year by the Broken Hill Proprietary Co., the quantities available for Europe may be reduced further. There does not appear to be the least chance of lead coming in from the United States to meet the deficiencies of the position, for the restriction of supplies of raw material, which is a direct consequence of the Mexican trouble, affects the output of soft lead in the United States to a material extent. As regards the market position, this seems to be fully sound, and there is still a bear account to be covered, while the consuming trades are none too well supplied, and a regular hand-to-mouth business is being done by the rollers and electrical trades. The Continental position appears to be pretty fair, and really good in Russia, to which market large quantities of lead are to be sent as soon as navigation reopens. This will be early this year. Considerable buying for this market has been in progress for weeks past, and the demand has naturally rather slackened off of late, but a good deal of metal is booked for despatch soon. The demand is now a little less urgent than it has been, and any material slackening in this respect for early lead would no doubt result in a temporary easing in the position, but for all this there is no alteration for the worst to be anticipated at present.

Contracts in Norway.

The British Consul in Norway has recently collected particulars as to the extent of the participation of British firms in Norwegian Government and municipal contracts, particulars of which are forwarded by him, as they occur, to the Commercial Intelligence Branch of the Board of Trade for the information of British manufacturers and contractors. It appears that out of 30 contracts awarded by the State railways at Christiania (omitting coal contracts), only three were secured by British firms. The following particulars have been furnished by the authorities to explain why British firms do not achieve greater success. In 9 of the 27 cases in which contracts were not awarded to British firms, no British tenders were received at all; in 16 cases British tenders were received, but were too high compared with the tenders accepted; in the two remaining cases it is not certain if British goods were offered among the rejected tenders. Moreover, five of the unsuccessful British tenders would have been disqualified in any case, owing to want of care in complying with the stipulations.

The chief cause of want of British success would seem to be too high prices. It is true that Norwegian manufacturers enjoy a preference in Government contracts of some 10 to 15 per cent., but this does not appear to prevent a large proportion of the contracts being secured by the resident agents of foreign firms who compete with British firms under equal conditions. A well-known Norwegian business man confirms the impression that in many cases British offers for these contracts are too high, or allow for too wide a margin of profit, as compared with those of Continental firms, and that British firms are not careful to appoint local resident agents, who are necessary to tender for Government contracts on their own behalf. The Consul's informant suggested that these contracts are largely secured by the agents of firms who are already known to the authorities from former deliveries, or (if by new firms) by those who tender at low prices, resulting sometimes in loss, either owing to ignorance of local conditions, or in order to get an entry into the market, or who wish to dump superfluous stock at a sacrifice. Doubtless there are times when British firms are too much engaged on large orders to find it worth while to compete in the Norwegian market. Nevertheless, it is felt that British manufacturers do not take full advantage of the friendly feeling towards them which prevails in Norway. As one man put it: "We would prefer to do business with your country, if only your countrymen's prices were not so prohibitive" (*i.e.*, compared with Continental prices).

In the case of Government contracts, there would appear to be no official departmental list of contractors. All Government contracts above a certain value must, at least formally, be put up to public tender. It is thus usually of little or no use for British firms to ask for the names of the authorities to whom tenders should be sent or to be placed on the official list in the hope of being thereby invited to tender when occasion arises. The better method is, while keeping in touch with the Commercial Intelligence Branch of the Board of Trade for news of contracts, to appoint local resident agents whose duty it is to look out for openings and communicate with the individual authority concerned in each instance. The Commercial Intelligence Branch of the Board of Trade is in possession of lists of agents who are members of the Christiania Agents' Association, divided up under practically all the chief branches of trade likely to occur in connection with Government contracts.

Electric Driving in the Mill.

Elsewhere in this issue we publish a short illustrated description of an electrically-driven textile plant which possesses features of considerable interest. In this case the mill had been in existence for a good many years, and there could be no doubt whatever that the friction load associated with the mechanical drive represented quite a considerable drain on the power plant at the mill, and that in this respect, at least, electrical transmission would prove a profitable substitute. Similar conditions exist in numerous mills at the present time, and it is generally agreed that, in these cases, electrification would be financially justified. But it is just on this question of carrying out the electrification that a difference of opinion is apt to arise, for while admittedly the conditions under which a machine, or group of machines, operates must exercise some influence on the driving arrangements, those conditions are interpreted so variously by engineers interested in this subject that we find advocates of schemes involving anything from one motor per mill to one motor per machine.

It is true that the electrical engineer rarely has a free hand in arranging a textile mill-drive, and that the installation of one motor, in place of an engine, to drive a mill, or a single motor to drive a weaving shed, for instance, is the utmost which considerations other than those of an engineering nature would permit of in some instances. At the best, however, such a scheme is usually but a half-hearted application of electric driving, as it obviously retains in great part the defects of the original mechanical transmission, including its friction load.

There is, in fact, little doubt that as between the extremists in individual and group driving, the former in any case risk far less in the matter of success than the latter.

In the particular mill referred to in our pages—a woollen mill which is somewhat exceptional in that every process of manufacturing involved in turning the raw material into the finished cloth is carried out in the one establishment—the question of individual or group driving naturally arose, and as a result of investigation of the conditions, the former system was adopted wherever possible and the latter where it was not easily avoidable. Among other things, it was found that on the average the machines were standing 40 per cent. and running 60 per cent. of the time, and this influenced the owners in favour of individual driving in order to get rid of the idle power load.

Although an increase in power costs should not weigh heavily in the scales as against increased production, an instance occurs to us of a Scottish group-driven jute mill using direct-current motors and purchased energy, where, owing to the cost of power, the question of reverting to steam driving was raised. Fortunately the owners were persuaded to experiment with a few looms individually-driven by three-phase motors, and in the end discarded their group drive in favour of individual driving for the weaving and preparation machinery, calenders, &c. The result was a saving of over 20 per cent. in power costs, using purchased three-phase current, and an admitted increase in production of 10 per cent.

Group driving has in the past been probably an unavoidable compromise, and we believe that in the future the conditions will be interpreted more and more to favour individual three-phase driving. Amongst many examples, we may mention one well-known Lancashire concern, which has, we understand, over a thousand motors in use, almost all for individual driving, the plant having been converted in sections as experience showed its success.

Of this we feel convinced—that the time has arrived for the whole position, particularly as regards methods adopted and results obtained, to be carefully reviewed in the light of the ample experience gained in this country and abroad.

A definite purpose is in view and indefinite methods should be avoided as far as possible. Not only the mill-owner, but also the manufacturer of electrical plant would benefit greatly if the textile applications of electricity were carried out on more definite and standardised lines.

Reactance.

The singular changes to which electrical practice is so remarkably subject are well exemplified in the paper read by Mr. Hollis before the Institution of Electrical Engineers, which we abstract elsewhere in this issue. As the author points out, it is not long since every effort was made by the designers of alternators to reduce the reactance of their armatures, in order to secure good regulation, and the specification of the Engineering Standards Committee contained a clause restricting the rise of pressure from full to no load under constant excitation. But the difficulties met with in the design of turbo-alternators, resulting in increased cost of manufacture without commensurate advantages, led designers to protest against the craze for excessively low inductance, and more recently the construction of machines with very large outputs, entailing disastrous consequences in the event of short circuit in or near the armature, has changed the situation, and now a reasonable amount of armature reactance is looked upon as not only harmless but desirable; moreover, it has become a common practice, especially in the United States, to add reactance external to the machine, to protect it and other apparatus against the effects of a short. The addition of reactance outside the machine has far less effect on the regulation than inside, because it does not increase the armature reaction also.

Very much the same applies to transformers, which to regulate well must have the minimum of internal reactance; in this case, however, the importance of good regulation is preponderant, and it is not usual to provide much internal reactance under ordinary circumstances, nor is it economical in first cost to do so.

Reactance is of the greatest value in the operation of rotary converters, enabling the D.C. pressure at the brushes to be automatically regulated according to the load; it is also most useful in connection with long-distance transmission lines abroad, greatly reducing the difficulty of maintaining constant pressure at the delivery end, in conjunction with synchronous motors or converters, which can be made to take a leading current. Again, where alternators of low reactance are to be run in parallel at widely separated points on a common network, interposing appreciable resistance between the generators themselves, or between the generators and synchronous motors, a certain amount of reactance is necessary to ensure satisfactory running in synchronism.

A point referred to by the author deserves special emphasis in the case of reactance used to limit the effects of short-circuits—namely, that while the average power developed by current and voltage 90° out of phase is zero, the instantaneous values of the power may reach enormous + and − values; and the mechanical stresses produced by wattless currents are just the same as those produced by watt currents, being independent of the voltage. While reactance in series with each generator limits the short-circuit current of that machine, it should be borne in mind that if several machines are running in parallel, enormous currents in the aggregate may be poured into a fault. For this reason there is much to be said in favour of reactances inserted between successive sections of the bus-bars, which are more efficient in localising the effects of a fault.

Mr. Hollis sketches out an ingenious idea of loading transmission lines somewhat after the manner of telephone cables, and providing sources of leading currents to enable the system to be made self-regulating and self-protecting; we doubt whether it would be found feasible in practice, but the idea should not be lost sight of—we never know what may become standard practice 10 years ahead. There is no doubt that reactances, acting as buffers, may be used to increase very greatly the reliability of supply, and the subject deserves more attention than it has hitherto received this country.

ELECTRICAL WAGES IN THE LONDON DISTRICT.

We print below the new working rules for the London district that have been approved and published by the London Electrical Masters' Association (secretary, Mr. L. G. Tate, 20, Bucklersbury, London, E.C.). We give them in extenso for the information of those who desire to make a comparison with the old rules of the Electrical Contractors' Association and those proposed by the Electrical Trades Union, concerning which Mr. R. W. Weekes wrote in our issue of February 6th, page 212. Mr. W. R. Rawlings is chairman, and Mr. H. J. Cash, deputy chairman, of the Masters' Association, and the following constitute the committee :—

H. Costa, Harrods, Ltd.
C. Curwen, Buchanan & Curwen.
J. H. Freeman, Tyler & Freeman.
H. Marryat, Marryat & Place.
F. W. Marshall, V. G. Middleton.
A. R. Phipps, Rashleigh Phipps and Co.
E. R. Radford, Trollope and Colls, Ltd.
D. M. Strode, Strode & Co.
H. B. Read, Edmundson's Electrical Corporation, Ltd.
H. F. Simon, Electrical Installations, Ltd.
F. H. Starling, Blackburn, Starling & Co., Ltd.
G. E. Taylor, G. E. Taylor & Co.
W. Walton, Pinching & Walton.
Duncan Watson, Duncan Watson and Co.

Area.—The area under which these rules shall apply is to be taken as within a radius of 12 miles from Charing Cross.

Scope of Rules.—These rules are not intended to apply to work on the undertaker's side of a supply authority's terminals, or to employés who may be engaged for full time in a factory on manufacturing work.

RULES.

1. *General.*—No exception shall be taken to the employment or non-employment of any workman in the electrical trade on the ground that he is or is not a member of any organised Trade Society, neither shall any exception be taken to the employment of a workman in any other trade on the ground that he is or is not a member of a Trade Society.

2. *Working Hours.*—The recognised working hours shall not exceed 53 per week.

3. *Night Shift.*—Workmen engaged on a "night shift" shall be paid 1d. per hour in addition to the ordinary rate of wages, provided that workmen on a night gang shall not have been employed during the preceding day. The hours worked without overtime rates not to exceed 10 per day of 24 hours. Double time to be paid for all time worked between Saturday midnight and Sunday midnight.

4. *Overtime.*—Overtime to commence after a day's work of 10 consecutive hours (meal times excepted), and to be paid at the following rates :—Up to 8 p.m., time and a quarter ; from 8 p.m. to 10 p.m., time and a half ; from 10 p.m. to starting next day, double time. Saturdays—from 1 p.m. to 4 p.m., time and a half ; after 4 p.m., double time. Christmas day and Sundays, double time. Each day to stand by itself. If the work continues after 1 a.m., and there is no ordinary means of conveyance home available, workmen shall be paid at overtime rates up to 6 o'clock next morning, unless some means of conveyance to their homes is provided by the employer.

5. *Wages.*—The following are the recognised rates of wages, and shall be observed as such :—

Wiremen, on and after the first pay day in April, 1914, 10d. ; on and after July, 1914, 10½d.

Pipe Fitter only, on and after the first pay day in April, 1914, 9d. No pipe fitter shall be engaged on wiring. Should wiremen be employed on pipe-fitting, their rates should be maintained as wiremen.

Improvers.—After having been indentured or engaged for three years, to be paid at not less than the following rates :—Up to the end of the fourth year, 4d. per hour ; fifth year, 5d. per hour ; sixth year, 6d. per hour ; seventh year, 7d. per hour. Apprentices subject to agreement with employer.

At least half the hands engaged on the actual erection of electric wires, tubes, casings, or fittings shall be wiremen or pipe fitters, or in receipt of equal rates of pay.

6. *Notice of Determining an Engagement.*—One hour's notice on either side.

7. *Payment of Wages.*—Wages shall be paid on the job, but if otherwise arranged, travelling time and expenses shall be allowed to get to the pay-table.

8. *Travelling Expenses.*—Workmen who are sent from the shop to a job to any point more than two miles from the shop within the London district, shall be allowed workmen's fares daily, but no travelling time, from the shop to the job, but this rule shall not apply to men taken on at the job.

9. *Country Expenses.*—Where men are sent outside the area covered by these rules, they shall be paid at the rate of 1s. 6d. per night, but when away for less than seven days at the rate of 2s. per night, together with fares out at the commencement of the job, and home on completion. Travelling time at ordinary rates. Such men to have the option, where circumstances permit, of working two hours per day extra without overtime at ordinary rates.

10. *Wireman.*—A fully-qualified wireman must be over 21 years of age, and have served an apprenticeship or have been engaged in the trade for a period of not less than seven years.

11. *Improvers or Assistant Wiremen.*—Shall either have been indentured for a term of not less than three years, or have been continuously engaged by a responsible firm or firms for a similar period in learning the trade of wireman, but have not the qualifications mentioned in the definition of a wireman.

12. *Apprentices.*—All apprentices shall be properly indentured for a term of not less than three years.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Motor Problem.

I should be glad if any of your readers could assist me in the following problem that I have recently had before me. It is desired to use a motor to drive a machine in which the power required is not directly proportional to the speed ; for example :—10 H.P. at 325 R.P.M., and 15 H.P. at 400 R.P.M. Of course, the usual method would be to have a motor to develop 15 H.P. at 325 R.P.M., and increase the speed by shunt regulation. Is it possible to have a motor to develop 10 H.P. at 325 R.P.M., and by shunt regulation only to increase to 400 R.P.M., thereby increasing the load of the motor to 15 H.P. ?

Perplexed.

The Cable Telegraph Service.

A paragraph recently appeared in a G.P.O. Journal with regard to the grant of substantial increases of salary by cable companies to their employés. While this may be true of the Eastern and Associated Companies, it is absurd to flaunt the idea that all cable companies are imbued with the same spirit of generosity.

At the present time, when a great deal of dissatisfaction has manifested itself in the ranks of the British postal service, chiefly due to the increased cost of living, it may be of some consolation to those interested to know that, considering all things, those in the telegraph branch of the G.P.O. are in a far more enviable position than their colleagues in the cable service. It has been frequently pointed out by those competent to speak, and equally acquainted with the inner workings of both services, that there is a very wide distinction between the Post Office telegraphs and submarine cable work, the latter being a much higher branch of telegraphy. The strenuous and exacting work required by competitive cable companies to-day is too well known in telegraph circles, and for this reason the Post Office operator cannot be induced voluntarily to resign his position in the Government service for an appointment in the cable service, at an apparently increased wage, as was formerly the case. This being so, the conclusion is that the conditions of service in the Post Office have improved of late years, whilst those of the sister service have remained stationary.

The demand for skilled operators by cable companies far exceeds the supply, consequently the shortage is made up of "Stewmers" and undesirables of the telegraph world. This introduction of the undesirable element has been the cause of lost prestige in the eyes of the public both at home and abroad, to the social detriment of the better class.

Wage-cutting is no doubt mainly responsible for this state of affairs, and only those employed in the cable service can fully realise the limitations of the pay and promotion offered.

Again, the cable operator has no association or union to which he can look for assistance in promoting his cause ; he has to be content with the remuneration and treatment meted out by the company, and whatever grievances he may have must be kept to himself for fear of dismissal from the service as an agitator.

Many of our most important cable stations are located in desolate and isolated parts of the coast, miles from a railway, and as compensation to the "exile" a small allowance is given as an inducement. It is just by this small amount that the pay of the cable operator exceeds that of his Post Office *confrère*.

It seems almost incredible to most people that such an important profession, with members scattered in every part of the world, who hold the business and commerce of great nations in their hands, should be unrepresented, and yet have remained pacified so long. It is only such generosity and forethought as is shown by the Eastern Telegraph Co. to its employés that helps to make the cable service what it originally was, and what it should continue to be. If other companies could be induced to follow the example of extending the same generosity to their staffs, continued loyalty would be assured, and the rank and file would be raised to the standard they attained in former years.

The writer of the above-mentioned paragraph would do well to banish from his mind the idea that cable companies are benevolent institutions any more than the British postal service, and from personal experience I do not hesitate to say that the British postal service of to-day is far preferable in every way to the cable service.

C. O.

Motors for Gassy Mines.

What is the latest practice with regard to the design of A.C. and D.C. motors to comply with the Home Office rules for use in gassy mines?

H. H.

Professional Etiquette.

Referring to the leader in your issue of the 27th ult., on "Professional Etiquette," I see serious objections to the publication of a visiting card in a technical paper by a professional man, if it involves any payment to the paper.

Further, if you refer to American publications, you will find that the advertisement does not stop at the name and address, but often states the qualifications and the specialities of the gentleman.

Humphrey M. Morgans.

London, E.C., *March 6th*, 1914.

Corrosion of Battery Plates.

Could any of your readers kindly explain the following curious defect shown in a storage battery of 54 11-plate cells, erected in, and hung on the sides of, glass boxes?

After being in use for nine months, all the positive lugs at the free ends of the plates developed what looked like a growth, and when this was cleaned off to prevent it falling into the glass box, holes of various sizes were visible on the lugs.

Accumulator.

"Charge" or "Shift" Engineer?

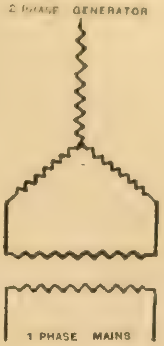
I should be glad to know the qualifications which constitute a "shift engineer," and a "charge engineer"; my reason for asking is that latterly I have been in the running for several appointments going for "engineers-in-charge," and have found that, where reference was made to my present position, I have been styled as "shift engineer." This may or may not be the stumbling block to my success, but it would be interesting to know the opinion of other readers as to whether this title is detrimental to my advancement. I may state that at the present time I am responsible for the operation and maintenance of steam and electrical plant of about 5,000 KW. capacity, all testing and repairs to such being carried out under my personal supervision during the week-ends (shifts being 12 hours day and night), which I take alternately with my colleague. Should you think this letter of sufficient interest to publish I should be greatly obliged.

An Old Reader.

[The question is very timely; the distinction between the two designations undoubtedly is somewhat indefinite. We should regard "charge engineer" as connoting the possession of capacity and fitness for responsibility superior to the attainments of a "shift engineer."—Eds. Elec. Rev.]

A Query.

I am interested in the question raised by "Ignoramus," but why does he specify that the load on the three-phase should be balanced, for the simplest, cheapest and most efficient way is to take a single-phase supply from two windings of the three-phase plant, as shown in the diagram. This is quite practicable if the single-phase load is small, as is usually the case, compared with the capacity of the three-phase supply. (I have heard that the single phase railway in London is supplied from two windings of a three-phase generator, and I shall be glad if you can confirm this rumour.)



I shall be glad if Mr. Raynor will state if the arrangement described by him is in use to any extent and its efficiency.

Mr. Johnstone's reply is not a very satisfactory answer to the question. His first diagram is not practicable, for the result would be similar to that obtained on a three-wire system without balancers (unless a connection were made between the star points of generator and transformer.) Transformers connected as shown in his second diagram will carry a considerable out-of-balance current.

B.

Reversing an Interpole Motor.

Would you please inform me, through your paper, the best way to quickly reverse the direction of rotation of an interpole shunt motor? Is it correct to reverse the brush leads, only leaving the fields, shunt and interpole coils alone? Some books say reverse armature current and interpoles, leaving shunt coils alone. What I want to know is if I reverse the brush leads, whether shunt or compound-wound interpole motor, will the machine be right, provided it was running correctly under load in the opposite direction before? I have asked several electrical engineers, and had very contradictory instructions.

Puzzled Winder.

Protection or Tyranny?

My attention has been drawn by the letters which have recently appeared under the above heading to another aspect of the rules of that somewhat ungrammatically titled body, the "British Electrical and Allied Manufacturers' Association," which is certainly more deserving of the heading than the one which has so far been dealt with, for purchasers, whether individuals or corporate bodies, can always protect themselves by methods quite unavailable to the worker.

The particular rule of the B.E.A.M.A. to which I wish to draw attention is one to which, if true, it were no misuse of words to apply the epithet "scandalous."

I understand that the gist of the rule is that should any employé of one member (A) of the B.E.A.M.A. apply, through advertisement or otherwise, to another member (B) for employment, then (B) shall immediately inform (A), and before taking the applicant into his employ, shall obtain the permission of (A).

I have no doubt but that the most philanthropic considerations contributed to the framing of this rule, but it requires very little thought to understand how impossible it is for a worker to improve his position under such circumstances, for the good worker is kept where he is, whilst the less efficient worker is not wanted by other employers, and is probably not retained by his present one.

Further, I would point out that almost all the principal manufacturers in all branches of the electrical industries are members of the B.E.A.M.A., and that the rule applies to all grades of workers, from the office boy or the greaser to the general manager—many thousands in all, most of whom are entirely ignorant of the fact that they are living under such tyranny—a tyranny which cynically and shamelessly violates the most fundamental of those laws which concern the liberty of the subject.

I do not desire for one moment to divert attention from the important aspect of the case at present under discussion—in fact, I join with Mr. Purse against the B.E.A.M.A., and think, with "Pollux," that the best way of dealing with the B.E.A.M.A.'s conditions is to submit them to the judgment of the public interested in the electrical trades.

It is for this reason that I venture to claim the hospitality of your columns.

Junius.

[We have no knowledge of the existence of the rule mentioned by our correspondent. Perhaps the Association may have something to say on the matter.—Eds. E.R.]

BUSINESS NOTES.

Electric-Light Switching Competition.—We are informed that there are nearly 200 entries in the competition conducted by our contemporary *Electricity.* Candidates had to send in answers to one of three sets of examination questions on the principles and practice of controlling lights by means of modern tumbler switches. These questions showed that there is very much more in the subject than many people suspect. The detailed results of the competition, with the names of prize and certificate winners, will be published in the April 24th issue of *Electricity.* The examiner is Mr. W. Perren Maycock, M.I.E.E.

Lantern Slides.—Messrs. Berry Skinner & Co. have prepared a series of lantern slides of their foolproof fuse-switchgear and "Ironsafe" switchboards. They will be pleased to lend these slides to engineers or lecturers at engineering societies who may be interested in this particular subject. Application should be made to the firm's head office at 78, Upper Thames Street, London, E.C.

Cinematograph Apparatus.—With reference to the new Westinghouse list of cinematograph supplies mentioned in these columns last week, we are asked to state that the British Westinghouse Electric and Manufacturing Co., Ltd., propose holding an exhibition of cinematograph and theatrical supplies and apparatus at 179, Wardour Street, London, W., from March 16th to 23rd, inclusive.

Trade Announcements.—With reference to our last week's notice of dissolution of partnership of W. F. Dennis & Co., we are asked to state that the retirement of Mr. F. W. Dennis will in no way affect the conduct of the business, which will be carried on, as heretofore, by Mr. F. A. B. Lord and Mr. J. E. Hood, who has now been admitted a partner. Mr. L. H. Hurburgh, who has been in the firm's employ for many years, will also assist in the management.

Mr. James Douglas announces that, having purchased the goodwill, patents, patterns, tools, &c., from the liquidator of the Accessories Manufacturing Co., Ltd., the business will in future be carried on under the name and style of the "Accessories Manufacturing Co.," at 11, Dean Street, Soho, London, W.

Messrs. H. R. Witting & Partners (now changed from H. R. Witting), removed on March 6th from Berners Street, W., to 125, High Holborn, W.C.

Messrs. Arthur Jones & Co. have commenced business as electrical factors at 15, Dock Street, Middlesbrough. Mr. Jones was sales manager for some years with the late firm of Warren, Beattie & Co., Ltd. The firm invite manufacturers and large wholesale suppliers to send catalogues, &c.

In future, all communications for the Benjamin Electric, Ltd., should be sent to 1a, Rosebery Avenue, E.C., where their sales office will be established; telephone number, "Holborn 1830." During the last two years the company have very considerably increased their manufacturing facilities at Rosebery Avenue.

J. & G. Odhams, ironmongers and manufacturing electricians, 206 and 207, Upper Thames Street, E.C.—Mrs. Rose Elizabeth Odhams, administratrix of the estate of the late M. G. Odhams, has transferred his and her interest in the goodwill, stock-in-trade, &c., in the business to Mr. G. P. Odhams, who will attend to debts and carry on the business, under the same style, at the same address.

Mr. R. Barron, who is in business as an electrical engineer at Fleetwood, has recently had his premises extended, and has made provision for a large showroom.

Catalogues and Lists.—Messrs. Morris & Lister (London), Ltd., Palace Chambers, Westminster, S.W.—Sixteen-page list (No. 342), giving illustrated particulars and prices of "Bacho" electric drilling and grinding machines.

Messrs. Neville's (Liverpool), Ltd., 79, James Street, Liverpool.—Eight-page list describing and fully illustrating Universal angle-bending machines, and showing their application in dealing with all sections of bars, tubes, &c.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—New catalogue (No. 377 February) of electric bell and telephone manufactures. It is of the firm's uniform size of page, and consists of 100 pages. A very complete range of electric bells is included, also the "Farringdon" bell, which is a speciality of the firm, and the "Atlas" secure locking indicator, which has a movement that the firm claims cannot possibly shake down, and can only be actuated by electrical action. This is one of a range of indicators of various types. Wood, china, brass pushes, and the usual complements to an electric bell catalogue, such as batteries, bell wires, flex, are exhaustively dealt with. The firm specialises in portable flash lamps of which a range is shown. The catalogue having been thoroughly revised, brought up to date, and all prices carefully calculated on current costs, the advances which have heretofore had to be charged are now entirely eliminated.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—Supplement 2 to Catalogue 532 contains illustrations and prices of high and low-tension motor-car leads.

Messrs. Adam, Rouilly & Co., 18, Fitzroy Street, London, W.—8-page illustrated and priced pamphlet, containing particulars of their "Rational" light reflector and bowl fittings.

Messrs. Krupka & Jacoby, Ltd., Chapter Street, Westminster, S.W.—Two leaflets, giving prices, &c., of flexible wires, bell wires and 600-megohm grade cable.

The Westinghouse Brake Co., Ltd., 82, York Road, King's Cross, London, N.—40-page illustrated catalogue (fifth edition) of their oil engines (Cross patents). Very fully illustrated details of the engines and parts of same are given, and small self-contained electric power and lighting sets and portable power plants are included.

Messrs. W. F. Dennis & Co., 49, Queen Victoria Street, London, E.C.—24-page catalogue, containing a full and illustrated account of the "Steidle" semi-automatic telephone system, its purposes, parts, application and operation. The main idea of the system is economically to link up outlying districts with an existing central exchange. It is the work of the South German Telephone Apparatus, Cable and Wire Works A.G., of Nuremberg, for whom Messrs. Dennis are sole agents here.

The Century Electric Co., St. Louis, U.S.A.—Two illustrated catalogues dealing respectively with single-phase self-starting motors of the repulsion-induction type, and alternating-current fans.

Messrs. J. W. Brooke & Co., Ltd., Adrian Works, Lowestoft.—Forty-eight page illustrated catalogue of marine motors and motor-boats.

Paracit G.m.b.H., Frankfurt-am-Main.—Brochure describing "Paracit," a new artificial insulating material mainly composed of cotton, and used either in the solid or dissolved form in the manufacture of electrical apparatus.

Messrs. Lester B. Betts & Co., 9, London Street, London, E.C.—The first number of *Betts's Bulletin*, a monthly publication of 16 pages containing prices and illustrated particulars of portable electric drills, electric fans and lighting fittings, and tabulated prices of many accessories.

Messrs. Willans & Robinson, Ltd., Rugby.—Forty-page illustrated brochure very fully describing their disk and drum steam turbines, with numerous half-tone illustrations of complete plants, also drawings and pictures of parts of machines. Seven pages at the end are occupied with tabular lists of public and other purchasers of their turbines, and particulars of the machines supplied.

The Electrical Supplies Co., 41, Cheapside, London, E.C.—Illustrated descriptive price list of paraffin-electric sets for picture palaces, yachts, portable service, country house lighting, &c.

Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, London.—Leaflet (H 19 P) contains description and prices of direct-current steel-clad motor-control pillars.

Dissolutions and Liquidations.—The Harrington Electric Light Co., Ltd.—A meeting will be held at the offices, Leopold Street, Long Eaton, on April 7th, to hear an account of the winding-up from the liquidator, Mr. W. Bladon Smith.

E. & V. Page & Co., electric suppliers, agents and merchants, 1, Dyer's Buildings, Holborn, E.C.—Messrs. Edward Percy Page and Victor Arthur Page have dissolved partnership. Mr. E. P. Page will attend to debts and carry on the business under the style of Edward Page & Co., at 28, Ely Place, Holborn, E.C.

New Superheater Co, Ltd.—A meeting of creditors will be held at 155, Salisbury House, London Wall, E.C., on April 14th, to hear an account of the winding-up from the liquidator, Mr. S. G. Bruff.

Bankruptcy Proceedings.—Clifton Robinson, London.—The Bankruptcy Court on Tuesday approved a composition of 10s. in the £, and discharged the order. Extravagance was the cause of failure.

Sequestration notice has been published in the *Edinburgh Gazette* respecting James Haig Willey, electrician, 20, Blackhall Street, Paisley.

A Calcutta Exhibition.—A financial daily states that preliminary arrangements for an International Exhibition to be held in Calcutta have been proceeding for some time.

Book Notices.—The March issue of "Concrete and Constructional Engineering" contains the first of two illustrated articles on "Concrete Masonry in the Panama Canal," by Mr. J. G. Leigh, and a description, with illustrations, of the Central Arno hydro-electric station near Milan, which has some unusual constructional features.

"Photo-Electricity." By A. L. Hughes. London: Cambridge University Press. Price 6s. net.

"Engineering Index Annual for 1913." New York: Engineering Magazine Co.

"Science Abstracts." Sections A and B, Vol. XVII, Part 2, February 25th. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Proceedings* of the American Society of Civil Engineers." Vol. XL, No. 2. February. New York: The Society.

"The Physical Review." Vol. III, No. 2. February. Lancaster, Pa.: The American Physical Society.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Spéciales." Vol. XVI, No. 3. January. Liége: Lahaye & Co. Price 1 fr.

"*Bulletin* Mensuel de la Société Belge d'Electriciens." Vol. XXXI. February. Brussels: E. Bruylant. Price 1 fr. 75c.

"Giornale ed Atti della Associazione Elettrotecnica Italiana." March 5th. Milan: The Association. Price L1.

Denmark. — The Danish Customs authorities have recently given a decision to the effect that "electric heating stoves" are to be classified under No. 301 of the tariff, the duty being 7½ per cent. *ad val.*

Patent Application.—The Worthington Pump Co., Ltd., have applied for restoration of Patent No. 18,866 of 1910, for "Hydraulic air compressor or pump," granted to O. H. Mueller.

LIGHTING and POWER NOTES.

Alaska.—The Bishop of Alaska has authorised the head of the electrical engineering department of the University of Pennsylvania to design an electric lighting plant, operated by a windmill, for the use of the Episcopal Mission at Point Hope, Alaska, which is more than 100 miles north of the Arctic Circle.

Altrincham.—Street Lighting.—The Council has decided to seek permission to borrow £750 for lighting the main streets by electricity.

Argentina.—The Buenos Ayres municipality has approved the plans presented by the Compania Italo-Argentina de Electricidad relating to its installations for the supply of electricity. The company is required to install a minimum of 15,000 kw. during the eight months following the approval of the plans.—*Review of the River Plate.*

Blackrock. — E.L. Scheme.—The U.D.C. has appointed Mr. J. P. Tierney, electrical engineer, to advise on the proposed E.L. schemes.

Bradford.—Hospital Lighting, &c.—The Health Committee has decided to recommend the City Council to install electric lighting at Leeds Road Hospital, in lieu of gas, at an estimated cost of £366.

The Sites and Works Sub-committee of the Education Committee has resolved that, owing to the unsatisfactory condition of the gas mains at Odsal House, arrangements be made for the building to be lighted by electricity.

Braunton.—E.L. Scheme.—The P.C. has accepted the offer of Mr. J. Dennis to supply E.L. in the hamlet of Knowle at £1 per lamp per annum, and the payment of £15 towards the capital outlay for seven years. Overhead wires will be used.

Bristol.—Street Lighting.—In connection with the offer of the Electricity Committee to supply free electricity to over 1,100 street lamps at present lighted by gas, the estimated saving being £1,000 per annum when the cost of changing over has been met, a Councillor intimately connected with the Ratepayers' Association has objected to the inclusion in next year's estimates of £390 expenditure on altering gas lamps for the electric lighting.

Bury.—Workhouse Lighting.—The Electricity Committee is negotiating with the B. of G. for the supply of electricity to the workhouse at Jericho, at an estimated cost of £3,200.

Carlisle.—L.G.B. Inquiry.—An inquiry was held on March 4th by Mr. W. N. Cross into the application of the Corporation for sanction to borrow about £30,000 for extensions to the electricity works plant and mains.

Clacton-on-Sea.—Street Lighting.—The U.D.C. has appointed a committee to consider the lighting of the principal thoroughfares with electric arc lamps.

Clutton (Somerset).—The B. of G. has decided upon an E.L. installation, at an estimated cost of £835.

Connah's Quay.—Proposed E.L. Scheme.—The U.D.C. has applied to the L.G.B. for a loan of £1,600 for carrying out an E.L. scheme. Plans are to be prepared by Mr A. J. Leigh, of Northwich.

Continental Notes.—Austria.—A plan for providing Vienna with electricity on a large scale was recently outlined by the Austrian Government - consulting engineer, Karl Deinlein. He proposes to utilise the rainfall on the northern slopes of the Niederen Tauern mountains, in two power stations in the valley. Calculations show that 570,000 h.p. will be available, which far exceeds the capital's present wants, and can be supplied at so low a price as to ensure the success of the venture.

Baden.—Supply Statistics.—An official report has just been presented to the Upper House of the Grand Duchy of Baden in regard to the position of electricity supply in the Duchy at the end of 1913. It is shown that out of the 1,557 towns or communes, 521, or 33·5 per cent., are provided with a supply, and the population of the districts served amounts to 64·5 per cent. of the total population. The report submits that it is now the duty of the Government to intervene with a view to controlling the development of the supply. Agreement as to future extension of the supply has already been effected with a number of communal undertakings, and further negotiations are in progress. In addition to the expansion of the system, the report refers to the movement proceeding in the direction of the unification and combination of the supply in larger undertakings connected together. The overland central stations are endeavouring to join with the small local works, both technically and economically, and large communal works and private works are also combining. It is not disputed that if the whole of the production and distribution were concentrated in private hands the danger of a monopoly would arise. But so long as the rights and obligations of the large overland stations are controlled by the State, as is the case in Baden, no apprehensions are entertained that the interests of the public are likely to be prejudiced. Apart from this, the establishment of a monopoly will be checked by the Government Murg electricity works, now in process of construction.

Germany.—The Municipality of Heiligenstadt proposes to convert its power station into the centre of an extensive overland supply system, and is considering whether this shall work in conjunction or in competition with a scheme projected by the A.E.G. In the former case the town will have to raise £50,000 of the capital. Parts of the remoter rural districts are to be supplied from either the Sudhärzer Kraftwerke or the water power station at the Erdtalsperre.

Crewe.—The Electric Lighting Committee has received an application for the lighting of Spring Gardens.

Croydon.—Plant Extensions.—The B.C. has sanctioned works at a cost of £3,154, to supplement the existing h.t. system.

Darlington.—Loan Sanction.—The T.C. has received the sanction of the L.G.B. to a loan of £6,500 for new pumping and generating plant in connection with the water undertaking.

The electrical engineer has reported to the Council that he has been requested to tender for a large supply of electricity to the N.E. Railway Co. for power purposes.

Dover.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £500 for electricity purposes, including house services, the extension of mains to the River portion of the borough, and the installation of E.L. in cottages at the Pier.

Dublin.—Proposed Loan.—The Corporation has decided to apply to the L.G.B. for a loan of £77,000 for the extension of the electricity undertaking.

The promoters of the Alliance and Dublin Consumers' Gas (Electric Supply) Bill have given notice that they will object to the *locus standi* of the Dublin Corporation to be heard against this measure.

Edinburgh.—Fuel Economy.—As a result of the test of an Underfeed stoker at the Dewar Place electricity works, it has been found that coal at 4s. per ton can be used, as against fuel costing 8s. to 10s. per ton at present. The E.L. Committee has therefore recommended that seven additional stokers of the same pattern be installed, at an estimated cost of £1,890.

Exeter.—New Plant.—The E.L. Committee has decided to install a 1,000-kw. B.T.H. high-pressure steam turbo-alternator at the electricity works, at a cost of £4,211. The total cost of the work is estimated by the electrical engineer at £6,200, and the annual saving at £440 per annum. At a joint conference of the E.L. and Tramways Committees last week the town clerk stated that of £43,024 expended upon plant at the electricity station only £5,638 had been apportioned to the tramway undertaking, which would be entitled to borrow £11,541, after paying £3,000 for the additional cars to be purchased. As the tramways utilised about a third of the current generated, the E.L. Committee considered that the apportionment of capital between the two undertakings should be reviewed. It was resolved to borrow £6,200 for the turbo-alternator.

Glasgow.—Street Lighting.—A big scheme for improving the lighting of the streets is under consideration.

Hazel Grove.—A further canvass of residents is to be taken to ascertain the demand for electricity in the area and the Electricity Sub-Committee of the Council has been authorised to engage the services of an electrical engineer or other suitable person.

Holywell.—Infirmary Lighting.—The B. of G. has decided that for the present the E.L. shall be installed in the new infirmary only: the lighting of the workhouse is to be deferred until a new classification is completed. Tenders for accumulators capable of lighting the whole institution are to be invited, and the specifications are to be prepared by Mr. A. J. Leigh, of Northwich.

Ilkley.—E.L. Scheme.—The Electricity Committee has adopted the amended plans of the electrical engineer for the erection of an electricity generating station, and the L.G.B. has consented to the work of cable laying being proceeded with at once. The L.G.B. inquiry into the scheme will probably take place next month. The Committee has decided that the cable laying be proceeded with immediately in accordance with the terms arranged with the Western Electric Co.

Keighley.—Proposed Loan.—The T.C. is applying to the L.G.B. for sanction to borrow £600 for electric motors to be let out on hire.

Kingstown (Co. Dublin).—E.L. Bill.—Mr. John Muldoon, M.P., has given notice of motion that it be an instruction to the Committee on the Kingstown Lighting Bill to insert a clause providing for the transfer of the undertaking to the Kingstown U.D.C. as might be approved of by the B. of T.

Knaresborough.—E.L. Scheme.—The U.D.C. has decided to apply for a prov. order to carry out the proposed E.L. scheme. Current is to be generated from the River Nidd, and the cost of the installation, &c., is estimated at £3,180. On a scale of 5d. per unit the estimated yearly revenue is £833, and the profit £312.

London.—Islington.—The B. of G. has received a letter from the L.G.B. stating that it is not satisfied with the proposal to install E.L. at the Board's institutions without further information, and, in view of an offer made by the Gas Light and Coke Co., the B. of G. has decided to hold an inquiry into the matter.

Woolwich.—Proposed Loan.—Application is to be made to the L.C.C. for a loan of £18,500 in connection with the electricity undertaking.

The L.C.C. Finance Committee has recommended the Council to sanction the borrowing of £500 for electricity meters by the Bermondsey B.C.; and £5,328, as to £2,142 for mains, £1,916 for services, and £1.270 for meters, by the Shoreditch B.C.

Malvern.—Proposed Bulk Supply.—At a meeting of the U.D.C. last week, a recommendation of the Electricity Committee to add a 150-kw. plant to the electricity works at an estimated cost, including extension of building, of £1,500, was discussed. It was stated that the Worcester Corporation had offered to supply Malvern with electricity in bulk, but the Committee felt that the offer did not warrant it scrapping its electricity works, which would have to be done if the offer was accepted. The discussion was eventually deferred for a month.

Merthyr Tydfil.—Bulk Supply Inaugurated.—The formal switching on of the bulk supply to the Merthyr Electric Traction and Lighting Co. took place last Saturday, at the Treforest power station of the South Wales Electrical Power Distribution Co. The visitors subsequently inspected the overhead transmission to Merthyr, and the 11,000/500-volt rotary converter plant installed there. The operations of the power company have extended greatly in recent times; included in its plant are two 6,000-h.p. turbine sets, while another of 10,000 h.p. is being erected at the present time.

Newport (Mon.).—Proposed Refuse Destructor.—A L.G.B. inquiry was held on March 5th into the application of the T.C. for a loan of £11,697 for a refuse destructor, proposed to be erected by Messrs. Heenan & Froude, Ltd. There was no opposition.

Oldham.—Referring to an increase in the coal consumption at the electricity works, the chairman of the Electricity Committee said he was informed that the increase was due to the turbine having broken down, and he strongly urged the Committee to spend £30,000 if need be on new machinery, so as to bring the figure down to 3 lb. of coal per unit.

Penmaenmawr.—E.L. Scheme.—A special meeting of the U.D.C. is to be held to consider the report of the consulting engineer with reference to the supply of electricity.

Peterhead.—Saving the Gasworks.—The local T.C. has been considering a scheme for supplying electricity in the burgh, but probably nothing will come of it, as the local Gas Committee has the matter in hand, and has taken the precaution to circularise the gas consumers to find out whether they will be "agreeable" to adopting electricity. With a view to assisting them in coming to a decision, the Committee informs them that electricity could be supplied at from 3d. to 4d. per unit for lighting, "which would mean that . . . . . the charge would be approximately 7s. 6d. to 10s. to be equivalent to 1,000 cb. ft. of gas at the present cost of 3s. 8d. per 1,000 cb. ft." And this with the metal-filament lamp! The circular is signed by the gas manager.

Radcliff.—Proposed Loan.—The U.D.C. has asked the L.G.B. to sanction the borrowing of £3,948 for the electricity undertaking, principally for new mains.

Rochdale.—Mill Driving.—The Corporation has arranged to supply 1,800 h.p. for electrically driving two new mills which are being erected between Sudden and Castleton. Half the supply is required by January 1st next, and the remainder by June, 1915.

Rochester.—Street Lighting.—The Gas Co. and the Kent Electric Power Co. are being asked by the Corporation to submit schemes and estimates for the lighting of High Street. Permission has been granted to the latter company to modify its experimental lamps in the High Street, in accordance with the experience gained, and to try them again for a short time before completing a scheme.

Scarborough.—Public E.L.—The Parks Committee has considered the advisability of lighting Peasholm Park by gas or electricity, and the borough engineer having submitted comparative tenders, it was resolved that the tender of Messrs. Walker and Hutton for E.L. be accepted.

Sheffield.—The City Council is being recommended to lay an e.h.t. main to supply the crippled children's institute and the proposed sanatorium for women in the Rivelin Valley Road, and a l.t. main for public lighting, at a total estimated cost of £3,940.

Southborough.—Proposed Bulk Supply.—The Tunbridge Wells T.C. has decided to inform the U.D.C. that, provided the permission of the B. of T. is secured, it is willing to afford a bulk supply of electricity on terms to be arranged.

Steyning (Sussex).—E.L. Scheme.—The electricity supply installed by Mr. E. Prior, of Burgess Hill, was switched on last week. About 30 consumers are being supplied. Steps are being taken to extend the supply to the villages of Bramber and Beeding.

Stockton.—Proposed Loan.—The T.C. is seeking sanction to borrow £2,000 for extensions to the electricity mains.

Stone (Staffs.).—Prov. Order.—The U.D.C. has offered to forego opposition to the Gas Co.'s Bill if the clause seeking powers for the supply of electricity is not proceeded with, as the Council intends applying for a prov. order for E.L. itself. The Gas Co. is to discuss the point raised with the Parliamentary agents.

Stratford-on-Avon. — The Stratford-on-Avon Electricity Co., Ltd., has secured the contract for the wiring of Alveston Manor. This old house, which has belonged to the Fortesques for many centuries, was built in the fifteenth century. It was in the main hall where Shakespeare was said to have been tried for poaching. The installation will comprise over 200 lights. Screwed tubing will be used throughout and the different circuits balanced on the three-wire system.

Street (Somerset).—Proposed E.L.—A meeting was held last week to consider a scheme for the formation of a company to provide an electric supply for the town. Messrs. C. and J. Clark, Ltd., boot manufacturers, convened the meeting, and, in conjunction with Messrs. Cristy Bros., electrical engineers, of Chelmsford, have formulated a scheme to extend the boot factory plant by expending £4,000. Messrs. Clark are prepared to take 1,000 shares in the proposed company. A charge of 6d. a week for two lamps and 1d. each a week for extra lamps is suggested. A provisional committee has been appointed to report on the scheme.

Tasmania.—Mr. Parry, of the New Zealand Public Works Department, has been appointed to report on the Hydro-Electric Co.'s undertaking.

Taunton.—Mains Extensions.—The Electricity Committee has been authorised to lay another high-pressure feeder cable in the centre of the town, in consequence of the overloading of two other cables.

Torquay.—Proposed Loan.—The T.C. is applying to the L.G.B. for sanction to borrow £5,000 for mains extensions.

Tunbridge Wells.—Sewage Works.—The T.C. has instructed its electrical engineer to install electricity for lighting and power purposes at the North Sewage Farm.

Wakefield.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £13,000 for the extension of the electricity undertaking.

Application is to be made to the B. of T. for an order authorising the Corporation to supply electricity to Warmfield-cum Heath.

Walmer.—E.L. Bill Opposed.—The U.D.C. has sealed a petition against the Bill of the Gas Co., which seeks power to supply electricity in the district.

Walsall.—Proposed Loans.—The Electricity Committee of the Corporation recommends that application be made to the L.G.B. for sanction to borrow £2,092 for the purposes of the electricity undertaking, £1,092 for a chain-grate stoker and economiser, additions to sub-stations and new services, and £1,000 in respect of prospective expenditure on services. A successor to Mr. A. S. Barnard, borough electrical engineer, is to be advertised for at a commencing salary of £500 per annum.

West Ham.—Proposed Loan.—The T.C. proposes applying to the L.G.B. for sanction to borrow £3,085, the estimated excess expenditure which will be incurred on the generating station extensions and a further £3,261 for items required to complete the work.

Worcester.—Reduction in Rates.—The City Council has resolved to abolish the maximum demand system of charging for electricity, and to offer private consumers alternative charges of a flat rate of 4½d. per unit, or the "Norwich" system; and also to allow power consumers to use current for lighting purposes at power rates up to one-tenth of the quantity used for power purposes. The present M.D. rate is 6½d. and 3d. per unit for lighting and 2½d. and 1d. for power. The chairman of the Electricity Committee said the alteration would assure to the undertaking a certain fixed income and would give consumers current at a cheaper rate and induce them to use it for purposes other than lighting.

Wye (Kent).—Proposed E.L.—At a meeting of the East Ashford R.D.C. a letter was read from Mr. G. Stanton, of Whitstable, intimating that a company was prepared to provide a supply of electricity for Wye, a town in the Council's area, and asking for consent to the use of overhead wires. Several members spoke in favour of the project, and the matter was referred to the Highways Committee for consideration.

TRAMWAY and RAILWAY NOTES.

Blackpool. — Electric Time. — A scheme for the installation of a municipal time service, with a master clock at the Town Hall and synchronised dials at various points on the tramway routes, has been adopted by the T.C.

Continental.—Austria.—The companies interested in the scheme for the construction of an underground electric railway in Vienna will shortly submit proposals to the Municipal Council. It is expected that a period of five years will be required to complete the railway. The financial side of the question has yet to be settled. The French companies which are interested in the undertaking have been granted until the end of March to ascertain whether they will be able to float a loan in Paris to provide a portion of the capital. If, however, co-operation from this source should fail, it is said that the German and Austrian companies combined will be able to carry the scheme into effect.

Spain.—The horse tramway between Irun and Fuenterrabia is to be converted to electric traction.

Italy.—Referring to a note in this column (January 2nd), a correspondent of *L'Electricien* points out that the Italian Edison Co., in spite of its name, is really Italian; it owns almost the whole of the Milan tramways. The tramway companies of Turin and Genoa, on the other hand, though they have Italian names, are of foreign constitution.

The question of railway connection between Salsomaggiore and Borgo San Donnino and the junction of the latter with the State railway system is engaging Italian public attention. Both a steam tramway and a steam railway have been suggested; but in view of the difficulties associated with these solutions, preference has fallen upon an electric line, the plans of which have just been laid before the Government in connection with an application for a concession and subsidies. The proposed electric traction will allow of a reduction in fares and goods rates.

Germany.—The Prussian State Railways have already adopted electricity as the standard illuminant for all sleeping cars, and a recent official statement in the Reichstag indicates that all new passenger rolling stock is to be fitted with electric lighting.

Costa Rica.—The Governor of the Province of Lemon has entered into a contract with Messrs. R. M. Fernandez and T. Mangel, both of Lemon, for the construction of a tramway in the latter town. The motive power is to be either petrol, compressed air, or electricity, the gauge either 75 or 90 cm. (about 2 ft. 5½ in. or 2 ft. 11½ in.). The tramway is to extend beyond the town of Cunequeta, a distance of 1½ miles.

Croydon.—The B.C. is opposing the L.U. Tramways Bill, as the provisions may affect the interests of the B.C. in the South Metropolitan E.L. and Tramways Co.'s lines between Croydon, Tooting and Sutton.

Edinburgh. — Tramway Extension Delayed.—The Tramways Committee has passed a motion for the delay of the proposed prov. order for a system of self-propelled tramway cars to Corstorphine, on the ground that the route is already sufficiently served by motor-'buses.

Farnworth (near Bolton).—Proposed New Tramway.—The U.D.C. has appointed a deputation to interview the Salford Tramways Committee on the question of a connection between the existing tramways in Clifton and Pendlebury, so as to afford a through system from Bolton to Manchester.

Liverpool.—Annual Report. — The annual report states that the total revenue of the Corporation tramways department for 1913 amounted to £715,120, and operating costs (including rental of leased lines) to £451.667, leaving a gross profit of £263,453. This has been apportioned as follows —Interest, £48,971; sinking fund and repayment of loans, £60,819; reserve, renewal and depreciation account £[illegible], and contribution in aid of rates, £100,000. The net profit for the year amounted to £154,162, an increase of £20,[illegible] over 1912. The contribution in relief of the rates is £33,071 in excess of last year's amount. The total sum set apart for sinking fund and redemption of debt is £1,091,771, and for reserve, renewal and depreciation, £[illegible]. The number of passengers carried during the year was 111,[illegible], an increase of 9,835,960 over 1912. The receipts in 1913 were £677,881, an increase of £[illegible]. Increased rates of pay to the tramway employés entailed an additional annual expenditure of £6,070.

London.—Marylebone.—With reference to a note published in this column on February 20th on the authority of a financial daily, we understand that at last week's Council meeting it was stated in reply to a question by Mr. Duncan Watson that the Council had not purchased a 5-ton F.R.A.M. electric vehicle for refuse collection, nor could it be conceived how such a report had obtained currency.

Nelson.—Railless Traction Proposal.—The T.C. has instructed a Sub-Committee to report upon the powers necessary for the construction of overhead equipment, and the provision and working of a railless traction system.

Newcastle-on-Tyne.—Proposed New Cars.—The T.C. has decided to apply for sanction to borrow £12,240 for the purpose of acquiring 15 double-deck top-covered tramcars.

North-Eastern Railway Electrification. — Lord Knaresborough, chairman of the company, in addressing the shareholders at their annual meeting, alluded to the electrification of the mineral line from Shildon to Newport. The work, he said, was well in hand, and the first of the 10 electric locomotives almost completed. The working of freight traffic by electric locomotives was not entirely new to the company, but this was the first instance in which it had been tried upon anything like a comprehensive scale, and the experiment—for such it was—would be watched with the keenest interest. In view of its experimental nature, the directors had deemed it advisable to defray the whole cost, £150,000, out of current revenue, instead of debiting it to capital account. If the venture realised the expectations formed in regard to it, they would then be justified in charging a portion, if not the whole, of the cost to capital account.

South Shields.—Electric 'Buses.—The Tramways Committee has recommended the T.C. to purchase two Edison electric 'buses with motor-generator and switchgear, at a total cost of £2,594.

Rate Relief.—The Tramways Committee has granted £1,700 out of the tramway profits towards the rates. It was explained at a meeting of the T.C. that the estimated surplus of £7,000 was not profit, and the sum offered in aid of the rates was more than half of the real profit of the undertaking. The proposal to contribute to rate relief evoked considerable opposition, but was eventually carried.

Stockport.—The T.C. has decided to oppose the Manchester Corporation Bill, especially with reference to the clause relating to the running of motor-'buses over roads along which that Corporation already has running powers, and which include some in Stockport.

Stretford.—The Parliamentary Committee of the U.D.C. has declined the offer of the Manchester Corporation Tramways Committee to run a service of motor-'buses through the town in lieu of the tramways and light railways scheme authorised in 1903 and 1906.

Tyne Tunnel Scheme.—The Bill for the incorporation of a company to construct an electric railway under the Tyne, from South Shields to Tynemouth, has been withdrawn.

Walsall.—It has been decided to insert powers in the Corporation Bill for extending the proposed trolley vehicle route from Cannock as far as Hednesford, an additional distance of 2½ miles, involving further expenditure of £7,000.

TELEGRAPH and TELEPHONE NOTES.

Canada.—Statistics recently issued show that there is a telephone for every 15·2 people in Canada; there are 1,075 telephone organisations. The capital of the companies is placed at $59,847,004, equal to $129·13 per telephone. The cost of operation in 1913 was $24·10 per telephone.

It is the custom at the Windsor Street station, Montreal, of the Canadian-Pacific Railway, to announce the train departures by megaphone; recently a series of loud-speaking telephones actuated by one transmitter has been installed, to enable a person speaking in an ordinary tone to announce the departures in a stentorian voice at all parts of the station.

Germany.—Until recently it has not been possible to obtain satisfactory telephonic communication with Milan from places north of Frankfort, owing to inductive interference from overhead power wires in the Simplon Pass. These difficulties have now been so far overcome that the line is to be opened to the public as far as Berlin.

It is officially announced that the new Anglo-Belgian telephone cable will not be available for communication with Germany, but the German Post Office is not without hope of an ultimate connection which will pass direct from German to English soil without touching Holland, Belgium, or France. This would involve a submarine cable nearly 300 miles long.

Imperial Wireless System.—Replying to a question on Monday last, the Postmaster-General stated that the second three stations of the chain were included in the contract with the Marconi Co., but the Postmaster-General had power to cancel the contract so far as those stations were concerned. His predecessor advertised last November inviting applications for leave to tender for them from any who were able, by practical demonstration, to prove the efficiency of their system; replies were received from the Universal Radio Syndicate (Poulsen system), the Société Française Radioélectrique (Béthenod system) and the Galletti Co.

Their proposals, however, were too indefinite, and the dates suggested for the demonstrations were too distant to justify waiting for them. They were informed that the Post Office would be glad to witness demonstrations of the systems, but no demonstrations, even of an experimental character, had yet been given.

In the House of Lords last week, Lord Salisbury, on behalf of Lord Lansdowne, gave notice that on Monday the Leader of the Opposition would move the appointment of the following to form the Select Committee to inquire into the allegations concerning Lord Murray:—The Earl of Halsbury, Earl Loreburn, the Earl of Desart, Lord Charnwood and Lord Sanderson. On Monday the constitution of the Committee was agreed to. The first meeting will be held to-day.

Nigeria.—In a Colonial report on Southern Nigeria for 1912, it is stated that a consignment of 12,000 yards of river cable for the Niger River crossings was received, and upon being tested it was found that the insulation of the whole consignment was defective. After some difficulty it was eventually discovered that the ship in which the cable was originally shipped had been on fire, and the cable had been subsequently transferred to another vessel. There was no outward visible sign to show that the cable had been damaged, but the heat had evidently destroyed the insulation. A claim was submitted for the damaged cable and an order placed for a new consignment.—*Financial Times.*

Norway.—The municipal authorities have accepted a contract for the delivery of 440 KW. to the Stavanger Radio-station, which is now under construction for the trans-Atlantic service. Energy is to be delivered at a price of somewhat less than one-third of a penny per KW.-hour, and the minimum amount to be paid annually is £1,111. The contract is drawn for a period of 25 years, but the purchasers have the right of terminating it on giving three years' notice. The station will be completed in the course of the year.

The directors of the Bergen Telephone Co. are going to submit to the shareholders a proposal for increasing the capital by £33,333, in connection with an extension of the whole service. The company is going to spend nearly £40,000 on laying new cables, and a new exchange, which will involve a capital expenditure of £22,222, will be equipped with automatic apparatus at a cost of £35,000.

The Telephone Service.—In the course of a recent visit to Germany Mr. Hobhouse was shown a party-line telephone system which appeared to work satisfactorily; it was specially intended for use in rural districts, and was so devised, that although a number of subscribers were served by the same line, it was not possible for any one of them to overhear other subscribers on the line. In a statement to the Press Mr. Hobhouse said that he hoped it might be possible to adapt the system for use in this country, and thus to facilitate the adoption of the telephone in rural areas.

We understand that the system in question is that of the South German Telephone Apparatus, Cable and Wire Works A.G., of Nuremberg, for whom Messrs. W. F. Dennis & Co. are the sole agents in the United Kingdom. It is known as the "Steidle" semi-automatic telephone system, and is described in a brochure issued by Messrs. Dennis. The essential feature of the system is that when one subscriber is using the line no other subscriber can listen upon it, and it is not possible for one subscriber to monopolise the line, for if another subscriber is waiting to use it, the line is transferred to the latter directly the conversation in progress is finished.

These results are attained by simple means, involving only the provision of an auto-switchboard for each group of subscribers, numbering, say, five or 10, on one common double line. The subscriber first calls up the local exchange, the operator at which connects his line with that of any other subscriber in the same or a similar group by means of special selector switches, which call only the particular subscriber who is wanted. The completion of a conversation is automatically announced, enabling another subscriber to use the line. The chief saving is the reduction of the number of lines from the group to the local exchange, and the substitution of an automatic switchboard for a small sub-exchange, which would not provide adequate employment even for a single operator, and of course could not be kept open day and night on account of the expense entailed. Further particulars will be given in a later issue.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Newcastle.—April 29th. P.M.G. Electrically-controlled clocks at Post Office, Newcastle, N.S.W. Schedule No. 361. See "Official Notices" to-day.

Melbourne.—April 7th. P.M.G. Accumulator batteries for radio-telegraph stations. Relays, non-polarised. Stores Schedule 996. See "Official Notices" February 27th.

April 21st. P.M.G. Telephone switchboards. Schedule No. 1,005. See "Official Notices" to-day.

March 24th. P.M.G. Automatic switchboard apparatus for Geelong. Schedule No. 1,016. See "Official Notices" February 27th.

Adelaide.—April 8th. P.M.G. Switchboards, various. Schedule No. 315. See "Official Notices" February 27th.

Bedford.—April 1st. Corporation. 12 months' supply of high and low-tension cables; one-phase A.C. induction house service meters; metal-filament lamps. See "Official Notices" to-day.

Belfast.—March 16th. Corporation. Renewal and reconstruction of permanent way for 12 months, for the Tramways and Electricity Committee. Forms of tenders (£1 1s.) from the City Surveyor.

Belgium.—April 22nd. Municipal authorities of Montegnèe (province of Liége). Concession for the supply of electrical energy for lighting and power purposes in the town, either by the establishment of a central station and network of mains, or by the supply from a neighbouring supply station.

Blackpool.—March 25th. Corporation. For the supply of six new open bogie cars for the Tramways Committee. Particulars from Mr. C. Furness, General Manager, General Offices, West Caroline Street.

Bray.—April 7th. U.D.C. General stores and stores for electric light works. See "Official Notices" to-day.

Burton-upon-Trent.—March 14th. Corporation. One 1,250-KW. three-phase turbine-alternator and condenser, pipe-work, valves and accessories. Extensions to high-tension switchboard. See "Official Notices" February 13th.

Canada.—March 28th. Electrical generating and distributing equipment, for the Regina Light and Power Department. Specifications from the Superintendent of the Department.

Cardiff.—March 18th. E.L. sundries for the City Mental Hospital, Whitchurch, for a year. Mr. T. D. Morgan, Clerk and Steward.

Darwen.—March 19th. Corporation. Brake blocks and castings. Town Clerk.

Dundee.—March 20th. T.C. For 12 months' supply of electrical stores, meters and carbons for the Electricity Department. Specifications from the Electricity Department, Dudhope Crescent Road.

Farnworth.—March 18th. U.D.C. 500-KW. rotary converter, transformer, switchgear and cables. See "Official Notices" March 6th.

France.—March 25th.—French State Railway authorities Bureau de Service Electrique (Ire Division), in Paris (43, Rue de Rome). Two high-tension multiphase cables to connect La Garenne and Suresnes-Puteaux sub-stations.

Guildford.—Three furnaces or mechanical stokers, for the Guildford Electricity Supply Co., Ltd. See "Official Notices" March 6th.

Hull.—March 20th. Corporation. Coal for 6 or 12 months, for the Property, Works, Tramways and Baths Committees. Forms of tender from the City Engineer.

Ilford.—March 14th. Stores for the tramways department of the U.D.C. for a year. Mr. L. E. Harvey, Tramways Manager, Ley Street.

Italy.—Rome.—April 15th. The Government of the Colony of Erythrea are prepared to receive tenders for a 15-year concession for the installation of an electric light system in the towns of Massana and Asmara. Cahier des charges, plans, &c., at the Ministry of the Colonies, Rome.

Kirkcaldy.—March 23rd. Corporation. Twelve months' supply of stores for the Electricity and Tramways Committee. Forms of tender from Mr. O. F. Francis, Burgh Electrical Engineer and Tramways Manager.

London.—L.C.C. March 18th. Electrical installation at the Upper Marylebone Street Elementary School, Gt. Portland Street, W (148 points, 200 lights). See "Official Notices" Feb 27th.

In connection with the scheme now before the Council for establishing a London ambulance service, it is proposed that the General Purposes Committee invite tenders for the supply of the ambulances.

LAMBETH.—March 17th. B. of G. Internal telephone system at the Infirmary, Brook Street, Kennington, S.E. See "Official Notices" March 6th.

WAR OFFICE.—Firms wishing to tender for supply of cables, electrical stores and scientific instruments should see a notice in our advertisement pages to-day. Application is not necessary from firms whose names are already on the War Office list.

Londonderry.—March 14th. Corporation. Meters and cables for the Electric Light Department. Specifications from the City Electrical Engineer.

Madeira.—Tenders will be received up to the end of March by the General Council of the District of Funchal, for a concession for the construction and working for a term of 75 years of an electric railway in the city and surrounding districts of Funchal. Deposit 10,000 scudi. Applications must be made in Portuguese.

Manchester.—March 17th. Corporation. (*a*) Tramway rail bonds, (*b*) hard drawn copper trolley wire (*c*), span wire brackets for tramway poles. Specifications for (*c*), 21s. (returnable) from Mr. G. M. McElroy, General Manager, 55, Piccadilly, Manchester.

March 18th. Education Committee. Electric lighting installation at Heald Place Municipal School, Rusholme. Specifications (£1 1s.) from the Secretary, Education Committee, Deansgate, Manchester.

New Zealand.—BOROUGH OF TAURANGA.—May 11th. Hydro-electric and sub-station plant. Specifications (£2 deposit) from H. W. Climie & Son —*N.Z. Shipping and Commerce.*

Oldham.—March 23rd. Corporation. Steam, exhaust and drain pipes, condenser pipes, &c. See "Official Notices" to-day.

Newport (Mon.).—Wood-working machinery and engineers' machine tools, for the Corporation electricity and tramways department. Mr. A. Nichols Moore, Borough Electrical Engineer.

Plymouth.—March 19th. Corporation. Registering punches for tramways system. Town Clerk.

Rawtenstall.—March 23rd. Corporation. Boilers, superheaters, mechanical stokers, and steam piping, for the electricity works. Specification from Mr. C. L. E. Stewart, Electrical and Tramway Engineer, Electricity and Tramway's Offices, Bacup Road.

Russia.—May 14th. The municipality of Ekaterinoslav is open to receive tenders for the installation and working of a tramway in the city.

Sale. — U.D.C. Metal-filament lamps and paper-insulated and lead-covered cables for 12 months for Electricity Department. Specifications from Mr. C. J. Wood, Electricity Works, 4, School Road.

Salford.—March 23rd. Two high-tension distribution switchboards, for Park Lane sub-station, and twelve oil-switch cubicles for separate wall-mounting. See "Official Notices" March 6th.

March 23rd. Superheaters, pipes and valves. Specifications, &c., from the Borough Electrical Engineer, Frederick Road, Pendleton.

South Africa.—DURBAN.—Corporation. Two electrically-propelled aluminium-lined ambulances. London agents, Webster, Steel & Co. A copy of the specification can be seen at the Board of Trade Commercial Intelligence Department in London.

South Shields.—The Corporation is about to place an order for two Edison accumulator omnibuses with seating capacity of 23.

Spain.—April 16th. Municipal authorities of Arænjuez, Concession for the electric lighting of the town until the end of the year 1919.

Swansea.—March 13th. Corporation. Cable ducts, cables, pilot and telephone wires, joint-boxes, &c. See "Official Notices" February 27th.

Swindon.—March 18th. Corporation. Cooling tower. See "Official Notices" March 6th.

Swinton and Pendlebury.—March 26th. U.D.C. 12 months' supply of cable, joint-boxes, joint-box compound, bitumen, &c. See "Official Notices" March 6th.

Townhill (Dunfermline).—Doubling plant at Townhill Station of the Fife Electric Power Co. Secretary, Fife Electric Power Co., Townhill, Dunfermline, Fife.

Wallasey.—April 7th. Economisers, extra-high-tension cables, extra-high-tension switchboard, engines alternators and condensers, hand-power overhead travelling crane rotary converters, transformers, water-tube boilers, for the Borough Electricity Department. See "Official Notices" to-day.

Warrington.—March 14th. Corporation Gas Committee. Dynamo, 220 volts direct-current, 30 KW. Particulars from Mr. W. S. Haddock, General Manager, Gas Offices.

March 17th. Electricity Department. Tenders for scrap metals. Mr. F. V. Mathias, Electrical and Tramways Engineer

March 31st. 750-KW. rotary converter. E.H.T. switchboard panel, for Electricity and Tramways Committee. See "Official Notices" March 6th.

Worle (Somerset).—March 19th. Street lighting for the Parish Council. Mr. Robert K. Clay, Clerk, Virginia Villa, Worle.

CLOSED.

Accrington.—The Corporation has purchased a 30-H.P. motor tower wagon from Messrs. Leyland Motors, Ltd., for use in the tramways department.

Australia.—NEW SOUTH WALES.—Postmaster-General's Department :—

3,000 transposition insulators, £189 ; 10,000 pattern "A" insulators, £266 25,000 pattern "B" ditto, £323.—Theodore Zwicker & Co.

3,200 C.B. wall pattern telephones, £6,000.—James Paton & Co.

21,000 steel spindles for use with various insulators, £433.—Williams and Co.

11,875 steel spindles for "B" insulators, £195.—Shaw Wireless, Ltd.

QUEENSLAND.—

800 strips protectors, £1,860 ; 200 ditto, £560 ; 3,000 double-pole protectors, £500.—Western Electric Co., (Aus.), Ltd.

N.S.W.—PUBLIC WORKS DEPARTMENT.—

For Homebush Abattoirs—Three-phase induction motors, £604.—Falkiner Electric Co.

Paper-insulated, lead-covered cable and accessories, £1,352.—W. T. Henley's Telegraph Co., Ltd.

CITY OF MELBOURNE.—

Bare hard-drawn copper cables, £450.—B.I. and Helsby Cables, Ltd.—*Tenders.*

BALMAIN.—Messrs. Johnson & Phillips, Ltd., through their Australian agents, have secured the contract for the supply of transformers.

Batley.—The T.C. has made contracts with the Brush Electrical Engineering Co., Ltd., for a 1,200-KW. Ljungström turbo-generator, and with the British Westinghouse Electric Co., Ltd., for rotary converters.

Bradford.—The Corporation Electricity Committee has accepted the following offers :—

Erection of a battery room at Valley Road electric works.—Thos. Obank and Sons, £344.

Constructional iron and steel work for the battery room.—Redpath, Brown and Co., Ltd., £659.

The Tramways Committee has accepted the tender of the North-Eastern Steel Co., Ltd., for 800 tons of steel girder tramway rails, at £6 6s. per ton ; and that of Messrs. Thermit, Ltd., for 800 welding portions required for the welding of rail joints, at 19s. 6d. per portion.

Messrs. Tramways Supplies, Ltd., whose tender was accepted for trolley bases for trolley vehicle cars, having refused to sign the formal contract, the latter has been cancelled, and in lieu thereof the tender of Mr. C. H. Spencer to execute such work, at £370, is to be accepted.

Burton-on-Trent.—The following tenders have been accepted by the T.C. for the supply of coal to the electricity works :—

Marriott & Co.—3,000 tons Swadlincote and 1,000 tons Netherseal.
Salisbury & Wood.—1,000 tons Bretby and 1,000 tons Ibstock.
R. B. Barrett.—4,000 tons Kingsbury.

Bury.—The T.C. has sealed an agreement with Messrs. H. Lotery & Co. for the supply of tramwaymen's uniforms.

Canada.—WINNIPEG.—Messrs. Johnson & Phillips, Ltd., have secured the annual contract for the supply of three-phase transformers for the City of Winnipeg, through their Canadian agents.

Colchester.—The T.C. has accepted the tender of Messrs. Joslin, Ltd., of Colchester, for lighting, fittings, ironmongery, grease and oils for the tramways for a year ; and that of Messrs. Williams & Co. for rubber and fibre.

Croydon.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a further contract for the annual supply of tantalum traction lamps for tram lighting, and "Wotan" drawn-wire lamps, for the county borough of Croydon.

Exeter.—The E.L. Committee recommends that the tender of the British Thomson-Houston Co. be accepted for a 1,000-KW. high-pressure steam turbo-alternator, at £4,211.

Ipswich.—The Corporation has placed the following contracts :—

Alternator, rotary converter, automatic voltage regulator and certain switchgear.—British Westinghouse Electric and Manufacturing Co., at £2,213.
Three 50-kw. transformers and a testing transformer.—Messrs. Ferranti, Ltd., at £194.
High and low-tension switchgear for main power station and sub-stations.—Voigt & Haeffner (England), Ltd., at £1,993.
Two rotary converters for Duke Street converter sub-station.—British Westinghouse Electric and Manufacturing Co., at £1,566.
High and low-tension underground cables. Secs. A and B.—Ateliers de Constructions Electrique du Nord et de l'Est (agents, W. H. Butler and Co.), at £6,158.
Fused mains disconnecting boxes for four-core three-phase l.t. distributors.—Messrs. W. Lucy & Co., of Oxford, at £196 (excluding fuses).
Service boxes.—The British Insulated and Helsby Cables, Ltd., Prescot, at £40.

London.—L.C.C.—The Stores and Contracts Committee recommends the acceptance of the following tenders for the supply of bitumen, pitch and green oil for the tramways department :—

Schedule No. 47, for the year ending December 31st, 1914.—E. Catchpole and Sons, Item 3 (one-half of estimated quantity); Forbes, Abbott and Lennard, Ltd., Item 2 (one-half of estimated quantity); Grindley and Co., Ltd., Items 2 and 3 (one-half of estimated quantity for each item); W. H. Keys, Ltd., Item 1.

The Highways Committee reports the receipt of the undermentioned tenders for 150 uninsulated trolley heads with booms, required in connection with the equipment of electric tramcars :—

Brecknell, Munro & Rogers, Ltd.	(accepted)	£195
British Westinghouse Co., Ltd.		195

The Committee accepted the tender indicated, as the firm are the actual manufacturers of the material, and their time of delivery is favourable.

The Committee has arranged for 100 car-sets of unbreakable grid rheostats, to be supplied by the makers, the Electro-Mechanical Brake Co., Ltd., for the tramways department.

The Education Committee has received the following tenders for installing electric light at the County Secondary School, Brockley :—

John C Christie (accepted)	£552	C. Cathcart & Co.	£600
Arthur Newman, Ltd,	559	G. F. Taylor & Co.	688
Lund Bros. & Co.	565	G. Weston & Sons, Ltd.	690

W. Dickinson & Co., £907.

The Metropolitan Water Board has accepted the tenders of Messrs. Buck & Hickman, at £147, for a motor-driven 8½-in. centre lathe; and the Selson Engineering Co., Ltd., at £60 10s., for a motor-driven vertical pipe-drilling machine. The tenders of the Maxim Works, Ltd., and the B.I. and H. Cables, Ltd., have also been accepted for annual supplies of electric lamps, electric wire and accessories.

The tender of Messrs. Toy & Winslow has been accepted by the Metropolitan Asylums Board for an electric charging apparatus at the Mead Ambulance Station; and that of Mr. H. J. Godfrey, at £68 10s., for an electric motor for driving a saw-bench.

CAMBERWELL.—The B.C. has accepted tenders for annual supplies of electric lamps from Cryselco, Ltd., Feld Bros. & Co., Ltd, and Brimsdown Lamp Works, Ltd.

HACKNEY.—The Electricity Committee reports that a further extension of the generating plant is necessary, and recommends that orders be given to Messrs. Willans & Robinson, Ltd., for a 5,000-kw. turbo-alternator, with condensing plant and accessories, at £13,500, and to Messrs. Ferranti. Ltd., for the necessary extensions of the switchgear, for £374; also that the pipework necessary be carried out as an extra to the contract with the Brightside Foundry and Engineering Co., Ltd.

WANDSWORTH.—The Guardians have accepted the tender of Messrs. Waygoods, at £94, for carrying out repairs to the two lifts at the St. John's Hill Infirmary.

L. & N.W. RAILWAY.—Messrs. Scholey & Co., Ltd., have received from the Maschinenfabrik Oerlikon an order for their special tool-steel gear wheels and pinions for the motor equipments to be used in the electrification scheme of the L. & N.W. Railway.

Manchester.—The Libraries Committee has accepted the tender of Messrs. Bertram Thomas for an electric lighting installation at the Chorlton-cum-Hardy branch library.

The Education Committee has accepted the tender of Messrs. W. P. Theermann & Co., Ltd., for an electric lighting installation at the North Manchester Secondary School.

The following tenders have been accepted by the Electricity Committee :—

Babcock & Wilcox, Ltd.—Two water-tube boilers and induced-draught plant at Stuart Street.
Lancashire Water Cooler Co.—Water cooler at Stuart Street station.
Edison & Swan Co., Ltd.—High and low-tension switchgear at Dickinson Street.
Crompton & Co., Ltd.—Balancing plant.
Vaughan & Son, Ltd.—7½ tons overhead travelling crane.
British Westinghouse Electric Co., Ltd., Electric Construction Co., Ltd., and Ferguson, Pailin & Co.—High and low-tension switchgear for sub-stations.
B.I. & Helsby Cables, Ltd., Johnson & Phillips, Ltd., Connolly Bros., Ltd., Chas. Macintosh & Co., Ltd., and Electrical Engineering and Equipment Co., Ltd.—Supplies of cable.

Middleton.—The tenders of Messrs. John Hulbert and C. B. Lockwood, for coal for the electricity works for 12 months, have been accepted.

Nelson.—The T.C. has accepted the tender of Mr. B. Schabatt for wiring the new Council Offices.

Newcastle-on-Tyne.—The City Council, on 4th inst., sealed a contract with Messrs. C. A. Parsons & Co., Ltd., for the supply of a duplicate turbine for Manors power station, at £8 170.

Newport (Mon.).—The B. of G. on Saturday accepted the tender of Messrs. R. Alger & Sons, of Newport, for E.L. fittings for a year.

Scarborough.—The T.C. North Side Sub-committee has accepted the tender of Messrs. Walker & Hutton for the lighting of Peasholm Park by electricity.

The Brightside Foundry and Engineering Co., Ltd., have secured the contract for a complete electric lighting equipment for Scarborough workhouse and infirmary.

Sheffield.—The following tenders have been accepted by the City Council :—

Gilbert, Heathcote & Co.—Constructional steelwork for extensions to the boiler house at the electricity works, £12,350.
Wellerman Bros., Ltd.—Additions to transformer sub-stations.
Wolseley Car Co.—One four-cylinder motor-wagon for the Electricity Department, £550.
T. A. Ashton, Ltd.—Wiring the Attercliffe baths, £128.
Electric Construction Co., Ltd.—Three feeder panels, £149.
Stirling Boiler Co., Ltd.—Retubing two Stirling boilers at Kelham Island power station, £703; two superheaters, £320.

The following tenders have also been accepted for annual supplies :—

Electrical fittings.—Marsh Bros.; Tasker, Sons & Co.; Makin & Co., Ltd.; Ediswan Co., Ltd.; Benton, Holdsworth & Co.; T. A. Ashton, Ltd.; General Electric Co., Ltd.; I.-R., G.-P. and T. Works Co.; Hallamshire Electric Co., Ltd.; David Ashton & Co., Ltd.

South Shields.—The Corporation has accepted the tender of Edison Accumulators, Ltd., for the supply of two electric motor-omnibuses for the Tramways Committee.

Walsall.—The following tenders have been accepted by the T.C. :—

Ferranti, Ltd.—150-k.v.a. transformer, £112.
Walsall Electrical Co.—Switchgear, £50.
General Electric Co.—Meter, £20.

West Ham.—The T.C. has extended the contract of the British Westinghouse Co. for transformers for a further two years as from April 1st next, the prices to be as at present, but subject to a discount of 2½ per cent. This will mean a net reduction of 2½ per cent. on the present contract, the credit also being extended from 7 to 30 days. The Council's contract with the Fuller Electrical Co., Ltd., is also to be extended for a further year on the basis of an advance of 15 per cent. on the present contract prices. The following tenders have been accepted for annual supplies :—

Electrical fittings and accessories.—Davies, Kent & Stewart; J. H. Tucker and Co.; Baxter & Caunter; Falk, Stadelmann & Co., Ltd.; Feld Bros. & Co., Ltd.; Edison & Swan Co.; J. & H. Grevener; E. Dewhurst; General Electric Co., Ltd.
Insulated wires and cables.—Gillespie & Beales; Armorduct Manufacturing Co.

Wolverhampton.—The T.C. has accepted the tender of Messrs. W. Hayward & Sons, at £1,012, for steel work and bunkers for the boiler house extension, and that of the United Electric Car Co., Ltd., for fixing six additional top-covers to cars, at £101 each. The reciprocating engine plant is to be repaired by Messrs. Belliss and Morcom, Ltd., at £95.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week :—

Monday, March 16th.—"A" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Tuesday, March 17th.—"B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Wednesday, March 18th.—All Companies. Rating examination, 7 to 10 p.m.
Thursday, March 19th.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Friday, March 20th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Saturday, March 21st.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

Copper.—The visible supply bears up bravely against demand, although, of course, the real test of its extent will come when the present unpleasant problems influencing all securities are a little more advanced towards solution. For the end of February, Messrs. Merton's circular shows English stocks of 10,399 tons, a decrease of only 20 tons on the figure for the end of January. The total visible supplies for Europe are given as 26,953 tons, an increase of 1,109 tons for the month. Demand has been quite unusually brisk, total deliveries being 52,390 tons. European arrivals from America have been considerable, 38,655 tons, against an average for the 12 months of 33,000 odd. Spain and Portugal are also strong, though small in actual quantity. Chilian and Australian shipments are—the former slightly below the average, the latter just over. American stocks lost 1,850 tons during January, and at the end of the month the world's supply showed 5,126 less than for the end of last year.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, March 13th. At 8 p.m. At Imperial College of Science, South Kensington. Ordinary meeting. Papers on "Time Measurements of Magnetic Disturbances and their Interpretations," by Dr. C. Chree, F.R.S.; "The Asymmetric Distribution of the Secondary Electronic Radiation produced by X-Radiation," by Mr. A. J. Philpot.

Manchester Association of Engineers.—Saturday, March 14th. At Grand Hotel, Aytoun Street. Topical Discussion Evening.

Institute of Marine Engineers.—Monday, March 16th. At 8 p.m. Discussion on Fuel Test.

Junior Institution of Engineers.—Monday, March 16th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "Some Practical Notes on the Running of Gas Engines and Gas Producers," by Mr. W. A. Tookey.

Friday, March 20th. At 8 p.m. At 39, Victoria Street. Paper on "Aeroplanes as Engineering Structures," by Mr. W. H. Sayers.

(North-Western Section).—Friday, March 20th. At 7.45 p.m. At Municipal School of Technology. Mr. Tookey's paper.

Royal Society of Arts.—Monday, March 16th. At 8 p.m. At John Street, Adelphi. Howard Lecture on "Surface Combustion," by Prof. W. A. Bone, F.R.S.

Illuminating Engineering Society.—Tuesday, March 17th. At 8 p.m. At House of Royal Society of Arts, John Street, Adelphi. Paper on "A Comparison between Illumination Estimates and Performance in Practice," by Mr. W. C. Clinton.

Institution of Civil Engineers.—Tuesday, March 17th. At 8 p.m. At Great George Street, S.W. Discussion on following papers to be concluded:—"Rail-Steels for Electric Railways," and "Rail-Corrugation and its Causes." And papers to be read:—"Some Recent Developments in Commercial Motor-Vehicles," by Mr. T. Clarkson; and "Comparative Economics of Tramways and Railless Electric Traction," by Mr. T. G. Gribble.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, March 17th. At 8 p.m. At Rankine Hall, 39, Elmbank Crescent, Glasgow. Ordinary meeting.

Electrical Trades Benevolent Institution.—Wednesday, March 18th. At 2.30 p.m. At Institution of Electrical Engineers, Victoria Embankment. Annual general meeting.

Chemical Society.—Thursday, March 19th. At 8.30 p.m. At Burlington House. Paper on "The Ignition of some Gaseous Mixtures by the Electric Discharge," by Messrs. H. F. Coward, C. Cooper and J. Jacobs.

Institution of Electrical Engineers.—Thursday, March 19th. At 8 p.m. At Victoria Embankment. Discussion on "Electric Battery Vehicles."

(Newcastle Local Section).—Monday, March 16th. At 7.30 p.m. At Armstrong College. Demonstration of Electrical Measuring Instruments, by Mr. Fawssett and Dr. H. Stroud.

(Western Local Section).—Monday, March 16th. At 2 p.m.: Visit to Messrs. E. S. & A. Robinson, Ltd., Malago Factory. At 4.30 p.m.: Annual meeting at the Merchant Venturers' Technical College. At 5 p.m.: Paper on "The Construction of a Wireless Station," by Mr. C. G. Roach.

(Manchester Students' Section).—Tuesday, March 17th. At 7.30 p.m. At Municipal School of Technology. Paper on "Diseases of Static Transformers," by Mr. J. L. Thompson.

(Students' Section).—Wednesday, March 18th. At 7.45 p.m. Paper on "Electricity in Docks and Harbours," by Mr. J. M. Heslop.

Royal Institution of Great Britain.—Thursday, March 19th. At 3 p.m. At Albemarle Street, W. Paper on "Heat and Cold," by Prof. C. F. Jenkin.

Friday, March 20th. At 9 p.m. Paper on "Fluid Motions," by Lord Rayleigh, F.R.S.

Saturday, March 21st. At 3 p.m. Paper on "Recent Discoveries in Physical Science," by Prof. Sir J. J. Thomson, F.R.S.

Institution of Mechanical Engineers.—Friday, March 20th. At 8 p.m. At Storey's Gate, S.W. Paper on "The Chemical and Mechanical Relations of Iron, Tungsten, and Carbon, and of Iron, Nickel and Carbon," by Dr. J. O. Arnold, F.R.S., and Mr. A. A. Read.

Electro-Harmonic Society.—Friday, March 20th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

Greenock Electrical Society.—Friday, March 20th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Paper on "Sub-station Equipment," by Mr. D. McDougall.

Association of Mining Electrical Engineers.—Friday, March 20th. At 7.30 p.m. At Royal Technical College, Glasgow. Paper on "Rock Drills," by Mr. C. E. Hart.

Association of Engineers-in-Charge.—Saturday, March 21st. Annual Dinner.

NOTES.

Technical Education in Australia.—An Australian paper states that one of the main features of the reorganised scheme of technical education brought about by the institution of trade schools is the creation of advisory committees, the members of which are to be appointed for two years. The functions of these advisory committees are to make suggestions as to the suitability and scope of the syllabus of instruction, to visit the classes periodically, to advise as to the efficiency of the teaching appliances, and to assist in awarding the certificates. The Electrical Engineering Trades Advisory Committee will consist of one member nominated by the Electrical Engineering Association; five from the Electrical Trades Union of N.S.W.; the Electrical Engineer, City Municipal Council; the Electrical Engineer, N.S.W. Government Tramways; Messrs. J. E. Donohoe, manager of the Electric Light and Power Supply Co., Ltd., T. Thompson-Bower, A. J. Hanson, F. O'Donnell, Allen Warburton and A. E. Waddell.

The Electric Vehicle Association of America.—Owing to the marked growth of the activities of the Electric Vehicle Association of America, it has been found necessary to establish the office of permanent executive secretary. Mr. A. J. Marshall has been selected to fill the new appointment, and the permanent offices of the Association have been located in the New York Engineering Societies' Building, Thirty-Ninth Street, New York.

An All-Electric Colliery.—In the *Daily Mail* of Wednesday last there was an interesting article by Mr. Basil Clarke on the reopening of Lostock Lane Pit; this pit was closed owing to unprofitable working, but has been equipped throughout with electrical machinery, including winding plant, and is now running successfully at twice its former output. The pit is the first in Lancashire to be worked entirely by electrical energy, which is supplied by the Lancashire Electric Power Co.

A South Metropolitan Electrical Exhibition.—There was opened yesterday, at the showrooms of the South Metropolitan Electric Light and Power Co., Ltd., 181-185, High Street, Lewisham, an Electrical Exhibition, which it is hoped every resident in the neighbourhood will attend whether he be or be not one of the 12,000 to whom invitation cards have been sent. A varied collection of apparatus is admirably arranged to demonstrate the advantages and flexibility of electric lighting and to illustrate the applications of electricity in other fields. The Exhibition will be closed on March 21st, unless circumstances justify its being kept open longer. The permanent showroom contains a comprehensive selection of the latest types of lighting fittings and accessories; electrically-heated kettles, toasters, saucepans, porringers and other kitchen and dining room cooking and heating appliances, including "Tricity" and "Eclipse" ovens, and a variety of electric radiators and convectors. Among the latter is a heater controlled on the Grundy thermostat system so that the heating elements are switched out of circuit when the room temperature reaches a predetermined limit; 40 of these heaters have recently been installed in a local picture palace, and a large number are in use in offices, &c. All the hot water required on the company's premises is provided by a "Therol" heater in the showroom, and the offices are heated by radiators and Belling fires. Among the innumerable devices exhibited are electric hat pads and irons, cigar lighters, displacement and high-vacuum suction cleaners, bachelors' grills, sterilisers, fans, ozone apparatus, vibrators, hot-air douches and an electric fountain. The lamp and lighting exhibits include Osram axial lamps, screw socket miniature lamps for "chain" decorations, half-watt "Wotan" lamps, and a demonstration board showing the stages of lamp manufacture. Other demonstration boards show wiring conductors and accessories, and a special exhibit has been arranged to educate the public in the magnitude of the work undertaken by the company in generating and distributing electrical energy. An electrically-driven sewing machine is exhibited, such as is used industrially in large numbers in this district; and an electrically-driven hack-saw demonstrates one of the many applications for electricity in small workshops. Special temporary exhibits include an electric bedroom and dining room. The arrangement and equipment of these rooms are really fine, and no more convincing demonstration of the applications, merits and convenience of electricity could be desired. Prospective purchasers will find that they are not restricted in choice, and thoroughly sound advice is given concerning the relative merits of various apparatus for particular services. The price of everything shown is right, and the company makes special arrangements for cash or hire-purchase, or mere renting of wiring and apparatus. A new scheme has just been inaugurated, under which the company wires a house for nine lighting points and provides everything complete, including fittings, lamps, shades and switches, &c., free of cost. If the consumer is dissatisfied at the end of three months, the gas lighting equipment will be replaced free of charge. Otherwise, the client may buy the electrical equipment (by cash or hire-purchase), or he may rent it at 4½d. per week. Competition with the South Metropolitan Gas Co. is especially keen, but during last year the Electric Co. established a record increase in consumers, lamps and net revenue (the latter has increased 50 per cent. during the last three years), and doubtless yet more rapid progress will be the reward of their present campaign. Houses of £26 per annum, or even lower rental, are being "electrified" by streets at a time, prepayment meters being very popular in this field since their use eliminates specific meter rents. Among the smaller electric heating appliances, irons, milk heaters and kettles are most popular. Individually the present exhibits represent the latest and best domestic electric fittings and appliances, and, as a whole, they are arranged to produce a most artistic effect—which is not, unfortunately, always the case in showrooms. To the good effect produced by the exhibits are added interesting and instructive periodical addresses, music and electric refreshments. Subsequently, there comes into operation a first-class publicity and canvassing service, in the case of residents in the district. The company is to be congratulated, not only on the excellence of the present Exhibition, but also on the energetic and effective means which it adopts continuously to refute the absurd fallacy that electricity is still in its infancy and to demonstrate that electrical methods and apparatus are well tried and have attained a perfection of manufacture and diversity of standard forms, which make them neither scientific curiosities, luxuries nor toys, but necessities capable of rendering real service at a cost which is decreasing steadily, while that of practically every other commodity increases.

Foreign Trade in February.—The following are the electrical and machinery figures given in the official returns for February trade:—

IMPORTS.	*Month of Feb.* £	*Inc. or dec.* £	*Two months, 1914.* £	*Inc. or dec.* £
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	143,200	+ 22,243	281,711	+ 24,562
Machinery	643,877	+ 123,654	1,243,268	+ 49,318
EXPORTS.				
Electrical goods and apparatus, excluding machinery and unsulated wire ...	258,218	− 97,747	511,939	− 212,644
Machinery	3,033,614	+ 320,985	6,421,349	+ 596,246

The Norwegian Electrochemical Export Trade in 1913.—Our Special Correspondent writes that the electrochemical industry in Norway has during recent years made progress which is quite unprecedented in the history of any country, in proportion to the population, and will very likely in a few years become one of the most important factors of the political-social economy of the country. The most important manufactures are now the nitrates, and Norwegian nitrates are already a well-known brand in the world's markets. The exports are increasing from year to year, and will no doubt continue to do so in the same ratio as the waterfalls are being harnessed and brought into use. The quantity of nitrates shipped from the manufactories at Saaheim and Notodden amounted in 1913 to 70,171 tons, as compared with 51,701 tons in 1912. There is thus an increase of about 40 per cent in weight, and the value has increased about 35 per cent. The value of the exports was in 1913 £611,100, as against £450,000 in 1912, while 1911 had only the very modest figure of £77,800 to show.

Another product also used for fertilising purposes is cyanamide which at the present time is manufactured at Odda, in Hardanger. The shipments of this product show a similar progress; thus in 1913 there were exported 22,111 tons, as compared with 13,892 tons in 1912, an increase of about 60 per cent. On the basis of the same market price as in 1912, the value of the exports amounted in 1913 to nearly £200,000, which compares very favourably with the corresponding figure for 1910, when this industry was in its early stages, which was £38,000.

As regards calcium carbide, the shipments show a small increase, viz., from 63,100 tons in 1912 to 66,876 tons in 1913. The value was about the same as that of the nitrates in 1912, viz., £450,000, but in 1913 the nitrates took the lead as the most valuable electrochemical product exported.

Of other products may be mentioned sodium nitride, ammonium nitrate and nitrate of soda, of which the total shipments during 1913 amounted to 17,028 tons, as against 13,480 tons in 1912. The electro-chemical industry is thus making good progress in every direction, and the time is quite within sight when these figures, at all events in respect of value, will have grown by 100-200 per cent., or even more. The Rjukan Nitrate Works No. 2 will be in operation in the course of next year, and when the Matre Waterfalls, not to speak of the large plants of the Aura Co., which are to be compared with those at Saaheim in regard to capacity, are completed, it is easy to understand that the above-mentioned expectations will be verified.

The increasing demand for artificial manures does not give this industry any opportunity for over-production. The market prices are still based on the quotations for the natural nitrates from Chile, although a change may easily take place, and the product from Chile become dependent on the artificial nitrates.

Electricity in Agriculture.—Particulars were given last month before an Agricultural Committee of the House of Commons, Ottawa, of the manner in which electrical power is being supplied to farmers by the Hydroelectric Commission of Ontario. The Commission builds the line to the farmer's gate, and charges him for the energy supplied, as well as a "service charge." It has been shown that a 5-H.P. equipment can do all the work of a 100-acre farm. The minimum contract is for ½ H.P., at $51 per annum; 1 H.P. costs $66: and 2 H.P. $96. About 500 farmers are connected in Western Ontario.

Electro-Harmonic Society.—The last smoking concert of the season will be held at the Holborn Restaurant (King's Hall) on Friday evening next, March 20th, at 8 o'clock. Mr. Justus Eck will be in the chair. The programme includes the following arrangements:—Vocalists, Mr. Robert Radford (baritone), Mr. Robert Howe (baritone), Mr. Anderson Nicol (tenor); violoncello, Mr. W. H. Squire; impressions from life, Mr. H. Hewson-Brown; magician, Prof. Anders; ventriloquist, Mr. Alan Stainer; humorists, Mr. Fred Curtis and Mr. George Blackmore; entertainer at the piano, Mr. Warwick Pryce; solo pianist and accompanist, Mr. Bernard Flanders, A.R.A.M.

German Miners' Lamp Competition.—No fewer than 52 entries were received for the competition recently organised by the Verein fur den Bergbaulichen Interessen in Oberbergamtsbezirk Dortmund for miners' electric lamps and fire-damp indicators. Although a number have already been eliminated by the preliminary tests that have been held, it has been decided that practical trials in collieries will have to be carried out with the remainder, so that the judges' awards cannot be expected for some time to come.

Educational Notes.—The London County Council having failed to provide a larger grant for science classes, asked for by the University of London, the evening classes at Goldsmiths' College, New Cross (one of the colleges of the University), have been closed, and some of the staff have left. The students have appealed to the Deptford Borough Council for its intervention.

Dinners.—About 35 members of the staff of the British Insulated and Helsby Cables, Ltd., Helsby Works, attended the annual staff dinner at the Hotel St. George, Liverpool, recently, and afterwards spent the evening at the Empire Theatre.

British Engineers' Association.—The annual dinner of this Association was held on Friday last at the Hotel Metropole, Mr. Douglas Vickers in the chair.

Inquiry.—Makers of "Kenrick" electric irons are asked for.

Institution and Lecture Notes.—Association of Electrical Station Engineers.—A general meeting was held at Stone's Restaurant, Ludgate Hill, London, E.C., on March 3rd. The attendance numbered about 60. A definite statement was made dissociating the A.E.S.E. from any Trade Union, and, after a short discussion, a resolution was put to the meeting confirming this statement, which was carried with one dissentient. A bad case of reduced salaries of the charge engineers in a large private power station was brought to the notice of the meeting, and it was resolved that all members of the Association be circularised with the facts of the case. The Weekly Rest Day Bill, which is to be re-introduced into Parliament next May, was discussed, and some comment was made on the clause which would make it compulsory for all workers to have 26 Sundays per year as rest days. The Hon. Secretary made a brief statement with regard to the circular letter sent to all London supply authorities asking them to consider the advisability of forming a committee to meet the A.E S.E.; he stated that more than 75 per cent. of those who were circularised had acknowledged the letter, and a number of chief engineers had indicated that they were in sympathy with the objects of the A.E.S.E. The Secretary hoped to be able to make a further statement at the next general meeting.

The result of the ballot for the new London District Committee was made known to the meeting.

A general business meeting was held recently at the Hotspur Hotel, Newcastle-on-Tyne, at which 40 members were present. The meeting indicated that it viewed with satisfaction the policy of the A.E.S E. in that it would not take action with any Trade Union. This policy has now been agreed to by the majority of the branches of the Association.

An Executive Committee meeting was held at the head office of the A.E.S.E. on March 7th, the proceedings of which will be printed and sent to each member in due course according to rule.

Nottingham Society of Engineers.—A company numbering nearly 100 assembled for the annual dinner of the Society on Friday last; Mr. J. Crawford, the President, occupied the chair. The toast of "The Society" was proposed by Mr. T. V. Miles, who described the present as essentially the age of the engineer. The labour-saving problem was one they would all have to consider within the next few years. The President, replying, spoke with feelings of pride of the healthy position of the Society. He agreed that if engineers, by the expenditure of money upon plans and machinery, could do anything to obviate the exhausting, and in many cases unnecessary, physical labour which many men were called upon to perform in this country they would only be doing their duty to the community at large. The labour unrest was merely a sign in many ways of personal ambition. They were all anxious to get on, and surely they were not going to deny to the working man that right which they claimed for themselves. He was sorry to say that at the present time engineering, as a whole, was not prosperous, but he hoped that things would not develop into a slump.

Mr. C. J. Hofton proposed "The City and Trade of Nottingham." Many of those present, he said, had witnessed the remarkable growth that had taken place in recent years in Nottingham, and yet they were not satisfied. He suggested to the Corporation the importance of endeavouring to attract new industries to the city, and pointed out the excellent work in that direction accomplished by the town of Derby.

Councillor Major Walker, in reply, said that as regarded new industries, they had greater difficulties to contend with than had their neighbours at Derby. Rates were higher, and high rates were an obstacle to the introduction of new industries. Moreover, he did not think any city or county paid higher wages than did Nottingham and Notts., and this, combined with high rates, tended to keep away new trades. If the Government could only be induced to take over and develop the waterways of the country, he believed it would do something to assist new trades, and Nottingham would be one of the principal cities to be benefited.

The speeches were interspersed with glees and songs, some well-known local vocalists contributing to the pogramme.

Institution of Electrical Engineers.—At the meeting of the Manchester Local Section on Tuesday last, Mr. F. Lydall read his paper on "Motor and Control Equipments for Electric Locomotives." The discussion was closed.

The Electrical Contractors' Association of Scotland (Glasgow Branch) recently held an "At Home," spending a pleasant evening at whist, enlivened with a musical programme.

Association of Mining Electrical Engineers.—Mr. Alex. Anderson, president of the Association, read a paper on "Electrical Transmission in Mines," at Leeds, on Saturday, before a joint meeting of the Yorkshire branches of the Association of Colliery Managers and the Association of Mining Electrical Engineers.

Greenock Electrical Society.—At a recent meeting a paper on "Power Transmission" was read by Mr. A. Zoller, in which he dealt with the advantages and disadvantages of overhead and underground cables for high-tension transmission.

At the meeting of the Yorkshire Local Section, on Wednesday last, Mr. H. H. Perry read his paper on "A Two-Rate Tariff System without Time-Operated Control." The discussion was closed.

The Reichsanstalt Extended.—A new building, costing £38,000, was opened at the Physikalisch-Technische Reichsanstalt, in Charlottenburg, on March 8th. It is to undertake the accurate testing of large plant and machines, and also high-tension work.

Tuberculosis and X-Rays.—Dr. Manoukhin, of St. Petersburg, recently stated that he had attained remarkable results in the treatment of tuberculosis by X-ray radiation of the spleen, the effect being to destroy the excessive number of white blood corpuscles, which are formed in that body.

A Discount Dispute.—Before Mr. Registrar Wild, in the City of London Court, on Tuesday, a claim was made by Messrs. G. Weston & Son, electrical engineers, 153, Fenchurch Street, E.C., for the sum of 19s. 3d., balance of account for electrical fittings supplied, and work done, for Mr. P. Leapman, pawnbroker, 789, Commercial Road, E. The plaintiffs' representative said that the defendant had made a deduction of 10 per cent. discount from the account to which he was not entitled. The discount was only allowable upon payment of the account immediately after completion of the work. The defendant did not pay until four months after. The defendant: Will you tell the Registrar why you did not get your cheque? The plaintiffs' representative said they agreed to allow the defendant 10 per cent. if he paid at once upon completion. They had completed the work in September. The defendant: No, you did not. The plaintiffs' representative said that after the work was done the defendant maintained they had damaged the ceiling. It was a very old ceiling and would not bear touching without some of it falling down. For that reason the defendant refused to pay his cheque. They had repaired the ceiling since without prejudice. The Registrar pointed out to the defendant that he might have a counterclaim for damage done to his ceiling, but that was the subject of another claim. He had entered into a contract for the work in that case to be done, and on completion if he paid he was to get 10 per cent. If the defendant wanted his discount he must pay the account. The defendant, in order to save the discount, must keep within the terms of the contract. Judgment was entered for the plaintiffs for the amount claimed, the Registrar remarking that the defendant could bring his action against the plaintiffs for the damage to the ceiling. The defendant: All right, I will, and I will bring it in this Court. They have put up a matchboard ceiling instead of a plaster one.

Parliamentary.—LONDON ELECTRIC SUPPLY BILL.—It was announced in the newspapers on Tuesday that a conference of chairmen and directors of the London Electric Supply Companies was held on the 3rd inst., when it was resolved by a large majority that the companies could not give their support to the scheme put forward by the promoters in connection with the London Electric Supply Bill now before Parliament.

In the above connection we are asked to point out that such notices tend to mislead in so far that the companies (*i.e.*, the shareholders) have not come to any decision on the question for the reason that the scheme has not yet been put before them. At none of the annual meetings yet held has any vote or resolution been taken, but the chairmen have indicated that the shareholders may anticipate that the scheme will shortly be laid before them. It is stated that since the above shareholders' meetings, no further conference has taken place between the directors of the companies and the bankers. From observations made by Mr. J. B. Braithwaite at the meeting of the City Co. on Wednesday, it appears that there is a difference of opinion among the directors of the companies themselves.

YORKSHIRE ELECTRIC POWER BILL.—The House of Lords' Standing Orders Committee have decided not to dispense with the Standing Orders in the Yorkshire Electric Power Co.'s Bill; and consequently the Bill cannot proceed.

In the House of Lords, on 3rd inst., the North Metropolitan Electric Power Supply Bill, and the Poole, Sandbanks and Westbourne Railless Traction Bill, were read a second time.

Marconis Again.—Another Committee of Inquiry has been appointed.

As if, by the thickening
Of all that is sickening
We hadn't been sated
Of this long ago!
Another Committee,
Without any pity,
Will soon, it is stated,
Be all in the know.

A plague on Marconis,
Whatever the bone is
Of endless contention
They're trying to pick!
The subject is dreary;
Our minds have grown weary;
And nothing they mention
Can make us more sick!

—*Financial Times.*

The Tramways and Light Railways Association.—The annual meeting of the members of this Association was held on Friday last, followed by the annual dinner and smoking concert, at the Trocadero Restaurant, London. The Hon. Arthur Stanley, M.P., presided at the meeting, and the Right Hon. Viscount Chilston, president of the Association, took the chair at the dinner.

Finsbury O.S.A.—The eighth annual smoking concert of the Finsbury Technical College Old Students' Association is to be held at the Waldorf Hotel, Aldwych, on Friday, March 27th, at 8 p.m. The musical programme has been arranged by Mr. C. B. Nadand, A.M.I.E.E. Mr. H. A. Humphrey, the president, will take the chair.

For Sale.—A large quantity of electrical apparatus, &c., is to be sold by public auction, by Messrs. Percy Huddleston & Co., at Railway Arches, Dalling Road, Hammersmith, W., on Wednesday, March 8th. Particulars are given in our advertisement pages to-day.

Platinum.—It is reported that an extensive field of platinum-bearing ore has been discovered in Westphalia, richer than the Russian deposits. Doubt is thrown on the report on the London metal market.

Radiotelegraphy and the Solar Eclipse.—The British Association Committee for radiotelegraphic investigation announces the organisation of a special investigation into the effect on the propagation of electric waves of the total eclipse of the sun, on August 21st, 1914. The eclipse will afford an exceptional opportunity of adding to existing knowledge of the propagation of electric waves through air in sunlight and in darkness, and across the boundaries of illuminated and unilluminated regions. The eclipse will be total along a strip extending from Greenland across Norway, Sweden, Russia and Persia to the mouths of the Indus. In Russia the duration of totality will be a little more than two minutes. There are two main points calling for investigation. In the first place, the propagation of signal-bearing waves through air in the umbra and penumbra will probably obey laws different as regards absorption and refraction from those obeyed in illuminated air. In the second place, the strength, frequency and character of natural electric waves, and of atmospheric discharges, may vary, either because the propagation of natural waves from distant sources is facilitated or impeded by the eclipse, or, possibly, because the production of natural electric waves or atmospheric discharges is for some unknown reason affected by the eclipse. These points have previously been investigated to only a slight extent. The observers of signals during the solar eclipse of April 17th, 1912, nearly all agreed that the strength of the signals was greater during the eclipse than an hour before or after. There was only one special observation of strays during the same eclipse, when very pronounced and remarkable variations were recorded during the passage of the shadow-cone across Europe. To investigate the propagation of signals across the umbra it will be necessary to arrange for wireless telegraph stations on either side of the central line of the eclipse to transmit signals at intervals while the umbra passes between them. Stations other than those favoured by their proximity to the central line should endeavour to keep a complete record of the variations of signals during the eclipse.

The investigation of strays is of as great interest as that of signals. So far as is yet known, the natural electric waves reaching wireless telegraph stations in latitudes higher than 50° appear to travel mostly from the south. It is desirable that statistical observations of such waves be made all over the world, and especially at places within an earth quadrant of Southern Russia. It is also desirable that meteorological observations, including those of atmospheric ionisation and potential gradient, should be at the disposal of the Committee when considering the records of strays and signals. The Committee proposes to prepare and circulate special forms for the collection of statistics of signals and strays, especially within the hemisphere likely to be affected by the eclipse; it will endeavour to make provision for the transmission of special signals at times to be indicated on the forms; and it will offer for the consideration of the authorities controlling stations near the central line a simple programme of work.

The Committee will be greatly aided in the organisation of this investigation if those possessing the necessary facilities and willing to make observations during the eclipse will communicate with the Hon. Secretary, Dr. W. Eccles, University College, London, W.C., at the earliest possible date.

Water Power in the Highlands.—In the Parliamentary Papers, Mr. Cathcart Wason asked the Secretary for Scotland if he was aware of the continuing depopulation of the Highlands and islands owing to lack of profitable employment, and that much might be done to encourage extensive cultivation and industrial development by utilising the water power now running to waste. Mr. McKinnon Wood said the suggestion would receive consideration.

Coke from Peat.—Enterprise in Germany has hitherto rested satisfied with utilising peat for the production of portable fuel, or its conversion on the spot into heat for the generation of electricity at the bulk supply stations. Lately a new departure has been made at Elisabeth-Fehn, in the Grand Duchy of Oldenburg. Here a turf-coking plant has been erected on the moor which converts the peat directly into coke, in the ratio of 30 tons peat to 9 tons of coke, with gas and tar as by-products. The ovens are of a special design, and the gas generated is used, in the first place, to heat the retorts, and the surplus for the generation of electricity, which is employed to drive the peat-dredging machines. From the tar are obtained creosote oil, gas oil, paraffin, pitch, sulphuric acid and ammonia. Peat coke is specially adaptable as fuel for smiths' fires, as well as for various metallurgical purposes. It is especially suited to the production of high quality iron, and may thus be employed as a substitute for charcoal.—*Zeitschrift fur Elektrotechnik und Maschinenbau.*

Fatality.—According to the *Cornish Echo*, a young man named Arthur Thomas, 21, was killed at East Pool Mine on March 4th. Thomas was second electrician working under the East Pool and Agar Mines, Ltd., and was at the time of the fatality engaged in the transformer house at East Pool, connecting an overhead line to the 440-volt supply. He was found dead in a sitting position in the house.

Appointments Vacant.—Assistant telegraph engineer for the Government of the Federated Malay States, age 24-30 (£360 passage); junior assistant engineer for Bedford Corporation Electricity Department; shift engineer (£120) for Barnes U.D.C. Electricity Department; charge engineer (£115) for Swansea Electricity Department. Particulars are given in our advertisement pages.

Dynamicables' Dinner.—The anniversary dinner of the Dynamicables will be held on Wednesday, April 1st, with Mr. Robert Hammond in the chair.

Large British Locomotive Tests.—In view of the interest which attaches to the electric locomotive of the future, which shall meet the conditions of main line working in this country, we reproduce some recent tests carried out on one of the new four-cylinder 4-6-0 North-Western locomotives, which were described in a recent issue of the *Railway News*.

Two runs were made, one with a special train loaded up to 434 tons behind the tender, from Euston to Crewe, and one in ordinary service, but running independently of schedule, with a train load of 360 tons between Crewe and Carlisle. In each case a dynamometer car was included, and the mean speeds in the two trips were 59·6 and 59·4 miles per hour respectively, the distances being 158 miles and 141 miles. The weights on the three coupled axles of the locomotive are in each case between 19 and 20 tons; the total weight of engine 77¾ tons, and of engine and tender 117 tons. The tractive force of the locomotive is given as 23,000 lb., and the adhesive force (quarter adhesive weight) 33,040 lb.

On the first trip 25 indicator diagrams were taken. The draw-bar effort momentarily reached nearly 14 tons at starting, continuing at approximately 5 tons for the first mile, with another momentary peak of 9 tons. At one mile from the start the data show d.b. pull, 7 tons; d.b.-H.P., 870; I.H.P., 1,155; speed, 21 M.P.H. At 30 miles, the greatest power reading is shown:—d.b. pull, 3½ tons; d.b.-H.P., 1,150; I.H.P., 1,617; speed, 56 M.P.H. At the highest-speed reading, the figures were d.b. pull, 2 tons; d.b.-H.P., 860; I.H.P., 1,183; speed, 72 M.P.H. The great majority of the draw-bar readings were between 2 and 3 tons—the mean for the whole trip being 2·4 tons. Ten out of the 25 readings showed less than 1,000 H.P. at draw-bar, and the average was 975, while the average I.H.P. was 1,358. The average d.b.-H.P. was 71·8 per cent. of the average I.H.P.

In the second run, with the same engine and driver, the starting d.b. pull was 14 tons; another record was 10 tons after a signal check on a bank; 5⅝ tons was recorded at the top of Shap bank, and in drawing up the train at Carlisle for traffic purposes, the d.b. pull exceeded the limit of the dynamometer spring (16½ tons) momentarily. Seventeen readings were taken in the journey, the greatest power reading showing d.b. pull, 2⅝ tons; d.b.-H.P., 1,082; I.H.P., 1,669; speed, 69 M.P.H. The next three readings covering 3½ miles on a 1 in 75 up grade (to Shap) show d.b. pulls, 3⅛, $4\frac{5}{16}$, 5⅝ tons; d.b.-H.Ps., 1,082, 1,094, 1,187; I.H.Ps., 1,606, 1,593, 1,496; speeds 58, 42½, and 37 M.P.H. respectively. Twelve of the 17 readings show under 1,000 d.b.-H.P. and the average of all was 920; the average I.H.P. was 1,387, and the average d.b.-H.P. was 66·3 per cent. of the average I.H.P. The d.b. pull readings were mostly under 3½ tons.

The figures show what one of the finest British steam locomotives can do and what the electric locomotive will have to do in order to satisfy the requirements of its prospective users.

Electrolytic Alkali Works.—A correspondent of the *Manchester Courier* states that the works of the Electrolytic Alkali Co., Middlewich, Cheshire, which have been closed for some months, have been sold to a new company, and will be restarted. The concern has been in the Receiver's hands since May last; attempts to reconstruct the company and sell the works as a going concern failed, but on Saturday last the Receiver was authorised by the Judge to accept an offer he has received for the works complete. The old company, which was formed to manufacture soda, &c., by a patent process, had a capital of nearly £500,000.

Lamp Business in Germany.—The glow lamp cartel or trust embracing the manufacturers of Germany, Austria-Hungary, Holland, Italy and Switzerland, will come to an end on the 31st of the current month, after an existence of 10 years. The sales office of the union will, it is stated, be closed on that date. At its start the sales of the associated carbon lamp makers totalled some 27,000,000 lamps. The formation of a metal-filament lamp trust is considered improbable.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Bradford Corporation Electricity Committee has decided to advance the remuneration of the following officers in the electricity department. Mechanical and shift engineers: Mr. G. Flett, from 60s. to 65s. per week; Mr. W. Chapman, from 60s. to 65s. per week; Mr. R. D. Spurr, from 60s. to 65s. per week; and Mr. V. Horman, from 55s. to 60s. per week; Mr. F. Walton, chief draughtsman, from 65s. to 70s. per week; Mr. C. A. Gillin, mains engineer, from 70s. to 75s. per week; Mr. Q. Arbuckle, mains engineer, from 55s. to 60s. per week; Mr. A. J. Harris, works foreman (Bolton Road), from 60s. to 62s. 6d.; and Mr. H. D. Howarth, mains assistant, from 52s. 6d. to 55s. per week; Mr. F. Martin, correspondence clerk, from 47s. 6d. to 50s. per week; and Mr. A. G. Thompson, assistant correspondence clerk, from 35s. to 27s. 6d. per week. Other advances in salaries affect Mr. J. H. Schnauber, deputy electrical engineer (from £300 to £350); Mr. J. Fairburn, works superindent (£275 to £300); and Mr. C. W. Brown, deputy works superindent (£225 to £237 10s.). Consequent upon the resignation of Mr. J. E. Schofield, commercial assistant of the electricity department, the following appointments have been made:—Mr. Chas. E. Allsopp, to be commercial assistant (£250); Mr. F. H. Barnett, to be superintendent, consumers' department (advanced from £2 17s. 6d. to £3 7s. 6d per week); and Mr. H. W. Walker, to be installation inspector (advanced from 35s. 6d. to 47s. 6d. per week).

The Watford U.D.C. has granted the following increases to the undermentioned members of the staff at the electricity works, the alteration to take effect from April 1st next:—Mr. A. W. Barham, chief electrical engineer, from £250 per annum to £350, with increases of £50 on April 1st, 1915, and April 1st, 1916; Mr. C. D. G. Greenhalgh, assistant electrical engineer, from £150 per annum to £175, with increases of £15 on April 1st, 1915, and April 1st, 1916; Mr. J. E. Walley, mains engineer, from £135 per annum to £145, with a further increase of £10 on April 1st, 1915; Mr. G. A. Ayre, consumers' engineer, from £105 per annum to £120, with a further increase of £10 on April 1st, 1915; Mr. C. H. Tritton, senior shift engineer, from £95 per annum to £100.

Mr. A. Redfearn, chief assistant engineer at Darlington electricity works, has resigned. A mains superintendent at £200 is to be appointed.

Mr. Spink, second engineer-in-charge at Nuneaton electricity works, has resigned his position in order to take up the post of station superintendent at Worksop.

The Halifax T.C. on March 4th decided to increase the salary of the electrical engineer from £600 to £700 a year. Alderman A. Taylor, a Labour member, resisting the proposal, said a mad race was going on at present between all the large municipal authorities in the country to see who could pay the largest salary. It simply meant that what Halifax did that night half a dozen other Town Councils would be trying to do next week.

On the occasion of his marriage to Miss M. Blease, Mr. Jas. L. Wilkinson has been presented by the management, electricians and office staff of the Urban Electric Supply Co. at Glossop with a silver cake and fruit stand and Wedgewood tea set; and by the tramway staff with a salad bowl and servers.

Tramway Officials.—The Bradford Tramways Committee has authorised the following advances in salaries in the Tramways Department:—Mr. T. B. Moseley, chief clerk, from £165 to £190; Mr. J. W. Foster, engineering assistant, £245 to £270; Mr. T. Stirk, traffic superintendent, £235 to £250; and Mr. J. W. Dawson, assistant electrical engineer, £245 to £270, with a further £25 in April, 1915. Technical assistants: Mr. T. G. Richardson, shed superintendent, 64s. to 70s. per week; Mr. T. P. Sykes, engineer's assistant, 64s. to 70s.; Mr. S. Pearson, draughtsman, 49s. to 55s.; and Mr. H. Sharp, draughtsman, 38s. 6d. to 45s. Works foreman: Mr. A. Olivant, foreman linesman, 50s. to 55s.; Mr. T. Shillam, engineering foreman, 46s. to 48s. The Committee has also decided to advance the maximum wages of depôt foremen to 50s. per week, to be reached by annual increments of 2s. per week, with an immediate advance of 2s. per week.

The Colne Corporation Tramways Committee, on Friday last, considered eight applications for the post of tramways manager and reduced the number to the following three:—Mr. L. C. F. Bellamy, tramway manager, Ilkeston; Mr. F. G. Richardson, assistant tramway manager, Bradford; and Mr. S. J. Hosken, tramway manager and engineer, Darwen.

Mr. W. T. Robson, general manager of the South Shields Corporation Tramways, was unanimously voted an increase of salary of £50 per annum at the monthly meeting of the Town Council on March 4th.

The salary of Mr. F. J. S. Hosken, tramway manager at Darwen, is to be advanced from £200 to £225.

General.—Mr. W. J. Larke, who for some 14 years has been manager of the power and mining department of the British Thomson-Houston Co., at Rugby, has, in view of the extensive developments which have taken place at the company's Rugby, Coventry and Willesden factories, been appointed to the engineering and manufacturing departments, to assist the chief engineer. Mr. Larke's headquarters will be at Rugby, and communications should be addressed to him care of the B.T.H. Co., Ltd., Rugby.

Mr. Percy Good informs us that he has now severed all active connection with Messrs. Neville, Williams & Co., and has joined Mr. C. le Maistre. His address in the future will be: Le Maistre and Good, 28, Victoria Street, Westminster.

Mr. Edward C. Wallwork, who has been appointed assistant contracts engineer of the Callender's Cable and Construction Co., London, has been employed in the Ashton electricity department for the past 14 years.

Mr. H. Rawlinson, who has left the staff at the Helsby Cable Works to take up another position, has been presented with a dressing case.

Mr. E. P. Barfield has resigned his position of commercial manager to the Edison & Swan United Electric Light Co., Ltd.

Mr. J. Austin Baker has joined the traction department of the British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester. He has resigned a position as assistant to the rolling stock superintendent, West Ham Corporation, in order to take up the appointment.

Mr. W. E. Miller, who has had many years' experience of Carron Co.'s cooking and heating apparatus, has been appointed works representative for their electrical cooking and heating department in Scotland and the Midlands.

The Newcastle-on-Tyne City Council, on 4th inst., adopted the motion of the Lord Mayor, referred to in our last issue, resolving to confer the honorary freedom of the city upon SIR JOSEPH W. SWAN, "in recognition of his distinguished services in the cause of science, especially in the inventing and perfecting of incandescent electric lamps, and improvements of photographic processes," and upon SIR C. A. PARSONS, "in recognition of his distinguished service in the cause of science, particularly in the invention and development of steam turbine engines."

It is announced that MR. CHARLES BRIGHT, F.R.S.E., has left for Panama, and that he will be away for some weeks.

The *Commonwealth Engineer* states that MR. ASHTON BREMNER, for some time with the Hydro-Electric P. and M. Co., is now engineer to the Harbour Board, Devonport, Tasmania.

MR. W. G. YUILLE, who has been for the past eight years with the General Electric Co. (Glasgow branch) as manager of the switchgear and arc lamp departments, was presented by the staff with a gold watch on leaving the company. Mr. Yuille has joined the firm of Mr. J. T. Cartwright, 3, Cadogan Street, and 102, Holm Street, Glasgow, as electrical manager.

Messrs. A. & P. Steven, of Glasgow, have appointed MR. W. H. FLOOD, late manager of the electrical department of the Thames Iron Works, as manager for their London branch.

MR. THOMAS R. MARTIN has resigned the position he has held for the past six years with the Metallic Seamless Tube Co., Ltd., and on the 30th inst. will join Messrs. J. H. Tucker & Co., of King's Road, Hay Mills, Birmingham, as their sales manager.

MR. W. T. BOWER, late supplies manager, Messrs. Siemens Bros. Dynamo Works, Ltd., Cardiff Branch, has been appointed general sales manager to the Metallic Seamless Tube Co., Ltd., Electrical Supplies Department, Meta House, Corporation Street, Birmingham. The trade are invited to forward their latest lists.

Obituary.—We regret to record the death, on February 9th, at the very early age of 27 years, of MR. N. C. ESPIE HALL, manager and engineer of the Penang branch of Messrs. Siemens Bros. Dynamo Works, Ltd. Deceased was widely respected by the whole of the company's staff in the Eastern branches, and the offices in Penang, Singapore, Kuala Lumpur, and Rangoon, were closed on the day after his death. The funeral took place in the evening, Messrs. Butcher and Rudd representing the firm. Military honours were accorded, Mr. Hall being a member of the Penang Volunteer Corps. Mr. Hall was transferred from the Siemens London office to Singapore in 1910, proceeding later to Penang, where he had been for two years. He was subject to attacks of dysentery for about a year, and this complaint and a cold were the cause of death.

MAJOR RICHARD BRADLEY, J.P., who died at Stalybridge on March 4th, was formerly in the service of the British and Irish Magnetic Telegraph Co. Subsequently, when the company was taken over by the Government he became a Government servant, and in 1884 he went over to the National Telephone Co., and took charge of a district from Halifax to Huddersfield and Penistone. Deceased was 77 years of age.

We regret to announce the death of MR. J. W. JACOMB-HOOD, chief resident engineer to the London and South-Western Railway. The deceased gentleman was out at the meet of the Dulverton Hounds last Friday, when apparently he was taken with heart failure, and was found dead by the side of his horse. Mr. Jacomb-Hood took a deep interest in the question of electrification of the South-Western Railway, and carried out a prolonged investigation into the subject some years ago; he also took a prominent part in promoting the adoption of electric lighting on the S.W. Railway trains.

MR. JOHN GOTT.—We deeply regret to record the death, which occurred at Hove on March 8th, of Mr. John Gott, the well-known chief engineer of the Commercial Cable Co. The deceased gentleman, who had been connected with the company from its inception in 1884, was a leading inventor and expert in the field of practical telegraphy, and we hope to refer to his work and career in our next issue. Mr. Gott was in his seventy-fourth year.

Wills.—The late MR. E. A. LAZARUS-BARLOW, a director of the Anglo-Argentine Tramways Co., Ltd., and once a chairman of the British Thomson-Houston Co., Ltd., left estate valued at £226,232 gross, and £221,315 net.

MR. J. H. R. TASKER, chairman of Tasker's Engineering Co., Ltd., of Sheffield, left £28,215 gross, and £21,309 net personalty.

NEW COMPANIES REGISTERED.

Argentine Traction Co., Ltd. (134,332).—This company was registered on March 4th, with a capital of £20,000, in £1 shares, to carry on the business of motor-omnibus, car, van and cab proprietors, carriers of passengers and goods, electricians, engineers, founders, &c. The subscribers (with one share each) are:—W. Postlethwaite, 119, Mildmay Road, Mildmay Park, N., clerk; F. H. Rover, 8, Newton Road, Stratford, E., clerk; E. F. Robson, 194, East Surrey Grove, Peckham, S.E., clerk; F. Channon, Meggen, Woodford Green, secretary. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; remuneration, 10 per cent. of the surplus profits after 10 per cent. dividend is paid, divisible. Solicitors, Francis Voules & Co., 65, Bishopsgate, E.C.

Harman Electric Co., Ltd. (134,368).—This company was registered on March 5th, with a capital of £2,000 in £1 shares, to take over the business of electrical engineers, carried on by Marryat & Harman, at 7, Fort Street, Spitalfields, E. The subscribers (with one share each) are:—H. Marryat, 28, Hatton Garden, E.C., engineer; E. J. Harman, 179, Kingston Road, Ilford, engineer. Private company. The number of directors is not to be less than two or more than five. The first are H. Marryat and E. J. Harman (both permanent); qualification, one share. Registered office, 7, Fort Street, Spitalfields, E.

Fenn Mirrograph Co., Ltd. (134,167).—This company was registered on March 6th, with a capital of £3,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, electrical and other mirrors, "Mirrographs," signs, lamps, reflecting, advertising and [illegible] appliances, &c., and to adopt an agreement with B. B. Fenn. The subscribers (with one share each) are:—F. J. Purdie, 23, King Street, E.C., managing clerk; B. Middleditch, 16, Palace Road, Crouch End, N., solicitor. Private company. The number of directors is not to be less than two or more than four; the first are B. B. Fenn (works manager), S. F. Sobell (general manager and secretary), and J. Feinstein (sales and organising manager), each of whom may retain office for life; qualification, 200 shares; remuneration of B. B. Fenn, £7 per week; of other two permanent directors, £5 per week. Registered office, Albemarle Mansion, Albemarle Street, Piccadilly, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

County of Dorset Electric Supply Co., Ltd.—Particulars of £13,000 debentures, created February 24th, 1914, filed pursuant to Sec. 93 (8) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital (if any). No trustees.

Rugby Lamp Co., Ltd.—Issue on February 25th, 1914, of £700 debentures, part of a series of which particulars have already been filed.

Liverpool Electric Welding Co., Ltd.—Issue on February 4th, 1914, of £100 debs., part of a series of which particulars have already been filed.

City of Oxford Electric Tramways, Ltd.—Particulars of £46,000 debs., created February 20th, 1914, and secured by trust deed of even date filed pursuant to Sec. 93 (8) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Tramways and the right of user of same, and of levying tolls, rates, fares and charges in respect thereof, and lands with buildings thereon, and all other premises vested in the company by the Oxford and District Tramway Acts (1907 and 1909), and the Oxford and District Tramways Bill, 1914, if and when passed, and all rails and appurtenances connected therewith, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Union Commercial Investment Co., Ltd., Dashwood House, 9, New Broad Street, E.C.

City of Ely Electric Light and Power Co., Ltd. (85,444).—Capital, £5,000 in £1 shares. Return dated January 12th, 1914; 3,003 shares taken up; 2s. per share called up; £300 6s. paid. Mortgages and charges: Nil.

Cutting Bros, Ltd. (81,178).—Capital, £6,000 in £10 shares. Return dated December 31st, 1913; 500 shares taken up; £10 per share called up on 100; £1,000 paid; £3,200 (£8 per share) considered as paid on 400. Mortgages and charges: £3,600.

Spagnoletti, Ltd. (94,447).—Capital, £20,000 in £1 shares. Return dated December 17th, 1913. 12,352 shares taken up. £2,707 paid. £9,645 considered as paid. Mortgages and charges: £12,500.

Sheffield Electric Power Co., Ltd. (106,880).—Capital, £2,000 in £1 shares. Return dated December 31st, 1913. Two shares taken up. £2 paid. Mortgages and charges: Nil.

Davies, Kent & Stewart, Ltd. (81,627).—Capital, £3,500 in £1 shares (2,500 pref.). Return dated December 31st, 1913. 1,974 pref. and 1,000 ord. shares taken up. £2,974 considered as paid. Mortgages and charges: £1,050.

Westinghouse Cooper-Hewitt Co, Ltd. (89,947).—Capital, £30,000 in £1 shares. Return dated January 12th, 1914. 10,000 shares taken up. 9s. 6d. per share called up on 30,000 ord. £14,250 paid. Mortgages and charges: Nil.

Osram Lamp Works, Ltd. (95,312).—Capital, £100,000 in 7,500 "A" and 2,500 "B" shares of £10 each. Return dated January 14th, 1914. All shares taken up. £10 per share called up on 5,000 "A," £50,000 paid; £50,000 considered as paid on 2,500 "A" and 2,500 "B." Mortgages and charges: £80,000.

Standard Cable Manufacturing Co., Ltd. (100,967).—Capital, £50,000 in £10 shares. Return dated November 6th, 1913, 2,494 shares taken up, £24,940 paid. Mortgages and charges: Nil.

CITY NOTES.

County of London Electric Supply Co., Ltd.

THE Directors' report for the year ended 31st December, 1913, states that the capital expended on account of the London districts amounted to £67,050, making the net total expenditure on those districts £1,952,698. The balance from revenue after deducting generation and distribution costs, rents, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries, has been £147,812 for the year plus £5,215 brought forward, making £153,028. There are deducted the following: interest on first and second debenture stock and interest on temporary loans, £43,049; reserve for depreciation, repairs, renewals, etc., £33,000; leaving for distribution £76,979. Interim dividends on 55,000 six per cent. preference shares, and on 59,000 ordinary shares, for the half-year ended 30th June, 1913, at the rate of five per cent. per annum, less income tax, have been paid and now require confirmation. These interim dividends absorbed £29,427, and leave for further distribution the sum of £47,552. Payments of 6 per cent. on the preference shares, and two dividends of 5 per cent. and 9 per cent. for the two half-years respectively on the ordinary shares, making 7 per cent. for the year, absorb £40,539, and leave £7,013 to be carried forward. The applications received during the past year amounted to the equivalent of 4,137 K.W., making the total at 31st December last 49,199 K.W. The total units sold were 25,743,323, an increase for the year of 3,230,845 units. The number of consumers has increased from 20,246 to 22,315. The Romford and District Electric Lighting Order, 1913, granted to this company, received the Royal Assent in August last. In order to provide funds for the further development of the company's business, the directors propose to make a further issue of 10,000 6 per cent. cumulative preference shares at £11 per share, and 6,000 ordinary shares at £11 10s. per share. These will be allotted to the existing preference and ordinary shareholders on the register of the company on March 6th in the proportions as nearly as may be of one new preference share for each twelve preference or ordinary shares already held, and one new ordinary share for each twenty preference or ordinary shares already held. It is proposed to send out the allotment letters with the dividend warrants. The shareholders were informed at the recent extraordinary general meetings that certain proposals had been made by influential financial houses to the London Electric Supply Companies with a view to association and the adoption of a general scheme for supply, with the object of assisting the development of electric supply in London. The chairman will outline these proposals at the meeting. The Bill promoted with a view to assisting the London Electric Supply Companies fully to exercise the powers conferred upon them by the London Electric Supply Acts, 1908 and 1910, by enabling the companies and the L.C.C. to enter into agreements for variation of date and terms of purchase of the companies' undertakings, was on the 9th February last approved by a special resolution of the company. The Bill has been introduced in the interests not only of this company, but also in those of all the other London Electric Supply Companies. This company will not have to bear any expense incurred in connection with the promotion of the Bill. The directors of the Bournemouth and Poole Electricity Supply Co., Ltd., have declared a final dividend on the ordinary shares of that company at the rate of 9 per cent. per annum, making 7 per cent. for the year. The progress made by the Coatbridge and Airdrie Co. during the past year has been satisfactory.

Units generated and purchased	34,224,914
Units sold—Public lamps	291,920
Private consumers, by meter	24,451,403
Total sold	25,743,323
Used on works	2,745,387
Total accounted for	28,488,710
Not accounted for	5,736,204
Public lamps	363
Total maximum supply demanded	14,400K.W.

The meeting is called for March 16th.

W. T. Henley's Telegraph Works Co., Ltd.

MR. SYDNEY GEDGE presided on Friday at the offices, 13, Blomfield Street, over the thirty-fifth ordinary general meeting of the above company.

In moving the adoption of the report (see ELEC. REV. p. 403) the chairman said it was just ten years ago when they met for the first time in that room. The year 1903 was not only remarkable to them in that they bought this property, but because they had then nearly completed the purchase of eleven acres at Gravesend, on which they had since erected works, in regard to which, with some experience, he had little hesitation in saying, there were no better anywhere in the United Kingdom. They had plenty of room and magnificent works. Ten years ago he ventured to prophesy that they would have to call up more capital, but he promised that this should not be done until such capital would be profitable. At that time they had £175,000 ordinary capital, £150,000 preference stock, and £50,000 debenture stock. Now they had £200,000 ordinary and £200,000 preference capital, and £150,000 debenture stock, and this, except the ordinary stock, had been raised at a rate of 4½ per cent. Ten years ago the profits came to £38,700, and they had a dividend of 20 per cent. It may have been imprudent to have paid such a large dividend, but the shareholders had waited patiently, and they divided the money. He was glad to say more prudent counsels had prevailed since, and they had paid a steady dividend of 15 per cent., with one bonus of 2 per cent. They were going to continue the 15 per cent. this year, but for special reasons they also proposed to pay a bonus of 5 per cent. Seeing that their total profit for the year was £93,500, no one would say they were imprudent in doing this. It looked a big dividend, but as he had pointed out, a great deal of their capital received only 4½ per cent., and they had £200,000 reserve fund, a great deal of which was employed in the business. Ten years ago the reserve fund was £100,000, and since then they had been increasing their business, purchasing property, making ample provision for dilapidations, and so on. Seeing their strong financial position, he was amazed that their shares did not stand a great deal higher than they did. Ten years ago Mr. Sutton said that the eleven acres at Gravesend was more land than they wanted at the time, but he said that the company was not for to-day or to-morrow. This was the thirty-fifth year of the company's existence, and, he thought, it bade fair to go on. The chairman proceeded to quote from articles written in the daily papers with regard to the progress of the company, and said that the company could be termed both conservative and progressive. They were progressing all over the world. In Australia, Argentina, China, Japan—in fact there was hardly any part of the world where they had not their agencies and were doing good and lucrative business. With regard to that year's accounts, it would be noticed that they had made ample provision for depreciation of the investments, although he was glad to say that since the 31st December some of their gilt-edged securities had risen very considerably. They had applied £16,000 to the depreciation of machinery and plant, which was £2,000 more than last year, and this was owing to their having dismantled certain plant so as to install fire sprinklers, which would not only be a protection in case of a fire, but would also result in a decrease in their insurance premiums. They had spent £35,000 on works at Gravesend, where they were introducing a motor tyre department. Altogether he might say that they were going on well, and there had been few accidents and very little ill-health amongst their employees. The chairman then referred to the ill-health of Mr. Newton, which had caused his retirement from the board, and said that they had elected Mr. Potter in his place. He also said that owing to the increase in their business they had appointed Mr. Rosling, who for some years was their agent in Australia, as assistant manager to Mr. Sutton. As they knew, Mr. Sutton had himself personally opened up many of their agencies, and it might be said that he would be going to South America on the business of the company, and it was well they should have someone to represent him when he was away.

Mr. SUTTON, in seconding the motion, said that comment had been made on the fact that whilst the report gave a clear statement of the financial position of the company, yet there was only a very bald statement of how the financial position had been achieved. No doubt that was the case, but a full statement of trade was always given at the meeting. The year under review had been the very best year the company had ever had. It was the best in all respects. It was the largest in the number of orders actually received, the largest in the actual amount of material which had been used at the works, and the largest in the actual amount of sales made. This was due to an increase in all departments of the works with one exception, namely, the submarine cable business, which in the first days of the company was practically the only business it did. It was natural that in a business of this kind the home trade should be the best asset the company had, and the board was quite satisfied with the growth of their home trade. A very large increase had taken place in their trade during 1913, and although the percentage of profit had not been so great as in the previous year, still they looked on it as a most healthy sign that by a reduction of profit they were able to do more business. The most remarkable feature of the year had been the foreign trade, which had grown by leaps and bounds. In telephony the company were getting a fair share of the cable work in connection with the extensions in this country. They had a mill manufacturing for the post-office the cables for laying down between Leeds and Hull, Coventry and Birmingham, Newport and Cardiff, Cardiff and Swansea, London and Slough, and so on. The foreign trade in connection with telephony was not a large one, but the Colonial trade was considerable. One important contract was for a submarine telephone cable, which was called a continuously wound cable, and was laid to connect Vancouver Island with the main land. It was 30 knots long, and they had received intimation that it was doing its work well. A similar cable was now being made for the Danish Government. They had to wind fine iron wires round the conductor, and they had to make 1,500 millions of turns of the iron wire round the conductor. It was difficult to realise what 1,500 millions meant, but they had had to construct machines to do the work within reasonable time. They had had many important contracts in connection with electric lighting, and perhaps the foreign contract which gave them the most satisfaction was a considerable order for Shanghai, because hitherto the cables for that place were supplied from other countries, and now, after many efforts, they had got an order. In connection with electric lighting the company had devised a new system—Henley's wiring system. It was a surface wiring system and had met with considerable success. Many orders had been taken, especially for abroad. It was useful for cottage property, for it made it possible to put electric light into workmen's cottages whilst at the same time it was used in the palace. It was used in the cathedrals of Lahore and Bermuda. He thought it had a good future before it. Having referred to the work done by the company for the Navy and for the mercantile marine, Mr. Sutton said that probably one of the most important fields of their work was to be found in the electrification of railways. Last year he told them that the most important order which had ever been placed for cables for the electrification of railways had been placed with them by the Central Argentine Railway. The whole of the cables had been manufactured and delivered in Argentine, and were now being laid. The order was not, however, finished, and would probably occupy them another year. In addition they had been entrusted with a small order by the London and North Western Railway for certain cables for the Willesden electrification, and quite recently they had had an order placed with them for the cables for the electrification of the suburban lines of the Buenos Aires Western Railway Co. They had not yet commenced to manufacture it, but the contract involved something well over £200,000. The shareholders could well understand the one reason why such great orders were placed with the company, involving such great responsibilities, was the strong financial position of the company as shown by its published balance sheet. Mr. Sutton next touched on business which had attended the manufacture of the "Why not" golf ball, which had enabled them to pay the 5 per cent. bonus that year, and he said that they were eleven years experimenting to get a ball which would bring them in a large sale. They commenced the manufacture of tires in August, but they were in no hurry to make a profit. They had as perfect a factory as could be constructed, and the management was in the hands of two men who had had a large and wide experience in the motor trade. They were trying to produce a tire which would be second to none and better than most. The sales they had been able to effect were such that they were already considering the trebling of the size of the factory. They had capital sufficient to enable them to carry out that extension now, and although, of course, if it became a large industry they might have to seek fresh capital, yet they had no intention to ask for further capital until they could show it would be profitable.

Mr. JENKINS congratulated the board on the success which had attended their efforts.

Mr. CRIGHTON raised the question of the company embarking on some profit-sharing system.

Mr. SUTTON pointed out that there were very great difficulties in formulating a satisfactory profit-sharing scheme for such a company as this. At the same time the board always had the welfare of the employees in their minds, and they had in many ways given effect to this.

The report was then adopted.

County of Durham Electrical Power Distribution Co., Ltd.

THE directors report that the total connections to the system at the end of 1913 (including the connections of the Associated Parliamentary Co., the County of Durham Electric Power Supply Co.) amounted to 70,495 h.p., an increase of 15,970 h.p. The profit for the year is £30,252 (as compared with £33,737). Including the balance brought forward, £1,863, the total is £32,115, against which has been charged interest on loans and Debenture stock, £12,504, leaving £19,611 (as compared with £20,364). A dividend of 5 per cent. for the year on the Preference shares absorbs £12,500; there is transferred to depreciation account £6,000, and £1,111 is to be carried forward. The expenditure on capital works during the year has been £14,985, of which £3,171 represents the outlay on the company's account, and £11,814 the outlay on behalf of its associated company, the County of Durham Electric Power Supply Co. The difference between the above figure of £3,171 and the credit of £6,423 shown in the capital account is accounted for by the fact that a sum of £9,594 has been written off manufacturers' installations accounts. The profit of the year has been adversely affected by the high cost of coal, and by a reduction in the dividend received from the County of Durham Electric Power Supply Co. owing to increased rentals and interest charges paid by that company. During the year the directors have appropriated the balance of £12,845 standing to the credit of depreciation and reserve account at December 31st, 1912, as follows: In writing off £678, being the balance standing in works in progress account, after transferring from that account £552 to lands accounts; in writing £9,594 off manufacturers' installations accounts; in writing £2,573 off expenses of issue of capital account. The boards of this company and the Newcastle-upon-Tyne Electric Supply Co., Ltd., have for some time had in view the advantage of a closer union of interests between the two companies, and after due consideration they have come to the conclusion that this will best be attained by the Newcastle Co. acquiring, by exchange, the shares in this company. The Board of the Newcastle Co. is recommending that the Newcastle Co. should acquire the outstanding shares in this company upon the following terms:—

The Newcastle Co. to give each Preference shareholder in this company £4 10s., fully paid, of the 5 per cent. Preference share capital of the Newcastle Co. in exchange for every £5 of Preference share capital held by him in this company, and to give each Ordinary shareholder in this company £1 10s., fully paid, of the Ordinary share capital of the Newcastle Co. in exchange for every £5 of Ordinary share capital held by him in this company. Fractions of £1 to be dealt with by issuing fractional scrip in the usual way.

The effect of the exchange to the Durham shareholders on the basis of the middle market prices as quoted on the Newcastle Stock Exchange on February 18th, 1914, is shown by the following:—

£4 10s. of the Newcastle Co.'s £5 Pref. shares was equivalent to	£3	19	10
Market price of the Durham Co.'s £5 Pref. shares	2	17	6
£1 10s. of the Newcastle Co.'s £5 Ord. shares was equivalent to	1	3	6
Market price of the Durham Co.'s £5 Ord. shares	0	18	6

The directors are satisfied that the proposed exchange would be advantageous, and accordingly recommend acceptance by the shareholders of the Newcastle Co.'s offer.

THE annual meeting was held in Newcastle-on-Tyne on 6th inst., Dr. J. T. Merz, the chairman presiding.

The CHAIRMAN, in moving the adoption of the report, said that although the profits of the company were smaller than last year, the progress in actual working of the company had been considerable. They had increased their h.p. connections by 15,970 against an increase of 11,000 the year before. The capital expenditure had been only small, £14,985 against £47,648, and the profit was rather less, being £30,252 against £33,737 in 1912. The total gross profit was really considerably more than appeared in that report. As a matter of fact, the actual amount of return on capital had increased from £68,000 to £75,000, or by more than £7,000, but inasmuch as the lion's share went to the Supply Co. in the form of a K.W. charge, which was a capital charge, it did not appear in their accounts, and therefore the profits that went to the shareholders were less than last year. If they took the actual earnings of the capital, they had a return of 5·7 per cent, but inasmuch as they had to pay such a large charge on a portion of their capital, what remained was not more than enough to pay the preference dividend, and leave over a small amount for depreciation. In regard to the fusion scheme, the reasons for fusion so far as the Durham Co. was concerned were very simple. The company could not carry on excepting by an increase of expenditure on capital account. The payment by the company for the supply of current was continually increasing. The only way the company had of obtaining money was to borrow from the Supply Co., or rather to defer the payments which they had to make to the Supply Co. as K.W. charge. In consequence of that the directors had thought it right and timely to put the business on to a right and proper footing, and inasmuch as the Supply Co. were very largely interested in the company—they were the Supply Co's. largest consumer—it was thought right that the Newcastle Co. should in some way or other absorb the whole of the business. The Newcastle Supply Co. had at their meeting an hour earlier, agreed to make an offer to the shareholders of the Durham Co. This offer involved a depreciation of the company's capital from £500,000 to £300,000. This depreciation had arisen from the payment of £50,000 for the agreement with the Supply Co., which, when it was made, nine years ago, was a good agreement; in £27,000 in preliminary expenses; and on stations that had become obsolete, amounting in all to £197,190. This reduction in the capital would have had to take place in any case.

Mr. MADGEN seconded the report. He said he had no interest in the Supply Co., and he thought that the fusion was desirable and the terms reasonable. The Supply Co. was the manufacturer of electrical energy on a large scale in that district, and the Durham Co. retailed it amongst its various consumers in the same district. That seemed a straightforward arrangement, but it had been found in practice that with large consumers anomalies occurred, and that it was difficult to make equitable adjustment. For that practical reason, and others, he thought the closer unity of interests was desirable. Fully 50 per cent. of the outside shareholders in the Durham Co. had expressed their approval of the scheme.

Mr. J. H. ARMSTRONG said there was an idea amongst shareholders—and it was quite true—that they need not join in that fusion. It was perfectly open for every shareholder to either exchange his share or to stay in that company. Some shareholders had an idea that, sooner or later, the Durham Co. would have to be wound up, and the Supply Co. would have to acquire its outstanding shares. That was not at all the case, for the Durham Co., on account of its Parliamentary powers, must continue even if the whole of its shares were acquired by the Newcastle Co. But with the capital written down, this fact would have a prejudicial effect on the market value of the Durham shares, and as the chairman had further pointed out, the tendency of the relationship of the two companies would be to put money into the Newcastle Co. rather than into the Durham business. It was not the wish of the directors to force any of the shareholders into this combine, but it would certainly be to their interests to be in.

The report was adopted without comment.

Jarrow and District Electric Traction Co., Ltd.—Dividend on ordinary shares for 1913 at the rate of 2½ per cent. per annum.

International Light and Power Co., Ltd.—A dividend of 1½ per cent. upon the preference shares, for the quarter ending March 31st, is announced.

Manila Electric Railroad and Lighting Corporation.—A quarterly dividend of 1¾ per cent. for the quarter to March 21st on the common stock is announced.

Canada.—The Western General Electric Co., Ltd., has increased its capital from $100,000 to $500,000. — *Canadian Electrical News.*

Capital Reduction.—In the Chancery Court on 9th inst. the reduction of capital of the British and Colonial Zoelly Turbine Syndicate, Ltd., was confirmed.

Brompton and Kensington Electricity Supply Co., Ltd.

The directors' report for the year ended December 31st, 1913, states that the revenue account shows a credit balance of £31,500, which, with the balance of £7,026 brought forward, and £425 balance of interest received and accrued, makes a total of £38,951. After deducting £1,484 for interim dividend on the 7 per cent. cumulative preference shares, and £7,091 interim dividend at the rate of 9 per cent. per annum for the half-year to June 50th on the ordinary shares, and £300 loss on the redemption and sale of investments, the directors recommend that £30,075 be dealt with as follows :—Written off cost of investments £1,333, written off shares in and advances to the Brompton and Kensington Accessories Co., Ltd., £8,000, reserve fund account (raising it to £39,500) £6,500, dividend on the preference shares for December half-year £1,449, dividend on the ordinary shares for December half-year at the rate of 11 per cent. per annum, making 10 per cent. for the year, £8,718 ; income-tax on dividends £922, directors' additional remuneration £1,000, carrying forward £7,153.

The following table shows the progress of the business :—

Year.	8-c.p. lamps connected.	Inc. in 8-c.p. lamps.	Customers connected.	Gross receipts.	Expenditure.	Net receipts.	Av. price per unit.	Div. on ord. shares.
1911..	259,554	12,580	5,453	£54,730	£24,038	£30,692	4·29d.	10%
1912..	272,701	13,147	5,798	£56,348	£23,170	£33,178	4·18d.	10%
1913..	291,108	18,407	6,118	£56,484	£24,984	£31,500	4·08d.	10%

The meeting was held yesterday.

British Engine, Boiler and Electrical Insurance Co., Ltd.

At the annual meeting of the above company held in Manchester on Tuesday the chairman (Mr. Longridge), in moving the adoption of the report and balance-sheet, remarked that as regards premium income there had been a satisfactory increase in each separate department of their business, but there had also been an increase in claims. In calculating the loss ratio for their class of business, the cost of inspection must be added to actual disbursements for claims, and the figures showed that the insurance of electrical plant was more costly than even the insurance of engines, which again was very much more costly than insurance of boilers. The maintenance of an efficient staff for the work of inspection was of course an expensive matter, but any reduction under this head would inevitably result in an increase of claims, and that inspection was appreciated as a preventive measure was shown by the very satisfactory way in which firms continued to renew their policies, even though for a sequence of years there had been no claims to be paid on them. The great increase in the volume of work had necessitated removal to new and more commodious premises at the corner of Fennel Street and Long Millgate, which it was hoped would be occupied within the next six months. It was agreed to pay a dividend of 5s. and a bonus of 3s. per share, which, after transferring £10,000 to reserves, would leave £2,818 to be carried forward.

Stock Exchange Notices.—The Committee has appointed special settling days as under :—

Thursday, March 19th.—Anglo-Argentine Tramway Co., Ltd.—Scrip fully and partly (£20 per cent.) paid, for further issue of £1,500,000 5 per cent. debenture stock.

And ordered the following to be quoted in the Official List :—

Anglo-Argentine Tramway Co., Ltd.—Scrip, £20 per cent. paid, for further issue of £1,500,000 5 per cent. debenture stock.

British Columbia Electric Railway Co., Ltd.—Further issue of £240,000 deferred ordinary stock, £240,000 pref. ordinary stock, and £240,000 5 per cent. cumulative perp. preference stock.

Cuban Telephone Co.—$1,000,000 pref. stock, in shares of $100, in lieu of scrip.

Application has been made to the Committee for a special settling day and quotation in :—

Christchurch (City of).—Scrip. fully paid, for £100,000 4½ per cent. Electrical Power Distribution Loan.

And for an official quotation in :—

Vancouver Power Co., Ltd.—Further issue of £650,000 4½ per cent. perp. guarantee debenture stock.

Direct Spanish Telegraph Co., Ltd.—The accounts for the year ended December, 1913, show, after providing for interest on and redemption of debentures, and for the dividend on the preference shares, a balance of £11,679. Out of this the directors recommend a final dividend on the ordinary shares of 2s, per share, which, with the interim dividend, will make a total of 4 per cent. for the year, and will absorb £2,586. After crediting the reserve fund with £9,000, a balance of £93 remains to be carried forward. £8,168, being the balance of the cost of the partial renewal of the Bilbao cable in 1911, has been paid out of the reserve fund. The Bilbao cable became interrupted on October 3rd last, 240 knots from the landing place in Cornwall. The necessary repairs were effected by the cable steamer *John Pender*, and the cable was re-opened for traffic on October 14th, after an interruption of 12 days. The cost of these repairs, viz., £2,507, has been charged to revenue.

Consolidated Gas, Electric Light and Power Co., of Baltimore.—Dividends of 1½ per cent., or at the rate of 6 per cent. per annum, on the common stock for the quarter to March 31st, and 3 per cent., or at the rate of 6 per cent. per annum, on the preferred stock for the half-year to March 31st, are announced.

Continental.—France.—La Société des Acieries Electriques de Paris et de la Seine is the name of a new company which has just been formed in Paris (23, Rue de Rome), with a capital of £50,000, to establish works near Paris for the electrical production of steel.

Holland.—The Philips' Glühlampenfabrieken Maatschappij, of Eindhoven, which was formed at the beginning of 1912, with a capital of £480,000, to acquire and carry on the incandescent lamp works of Messrs. Philips, is meeting with considerable success. For the past year a net profit of £143,204 is reported, as compared with £109,760 in the first year of the company. A dividend of 11 per cent. is being paid on the ordinary, and one of 7 per cent. on the preference shares.

Norway.—It is reported from Porsgrund that a new company has recently been formed and registered, under the name of the "Porsgrund Elektrometallurgiske Aktieselskap," for the purpose of erecting manufactories for electrometallurgical processes. The company has a capital of nearly £84,000, and the sites for the factories have already been acquired. The company will have at disposal some 10,000 electrical horse-power, which will be supplied by the Skiensfjord Power Co. from the Aarlifas, which is now being harnessed. The capital is chiefly Swiss, and one of the directors is a Swiss engineer, Mr. Ullman, while the other two are Advocate Knagenhjelm and Engineer A. Christiansen, both of Christiania.

Spain.—A company has just been formed at Sabadell with a capital of £22,000 and the title La Sociedad Energia Electrica Balear, to establish electric lighting undertakings in the Balearic Islands.

Wemyss and District Tramways, Ltd.—Mr. G. Balfour, presiding at the annual meeting, referred to the prosperous year enjoyed by the company. With the view of expediting the increasing traffic, certain stretches of the track between Kirkcaldy and Leven were being doubled. The first section, covering about half of the track, to be doubled, meantime, would be completed in the course of three to four weeks, and the other half would be pushed forward without delay. Mr. Balfour called attention to what he described as the iniquitous system which prevailed of rating undertakings of the nature of the Wemyss and District Tramways. The system was one requiring the prompt attention of shareholders. Assuming a company's revenues for successive years were the same, but that through skill economies were effected to the extent of £1,000, the valuation under the existing system of rating would be increased by that amount. He thought that the system simply meant a double super-income-tax.

Carmarthen Electric Supply Co., Ltd.—Mr. W. A. Shultz presided at the annual meeting held at 50, Cannon Street, E.C., on February 25th, and in moving the adoption of the report, said that they had been able to put one-third of the profit this year to reserve, after paying a 5 per cent. dividend. The revenue had increased from £1,868 to £2,449, an increase of 20 per cent., while the expenses had increased only 18 per cent. in spite of the heavy price of fuel oil. The number of consumers had increased by 50 per cent., and the units sold had advanced by 23,424 to 103,910. In addition to the 100-KW. Diesel plant installed in 1912, they had ordered a 100-KW. vertical suction gas engine from Browett, Lindley & Co. This was now being erected. It would entail a further issue of capital.

Cambridge Electric Supply Co., Ltd.—Mr. D. Munsey presided at the annual meeting held on February 25th at Cambridge. He said that the progress made was very satisfactory. They had connected more consumers than in any previous year. The increase of £560 in cost of coal was due to an increase of 2s. 4d. per ton, and an increase of 195 tons consumed. They generated 19,000 more units. The company was in a sounder position than ever before. Sir C. A. Parsons seconded the adoption of the report. He said that they had got over the introduction of the metal-filament lamp. The price of coal would probably fall in the near future. The dividend declaration (6 per cent. for the year) was moved by Mr. A. A. C. Swinton.

International Railophones, Ltd.—According to reports in the financial Press, this company held its annual meeting at Gresham House, E.C., on 3rd inst., Mr. C. H. Potter presiding. The chairman referred to negotiations that were proceeding for the sale of the patents in Germany and America, and to the experiments with the system in Germany, and on the Midland Railway.

Midland Electric Corporation for Power Distribution, Ltd.—The accounts for the year ended December 31st last (according to the *Financial Times*) show that the balance to credit of profit and loss account, after payment of debenture interest, is £16,919 (as against £12,843 in the previous year), which the board recommend be applied as follows :—Final payment of debenture guarantee premium, £625 ; written off expenses of issue of debentures, &c., £4,277 ; for depreciation of plant, &c., £8,044 ; leaving to be carried forward £3,573.

Consolidated Diesel Co.—The meeting arranged for 10th inst. could not be held owing to unavoidable delays in making the valuation of the property of Messrs. Usines Carels Frères Soc. Anon.

Mirrlees Watson Co.—The *Financial News* says that the directors recommend a dividend of 5 per cent. for 1913, as compared with 10 per cent. and a bonus of 5 per cent. for 1912.

(*Continued on page 453.*)

AN ELECTRICALLY-DRIVEN WEST COUNTRY WOOLLEN MILL.

The electrical driving of textile mills can no longer claim to be a novelty, even in this country—the home of the textile industry—where accepted methods, due to long years of successful manufacturing, were not easy to displace. Numerous instances of cotton, woollen, silk, jute and linen factories which have adopted the electric drive, either wholly or in part, can now be quoted, and this applies to both new and old mills, the latter of which frequently offer great scope for the increased all-round efficiency which electric driving makes possible.

Messrs. Bliss & Sons' Mill, Chipping Norton.

Amongst the older firms, a typical and most useful example of modern electrification is found in the woollen mills of Messrs. Wm. Bliss & Son, Ltd., at Chipping Norton, in Oxfordshire, a firm which has been in successful existence for 170 years. The business evidently antedates power driving, and contrary to the custom in the textile districts of Yorkshire, where woollen manufacturing has become split up into a number of separate trades, it embraces every process of woollen manufacturing, from the raw material (wool) to the finished cloth, in one factory—a feature which is of particular interest in view of the diversity of the machinery, all of which is now electrically driven, and the admittedly satisfactory results which have been attained.

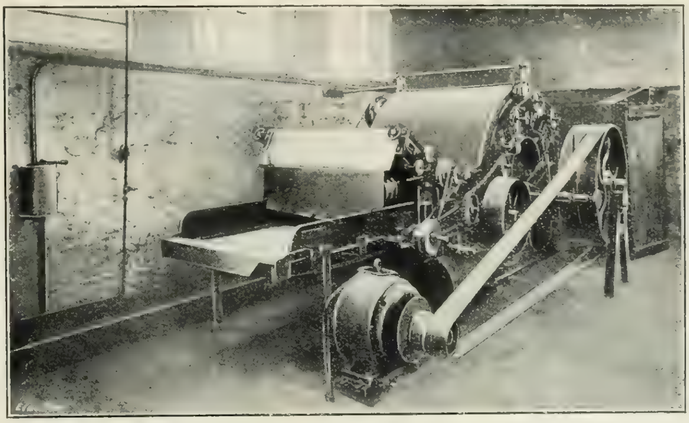
Originally this mill was driven by two 130-H.P. slow-running beam engines, which it is recorded each used some 26 tons of coal per week; with a view to improving on this performance, and at the same time overcoming a difficulty which arose from shortage of condensing water, two Crossley double-ended gas engines were installed, with a producer plant which utilises the same class of bituminous slack which had previously been used under the boilers.

The introduction of gas engine plant reduced the coal consumption from 7 lb. per H.P.-hour to 1·8 lb., and enabled the machinery to be speeded up 10 per cent., owing to the improved speed regulation of the modern prime movers.

The gas engine drive was through ropes on to the old shafting, with numerous instances of bevel gearing on the various floors, and it is therefore not surprising that during a test some 28 per cent. of the power of one engine was found to be absorbed in transmission only.

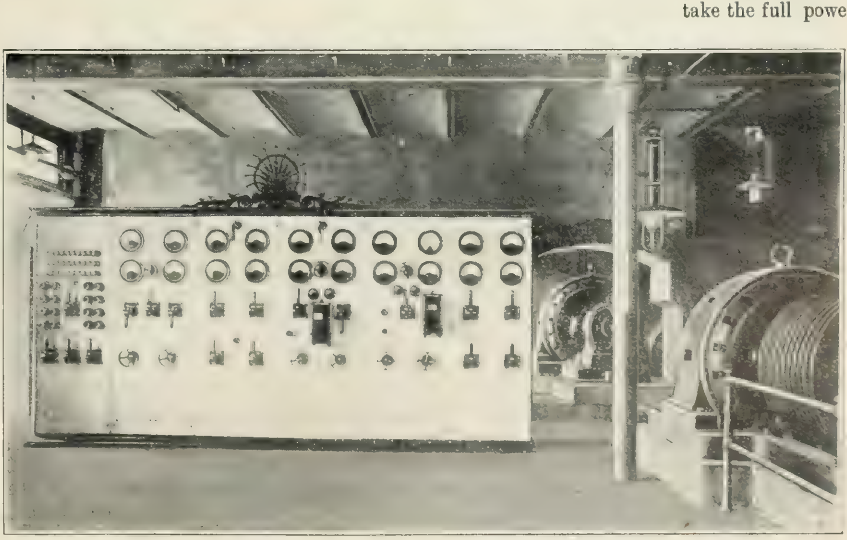
With a view to cutting down losses of this kind, the firm were led to consider the question of electric driving, and a 120-K.V.A. three-phase generator and a number of motors were installed in 1910, this equipment being provided by the Schorch Electrical Co., who, as many of our readers are aware, specialise in electro-textile installations, and were pioneers in the "single" or "individual" drive system.

This installation proved so successful and led to such a saving in power, that Messrs. Bliss—who were adding further weaving, spinning and carding plant, and had actually obtained tenders for a further gas engine consequent on those already in use being overloaded—decided to proceed with the electric drive.



Electrically-Driven Willey, with 7-B.H.P. Motor.

The Schorch Electrical Co. were then entrusted with the installation of a 250-K.V.A. three-phase generator to take the full power

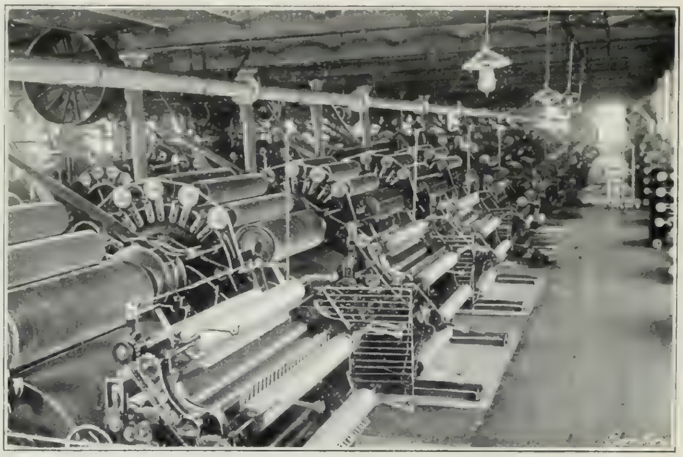


Main Switchboard and Rope-Driven Generators.

of one of the gas engines, and gradually other sections of the plant were converted to electric driving, the resulting saving in power being such that at times one engine drove the whole mill. Early last year the generating plant was duplicated, another 250 K.V.A. generator being coupled to the other engine and the remainder of the plant was converted to motor driving.

The result has been in every way satisfactory; the two gas engines which were originally overloaded do not now develop their full output by about 100 H.P., and this despite various machinery additions in the meantime.

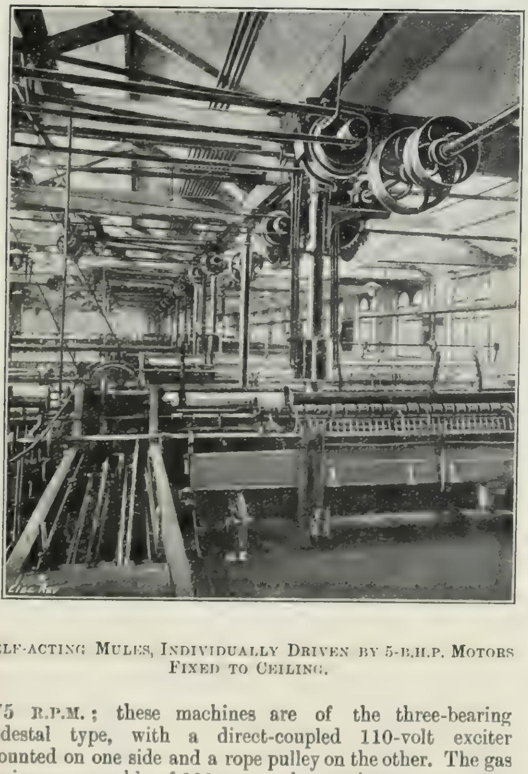
In this as in other mill electrification schemes the question of individual or group driving arose, and with a view to deciding the question records were made of the average time during which machines were standing and running, it being found that these were 40 per cent. and 60 per cent. respectively.



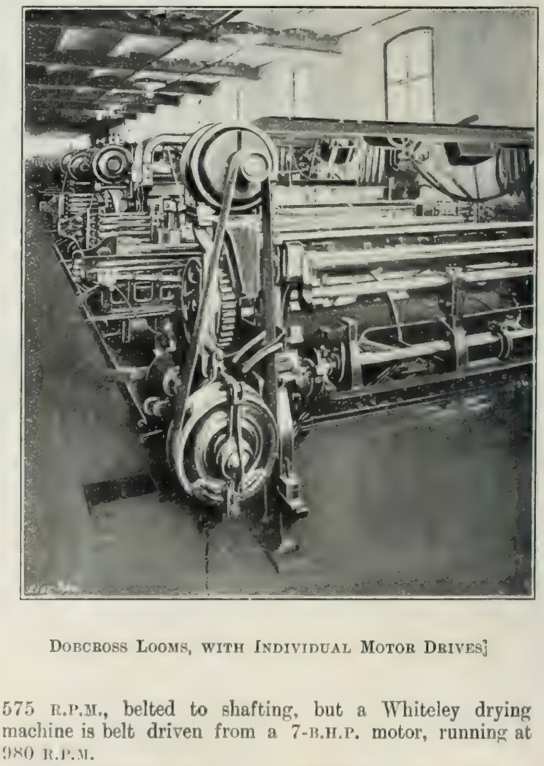
Carding Machinery, Group Driven from Ceiling Motors.

It was eventually decided to install individual drives wherever practically possible, and the expert experience of the Schorch Electrical Co. was utilised in rearranging the various drives.

Turning to the installation, two 250-K.V.A. 50-cycle 220-volt three-phase generators are in use, running at 375 R.P.M.; these machines are of the three-bearing pedestal type, with a direct-coupled 110-volt exciter mounted on one side and a rope pulley on the other. The gas engines are roughly of 300 H.P. each, running at 185 R.P.M., and each drives through 10 $1\frac{3}{4}$-in. ropes.



Self-acting Mules, Individually Driven by 5-B.H.P. Motors Fixed to Ceiling.



Dobcross Looms, with Individual Motor Drives]

A marble panel switchboard is provided, coupled to the generators and to distributing points in the mill by three-core, lead-covered and steel-armoured cables; this contains six panels, which control the mill lighting circuits, the two main generators and eight feeders.

The generator panels are each fitted with an Aron meter, exciter and generator ammeters, a voltmeter and a watt-hour meter, and an ammeter is provided for each feeder.

The switchboard is of the Schorch Co.'s standard pattern, with no current-carrying fitting in front and flush type instruments; the fuses are behind, and an automatic magnetic voltage regulator is provided.

One result of the adoption of electric driving has been the building of a willey house separate from the main buildings, with a view to isolating this dirty process from the others. In this building are installed a tenter-hook willey and a shake willey, both by Messrs. Morton, Son and Co., for breaking up the incoming wool and preparing it for the carding department. Each machine is belt driven from a 7-B.H.P. motor, 980 R.P.M., both motors and lighting being supplied through a 220-volt three-core armoured cable leading to a distributing box in the building.

In the scouring department the wool washing and drying machinery is partly driven from a 15-B.H.P. motor, speed 575 R.P.M., belted to shafting, but a Whiteley drying machine is belt driven from a 7-B.H.P. motor, running at 980 R.P.M.

Both machines are of the squirrel-cage type, bolted to sliding bedplates on the ceiling, and thus occupying no valuable space. It should be mentioned that all the motors, except one of 50 B.H.P., are of the Schorch squirrel-cage totally-enclosed type, and are provided with the company's oil-immersed, star-delta starting switches, fitted with a mechanical slow-motion starting device.

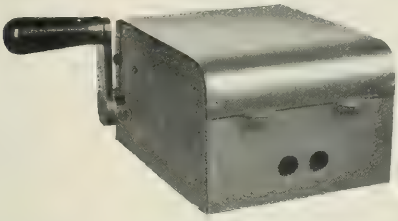
The 50-B.H.P. motor is of the open slip-ring type, speed 580 R.P.M., with a Westinghouse chain drive on to a line shaft which operates certain machinery in the finishing and milling departments. In the dyehouse a 7-B.H.P., 960 R.P.M. motor drives various plant through shafting, and a 3-B.H.P. back-geared 1,500 R.P.M. motor operates a two-piece dyeing machine and a wool-dyeing machine.

The first floor of the main mill contains twisting machinery by Messrs. Prince, Smith and Messrs. Sykes, each machine being individually driven by totally-enclosed 6 and 7-B.H.P. motors, running at 980 R.P.M., through fast and loose pulleys.

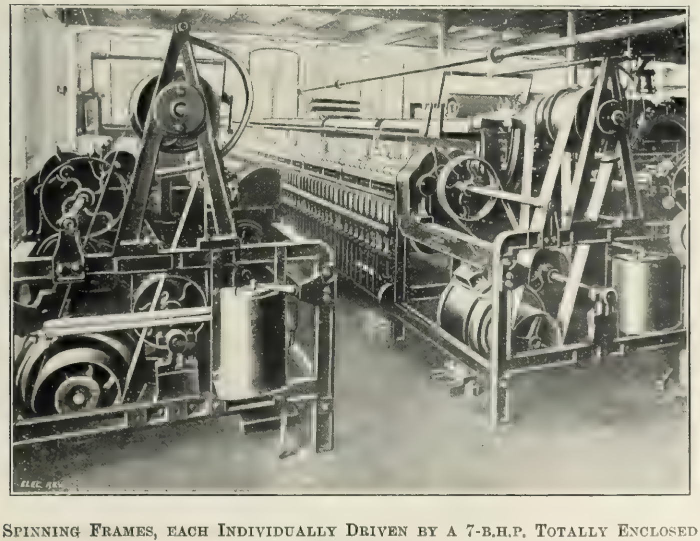
On the second floor are 17 sets of carding machinery, each consisting of a scribbler, intermediate and condenser. These are divided into groups for motor driving purposes, *i.e.*, three groups of four machines, and one of five, as the power required for starting up is considerable, but subsequently falls off, and the machines are run continuously from morning to night.

The motors are of 20 B.H.P., 575 R.P.M., with a driving pulley at both ends of the shaft, and are fixed to the ceiling.

On the third floor of the main mill weaving, carding and spinning machinery is installed. Here a number of 90-in. reed space 100-pick Dobcross looms, by Messrs. Hutchinson, Hollingsworth & Co., are individually driven, the 1 B.H.P., 950 R.P.M. Schorch loom motors being mounted on the frames, with a belt drive from a 4-in. motor pulley on to a 14-in. clutch pulley geared to the loom. A small spring-controlled totally-enclosed starting switch is fitted beside the motor and a testing socket is provided on the motor to enable a portable meter to be plugged in for ascertaining the current taken.



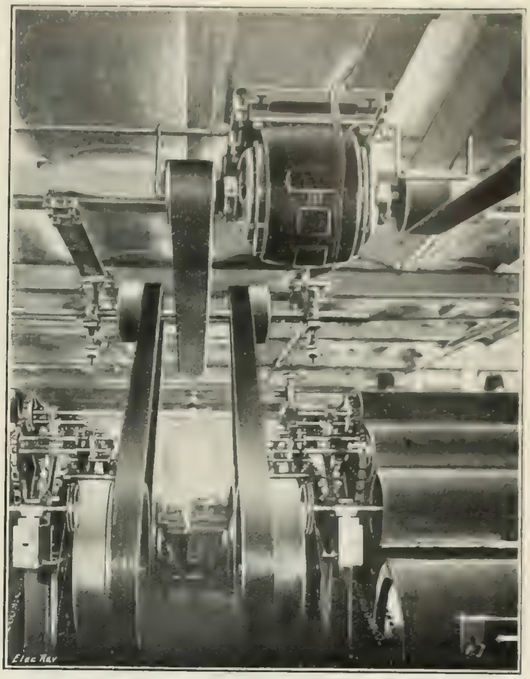
Standard Schorch Loom Motor Switch for Friction Drive.



Spinning Frames, each Individually Driven by a 7-B.H.P. Totally Enclosed Motor.

Each pair of loom motors is supplied from a cast-iron distribution box sunk in the floor, the motor circuits being taken out through Zed fuses and carried in steel tubing up to the starters.

A main distribution cable, run in buried screwed steel tubing couples up the boxes in series to the main distribution board for the room.

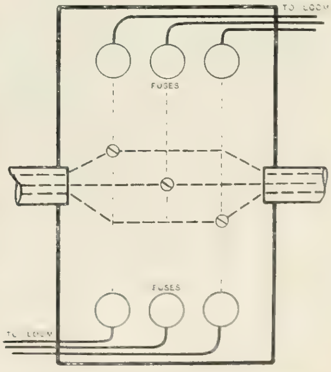


15-B.H.P. S.C. Motor driving Two Large Sets of Carding Machines.

Thirteen looms of an older pattern, which it was not easy to convert to single driving, are group driven from a 12-B.H.P. motor, while on the same floor a 15-B.H.P. motor, 575 R.P.M., attached to the ceiling, drives two large sets of Yorkshire carding machines, by the Chadwick Machine Co., each set consisting of a scribbler, two swifts, a carder, and a tape condenser.

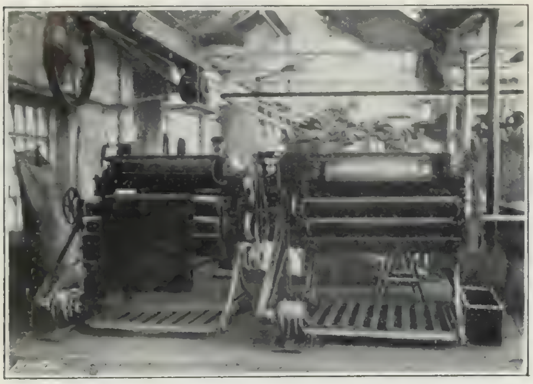
There are also five Sykes spinning frames, each with 210 spindles, and these frames are each equipped with a 7-B.H.P. motor, 980 R.P.M., giving an individual drive.

On the top floor of the mill are 18 self-acting mules, with about 4,000 spindles. In these mules the variation in speed is made on a counter-shaft, and each of the latter is driven by a 5-B.H.P. totally-enclosed motor, speed 970 R.P.M., fixed to the roof, and having a different diameter pulley at each end of the rotor shaft; it may be mentioned

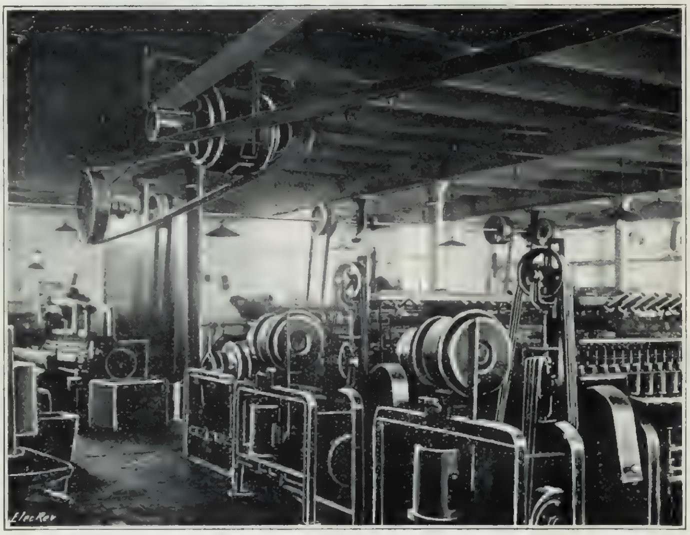


Floor Distribution Box for Loom Motors (Plan).

that with the type of mule generally used, only one pulley is required for driving a countershaft, which drives the mule headstock. The starting switches are on adjacent pillars, and the wiring is run in steel tubing along the roof to the main distribution board.



Cloth Cutters singly driven by $\frac{1}{3}$-H.P. Motors.



Twisting Frames, with 6-B.H.P. Individual-Drive Motors ; also 20-B.H.P. Motor for Group Drive.

It may be added that the standard distribution board is of the ironclad type, equipped with Zed fuses, the latter type of fuse being used for all services up to 60 amperes ; beside the above board is an ironclad terminal board containing a main switch, ammeter, voltmeter, and a watt-hour meter for checking the operation of the motors.

In another old portion of the mill a 15-B.H.P. and two 5-B.H.P. motors, all back geared, are employed in driving weaving and finishing machinery ; in the finishing department there are individually driven, a Bailey steam-blowing and air-cooling machine by a 7-B.H.P. motor, a Tomlinson brushing machine by a 3-B.H.P. motor, and an hydraulic pump for supplying the cloth presses, by a 3-B.H.P. motor, while three other small motors are employed for driving, cutting and folding machines in this department.

A 5-ft. diameter Blackman fan is driven singly by a 5-B.H.P. motor, and the various machine tools in the mechanics' shop are group driven by a 5-B.H.P., 980 R.P.M., motor.

The riggling and cuttling machine, which runs at a very slow speed, is driven from a back-geared motor of $\frac{1}{3}$-B.H.P. output ; five International winding frames in another part of the mill are also driven singly by $\frac{1}{3}$-B.H.P. motors running at 1,450 R.P.M.

The chain and box hoists have separate motors, both driving through belts on to the fast and loose pulleys of the gears.

A 5-B.H.P. motor is also in use for driving the mechanical stokers of the boilers, which supply steam for the processes in the mill, and the machinery in the joiners' shop.

The motors are all wound for 220 volts, and those actually in the mill rooms are all of the totally-enclosed type fitted with ball bearings ; the Schorch Co. have been exponents of the three-phase single-drive system from the beginning, and they favour a working voltage of about 220, for all small single-drive motors as being safer, cheaper and more efficient than higher pressures.

Wherever possible similar sizes of motors are installed, so that only a few spare machines, and some spare parts for the larger motors, are required. In this case only one loom motor and one mule motor are kept as spares, and, if required, a quick change over can be made in case of breakdown, which, in any event, would, with the single drive, only affect one machine.

The Schorch motors, even in the small sizes, have a high efficiency over the usual running range, a matter of extreme importance where many such motors are in continuous use all day long ; on a 10-hour rating the temperature rise, despite total enclosure, does not exceed 50°-60° F. above the surrounding atmosphere, and we understand that experience with ball-bearings has been that attention and maintenance decrease with use, owing to the elimination of faulty bearings at an early stage. We reproduce some efficiency curves of small Schorch textile motors which may be of interest in this connection.

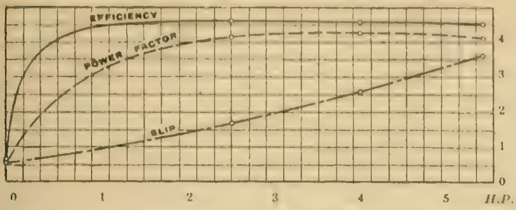
In the ordinary way the company also uses 2,500-meg. or 600-meg. grade rubber-covered cable in screwed tubing for distribution purposes up to 15 H.P., and beyond that three-core bitumum-insulated lead-covered cable cleated to the walls, &c., armoured cables being used in yards or damp places.

In addition to the motor installation, this mill is electrically lighted throughout, some 700 tungsten lamps being in use. We understand from Mr. J. S. Hall, the general manager—to whose courtesy we are indebted for the opportunity to visit this plant—that the change to complete electrical driving has given the greatest satisfaction, not only to the directors of the firm, but also to their workpeople ; while it has obviously meant a great saving in friction load as compared with the mechanical drive for intermittently-running machines, a far more important point is the increased production, amounting to

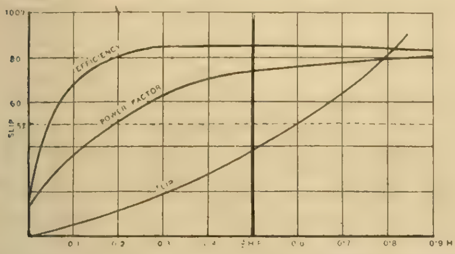
Wool Scouring Department : 15-B.H.P. Motor driving Scouring, Drying and Extracting Machinery.

from 6 to 8 per cent., due to the even speed maintained, which has been verified in similarly equipped mills, and will doubtless be proved in this case when complete records have been secured.

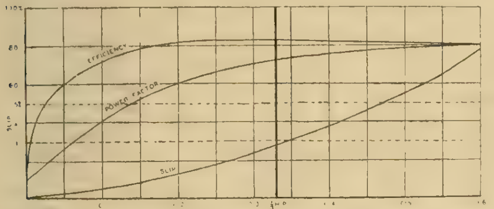
There is no doubt that for the great bulk of textile machinery operating under ordinary conditions there is very much to be said in favour of individual driving, and in proof of the growing appreciation of this fact, one has only to point to the installation by the allied Rochdale firms, Messrs. S. Turner & Co. and Turner Bros., Ltd., of over 1,000 Schorch single-drive motors in their mills, one section after another having been converted as the result of their experience.



Characteristic Curves, 5-h.p. Totally-Enclosed Spinning Motor.

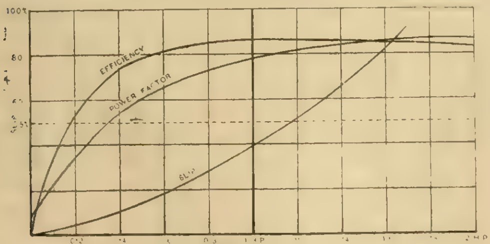


Characteristic Curves, ½-h.p. Totally-Enclosed Motor, No-Load Speed, 1,000 r.p.m.



Characteristic Curves, ⅓-h.p. Totally-Enclosed Motor, No-Load Speed, 1,000 r.p.m.

Mr. W. R. Rothenberg, general manager of the Schorch Electrical Co., of 35, Basinghall Street, E.C., to whom we are also indebted for assistance in the preparation of this article, informs us that the maintenance charges on an electrical installation of this kind are not more than from 1 to 1½ per cent. per annum.



Characteristic Curves, 1-h.p. Totally-Enclosed Loom Motor, No-Load Speed, 1,000 r.p.m.

CITY NOTES.

—Continued from page [illegible].

Bruce Peebles & Co., Ltd.

At the fifth annual meeting, held at Edinburgh on Feb. 27th, Mr. F. E. [illegible], who presided, said that the accounts showed an appreciable advance, indicating a distinct improvement in the affairs of the company. Nevertheless, the year just completed had not been without considerable difficulties and anxiety, for in the early months they still suffered to some extent from labour troubles, and the Leith Dock Strike in June, July and August hampered their work very much indeed. Until quite recently also they had been greatly handicapped by the impossibility of obtaining reasonably quick deliveries of raw materials. Conditions such as these were bound to increase the cost of manufacture, and the contracts completed during the early months of the year were naturally very adversely affected as regards cost by the aftermath of the grievous labour disturbances of the previous year, but matters had gradually improved and settled down to a more normal course, so that the last five or six months had been much more satisfactory, the output having been greater and the works much more profitably employed. During the year, Mr. Bastow, their engineering manager, had given special attention to the internal organisation of the works with a view to cheapen the cost of production and at the same time improve the high standard of their electrical machinery. As a result, improvements had been made and economies effected whereby the establishment charges had been reduced. In a highly specialised and progressive industry such as this, however, standing charges were bound to be high, and it was impossible to reduce them beyond a certain point without impairing efficiency, so that very serious consideration had to be given before any reductions were carried out, in order to make sure that they were true economies. Any savings they had been able to make, however, were, to a large extent, offset by the cost of the National Insurance Act, which was a heavy burden without any compensating advantage to manufacturers. He was still unable to find that they derived any benefit whatever from this act, which, in its present form, was obnoxious and disliked as much by the workman as it was by the employer. For some years past manufacturers of dynamo electric machinery had been through a very bad time. Competition from foreign manufacturers had been, and and still was, very active, and a serious menace, shut out as British firms were by absolutely prohibitive tariffs from competing in their home markets. Reference to the Board of Trade returns gave some idea of the large amount of wages lost each year to British workmen by the placing of contracts abroad by municipalities and others, and would enable them to realise to some extent the tremendous difficulties with which British manufacturers had to contend owing to Free Trade policy. Then, owing to the fact that there had not been enough work to keep British factories adequately employed, such keen competition and cutting of prices had taken place that the margin of profit had been insufficient to cover normal establishment charges, let alone to give any return on the large amount of capital invested. It was a good feature to note, however, that prices, although still very low, had during the past year shown a tendency to harden slightly, and were not so absolutely unremunerative as they were two or three years ago, many of the home manufacturers having at last recognised the utter futility of the senseless and suicidal policy of taking orders at any price merely for the sake of getting them. Their own volume of work had been fairly well maintained. In the home market they had been able to secure a fair share of the orders given out during the year, and what was equally important they had obtained them at somewhat more satisfactory prices. They had given special attention to colonial and foreign trade, and the results of their persistent cultivation of the over-seas markets had been very gratifying, so that they were hopeful of a steady increase in the orders from their various agencies abroad. One of their engineers who had been in South Africa on their behalf for the last three years, came home on leave in the summer, when they discussed with him future policy and prospects. Their position and reputation in that part of the world were firmly established, and their business from that agency, which had already been quite satisfactory, was expected to appreciably increase in the near future. In the case of Canada, their friends, the Ferranti Electrical Co., Ltd., had taken steps to carry on a very active campaign in that country, and an agreement had been made between them by which their interests would be efficiently and vigorously represented. They had already been fairly successful in the amount of work obtained from that quarter, but he anticipated greatly improved results from the new arrangement.

In the annual accounts, buildings, machinery and plant stood at the same figures as before; the auditors mentioned the question of depreciation—that was a question that had, of course, had the attention of the board, and as soon as their profits permitted they would deal with the matter. Meantime, during the year, they had spent not less than £4,737 on maintenance, and ever since this company was formed they had annually expended a large amount out of current revenue in keeping the plant and tools in a high state of efficiency. Stock, stores and work in progress amounted to £47,885, as compared with £52,282 a year ago, and this was perfectly satisfactory. The manufacturing and trading account showed a gross profit of £11,751, compared with £3,864 a year ago, and adding interest, etc., and deducting administration charges, the profit, before allowing for debenture interest, was £10,250. After paying the interest on mortgage debentures and allowing for the interest accrued on the unsecured debentures, they had a net profit balance of £2,820, which compared with a loss of £4,593 a year ago. This sum went to diminish the total adverse balance standing against profit and loss account, bringing it down to £21,675, of which amount £20,218 represented the total interest accrued to date on the unsecured debentures. Debts due to the company amounted to £53,816, and cash at bank to £10,993, making a total of £64,809, whilst the debts they owed only amounted to £25,300, as compared with £30,517 a year ago, so that their financial position was much strengthened and was quite sound and satisfactory, and substantial improvement and distinct progress had been made during the year 1913. With regard to the future—gas, whether for heating, lighting or power, was doomed—electricity was rapidly sweeping it aside. He was convinced that they were on the verge of a largely increased demand for electrical machinery and apparatus of every description, and for all purposes; from that increased demand they, in common with all other electrical manufacturers, were bound to benefit. They started the new year with a satisfactory number of orders on the books, the staff was able, hard-working, and enthusiastic, the outlook was brighter than it had been for a long time past, and he had every hope that during 1914 they would be able to improve on the considerable progress already made.

This motion was seconded by Mr. A. B. Anderson and carried unanimously, and a vote of thanks was accorded to the managers and staff.

Notting Hill Electric Lighting Co., Ltd.

The annual meeting was held on February 25th, Sir William Crookes presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev., page 325), first referred briefly to the capital account and to the sale of a part of their surplus freehold property at Lancaster Road. The revenue account showed an increase of £1,338, most of which was absorbed by increased expenses. The chief increase was in the case of the current purchased from the Wood Lane Works, which was about £650 higher. That was mainly brought about by the increased price of coal, and was also due to the fact that the Wood Lane Works did not have the benefit of a supply to the White City Exhibition, which was closed during 1913. They were arranging terms for a supply to the exhibition which would be held this summer. The distribution expenses had increased by £260, and, with the £400 addition to the directors' fees which was voted at the last annual meeting, they would clearly see how the additional revenue had been expended. The net result of the account showed a total profit of £24,465, which was slightly in excess of the previous year. The depreciation, renewal, and reserve fund account now stood at £43,151, and as the machinery and mains were kept in an efficient state out of revenue, the balance of that account should be certainly more than ample to cover depreciation on the undertaking. Their property, other than land and buildings, was valued at £211,000, so that the depreciation was over 20 per cent. of it. The total contributed by the company to the Kensington and Notting Hill Joint Debenture Stock Sinking Fund had reached £51,889, and the total was now over £59,000, which was invested in trustee securities and was rapidly increasing by compound interest to meet the redemption of the joint Debenture stock which had been issued up to a total of £231,500. Most of those securities fell to be repaid when the company's Debentures were redeemed, and on that there could be no question of loss or depreciation. The statistics showed that during the year they had added over 11,000 new lamps to the circuit, bringing the total connected up to 222,350. Although they were continually adding lamps, the revenue did not increase in full proportion at present, as the old consumers gradually adopted metal filament lamps, so that a portion of the new connections went to make up the loss they sustained by the more general use of those lamps. A half-watt lamp had recently been placed on the market which was supposed to consume only a half-watt per candle-power, and when they remembered that the original carbon lamp consumed between three and four watts, it would be seen that consumers were now getting more for their money than they did a few years ago. In addition to the enormous drop in the current consumed by the lamp, the price per unit had also been reduced. He saw no reason to fear the introduction of the new lamp, as he did not think it would affect their revenue seriously for some years, as at the present time it could only be obtained in sizes for 600 candle-power, and could not therefore be adopted for private house lighting. The co-partnership scheme for the staff which was initiated in 1912 was working very satisfactorily, and the employees would each receive out of last year's profit an addition of 8 per cent. to their wages. With regard to the future, he was able to speak very hopefully, the current year showing signs of increased prosperity. He believed the revenue would increase, and the costs would probably be lower. The resignation of Mr. Schultz, their engineer and manager for the past 23 years, through ill-health, would mean a saving in expenditure, but in accordance with agreements that saving would not come into effect until next June. They might expect him to say something with regard to the application which was being made to Parliament for powers to form a bulk supply company for the whole of London. Except to assure them that the directors were very closely safeguarding the shareholders' interests and that they had petitioned against the Bill in order to ensure their being heard in the Parliamentary inquiry, he did not think it was advisable for him to say anything further on the subject.

Sir R. B. Martin, Bart., seconded the motion.

Mr. R. A. Pfungst called attention to the provision for depreciation and reserve, and said it was the general opinion amongst electrical authorities, that that company had been one of the principal offenders, especially in the past, in neglecting to make proper allocations for that purpose. If, as the board said, they had made sufficient depreciation, he would like to know how it was that other companies similarly placed had found it necessary to make much larger provision. He ventured to suggest that the dividends were only paid by neglecting to put to depreciation and reserve a proper amount.

The Chairman, in reply, said he could only repeat what he had said in his opening speech, but he would also remind the shareholders that in addition to the reserve mentioned in the balance-sheet there was the sinking fund on the Wood Lane Works, and in 1913 the company would come in for its share of those works free of cost, which would probably be worth some £60,000.

The report was adopted.

Para Electric Railways and Lighting Co., Ltd.

The annual meeting was held on February 27th at the Cannon Street Hotel, E.C., under the presidency of Mr. F. Holt.

In moving the adoption of the report (see Elec. Rev. p. 368), the Chairman, after referring to the death of Sir W. Evans Gordon, who had been chairman of the company since its inception, said that the results spoke well for the efficiency of the management in Para. The city had a population of 180,000 inhabitants, and was the principal collecting and distributing base for the export and import trade of the Amazon Valley. Their concession was for a period of ninety-nine years from 1905, after which the whole of the property reverted to the municipality without payment. The concession covered tramways, electric public lighting, commercial power, and private lighting. Briefly, the property consisted of a power house, having at present a capacity of 3,300 k.w., 12 miles of double track and 11 miles of single track, 94 motor cars and 24 trailers, a well equipped carshed, capable of accommodating 136 cars, and a complete system for the distribution of electricity for public and private lighting and power. In the past year the total gross receipts derived from working these properties suffered a reduction of 2.4 per cent to £299,925, and the operating expenses 1.8 per cent. to £164,262, the ratio of expenses to receipts working out at 54.8 per cent, as compared with 54 per cent. of the previous year, exchange having remained more or less constant. During the first four months the net earnings showed substantial increases, but from April onwards the net gross earnings began to fall off. Some statistical results for the whole year might be of interest. In the tramways department the number of passengers carried increased by 32,000, to a total of 23,254,000. Of these first-class decreased by 739,000, and second-class increased by 771,000, the result being that the gross receipts from this branch of the business decreased by 1 per cent. to £210,673, but as the operating expenses decreased by 3.5 per cent. to £119,889, the net gain amounted to £2,445. In the lighting and power department the gross revenue decreased by 5.7 per cent. to £89,251, but here the operating expenses increased 3 per cent. to a total of £44,372, the net result being, therefore, a decrease compared with the previous year of £6,684. The public were being forced to economise in every direction, and this was shown strikingly by the fact that although the number of private consumers increased during the year by 13 per cent., the gross revenue from this source, £48,200, showed a decrease of 15 per cent. The public lighting business had also undergone some change. After improved lamps had been installed, in view of the difficulties through which the city was passing, the directors decided to offer the municipality a reduction in the rate for public lighting equivalent to about £800 per month, together with a discount on all their cash payments. In friendly acknowledgment of this action, the municipality adjusted several matters which tended toward the reduction of operating expenses and smooth working, and the changes made had been very greatly appreciated by the mayor and the other authorities. For the year the municipal account amounted to £28,300. The power supply to the public for commercial motors, while still comparatively small, had increased during the year from 185 horse-power to 470 horse-power connected load. After payment of the debenture interest and sinking fund, amounting together to £38,500, there was left a balance of £102,405 for renewals, reserves, and dividends. From this balance the directors proposed to transfer £15,000 to reserve for depreciations and renewals, bringing this fund up to £72,155, and a further £10,000 to the contingencies reserve, which would raise the total under this head to £40,522. The sum that they had in reserve, accumulated from earnings, at the commencement of the current year amounted to the substantial figure of £112,677, or including the carry forward, to £131,883. After transferring this £25,000 to reserves and allowing for the interim dividends, a balance of £48,305 remained, from which they recommended the payment of a further and final dividend of 3 per cent. on the Preference shares (making 6 per cent. for the year) and 5 per cent. on the Ordinary shares (making 10 per cent. for the year), leaving £19,205 to carry forward to next year's accounts, £9,000 more than that brought in. He trusted they would consider these recommendations satisfactory. The directors made them because in their opinion the earnings of the year fully justified the same dividend on the Ordinary shares as in the previous year, but they felt it their duty to point out that the immediate prospects were such that, unless a great improvement in trade took place, it might not be possible or wise to recommend the same high rate for the current year. Since April last the commercial conditions on the Amazon had been the cause of a material reduction of the receipts, but for some time before April trade in Pará had been much affected, mainly on account of the severe fall in the value of rubber. This depression increased throughout the year, and, incidentally, caused the failure of a number of important and hitherto strong commercial houses. All of this had brought about a decrease in the earning and spending power of the people. It behoved them, therefore, to be more than ever careful in the management of the business until normal times returned to the district they served. This they thought must be preceded by a readjustment of economic conditions there and an earnest effort to develop and conserve all old and new sources of trade, for it was unlikely that the people of the Amazon Valley would ever again be able to depend entirely on rubber to maintain the progress the vast valley demanded, as they had appeared willing and able to do heretofore. The first two months of the current financial year showed on their earnings the continuance of those adverse factors, as the gross receipts had decreased by £8,159, which was met to some extent by a reduction of £3,662 in operating expenses. Every effort was being made to keep these to the lowest figure compatible with the efficient maintenance of the property, and it was not only a pleasure but a duty to testify that their manager, Mr. Walter Binns, assisted by a loyal and efficient staff, had managed the property and cared for the company's interests in Pará during the past year in a most satisfactory manner.

Mr. Hubert Ansell seconded the motion, which was adopted.

Llanelly and District Electric Lighting and Traction Co., Ltd.

The annual general meeting was held on February 27th, at 66, Queen Street, E.C., Mr. A. R. Holland presiding.

The Chairman, in proposing the adoption of the report (see Elec. Rev., page 371), said that during the year the tramway, lighting, and power receipts amounted to £24,951, showing an increase of £6,000 as compared with the previous year, and it was especially gratifying to add that each of the three departments had contributed their fair and proper share to the increase. The tramways showed a very good return, and the lighting section steady progress. New customers were being constantly connected up, and when once premises were wired, the customer as a rule remained a constant customer. They had also secured additional contracts for power, and with the other negotiations now on foot he considered the prospects of the company to be exceedingly good—in fact, so good that they were now seriously considering what additional plant should be added so as to cope with the additional load they undoubtedly would have to deal with at the commencement of the winter period. Their present plant was already so loaded that, after making a fair allowance for margin, new plant was absolutely necessary. For the purpose of paying off the indebtedness already incurred on capital account, the board proposed to issue a further £15,000 6 per cent. Preference shares in the immediate future. The operating expenses naturally showed an increase, the greater part of which was caused by the extra coal consumed; and unfortunately during the year the price of coal had been exceedingly high. The new contracts recently entered into showed a fair reduction in price, which would somewhat benefit their cost sheet. In addition, the engineers were contemplating certain alterations at the power house which could not fail also to effect a material economy in the cost of current to the company. The result of the trading was that they were able to carry down £10,137 as profit for the year, which, with the amount of £2,801 brought in, made a total of £12,939, as against £9,595 in 1912. Having fairly good accounts to deal with, they considered it wise on this occasion to place to various reserve accounts £3,500 with a view to strengthening the position. He did not know that it would be necessary to put quite such a large amount to these reserves another year. £61,000 of Debenture stock had been issued and placed, a further £14,000 having been lodged with their bankers as security for a temporary loan, and naturally from the proceeds of the 15,000 Preference shares already referred to, the loan would be paid off, thus rendering those Debentures available for the other purposes of the company. On the credit side the cost of the undertaking had during the year been slightly increased by £[illegible] for various capital purposes, cable, etc. The item of stock was quite normal. As regarded the debtors, on this occasion they stood at £4,015, or a little more than £500 less than on the previous occasion. This naturally arose from their local office having now got into thorough working order, and therefore the accounts were collected more promptly.

Mr. A. H. Beatty seconded the motion, and the report was adopted.

Underground Electric Railways Co. of London.

The Rt. Hon. Sir Edgar Speyer, Bt. (Chairman), presided on March 5th at the Westminster Palace Hotel over the annual meeting of the above company.

In moving the adoption of the report (see Elec. Rev., page 370), he said he thought, considering the various factors affecting the situation, there was no reason for dissatisfaction with the result achieved. The policy of working as one unit the various enterprises in which the company was now interested had been further developed, and he could only repeat that the hope for the shareholders to get a return on their capital and for the travelling public to get the best possible service lay in the closest possible co-operation between the various transport companies. What was of importance and interest to them was not so much what each individual company had done by itself, but what the companies had achieved as a combined undertaking both for the shareholders and the public. During the period under review the companies in which they were interested had gross earnings amounting to £6,385,500. They carried the huge total of approximately eleven hundred million passengers, at an average of 1.4d. per passenger. Their total pay roll amounted to over £2,350,000, and they spent more than £1,563,000 on capital account for various improvements in order to put the transportation services of Greater London on a still higher level. To perform this service 27,000 men were employed. The company which had been the largest factor in securing the result was the London General Omnibus Co., which carried a total of over 580,000,000 passengers and whose gross passenger earnings amounted to £3,200,000. Although it had not been the policy of the Omnibus Co. to work unnecessarily competitive routes, the development of the company's services had undoubtedly prejudiced the growth of the Underground Railways, and this was unavoidable so long as there was a public demand for new motor 'bus routes. It was expected that this effect would be, in part, at least, offset by a system of working and of through tickets between the motor 'buses and the railways, and it was to secure this object that the company became interested in motor 'buses. The fact that the working results of all the companies had in the aggregate been so successful was a complete justification of this policy. The Chairman next touched on the importance of unification of services, and afterwards dealt with the report of the Select Committee of the House of Commons on Motor Traffic. Some of the recommendations embodied in the report were, he thought, sound, and could be adopted with advantage to the public, but others would in their opinion only add to the difficulties of the present situation instead of effecting an improvement. They entirely dissented from the view that the London County Council, who were interested in a competitive service of tramways, should be given wide powers of control over the working of mechanical stage carriages, even with an appeal to some new public department. They considered that the true solution of the great traffic problem of London lay in all the transport agencies being brought under one, but only one, control, which, however should be absolutely independent and impartial. As repeatedly stated, they believed the best results to the public would be secured by means of an owning, and not merely an advisory, authority. Although the Omnibus Co. had progressed more rapidly than the railways, he did not wish it to be understood that he thought the District and Tube Railways had come to the end of their development. This was, in his opinion, very far from being the case; but in order to secure better results these railways could not stand still. There was good ground for hope that all of them would benefit not only from the natural and continuous increase in the population of London and the congestion in the streets, but also from the extensions which were planned and which would be pushed forward now that the requisite Parliamentary sanction had been obtained. The Chairman next dealt with the various services in which the company was interested. With regard to the City and South London Railway, until the tunnels had been enlarged and the train service modernised no better earnings could be looked for from this railway. As regarded the Central London, the Great Western Railway was progressing with the construction of the connecting line between Shepherd's Bush and Ealing, and it was anticipated that through trains would be running between Liverpool Street and Ealing well within a year from now, and that the revenue account of the company would correspondingly benefit thereby. After the improvements referred to both in the case of the City and South London and Central London Railways had been completed, these companies should earn sufficient net revenue to wipe out any deficiencies which their company now had to meet. The London Electric commenced working a service of trains to Paddington

Station on December 1st last, and within the next two months the extension to the Embankment at Charing Cross, and the escalators at Oxford Circus, should be open for traffic. The Queen's Park extension was progressing very rapidly, and should be ready during the current year. The District Railway Co. had no large works in hand, but when the construction of the Wimbledon and Sutton Railway now under discussion was completed, the earnings of the District Railway Co. would be substantially improved. But quite independent of this extension the traffics of this railway should continue to expand. The London and Suburban Traction Co. had fully come up to expectations during the short period of its existence, and had paid a full 5 per cent. dividend on its Preference shares. The outlook for this company was encouraging, and some distribution on the Ordinary shares, of which their company held 744,324 shares, seemed now a likely event in the near future. The results of the Omnibus Co. had been quite satisfactory, and unless the normal working of the company was impeded by unforeseen circumstances there was every reason to hope that the expansion of its traffics would continue and a good net result be obtained. The Associated Equipment Co. had earned large profits compared with its small capital, and these had been obtained from three sources: The construction of chassis; the manufacture of various parts for the companies in which they were interested as well as for others; and from the operation of 'buses by the subsidiary company called the Metropolitan Steam Omnibus Company. The revenue account showed total receipts of £629,817, as compared with £494,934 in 1912, an increase of £134,883, of which £107,500 was due to the income from the company's holding of Associated Equipment Co. shares. The larger portion of the increase in the latter was due to the fact that owing to the Associated Equipment Co. having started operations on 1st August, 1912, only five months' revenue from this source was included in the 1912 revenue account. The income from holdings in the London Electric Railway Co. was £121,120, as compared with £152,124. The decrease was almost entirely accounted for by the acquisition of the City and South London Ordinary stock, the former holders of which received 40 per cent. in London Electric Preference stock and 25 per cent. in London Electric Ordinary shares in exchange for their Stock. As the income from the holding of City and South London Ordinary stock only amounted in 1913 to £1,821, there was a loss of income from this source of about £25,196. The income from holdings in the Metropolitan District amounted in 1913 to £39,900, as compared with £35,471 in 1912; that in the London General Omnibus Co. was practically the same each year, and sundry receipts amounted to £58,605, as compared with £38,383. As to the debit side of the revenue account, he need only refer to the item of £26,830 representing the amount paid on Central London Railway stocks under guarantee. Their company made itself liable to holders of Central London stock who came in under the scheme for a dividend of 4 per cent. per annum. The Central London Railway Co. only declared a dividend of 3 per cent. on its Ordinary stock, and the amount charged to revenue account represented the extra 1 per cent. paid to holders of Assented stock. The surplus for the year after paying all fixed charges and the full interest on the Underground Income bonds amounted to £42,174, as against £2,996 in 1912; these two sums amounting to £45,170 represented the balance carried forward to the current year. Having regard to the adverse factors which militated against the results of their railways, the net results of which had been materially affected by the high price of coal, the increases in wages and the improvement in the conditions of service of certain grades of employees, he thought the progress shown was distinctly encouraging. The Underground Co. had made very rapid strides during the last three years, and shareholders might therefore have expected some distribution before now. But it should be borne in mind that the various acquisitions to which he had referred had inevitably delayed this, and as was always the case with new acquisitions and responsibilities, the burdens preceded the benefits. These benefits had now begun to accrue. The company had long since completed the railway construction and equipment work which it undertook, and had disposed of its Power House to the Metropolitan District and London Electric Railway Companies. Its assets now consisted almost entirely of its holdings in stocks and shares in the subsidiary companies. The company was therefore to-day in substance a share and securities holding company, but it was not one at law, and in consequence could not declare and pay dividends without an annual valuation of its assets. Owing to the fact that in some cases these assets were unquoted and that in others only such small amounts were in the hands of the public that the dealings in them afforded no true criterion as to their value, it would cast an undue burden on the directors if they were called upon to make such an annual valuation. This could be obviated if the Company were actually turned into a holding company with wide powers, and with the approval of the shareholders the directors proposed to take this course and to alter the Memorandum and Articles of Association and obtain the necessary sanction of the Court.

Lord Farrer seconded the motion.

Mr. Walford said it had been publicly stated that the Great Eastern Railway Co. intended to electrify its lines. Would it not be possible for their company to make an arrangement with the Great Eastern Co. by which the Central London Railway could be carried on down to Walthamstow?

Sir Robert Perks pointed out that their companies were carrying the public at an extremely low rate. If they could add ½d. to the average fare per passenger on the District Railway, as they told the Parliamentary Committee they intended to do when they got their electrical powers, and slightly add to the fares of the other companies, they would have a very large increase of income, and they would then be far below the rates at which New York and Paris were carrying their passengers.

The Chairman said the suggestion of Mr. Walford would, of course, be considered. The question of raising fares was a delicate one. The policy of the Underground Railway was in the direction of low fares, and they thought the best results were to be obtained by carrying the public as cheaply as possible. They were in a different position in London to Paris and New York, as here the local authority was competing with them.

Sir Robert Perks: And losing money.

The report was adopted and the retiring directors re-elected.

British Electric Transformer Co., Ltd.

The eleventh annual meeting was held on March 5th, at Salisbury House, London Wall, E.C. Mr. A. F. Berry presiding.

The Chairman, at the outset of the proceedings, referred with regret to the continued indisposition of the chairman of the company, Mr. J. F. Albright, and said that that gentleman had expressed to him (Mr. Berry) a wish to resign from his position. In view, however, of his past services, he (the speaker) felt sure it was the wish of the shareholders that Mr. Albright should continue to act as chairman, and he would like an expression of opinion from the meeting on the subject. Proceeding to propose the adoption of the report (see Elec. Rev. p. 360), dealing first with the debtor side of the balance sheet, he said the item of sundry creditors had decreased by £3,274, which meant that the directors had followed their usual practice of getting the maximum amount of cash discount by paying their bills promptly. With regard to depreciation reserve, owing to the valuation of their freehold land, buildings, plant, machinery, and leasehold premises, it was unnecessary last year to increase that reserve, but this year they proposed to add £1,500, bringing the reserve up to £9,300. The general reserve would, with the proposed addition to it, stand at £29,245, which was a fairly substantial figure. On the credit side of the balance sheet it would be seen that the item of freehold land, buildings, etc., had been increased by £3,991, due to purchase of some freehold land adjoining their old site, in order to facilitate extensions in the future. Turning to the profit and loss account, they would see that the general charges had increased by about £1,800, which was due to extra work carried out during the year, which, he might say, had been the heaviest year that the company had ever had. By reason of the competition they encountered, the works output every year represented more actual work than in the previous year. In other words, they had to deliver a far greater output of machinery for the same amount of money. He need hardly say that they watched the general charges as carefully as they could, and he did not think it would be safe to attempt to reduce them. The gross profit of £31,920 was £3,766 higher than that of the preceding year. The item of interest and discount was practically the same, and the net profit was about £500 more. He thought the ordinary shareholders were to be congratulated on the fact that this was the third year in succession in which the directors had been able to recommend a dividend of 10 per cent., and when it was considered that they were distributing less than half the total profits available, and had put considerable sums to reserves, it would be seen that the position was eminently sound. With regard to the question of extra remuneration to which the directors were entitled, they did not think it fair either to the shareholders or themselves that it should be dependent upon the ordinary shares receiving 10 per cent. As it would take some time to call extraordinary meetings to alter the articles in that respect, the board thought that their best course was to waive their right to the extra remuneration and leave themselves in the hands of the shareholders, as a body, to vote them what extra remuneration they thought fit. In due course notice of extraordinary meetings would be sent out, at which resolutions would be proposed for altering the articles to make the extra remuneration dependent on the amount of profit earned instead of the amount of the dividend. The business during the year had shown very marked expansion as they anticipated it would Their shipping orders were particularly satisfactory and showed considerable increases. Repeat orders followed in almost every instance where they shipped abroad, and that they considered a very good testimonial to the nature of their products. They commenced 1914 with orders far in excess of anything they had ever had before. They were in excess of those in hand for January, 1913, which were 25 per cent. ahead of those for 1912, while both 1912 and 1911 were record years in their turn, so it would be seen that their progress had been continuous. With competition always around them, it was not easy to forecast the results for the current year, but from the extended use of electricity in this and other countries, taken with the sound condition of their business, they were enabled to hope for a proper share of orders during this and future years. Their employees, both in the office and works, had worked together this past year, as for many years past, in a way that had enabled them to give continuous employment for many years, and it was a great pleasure to see the sons of some of the workmen coming into the factory to make a start, which meant that some of them had actually worked together for just over twenty years. With regard to the question of a Stock Exchange quotation for their preference shares, the secretary had just furnished the required information to the committee of the Stock Exchange, and, in spite of the comparatively small number of these shares, he expected they would be granted a quotation for them. If the shareholders made a comparison with the results of previous years, they would find that the progress of the company had really been very marked. He had been greatly struck by some figures which he had drawn up showing those results, and he proposed to send a copy of them to the shareholders in order that they might clearly see the progress which the company had made during the last five years.

Mr. T. Rowe seconded the motion, and the report was adopted.

The retiring directors having been re-elected, a resolution was passed awarding the directors the sum of £843 as extra remuneration.

South London Electric Supply Corporation, Ltd.

The directors' report for the year ended 31st December, 1913, states that the gross receipts for the year have been £51,645, and the expenditure £23,475, leaving a profit balance of £28,170 plus £883 brought forward. After providing for depreciation on plant and machinery (£6,300), debenture and other interest accrued, etc., £14,026, there remains £15,028. Out of this a dividend at the rate of 5½ per cent. for the year on the ordinary shares, amounting to £14,300, is recommended; carrying forward £728. At the end of 1913 there were connected to the company's mains the equivalent of 302,124 (35 watt) lamps, a net increase for the year of 28,818. At present there are 310,600 (35 watt) lamps (equivalent) connected, and applications are in hand for a further 12,845 lamps. During the year the plant, machinery and mains have been maintained out of revenue in a high state of efficiency. The units sold were 5,741,226, an increase of 741,108, or 14.8 per cent. Though the total cost per unit sold was 0.98d. as against 1.0d. in 1912, the revenue per unit has decreased in a greater ratio owing to the increased output being sold chiefly for motive power. The ratio of total costs to revenue is 45.5 per cent. During the year the balance of the 5 per cent. first mortgage debenture stock was disposed of, and in order to provide the necessary capital for further extensions the directors have decided to ask the shareholders for their sanction to an issue of cumulative preference shares. They are also asking the shareholders to so alter the articles of association of the company in accordance with recent legislation, as to allow the payment of an underwriting commission. It is not proposed that the commission payable on the shares now to be issued shall exceed 2½ per cent.

Units generated	7,253,593
Sold to consumers and used by public arc lamps ...	5,741,226
Used on works	431,525
Total	6,172,751
Expended in distribution	1,080,842
Total connections in K.W., December, 1913	10,580

The meeting is to be held on March 16th.

W. T. Glover & Co., Ltd.

The directors' report for the year ending 31st December, 1913, shows that the result of the trading is a credit balance of £33,796, plus £8,326 brought forward. There have to be deducted the following:—Directors' remuneration and expenses, £1,020; interest at 4¼ per cent. on first mortgage debenture stock, £4,250; interest at 5 per cent. on second mortgage debenture stock, £3,800; written off investments, £3,603; appropriation for payment to trustees of second mortgage debenture stock, £4,000; leaving £25,448. Out of this are paid the following:—Dividend on 5 per cent. cum. preference shares, £4,708; first mortgage debenture redemption fund, £2,500; dividend on ordinary shares at the rate of 5 per cent., £5,407; bonus on ordinary shares, at the rate of 2½ per cent., £2,704; to reserve fund, £5,000; leaving to be carried forward, £5,128.

After making the above appropriations, the redemption fund for the first mortgage debenture stock will stand at £35,500, the redemption fund for the second mortgage debenture stock at £28,000, and the reserve fund at £25,000. The Trafford Power and Light Supply (1902) Ltd., of which this company holds the majority of shares and also a second debenture for £25,000, have agreed to sell to the Manchester Corporation their concession and entire business of generating and supplying electricity in and near Trafford Park, subject to the necessary sanction being obtained from Parliament during the 1914 session.

The meeting is called for March 16th.

North Metropolitan Electrical Power Distribution Co., Ltd.

The directors' report states that the revenue for the year ended December 1913, amounted to £19,149, an increase of £1,6[illegible]. The balances from the local revenue accounts amount to 7,2[illegible], plus sundry receipts and £291 brought forward. Deducting administration and promotion expenses, and debenture interest, there remains £5,327, which is to be appropriated thus: To renewals fund, £1,000, to reserve £1,000, to ordinary dividend (6 per cent. per annum), £3,000; to be carried forward, £327.

The expenditure upon capital account during the year was £3,503, of which £2,782 was in respect of extensions of mains and installations upon consumers' premises.

The revenue for the year from Barnet electric supply was £6,035, compared with £5,639 for 1912. The installations connected at December were 23,900 30-watt lamps.

The revenue from Enfield electric supply for the year was £4,469, compared with £3,821 for 1912. The installations connected at December last were 23,300 30-watt lamps.

The revenue from Hertford electric supply for the year was £3,998, compared with £3,820 for 1912. The installations connected to the mains at December were 22,200 30-watt lamps.

The revenue from St. Albans electric supply for the year was £4,858, compared with £4,334 for 1912. The installations connected to the mains at December were 24,650 30-watt lamps.

The additional connections made during the year in the four districts represented 3,000 30-watt lamps, making a total of approximately 93,450 30-watt lamps. The units sold were 1,440,024, compared with 1,337,157, an increase of approximately 8 per cent. The company have during the year under review lost some important consumers who are now supplied direct by the North Metropolitan Electric Power Supply Co. The Barnet E. L. (Extension) Order, 1913, received the Royal Assent on 15th August, 1913.

An agreement has been entered into with the corporation of Hertford, whereby the first date of the purchase of the undertaking authorised by the Hertford E. L. Order, 1891, has been extended from 1912 to 1923. The company is, jointly with the North Metropolitan Electric Power Supply Co., promoting in the next session of Parliament a Bill to confer further powers upon both companies. Mr. George Offor has resigned his seat on the board, and Mr. A. L. Barber has been appointed in his stead.

	Barnet.	Enfield.	Hertford.	St. Albans.	Total.
Units purchased	576,348	291,753	290,130	397,682	1,555,913
Units sold—Public lamps	51,213	—	7,384	—	58,597
By contract	306,535	55,572	103,257	188,033	653,397
Private consumers, by meter	150,792	221,927	159,731	195,580	728,030
Total sold	508,540	277,499	270,372	383,613	1,440,024
Total not accounted for	67,808	14,254	19,758	14,069	115,889
Public lamps	201	—	31	—	232
Maximum supply demanded	295K.W.	218K.W.	168K.W.	257K.W.	—

The meeting was held on March 5th.

Scarborough Electric Supply Co., Ltd.

At the annual meeting held a Scarborough on February 28th, Mr. G. Alderson-Smith, in moving the adoption of the report (see Elec. Rev., page 366), said that next August they would come of age and be twenty-one. The report was not perhaps as satisfactory as they could have wished, but still it was an improvement. As far as he could see, they had rounded the corner. The capital account showed that last year they spent £717, but they put £1,000 to that account, so that they were to the good there. The capital account really stood at £114,000. Of that £14,000 had been paid out of revenue account, and they had simply to pay a dividend on the £100,000. Turning to profit and loss account, they had an increase on the sale of electrical energy of £515, and on the sale of lamps of £109. There were other smaller increases, but coal had cost them £323 more. They had in stock some 230 tons of coal against strikes or other emergencies. The balance was £300 more than for the preceding year, and they were carrying forward £847 against £401.

Mr. A. A. Campbell Swinton, M.Inst.C.E. (managing director), in seconding, said he was in touch with, he thought, something over forty different electrical undertakings of this character in various parts of the country, ranging from Inverness to Cornwall. During the past few years all these electrical undertakings had been going through more or less the same experience. The advent of the metallic filament lamp in all cases produced a great drop in revenue, followed by a more or less rapid return to the previous position. Scarborough unfortunately had been much slower in its return to prosperity than any of the other concerns with which he was connected. He thought they might take it that they were now on the upgrade, and that they were at least making a sufficient amount of new business to make up the loss of revenue due to the less amount that each individual consumer paid. All these electrical undertakings were on a sounder basis now than before, because they had more consumers and each consumer paid a little less. They were on a sounder basis because they were in a better position to compete with the incandescent gas mantle.

The report was adopted without discussion, and a dividend of 3 per cent. was declared.

In referring to the retirement from the board of Mr. Simpson, Mr. Campbell Swinton remarked that that gentleman was a large shareholder, and the board would still have the advantage of his advice with regard to coal contracts.

Rhondda Tramways Co., Ltd.

The annual meeting was held on March 5th at the offices, 3, Laurence Pountney Hill, E.C., Mr. L. B. Schlesinger, the chairman, presiding. The proceedings were private, but from the directors' report which was supplied us, it appeared that the balance to credit of revenue account for the year ended December, 1913, was £27,686, plus £1,976 brought forward. From this had to be deducted: rent to the Rhondda Urban District Council £2,255, debenture interest paid and accrued £11,690, sinking fund for redemption of debentures £2,710, written off uniforms £222, written off furniture, fittings, plant and tools (10 per cent.) £191, leaving a balance of £12,593. The directors recommend that there be put to reserve and renewals account (bringing it up to £14,000) £4,000 dividend on preference shares, being the full dividend of 6 per cent. for 1912, and 2 per cent. on account of 1913, £8,000, carrying forward £593. The powers for construction of a railless traction system to connect the tramways with the rapidly developing mining districts of Tonyrefail and Gilfach Goch were authorised by Parliament, and the construction of the system was about to be started. The results for 1913 cannot be compared with those for 1912 without taking into account the coal strike and the strike of the company's own employees in that year.

	1912.		1913.
Gross revenue	£50,859	...	£65,241
Traffic revenue	£49,778	...	£63,721
Profit before providing for debenture interest, reserves and depreciations, etc.	£18,680	...	£27,686
Passengers carried	9,035,974	...	11,660,230
Car miles run	1,093,584	...	1,311,408
Average receipts per car mile	10.92d.	...	11.66d.
Average receipts per passenger	1.32d.	...	1.31d.
Cost of energy per car mile	2.18d.	...	2.35d.
Percentage of operating costs to traffic revenue	64.67	...	58.94
Percentage of operating costs to total revenue	63.26	...	57.56

Lot's Road Power House Joint Committee.

A meeting of the holders of Metropolitan District and London Electric Railways' Joint Power House Rent Stock Charge was held on Monday, March 2nd, at the Westminster Palace Hotel, Mr. W. M. Acworth presiding.

The Chairman explained that the object of the meeting was to ask their approval of an increase of the Power House Rent Charge Stock. On January 15th, 1912, the purchase of the generating station and the statutory lease to the two railway companies were duly carried out, and the joint committee then created had issued £2,250,000 4 per cent. Joint Power House Rent Charge Stock. Since that date the generating station had been worked by the two railway companies for the supply of all electric current used on their railways, and also for supplying current to certain other railway companies and consumers whom they were authorised to supply. For the year ended December 31st, 1910, the output of the generating station was about 130,000,000 Board of Trade units, while for the year ended December 31st, 1913, the output amounted to not less than 156,000,000 units. Certain extensions of the railways of the two companies were under construction which, when completed, would require an additional supply of current. In order to provide for this increased output, and for other supplies which the two railway companies were authorised to furnish, and which they saw their way to supply on remunerative terms, and in order also to ensure greater economy in working, the two companies, with the consent and at the charge of the joint committee, were proposing, and had, in part contracted for, certain enlargements and extensions of, and additions to, the generating station undertaking. The estimated cost was about £216,000. The principal additions included a large tank for the storage of a reserve supply of coal, injection and overflow pipes to the river Thames for cooling water for condensers, and further generating plant (including two 15,000-k.w. turbo alternators). It was proposed to raise this sum of £216,000, together with the amount required to pay the stamp duty on the further stock and other expenses, by the issue of the requisite further amount (not exceeding in all £250,000) of Joint Power House Rent Charge Stock, which would rank in all respects *pari passu* with that already issued. Under the Act and the statutory lease of the generating station undertaking to the two railway companies, the rent payable by the companies to the joint committee automatically increased by the amount of dividend payable on any further issue of rent charge stock as and when issued. The issue of new stock therefore did not impair the security for the existing stock, and he would point out that under the provisions of the Act all enlargements, extensions, and additions to the generating station undertaking would, upon completion, be comprised in the lease granted by the joint committee to the two railway companies. The rent which covered and guaranteed the dividend on all the stock for the time being issued, was payable by the two railway companies in equal moieties as part of their respective working expenses, thus the stock already issued and the proposed further issue were abundantly secured, as they ranked in front of the entire net revenue of the two companies. The additional outlay had, after careful consideration, been sanctioned by the respective boards of the two railway companies, and approved by the joint committee, who considered that it was desirable, in view of the recommendations received from Messrs. Merz and McLellan, their electrical advisers, that in the interests both of the railway companies and of the joint committee, the sanction of the stockholders should be given. He concluded by proposing a resolution to this effect.

Sir Algernon West seconded the resolution, which was carried by the requisite three-fourths majority, Mr. Mandelick, the secretary, stating that either in person or proxy, the votes in favour of the resolution represented a total of £493,410, and those against £5,500.

Bath Electric Tramways, Ltd.

The annual meeting was held on March 4th, at Winchester House, E.C., Sir James Sivewright, K.C.M.G., presiding.

In moving the adoption of the report (see Elec. Rev., page 360), the Chairman said that the year just closed was without exception the best which the company had ever had, both in the mileage run and in the traffic receipts, and in the net earnings. Fortunately the weather, upon which the whole success of the company depended, had been good. The motor omnibuses, which formed a prominent and increasing feature of the business, had had an excellent season, and the prospects were better than they had been; already they had got orders running into £1,000 for the summer season. The net profit for the year was £2,354 more than for the preceding year, and he only hoped that their profits would be equally good this year. In regard to working expenses, they could claim to have maintained their usual excellent record. Taking 22 other tramway companies, their working expenses for 1912 averaged 15.98d. per car mile, and those for 81 local authorities which possessed tramways were 6.68d. In their case their working expenses, which included administration, worked out at only 5.32 per car mile, which, he thought, was a testimony to the work of their general manager. With much that was satisfactory there was a very serious problem before them on which naturally there was a good deal of difference of opinion. The shareholders had received particulars of a scheme to provide for the future of the company, and he wished to make it quite plain that the board had only one object in view, and that was the interests of the shareholders. For many years past they had owed their bankers a very considerable sum of money. That money had been spent upon capital, and they looked forward to repaying the loan either by raising Debentures or by the issue of Preference shares or in some other way. Time ran on, and they had paid substantial amounts off the loan out of capital, but at last the bank was extremely urgent, and said that such a permanent loan was not a banking matter, and the board also found that they were crippled for lack of capital, and that they could not extend their motor omnibus service to the extent that the public demanded. They therefore approached the bank, and they allowed them to suspend the repayments for a time out of revenue, and they had been putting the money into motor omnibuses, which at the present time were yielding a magnificent profit. It was apparent, however, that that condition of things could not go on indefinitely, and the board had tried their very best during the last two years to obtain financial assistance, but the terms which would have been exacted were of such an onerous character that they absolutely declined to entertain them. They were told by some that they could get the money by prior lien bonds. He, however, was perfectly certain that the Preference shareholders would not agree to such a security being placed in front of them. Then it was suggested that there should be an assessment of all the shareholders. He deprecated that course because it would possibly have meant that many of the shareholders would have been unable to meet the call and their shares would have been forfeited. He wished to make it clear that the scheme had not emanated from the company's auditors as had been stated in certain quarters. It emanated from their local director in Bath, Mr. Clutterbuck, in conjunction with the general manager. The board called in the auditors to confer with them; they laid their plans before them and the scheme was their joint production. It was a drastic scheme, there was no doubt about that; but they believed most firmly that it was in the best interests of the company and of every stockholder, debenture-holder and shareholder alike. The bank was quite satisfied with it as it repaid their loan over a term of years and it also provided for the relaying of the track. In ten years' time certainly, probably before, they would have to commence that work, and a very moderate estimate of the cost was £30,000. The figures on which the board had worked in framing the scheme were most conservative. They had suggested the suspension of the preference dividend for four years, but it was a cumulative dividend and would undoubtedly be paid. It was said that they were favouring the preferred ordinary shareholders by the scheme, at the expense of the preference shareholders. That was not so. The preferred ordinary shareholders had stood by and seen their dividends go into capital for a good many years past for the repayment of the bank loan, and by that means the position of the debenture-holders and preference shareholders was strengthened, and their dividend was pushed further off by the scheme for it was not cumulative. He (the chairman) held £10,000 preferred ordinary shares and he did not hold one preference; but he was satisfied in his own mind that it was to his advantage as a preferred ordinary shareholder to agree to the scheme and that one day his stock would be valuable. As showing how conservative they had been in their estimates, he might mention that they had estimated the revenue for the current year at £1,300 less than the actual earnings for the past year. If the earnings should come up to last year that gave them £1,300 for payment of a portion of the preference dividend. Supposing they were lucky enough to earn £2,400 more this year than last they would be able to pay nearly the whole of the preference dividend, for they intended to make a saving of £400 a year by reducing the board from five to three. He was extremely sanguine that the preference dividend would not be suspended altogether; but that they would be able to pay a portion of it and before four years had passed he believed they would be paying a good proportion of it. They had received promises of support to the scheme from a very large number of shareholders, and out of £75,000 preference capital they had received promises of support amounting to £13,128.

Mr. H. F. Clutterbuck seconded the motion and the report was adopted.

The Chairman then formally proposed a resolution approving of the scheme as set out in his speech.

Mr. Clutterbuck, in seconding, said that at first he was strongly opposed to the idea of waiving the preference dividend for even two or three years because the company had a successful tramway doing good business. They had, however, taken the best expert advice they could get and it appeared to him that if they were to continue as they were, in the long run they would be doing far greater injustice to the shareholders than they were by facing the position now.

Considerable discussion ensued in which several shareholders asked the board to adjourn the matter in order to see whether it was not possible to arrive at some scheme whereby the preference dividend would not have to be waived, and eventually the chairman agreed to adjourn the matter for at least three months, on the understanding that in the meantime the directors would be pleased to give consideration to any proposals that shareholders might make.

Bournemouth and Poole Electricity Supply Co., Ltd.

The directors' report for the year ended December, 1913, states that the capital expended during the year amounted to £3,819, making the total £473,397. The balance from revenue account for the year, after deducting generation and distribution costs, rent, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries, was £39,452, plus £2,144 brought forward, making the total amount available £41,596. From this there are deducted: Interest on debenture stock and interest on temporary loans, less income tax, £9,723; leasehold and special redemption funds and interest, £1,829; amount written off suspense accounts, £358; amount carried to reserve for depreciation, etc., £6,000; leaving available for distribution for the year, £23,686. After paying the 4½ per cent. and 6 per cent. preference dividends, a final dividend at the rate of 9 per cent. per annum is declared for the last half-year, in addition to the interim dividend at the rate of 5 per cent., and there remains a balance of £2,145 to be carried forward.

The total applications received at the 31st December last amounted to the equivalent of 8,790 k.w., an increase of 545 k.w. for the year. The total number of units sold for all purposes was 3,668,007. The directors of the Richmond (Surrey) Electric Light and Power Co., Ltd., have declared a dividend of 6 per cent. on their ordinary shares.

Units generated	4,721,639
Units sold—Public lamps	20,891
Private consumers, by meter	3,647,116
Total sold	3,668,007
Used on works	381,857
Total accounted for	4,049,864
Not accounted for	671,775
Public lamps	131
Total maximum supply demanded	2,692k.w.

The annual meeting was held yesterday.

Newcastle-on-Tyne Electric Supply Co., Ltd.

The annual meeting was held in Newcastle on 6th inst., Dr. J. T. Merz, chairman, presiding.

In moving the adoption of the report (see Elec. Rev. p. 403) the Chairman said the ordinary business of the company had progressed satisfactorily during the past year. The h.p. connections had increased by 29,349, which compared with an increase of 22,700 in the preceding year. The horse-power connected cost £5 18s. 5d., as compared with £7 7s. in the previous year. Their total profit of £141,000 was £20,000 more than in the preceding year. Their capital expenditure had been £174,000, and of this £19,000 had been spent on the Dunston power station, which was only the beginning of large extensions which the company would have to carry out there during the year to meet the demands. £41,000 had been spent on mains, £35,000 on sub-stations, and £79,000 had been spent in acquiring the assets of the Durham Collieries Electric Power Co., Ltd. The latter company started with Parliamentary powers to supply electricity by private wayleaves in the centre of congested coalfields in the County of Durham, and at a time when the opinion as to the low cost at which electricity could be produced was exaggerated. The promoters of the company offered to supply electricity in their neighbourhood to colliery owners at prices which were considerably below the level of prices at that time. To induce custom the prices were considered ridiculously low, but they had the effect of bringing down the price for power considerably, at least 25 per cent. below what it should have been at that period. The consequence was that damage was done to the electric power business as a whole, and the company did damage to itself, because it found it could not make the business pay. The company got from bad to worse, but the colliery owners who had contracted with it had very judiciously inserted a clause in their agreement to the effect that if the company was not able to supply them, they (the owners) were to be allowed to take the power station into their own hands and work it themselves. The colliery owners ultimately asked the Newcastle Electric Supply Co. to supply them as being the most experienced producers of electricity, and to work the station for them, and, if necessary, to supplement the production through the company's own mains. An agreement was entered into which gave the company a substantial profit. The Newcastle Co. assisted the Durham Collieries Co. with capital and also became part owners of the power station by adding to it a certain amount of plant. It was afterwards suggested that the Newcastle Co., being interested in the supply of electricity in Durham county, should acquire the assets of the Collieries Co., and negotiations were afterwards completed at a figure which was considered satisfactory. The business of the Durham Collieries, Ltd., cost them £148,000, and it brought in a revenue of £46,500. The assets in the Durham Collieries included shares in the Houghton-le-Spring Lighting Co., which had a provisional order. The Houghton Co. had a capital of about £15,500, and its business was increasing. The chairman, speaking of the financial position of the Newcastle Co., said that during the year they had made an issue of £400,000 second debenture bonds bearing interest at 5 per cent. Of the profits, £10,000 of the increase had been placed to reserve, increased dividend represented £5,000, and the remainder went to increased interest. As to upkeep and repairs, £66,000 had been spent this year over their whole system, and in the last ten years something like £340,000 had been spent, which had kept the system at the highest point of efficiency. The cost of producing electricity at the present time was lower than it had ever been.

Dr. Merz next spoke of the directors' proposal to acquire the shares of the County of Durham Electrical Power Distribution Co. The first reason for the proposal was, he said, purely local or geographical. The Newcastle Co. already had a large interest in the Durham County Co., and had also a large amount of property in generating stations and mains, which enabled them to supply electricity through the Durham Co., and to reach the waste heat stations, which constituted a very important item in the Newcastle Co's. business. The Newcastle Co's. capital over the whole Durham area amounted to £619,000. This showed their financial interest in the county. The progress of the Durham Co. had been slow, and the Newcastle Co. had helped it as far as possible. The Durham Co. was their largest consumer, a further important point of interest. They got £119,000 from the Durham Co. last year, or 26 per cent. of their total revenue. If the shareholders lost that customer all at once they would lose all the money they now enjoyed in the form of ordinary dividend. In addition, the Newcastle Co. owned nearly £49,000 of the Durham Ordinary stock, and shareholders in the Newcastle Co. held £183,600 in the aggregate in the Durham Co. The Durham Co. was now managed under dual control, the distribution of electricity being carried out by the Newcastle Co. The scheme for acquiring the shares in the former company had been framed by a committee of three directors from each company, and the figures as set out in the memorandum were considered fair to both parties.

Mr. J. H. Armstrong seconded the adoption of the report, and said it was not that Co's. intention to spend a large sum of money on developments in the Durham area, but they would meet developments as they came on. It was not their idea to go in for huge developments. The Durham Co. had been progressive so far as development was concerned, but of the gross profits the greater benefits had gone to the Newcastle Co.

The report was adopted.

The proposals for acquiring the shares of the County of Durham Co. were confirmed, as also was the following recommendation:—"That each of the existing £5 preference shares in the capital of the company whether issued or unissued, be sub-divided into 5 preference shares of £1 each, and that each of the existing £5 ordinary shares in the capital of the company, whether issued or unissued, be sub-divided into 5 ordinary shares of £1 each."

Japan.—The amount of new capital invested in electrical companies in Japan during January last is returned at £219,000, £30,000 being in connection with newly-organised concerns, and £189,000 for the extension of existing undertakings.

Madras Electric Tramways (1904), Ltd. — The accounts for the year ended December 31st, 1913, show a gross profit of £21,345. After debiting interest and London office expenses, making provision for the debenture stock sinking fund, and transferring £7,000 to the depreciation and renewal fund (being an increase of £2,000 on amount transferred in 1912), there remains a balance of £9,121, plus £3,432 brought forward, making £12,553. Out of this it is proposed to pay 6 per cent. per annum on the preference shares, absorbing £5,869, 5 per cent. per annum on the ordinary shares, £2,863, and to write off from the cost of issue of new preference shares £500, leaving to be carried forward £3,321. The traffic receipts, which show an increase of 7·71 per cent. upon 1912, continue to develop satisfactorily, and further rolling stock is being provided. The undertaking has been maintained, as heretofore, out of revenue, and special improvements and renewals have been debited to the depreciation and renewal fund, as formerly. The reserve arising from the debenture stock sinking fund now amounts to £5,424. During the year 2,640 additional 6 per cent. cumulative preference shares were allotted, the total number issued being now 20,000. The meeting was held yesterday.

The Mackay Companies.—The annual report states that the Commercial Cable Co. is engaged in a further suit against the Newfoundland Government for repudiation of a contract, the Government, notwitwstanding the company's legal victory when the case was referred to the British Privy Council, having declined to carry out the provisions of the contract. A substantial increase has been made in reserves, and extensions have gone on as usual without the issue of obligations or the use of any portion of the reserves. The Gott invention, by which the companies' submarine cables and landlines may be joined at will into one continuous circuit, and the whole operated by Morse instruments in the Morse code, is in daily use.—*Financial News.*

Hadfields, Ltd.—The directors of this company (which last year changed its name from Hadfield's Steel Foundry Co., Ltd.) in their report for 1913, state that they propose to add £15,000 to the reserve and renewal account and carry forward £50,469. In addition to the interim dividend of 1s. per share paid in August last on the ordinary shares, a further dividend is to be paid on the ordinary shares of 2s. per share, together with a bonus of 1s. per share. The directors record the death of Mr. Benjamin Freeborough, one of the first directors of the company.

Melton Mowbray Electric Light Co., Ltd.—Mr. W. J. New presided at the annual meeting held last Friday. The directors reported that the revenue for the year, including a balance of £411 brought forward, amounted to £3,065, and after providing £1,000 for debenture interest, there remained £2,065 available for distribution. A dividend at the rate of 3½ per cent. per annum was recommended, placing £750 to reserve fund for renewal of plant, and carrying forward £615. The chairman referred to the substantial reduction of the fuel account.

Automatic Telephone Manufacturing Co., Ltd.—According to a financial daily, the profit for 1913 amounted to £22,941, against £13,498 for the preceding year. After payment of preference dividend and writing off £8,000, against £1,313 a year ago, there remains £3,000 to be carried forward, against £370 brought in.

Canadian General Electric Co., Ltd.—A quarterly dividend of 1¾ per cent. for the three months to March 31st (at the rate of 7 per cent. per annum) on the common stock is announced.

Alley & MacLellan, Ltd.—Dividend on ordinary shares 6 per cent. per annum, carrying forward £1,741. For depreciation, £5,012 was written off, and £6,000 was put to reserve.

STOCKS AND SHARES.

Tuesday Evening.

MONDAY in this week was one of the most depressing days that the Stock Exchange has seen for months. Apart altogether from the fact that it poured with rain from start to finish, there was fairly heavy liquidation in the Stock Exchange as well. Ulster at home, Brazil, Mexico and the United States abroad, were given as the principal causes for the prevailing depression, and for the unwillingness of capitalists, small or large, to come forward with any buying orders.

We reproached a partner of one of the biggest financial houses in the City for not supporting the particular markets in which his firm are interested, but he protested that they had already done so, though all their energies were wasted. Some men said that there was a wet blanket over the Stock Exchange, while others called it "dry rot"; whichever designation may be the more correct, it is certain that the bears were in possession of the field at the beginning of the week; though the sharp recovery which occurred on Tuesday from the lowest prices touched went some way towards wiping out the previous falls.

Mr. Asquith's speech was read as a sign that all danger of civil war in Ireland could be regarded as over. Upon this, and fresh indications of money's remarkable easiness, came substantial rallies in most of the markets, optimism once more raising a timid head.

Electricity Supply shares are mostly steady, in view of the latest development which has arisen, namely, the possible formation of another group composed of certain members of the London supply companies for the purpose of presenting a Bill of their own, as distinct from that initiated by the County of London Company to come shortly before Parliament. This was an unexpected step; and, pending further details, those in the Stock Exchange who are mainly interested in the matter are cautious in their expressions of opinion. The idea of a super-company, however, on the lines already mooted, did not meet with whole-hearted approbation.

The County of London Company has decided to make a fresh issue of new Ordinary shares at 11½ and of new Preference shares at £11. As the existing quotations are 12⅜ and 12 respectively, these prices including dividends of 9s. and 6s. per share, no doubt the proprietors will subscribe readily enough. The South London Company, in its report issued early this week, gives notice that at next Monday's meeting resolutions will be submitted for increasing the capital by the issue of 12,000 new £5 Preference shares; while the South Metropolitan may be asking for fresh capital before long.

It is possible, too, that there may be some kind of issue made to deal with the electric lighting at Hendon and its vicinity; while there is a somewhat ambitious scheme on foot in connection with the supply of power to a number of provincial centres where electricity may be said to have scarcely emerged from the stage of infancy. Of this last-named project, however, there will probably be more to say by-and-bye. Westminsters and Kensingtons are rather easier on the week, and Charing Cross "City undertaking" Preference fell ⅛. On the other hand, rises have been secured by Edmundsons' Preference and South Metropolitan Preference, while several of the Debenture stocks are advanced. Bournemouth and Poole Ordinary rose 10s. on the increased dividend, and on a slight demand, to supply which, however, there were no shares offering.

The railway group showed pronounced weakness, Ordinary, Preference and Debenture stocks all giving way, but in Tuesday's improvement, this market shared to the full. Underground Electric shares dropped to 2⅞, a fall of 5s., to recover to 3⅛, and the Income Debentures lost 1 on balance, holders being disappointed with the speech made by Sir Edgar Speyer at the meeting last week, when he presented masses of interesting statistics, but did not indicate when the company's shares might be likely to come into receipt of the dividend. The 6 per cent. First Income Debenture stock is also a point lower. City and South London Junior Preference stocks are flat; to pay the full dividend on the 1903 Preference, the sum of £7,400 has been debited to capital account.

British Electric Traction issues show falls, with the exception of the two Debenture stocks, both of which are a point higher. The six different kinds of securities seem to be a nuisance to the market, and this may give point to the whisper of a possible reorganisation of the company's capital account. If there be any truth in it, the hope may be permitted that another scheme would be so worked out as to do away with the present cumbersome arrangement, by the substitution of one single security for some of the existing stocks.

The American market has furnished one of the principal reasons for depression in the Stock Exchange, by consequence of some of its shares falling with unexpected rapidity. This induced realisations from some of the Continental bourses, and, sympathetically, Canadians have been affected. British Columbia Electric Deferred dropped 6 points, the Preferred Ordinary and the Preference stock 1 and 2 points each. Shawinigan Water is 2 down, though the company's First Mortgage bonds at 108 are 1 better. Montreal Common stock, after its rise of 5 last week, reacted 3 points.

The Mexican débâcle, of course, added emphasis to the uneasiness already prevailing. Mexico Trams are 1 down, and Mexican Light and Power Common shares fell 1, though several others in this group have hardened—notably Mexican Light and Power bonds, and Mexico Tramways Firsts. Brazil, too, has a crisis of its own, and in a severe slump which overtook Brazilian Government bonds and other securities connected with that country, Brazil Tractions receded to 85, a fall of 4½, from which came recovery to 87. Para Electric Preference are ¼ down, and sharp falls took place in the bonds of the Rio Tramways and the Sao Paulo Tramways Companies. River Plate Ordinary stock added another 10 points to its rise of 18 early this month, the quotation at present being 240 middle—which, by the way, makes the 6 per cent. non-cumulative Preference stock look cheap at its present price of 105½ middle, at which the yield, allowing for accrued interest, is nearly 5¾ per cent. on the money. The next dividend is payable at the end of April.

The Telegraph market is quiet, although several of the principal securities have been adversely affected by the severe falls in American Rails. New York Telephone bonds, for instance, are ¼ lower, and the Anglo-American Telegraph group has given way. Marconis have been flat, dropping to 3½ at one time, though the loss was more than regained. The Preference are $\frac{3}{16}$ higher. Oriental Telephones at 2⅛ are $\frac{1}{16}$ harder.

In the Manufacturing division, Brush 4½ per cent. First Debenture stock recovered most of its dividend, rallying to 41, but the Second Debenture remains at 25. British Thomson-Houston Debenture is firmer, and, amongst the shares, British Aluminium Ordinary hardened to 1$\frac{3}{16}$. India Rubbers fell to 11. Electric Constructions went back a trifle, and Castner-Kellners eased off to 2⅜. The market, as a whole, is uninteresting. The Rubber share market, like most of the others, has been depressed, and the listing of 1,200 tons at the Mincing Lane auctions this week was sufficiently heavy to cause a little promiscuous selling of the principal shares. But the sales went better than people expected, and the Stock Exchange put up prices of most of the leading issues, giving the market a firm appearance.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 10th.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	³⁄₁₆— ⁵⁄₁₆	..	Nil
Do. 5 % Pref.	1	5	5	⅝— ⅞	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	15½— 17½	+ ⅛	..
Do. Do. Deferred ..	100	..	..	6½— 8½	— ⅛	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	—1	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	3	..	56 — 59	—1	5 1 8
Do. 5 % Perp. Deb. ..	100	5	5	95 — 98	+ 1	5 2 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 85	+ 1	5 8 5
Central London Railway, Ord...	100	3	3	57 — 62		4 16 9
Do. Gtd. Assented	100	..	4	80 — 82	—1	4 17 5
Do. Pref...	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 8
Do. Def.	100	2	2	57 — 62		3 4 6
Do. Gtd. Assented	100	..	4	79 — 81	—1	4 18 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	95 — 97	.	5 3 1
Do. Do. 1901	100	5	5	89 — 92	—3½	5 8 8
Do. Do. 1903	100	5	5	89 — 92	—2½	5 8 8
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½— ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	67 — 72	..	6 5 0
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 8
Lancashire United, 5 % Deb. ..	100	5	5	85 — 87	..	5 15 0
London and Suburban, Ord. ..	1	..	..	¼— ⁵⁄₁₆	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅝— ⅞	..	6 13 4
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	79 — 84	..	5 7 2

NAME.	Stock or Share.	Dividends for		Closing Quotations March 10th.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	63 — 67	..	5 19 6
Metropolitan Railway Consol. ..	100	1⅝	1⅝	42½— 43	..	3 15 7
Do. Surplus Lands	100	2¾	2¾†	63 — 65	..	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82 xd	..	4 5 4
Metropolitan District Ord. ..	100	Nil	..	29½— 30½	— ½	Nil
Do. 6 % Deb.	100	6	6	138 —141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	86 — 89 xd	..	5 1 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76		4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	91 — 94	— 2	4 15 9
Do. 5 % Deb.	100	5	5	89 — 92	—1	5 8 6
Potteries, Ord.	1	3½	..	⅜— ½	..	..
Do. 5 % Pref.	1	5	5	[illegible]	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 8 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝— ⅞	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	3⅛— 3⅜	+ ⅛	Nil
Do. "A"	1/-	..	..	⅜— ⁷⁄₁₆	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 —114	—1	5 5 3
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 0
Do. 6 % Income	100	6	6	89 — 90	—1	6 13 4
Yorkshire (West Riding). Ord. ..	5	Nil	..	⁵⁄₁₆— ⁷⁄₁₆	..	Nil
Do. 6 % Pref.	5	3	4	3⅞— 4⅜	..	4 11 5
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4¹³⁄₁₆— 5¹⁄₁₆	..	5 8 7
Do. 2nd Pref.	5	5½	5½	4⁵⁄₁₆— 4⁹⁄₁₆	..	6 0 7
Do. 4 % Deb.	100	4	4	92½— 94½	— ½	4 4 8
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
Do 5 % Deb.	100	5	5	96½— 98½	..	5 1 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 —106	..	4 14 3
Bombay Elec. S. & Trams, Pref,	10	6	6	10⅞— 11⅛	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½— 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	86 — 88	—2½	6 16 4
Brisbane Trams Invt., Ord. ..	5	8	8	7⅝— 8⅛	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞— 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	113 —117	—6	6 16 9
Do. Pref. Ord.	100	6	6	105 —109	—1	5 10 1
Do. 5 % Pref.	100	5	5	101 —104	—2	4 16 2
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	95 — 98	..	4 6 9
Calcutta Trams, Ord.	5	7½	5†	6¼— 6¾	..	5 11 1
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝— ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5¼— 5½ xd	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½— 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — ¹⁄₁₆	..	Nil
Do. 5 % A Deb...	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb...	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord. ..	1	..	..	⅜— ½	..	..
Do. Pref...	1	4⅜d.	6	⅞— 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1⅛— 1⅜	..	4 7 8
Do. 6 % Pref.	1	6	6	¹⁵⁄₁₆— 1³⁄₁₆	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	5 — 5⅜	..	5 11 7
,, Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com	$100	7	7	70 — 73	—1	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	80 — 84 xd	+ 1½	5 19 1
Do. 6 % Bonds	100	6	6	81 — 85	..	7 1 2
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	4⅞— 5⅜	..	9 6 0
Do. 6 % Pref.	5	6	6	4¼— 4¾	— ¼	6 6 4
Do. 5 % 1st Deb.	100	5	5	93 — 95	..	5 5 3
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97 — 99	—3	5 1 0
Do. 5 % Mort. Bonds	100	5	5	87½— 90½	—4	5 10 5
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	98 —101	—2	4 19 0
Singapore Trams, 5 % Deb. ..	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½— 97½	—1	5 2 7
Un. Elec. Trams Monte Video ..	5	7	7	4⅝— 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞— 5¼	..	5 14 8
Do. 5 % 1st Deb.	100	5	5	95 — 98	+1	5 2 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord. ..	10	6	7	10 — 11	+ ½	6 7 4
Do. 4½ % Pref.	10	4½	4½	8¾— 9¼	..	4 14 9
Do. Second 6 % Pref... ..	10	6	6	10 — 10½	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 97	+1	4 12 9
Brompton & Kensington, Ord...	5	10	10†	9 — 9½	— ⅛	5 4 0
Do. 7 % Cum. Pref.	5	7	7	8⅝— 9⅛	..	3 16 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91 — 94	+1	4 5 1
Charing Cross, West End & City	5	5	6	4¾— 5¼	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜— 4⅞	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞— 4⅜	— ⅛	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4⅞— 5⅜	..	4 13 0
Do. 4½ % Deb.	Stock	4½	4½	97 - 100	..	4 10 0
City of London, Ord.	10	9	10	18 — 19	..	5 5 3
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	116 —120	.	4 7 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 —103	+1	4 8 1
County of London, Ord.	10	6	7	12½— 13	..	5 7 8
Do. 6 % Pref.	10	6	6	11¾— 12¼	+ ⅛	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	102 —105	+1	4 5 9
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	£3	..	..	⅜— ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞— 4¼	+ ⅛	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝— 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4½— 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅜— 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	93 — 95	+1	4 14 9

Hove	5	8	8†	8¾— 9¼	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	9	7½— 8 xd	..	5 12 6
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1½— 2	..	4 10 0
Do. 6 % Pref.	5	6	6	5 — 5⅜	..	5 11 7
Do. 4 % First Mort. Deb. ..	Stock	4	4	91 — 94	+1	4 5 1
Metropolitan	5	4¼	4½	3⅞— 4⅛	..	5 9 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞— 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾— 10¼	..	5 14 3
Oxford..	5	7	7†	6 — 6½	..	5 7 8
St. James' and Pall Mall, Ord...	5	10	12	9½— 10 xd	..	6 0 0
Do. 7 % Pref	5	7	7	6½— 7 xd	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5½	5½	3 — 3½	..	6 10 4
Do. 5 % First Mort. Deb. ..	100	5	5	98 — 101		4 19 0
South Metropolitan, 7 % Pref. ..	1	7	7	1⅛— 1¼	+ ¹⁄₁₆	5 12 0
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord...	£3	Nil	..	⅜— ⅝	..	
Do. 5 % Cum Pref.	5	3‡	..	2⅞— 3⅛	..	4 12 0
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86 — 89		5 1 3
Westminster, Ord...	5	10	10	8½— 9	— ⅛	5 11
Do. 4½ % Cum Pref.	5	4½	4½	5¹⁄₁₆— 5⁵⁄₁₆	..	4 4

* Unless otherwise stated all shares are fully paid. † Interim Dividend. ‡ 3s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 10th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5 — 5½	..	5 14 3
Calcutta, Ord.	5	8½	5†	7⅞— 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5⅛— 5⅜	+$\frac{3}{16}$	4 13 0
Calgary Power, 1st Mort. Bds. ..	100	5	5	90 — 92	..	5 8 8
Canadian Gen. El. Com.	$100	7	8	113 —117	..	6 16 9
Do. 7 % Pref.	$100	7	7	123 —128	..	5 9 5
Cordoba Lt., Power and T., Ord.	1	5	..	$\frac{7}{16}$— ⅝	..	7 13 0
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88 — 90	..	6 13 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	..	5 5 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	$\frac{1}{32}$— $\frac{3}{32}$	..	Nil
Do. 6 % Pref.	1	6	6†	$\frac{13}{32}$— $\frac{17}{32}$	..	10 11 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1¼— 1¾	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103½—106½	+ ½	4 14 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	67 — 72	+2	6 19 0
Mexican Lt. & Power, Common	$100	4	4†	41 — 44	—1	..
Do. 7 % Cum. Pref.	$100	7	7	79 — 84	..	8 6 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	80 — 84	+3	5 19 1
Do. 5 % 2nd Mort. Bonds ..	100	5	5	65 — 69	+1	7 4 11

NAME.	Stock or Share.	Dividends for		Closing Quotations March 10th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	191			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	54 — 59	..	..
Montreal, Lt., H. and Power ..	$100	9	10†	280 — 285	— 3	4 5 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	235 —245	+10	4 1 8
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	103 —108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	102 —104	..	4 6 7
Shawinigan Water, Capital ..	$100	5½	6†	142 —146	— 2	4 2 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	+1	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	+1½	4 8 8
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	96 — 99	..	4 11 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Victoria Falls Power, Pref. ..	1	6	6	$\frac{23}{32}$— $\frac{25}{32}$	..	7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	100 —102 xd	..	5 17 8

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 10th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	$\frac{11}{16}$— $\frac{13}{16}$	..	8 12 4
Do. 6 % Pref.	1	6	6	¾— ⅞	..	6 17 2
Babcock & Wilcox	1	16	14†	3⅛— 3¼	..	5 18 6
Do. Pref.	1	6	6	1$\frac{5}{16}$— 1$\frac{7}{16}$	..	4 8 6
British Aluminium, Ord. ..	1	..	..	1⅛— 1¼	+$\frac{1}{32}$	..
Do. 6 % Cum. Pref.	1	6	6	$\frac{13}{16}$— $\frac{15}{16}$	..	6 8 0
Do. 5 % Prior Liens Debs. ..	100	5	5	96 — 99	..	5 1 0
Do. Deb. Stk.	100	5	5	88 — 93	..	5 7 6
B.I. & Helsby Cables	5	10	13	9¾— 10¼	..	4 19 1
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	+1½	4 15 9
British Westinghouse, Pref. ..	2	Nil	..	1$\frac{7}{16}$— 1$\frac{9}{16}$	..	Nil
Do. Deb.	100	4	4	68 — 71	..	5 12 8
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	39 — 43	+2	10 9 6
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	11½— 12½	..	6 2 4
Do. Pref.	5	5	5	4$\frac{15}{16}$— 5$\frac{3}{16}$	..	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	22½	2$\frac{21}{32}$— 2$\frac{25}{32}$	—$\frac{3}{32}$	..
Do. Deb.	100	4½	4½	103 —106	..	4 5 1

NAME.	Stock or Share.	Dividends for		Closing Quotations March 10th.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	$\frac{5}{16}$— $\frac{9}{16}$	..	..
Do. Pref.	1	6	6	$\frac{23}{32}$— $\frac{27}{32}$	..	7 2 2
Edison & Swan, A, £2 paid ..	5	Nil	..	$\frac{1}{16}$— $\frac{3}{16}$	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	$\frac{17}{32}$— $\frac{21}{32}$	—$\frac{1}{32}$	7 12 6
Do. Pref.	1	7	7	$\frac{15}{16}$— 1$\frac{1}{16}$	..	6 11 7
Greenwood & Batley, Pref. ..	10	7	7	6¾— 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref. ..	10	6	6	10¼— 10½	..	5 14 3
Do. Deb.	100	4	4	86 — 90	..	4 9 0
Henley's, Ord.	5	15	20	14 — 15	..	6 13 4
Do. Pref.	5	4½	4½	4⅞— 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	7½	10½— 11½	— ½	6 10 5
Do. Pref.	10	5	5	8¾— 9¼	..	5 5 3
Telegraph Construction	12	20	20	39½— 41½	..	5 15 7
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref. ..	100	..	..	50 — 55	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 10th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	6¼— 6¾	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 —126	..	6 7 0
Do. Collat. Trust	$1000	4	4	91 — 94	—1	4 5 3
Anglo-American Telegraph ..	Stock	3	3	64 — 67	—1	4 9 7
Do. 6 % Pref.	Do.	6	6	108½—109½	— ¼	5 9 4
Do. Def.	Do.	30/-	30/-	23½— 24	— ⅜	6 5 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104 xd	..	4 16 2
Chili Telephone	5	8	..	7⅜— 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	81½— 83½	..	4 16 0
Cuba Telegraph	10	6	6†	8¾— 9¼	..	6 8 1
Do. 10 % Pref.	10	10	10	15¾— 16¾	..	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3½— 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	..	7½— 8	..	6 5 0
Direct United States Cable ..	10	4	4†	6¾— 7¼	..	5 10 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	133 —136	..	5 3 0
Do. 3½ % Pref. Stock	Do.	3½	3½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	..	4 2 4
Eastern Extension	10	7	7	12⅜— 12⅞	..	5 8 9
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust ..	10	6	6†	11⅜— 11⅞	..	5 1 1
Do. 6 % Pref.	10	6	6	12½— 13	..	4 12 4
Great Northern Telegraph ..	10	20	5†	32½— 34½	..	5 16 0
Indo-European Telegraph ..	25	13	5†	58 — 60	..	5 8 4
Mackay Companies Common ..	$100	5	5	86 — 90	..	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7

NAME.	Stock or Share.	Dividends for		Closing Quotations March 10th.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph ..	1	20	20	3⅝— 3¾	+ ⅛	5 6 8
Do. 7 % Cum. Partic. Pref. ..	1	17	..	3$\frac{1}{16}$— 3$\frac{3}{16}$	+$\frac{3}{16}$	5 6 8
Monte Video Telephone, Ord. ..	1	6	6	$\frac{13}{16}$— $\frac{15}{16}$	..	6 8 0
Do. 5 % Pref.	1	5	5	¾— ⅞	..	5 14 3
New York Telep., 4½% Gen. Bnds.	100	4½	4½	99¾—100¾	— ½	4 9 0
Oriental Telep. and Elec. ..	1	10	10†	2 — 2¼	+$\frac{1}{16}$	4 9 0
Do. 6 % Cum. Pref.	1	6	6	1⅛— 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½— 89½	..	4 9 5
Pacific and European Tel., 4% Guar. Debs.	Do.	4	4	98 — 100	..	4 0 0
Reuter's	10	10	10†	8¼— 9¼	..	10 16 2
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½— 98½	..	4 11 5
United River Plate Telephone	5	8	6†	6⅜— 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5⅛— 5⅜	..	4 9 0
West Coast of America	2½	2½	..	1$\frac{5}{16}$— 1$\frac{7}{16}$	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	1¼	2$\frac{7}{16}$— 2$\frac{11}{16}$	..	4 13 0
Do. 6 % Cum. 1st Pref. ..	10	6	6	9¾— 10¼	..	5 17 0
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd. ..	10	7†	7	13⅛— 13⅝	..	5 2 8
Do. 4 % Debs.	Stock	4	4	95 — 97	..	4 2 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 — 98	..	4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants

Bank rate of Discount 3 per cent., January 29th, 1914.

The F.T.B.I. — Subscribers are reminded that the annual meeting of the Electrical Trades Benevolent Institution will be held at the Institution of Electrical Engineers, on Wednesday, March 18th, at 2.30 p.m. The report of the Committee and the accounts for the year will be received and auditors re-elected. The following members of the Committee of Management are eligible for re-election at the meeting :— Messrs. W. B. Esson, E. Garcke, T. E. Gatehouse, C. E. Hunter, C. Koettgen, W. Schmahl, A. A. C. Swinton, L. Thurnauer and R. J. Wallis-Jones.

New Association.—The Association of Bristol Electrical Engineers and Contractors has been formed, and has been joined by many influential members of the electrical trade in the city. The objects of the Association are the mutual support and protection of its members. The secretary is Mr. Burkitt, of Messrs. Baxter and Impey, 10, Orchard Street, St. Augustine's, who will be glad to give any information, and Mr. Buchanan, of Messrs. Buchanan and Curwen, Baldwin Street, has been appointed chairman for the current year.

THE WET FILTRATION OF COOLING AIR FOR ELECTRICAL MACHINERY.

By D. A. HACKETT, A.R.C.Sc., A.M.I.E.E.

The application of air, cleaned by what is now generally known as wet filtration, to the cooling of electrical machinery is a comparatively recent innovation, and the installations of this type are as yet few in number. Owing to the rapidly increasing number of turbine-driven generators requiring large and constant volumes of ventilating air, central station engineers are much interested in the method, and are discussing its possibilities. Whilst on the one hand some are favourably disposed towards the new practice, the majority, frankly doubtful, prefer to await the verdict of time in those cases where it is in use before coming to a final decision, and as the time is opportune, this contribution has been written, dealing with a few of the technical aspects, with the view of stimulating the discussion of the practice.

The process of wet filtration may be briefly described as the bringing of the air which is to be cleaned into intimate contact with water in the form of a very finely divided spray. The air may thus be said to be actually washed, for as the particles form nuclei for the formation of drops, they are removed from the air current passing through the apparatus, both by their rate of fall being rendered greater and by the interposition, in the path of the spray-laden air, of specially shaped baffles, from which the air issues clean and without trace of suspended moisture. In addition to the removal of dust particles, the no less objectionable acids, or acid-forming gases, are removed, being absorbed by the water.

The first question that arises is whether it is possible for the water particles to be carried over from the filter by the moving air. It is simply a matter of installing apparatus capable of dealing with the quantity of air required, and there is little doubt that manufacturers of this class of plant would be able to fulfil guarantees of the absolute absence of every trace of suspended moisture in the discharge from the filter.

The air leaving the apparatus is humid, and the greatest amount of discussion in connection with this subject has been devoted to the possibilities attaching to this condition. The insulation resistance of material is reduced by the presence of moisture in it, and considering only the humidity of the filtered air, it might be unsafe, to say the least, to pass it in its practically saturated condition through a machine. This view may be considered from several aspects. It must be remembered that the climate of this country is such, that electrical machines are frequently subjected (more often of course in winter) to atmospheric conditions approximating to 100 per cent. humidity for long periods. This is the case particularly where the machines are of the type requiring forced ventilation, and it is ordinary practice, where the environment is suitable, that is, where the atmosphere remains clean, to pass the air through machines unfiltered, without damage resulting to the insulation. In foggy weather the air is supersaturated and contains particles of moisture, but there is no record of machines having broken down due to the reduction of the insulation resistance at such times, nor is any provision ever made to reduce the quantity of moisture in the event of a fog or unusually humid atmospheric conditions. Finally, machines are insulated for use under ordinary conditions of surrounding air; in practice manufacturers' tests are specified to be made without any special precautions with regard to humidity, and in very many cases it is even specified that the apparatus under consideration should remain in the shops for some days previous to testing subjected to ordinary atmospheric conditions. It would appear then, that the factor of safety of insulation as applied to electrical machines in general would cover such of these as are ventilated by wet filtered air.

It might be of interest to examine the effect of the passage of the air to and through the machine, on the air itself. Let it be assumed that the filtered air is saturated, that is, that its humidity is 100 per cent. (actually it does not always reach this, the average condition being more nearly represented by 95 per cent.). The air leaving the filter passes to the machine but before coming into contact with the windings, it has to encounter resistance in the form of ducts and bends, and has also to be forced through the machine by some form of fan. In this process energy is expended, the air temperature is raised, and the humidity thereby reduced. It may seem that this effect is slight, but in the first place it requires a comparatively small amount of energy to raise the temperature of a cubic foot of air through one degree (0.575 watts per cubic foot per minute), and for a given moisture content the humidity of a given weight of air decreases rapidly as its temperature rises.

If air at 19.5 degrees C. and 100 per cent. humidity at normal atmospheric pressure, have its temperature raised one and a half degrees, the humidity drops to 90 per cent. If an actual case be taken, and assuming 65 per cent. as an average figure for the efficiency of the external fan supplying air to the machine, calculation shows that the losses in the fan and ducts produce an increase in temperature of about three degrees before the air comes in contact with the windings. The resulting humidity in this case with 100 per cent. leaving the filter is 79 per cent., which is below the average for winter atmospheric conditions in this climate.

It has also been pointed out that the air around a central station, by reason of the water vapour liberated in various operations, has, as a rule, a large amount of suspended moisture present against which no special precautions are taken.

The effect of the heating of the machine itself must be considered. An examination of the heating curve shows a sharp and immediate rise in temperature after putting on load. This should act in the direction of preventing an undue absorption of moisture by the windings, should the humidity be high. It is also worthy of consideration to note that in a generating station, due to the radiation from steam pipes, engines and generators, the air temperature is higher than the external air, and, as a result, the windings of a machine, when put on load, are already several degrees higher than the cooling air, and therefore initially more likely to resist the condensation of moisture in them. This fact taken in conjunction with the rapid rise in temperature referred to previously, and the increase in temperature due to work done in moving the air, tends towards the reduction of the percentage of humidity, and therefore to the original condition of the air as regards moisture previous to filtration.

It is claimed that the air is cooled as well as cleaned by the process of wet filtration, and as this tends in the direction of a lower maximum temperature, it is desirable to form some idea as to the amount of the reduction in air temperature and the effect of the increased moisture content on the cooling qualities of the air, that is, practically speaking, on its specific heat. If air be taken at atmospheric conditions of temperature, pressure and humidity, and caused to take up water vapour in such an apparatus as the filter under discussion, the air will be cooled owing to the heat absorbed in the evaporation of the water. It is correct to assume that the quantity of heat lost by the air is equal to that absorbed by the water during evaporation. From this consideration the reduction in temperature due to air taking up various quantities of moisture can be calculated, and from hygrometric charts it is a simple matter to obtain the amount of vapour present at the assumed condition (for air leaving the filter) of 100 per cent. humidity at any temperature. The temperature to which air at any other temperature and humidity falls when saturated in this manner, can be obtained with reasonable accuracy. The air temperature will not be reduced quite to the wet-bulb temperature corresponding to the atmospheric conditions, but to a temperature slightly higher, due to the increase of the moisture content consequent on the passage through the filter. A concrete example will make evident the extent of the cooling effect.

If air at 13.9 degrees C. and 81 per cent. humidity, corresponding to average summer conditions, be treated in a wet filter so that it emerges at 100 per cent. humidity, the resulting air temperature is 12 degrees C. The wet-bulb temperature corresponding to the original conditions is 11.75 degrees C. The cooling effect is due mainly to the latent heat absorbed by the water in evaporating, and it does not seem feasible except possibly in special cases still further to reduce the temperature materially by the addition of refrigerating plant, cooling the water supplying the sprays in the filter. It is doubtful if much advantage can be gained in this way unless some highly efficient, compact refrigerator capable of operating without supervision, can be found.

With regard to alteration in cooling qualities, an investigation of the change in specific heat and density, for the average conditions given, shows a 0.2 per cent. increase in specific heat, and an increase in density of, approximately, the same amount, so that there is a slight advantage in these respects also.

Summing up, it would seem that there is a fairly good case for the installation of wet air-filtration apparatus from the purely technical aspect. It undoubtedly produces clean air, the advantages of which it is not necessary to dwell upon, and whilst the reduction in temperature may not, generally, be great, the air is certainly cooler after filtration. With regard to the danger of breakdown, it would be of interest if some experiments were carried out under actual conditions to discover if any material alteration in insulation resistance does occur, and in this connection experience might be gained at first on low-voltage machines, where the risk of breakdown is less. It is outside the scope of this article to discuss the costs of such installations, the different types, or comparative figures for upkeep, but it might be urged that the publication of such particulars would be of the greatest interest to electrical engineers in general at the present time.

HOW TO OBTAIN SINGLE-PHASE CURRENT FROM A THREE-PHASE SUPPLY.

By "SNICK."

This article is intended briefly to describe how, by suitably connecting static transformers to a three-phase system, it is possible to obtain a single-phase circuit, meaning by the latter one monophase circuit, and not three separate two-wire circuits, the phase displacement between each pair being 120°.

In nearly all cases single-phase current is only required for lighting, whereas for power purposes it is needless to wastefully convert the existing three-phase system, which so admirably lends itself to power applications. Of course, if a three-phase system is available, the lighting load may be split up into three portions, each being supplied from one phase of the secondary. This, to a certain extent, needlessly complicates the wiring, and if a single-phase system consisting of two wires only could be obtained, a much simpler installation would result. It will be seen later, however, that such a transformation gives rise to a considerable out-of-balance on the primary side, which may or may not be of importance to the source of supply, depending, of course, upon the size of the plant supplying the system. Three ways of connecting up transformers to give single-phase on the secondary are described herein, the first method using two single-phase transformers, the second one transformer, and the third method three transformers. In the first, two transformers are coupled together, with the winding of one reversed, as shown in fig. 1. The phase relations of the currents and voltages are shown upon the diagram in fig. 2.

Starting from the generator, the voltages of the three phases, N P, N Q, and N R are given by—

$$V_1 = V_2 = V_3.$$

The voltage across the primary winding of transformer 1 is the vectorial sum of V_1 and V_2, *i.e.*, P Q; similarly, the voltage across the primary of transformer 2 is P R. The voltage across the secondary of transformer 1 will have the phase of P Q, and that of the secondary of transformer 2 will be in phase with P R reversed (as one winding is reversed). The total voltage of the secondary circuit will, therefore, be in phase with the vectorial sum of P Q and P M, viz., M Q. As the secondary load is non-inductive the secondary current, and consequently the primary currents, are in phase with M Q. It will be seen, therefore, that in the wire leading from Q the current lags V_2 by 60° (*i.e.*, a power factor of 50 per cent.) whereas in the line leading from R the current leads V_3 by 60°, but as $A_1 = A_2$, A_3, the current in the middle wire leading from P, will be in phase with V_1; thus considerable out-of-balance results on the primary side, and consequently the advisability of installing such a system as the one in question depends on the relative sizes of the lighting load and the power station capacity. On referring to fig. 1 and fig. 2 it will be seen that the transformer unit must have a total capacity of 115·6 per cent. of the lighting load (because the voltage across the secondary of each transformer is 57·8 per cent. of the total secondary voltage, as will be seen by comparing the

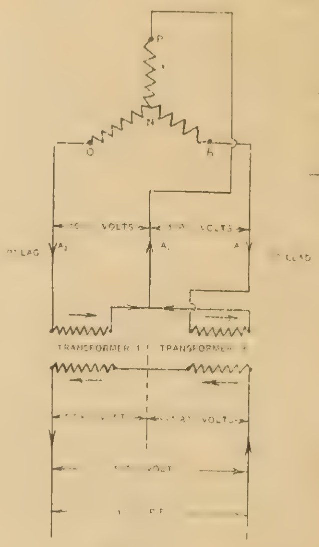


Fig. 1.

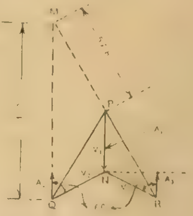


Fig. 2.

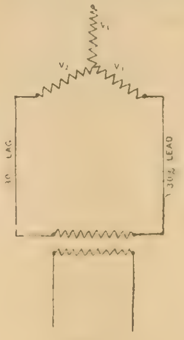


Fig. 3.

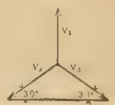


Fig. 4.

lengths of P M and M Q). The power factor of the unit will therefore be 100/115·6 = 0·865.

Another method of obtaining single-phase current is illustrated in fig. 3, where one single-phase transformer only is used. Again, considerable out-of-balance results, the currents differing in phase from the generator phase voltages by 30°, leading in one wire and lagging in the other wire, as is shown on the vector diagram fig. 4.

This method is, of course, somewhat cheaper than that first described, as only one transformer is used, and the capacity of the set is 100 per cent. of the total output, as against the capacity of 115·2 per cent. as described in the first case.

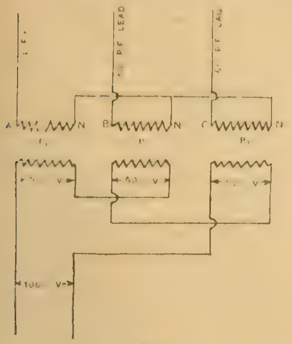


FIG. 5.

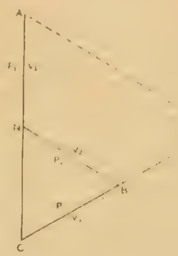


FIG. 6.

The third method using three single-phase transformers, or one three-phase instrument is sometimes used, the connections being shown in fig. 5, the corresponding vector diagram to which is fig. 6. In the latter A N, B N and B C represent the voltages of the three phases P_1, P_2 and P_3 respectively. The vectorial sum of these, *i.e.*, A C will represent the voltage of the secondary circuit, and it is at once seen that this is twice the voltage across any one of the secondary windings. The secondary current, and consequently the primary load currents, will therefore be in phase with A C. The current in the wire leading from A will thus be in phase with V_1; that in wire leading from C will lag 60° behind the phase voltage V_2; whilst that in the wire leading from B will lead the phase voltage V_3 by 60°. The output of the transforming set will consequently be 150 per cent. of the total output, giving a total power factor of $\frac{100}{150}$ = 66·6′ per cent. Even if the phase P_2 were reversed, the same degree of out-of-balance would result, the current in the wire leading from B being in phase with V_3, and the other two phases having currents leading and lagging by 60°, as already described. This method is more complicated than those already described, as three transformers are used, and the total power factor is considerably less.

It will be seen that with the methods described, although single-phase is obtained on the secondary side, the system is out of balance on the primary side. Of course, if the lighting load is small compared to the capacity of the generating plant, this out-of-balance may be unimportant, and the method of connecting may be permissible, although in cases where such out-of-balance would materially affect the supply system, some method, such as the one using three separate transformers giving three separate two-wire single-phase circuits, would have to be adopted, such an arrangement being shown in fig. 7.

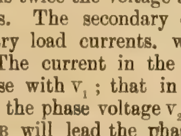


FIG. 7.

An alternative to the latter system would be to use the Scott method of connecting, when two single-phase two-wire circuits would be the result, the phase difference between them being 90°.

REACTANCE AND REACTANCE COILS IN POWER CIRCUITS.

By E. P. HOLLIS A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Newcastle-upon-Tyne January*, 1914.)

UNTIL recently engineers endeavoured to avoid reactance in all its forms; but it is now realised that reactance has virtues hitherto unsuspected, which if turned to account confer important benefits on electrical power supply systems.

One of the problems that beset engineers concerned with the operation of extensive power supply systems is that of limiting the excessive current that may momentarily flow in the case of a short circuit. In the case of a generator in which no special care has been taken to ensure a high self-induction, the current rises at the first instant of short-circuit to something like 30 times the full-load current.

The first rush of current is controlled by little more than the self-induction of the armature and the resistance of the circuit, which act practically instantaneously in stemming the rush of current.

Recent developments in design have tended to reduce the self-induction of the armature, with the result that in a modern turbo-generator, unless very special endeavours are made, the leakage reactance (*i.e.*, that due to self-induction only) represents only from 10 to 15 per cent. of the synchronous reactance measured on the short-circuit test. Nowadays, however, designers have paid special attention to increasing the self-induction of the armature, and by various devices have increased the ratio between the armature inductance and the whole inductance.

Taking a power-supply system in which generating plant to the amount of about 50,000 KW. is in use daily, a short-circuit between phases near the power station might mean a current of 120,000 amperes, which of itself would exert sufficient mechanical force to cause serious damage to cables, bus-bars, and connections. On the switches, also, its action would not be negligible. With the switch closed the current is 120,000 amperes, and the voltage negligible; and with the switch open the current is zero and the voltage is the full phase value; but between these positions there is a moment when the amount of power is exceedingly large. It can be expressed in kilovolt-amperes for one phase by half the product of the maximum current and the maximum kilovolts, which comes to over half a million kilovolt-amperes.

It appears, then, that a good case can be made out for imposing some limits to the amount of short-circuit current, and in many instances reactance coils are being successfully employed for this purpose.

Apart from their ability to relieve the power station of the shocks and stresses due to short-circuits, reactance coils largely promote the stability of a system, and it will probably happen that when the time comes for the operation in parallel of distant large power stations, reactance coils will become essential, assisting the synchronous machinery at a distance—whether generating or motoring plant—at critical moments. Hitherto the reactance of the transformers and transmission lines only has been available for this purpose.

For some years attempts have been made to promote continuity of supply in power stations by adopting the so-called "unit" system of running. Unless the expenditure be very great the generators must run in parallel, either through the bus-bars or the network, and all the troubles incidental to a breakdown on the bus-bar side of a grouped station are repeated in the case of a system operated on the unit principle. Power-limiting reactance coils are valuable not only when inserted in the phase leads of the generator, but also between the bus-bar sections.

Reactance coils inserted in the bus-bars limit the amount of power which a group of machines can supply on short-circuit to a feeder the normal load of which is being supplied in part by another group of generators. The station bus-bars would be "ring" connected and a set of reactance coils would be placed between each group of machines. Thus the perfect unit system can be more nearly attained by using reactance coils. Circumstances peculiar to every case fix the exact value of the reactance, for which 20 per cent.* of the generator capacity of each section would be an approximate figure.

Reactance coils in feeder circuits naturally follow for limiting the power on short-circuit in underground and short overhead lines. In the case of interconnecting mains between power stations, reactance is also desirable to promote parallel running, especially where the resistance of the feeders is large.

The heavy duties which the modern oil circuit-breaker is called upon to perform present severer difficulties as the size of the generating unit increases. For rupturing heavy currents a "resistance" circuit-breaker was developed; reactance, however, is preferable to resistance. The reactance coils are so connected that they may be placed in series with the line, the load, and the main contacts; but with the circuit-breaker closed they are short-circuited by auxiliary contacts. These contacts are the first to open, and thus connect the coils in series with the line and reduce the current before the main contacts separate. These main contacts then break the load current at its reduced value.

In several instances abroad operating engineers, by inserting reactance coils between the incoming generator and the bus-bars, have freed themselves from the anxieties of synchronising. These coils have been designed to allow the generator to be switched in when 180° out of phase with the bus-bar voltage without undue stresses being caused.

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* The value of the reactance coil is most conveniently referred to in terms of the percentage drop of voltage across its terminals with full-load current flowing.

With the development of the so-called "self-synchronising" synchronous motor, it is not improbable that reactance coils will be employed to limit the rush of current on switching-in, taking the place of more complicated starting devices.

Experimental results at the Fisk Street station, Chicago, clearly indicate that reactance coils do materially reduce the short-circuit current. The conclusion reached as the result of this investigation was that the total leakage reactance should not be less than 15 per cent.

The tests demonstrated that the presence of steam on the turbine in no way affected the results, *i.e.*, the short-circuit energy came from the rotating mass of the machines.

One of the earlier uses to which it was suggested to put reactance coils in alternating-current power circuits was that of limiting the flow of the third-harmonic currents between three-phase star-connected generators. A 10 per cent. reactance inserted in the phase leads renders the third harmonic negligible; and even an 8 per cent. reactance does all that is necessary in this direction.

Increased reactance in a circuit with a lagging power factor naturally adversely affects the regulation; but this is a matter which is not so important as it was some years ago. The development of the automatic regulator offers a solution, and a generator with poor inherent regulation can be made to give a pressure curve comparing favourably with the best that can be obtained from the most carefully-designed good regulating machine. In a sense reactance improves the regulation, since at critical moments in the case of a short-circuit it helps to maintain the voltage when otherwise the pressure would have decreased and the synchronous machinery have fallen out of step.

The problem of protecting a transformer against high-frequency surges is an old one. It has been found that these dischages flowing into the tranformer break like a wave against a breakwater, and expend their energy in the first few turns of the transformer winding, occasionally breaking it down. Reinforcing the insulation of the end turns has been successfully resorted to. An external reactance coil not only would prevent abnormal waves from entering the transformer, but it would retain inside the latter all those oscillatory currents which either arise inside the transformer or come from the line, and are transformed to a higher pressure at the point where the line is connected to the transformer. It would appear, then, that endowing the transformer with high internal reactance would be preferable.

Up to recent years consulting engineers specified transformers with low reactance. Now the position is reversed, and consulting engineers specify high reactance and obtain it. The interior of a transformer is, however, no place for a large amount of reactance.

A small amount of reactance can be secured in a transformer of standard design sufficient for most rotary converter work, and higher reactances up to 25 per cent. are possible by introducing special arrangements, such as the use of magnetic shunts to increase the leakage flux. But it is impossible to design a transformer with magnetic shunts which will maintain its reactance in the case of a heavy short-circuit current. Far too much iron would be necessary in the shunt to carry the very heavy flux, and the regulation at normal loads would be very bad. In the external reactance no iron at all is used, an air core being employed in order to avoid this defect.

Reactance can only be relied on as a current-limiting factor so long as the iron paths which carry the leakage flux remain unsaturated; high internal reactance does not improve the transformer—very often it will mean much greater eddy-current losses. It seems better to obtain any large amount by the aid of external coils, especially when the limiting of the short-circuit current is in mind.

Inductance plays a prominent part in the characteristics of transmission lines. In long lines, the line inductance is coresponsible with the capacity for a large rise in pressure towards the receiving end of the line.

This excess pressure is a cause of anxiety in long lines, for the voltage regulation is bad. On switching-in the line the pressure at the far end rises at least to its no-load value, which may often be 150 per cent. of the generator pressure, but frequently a pressure 200 per cent. of that of the generator may be reached. With varying loads, too, the pressure changes are great at the end of the line and are a considerable source of inconvenience. Shunting capacity can be compensated for by shunted inductance,[*] and the best palliative would be a uniformly distributed inductance throughout the whole length of the line. The best that financial considerations would permit would be a few reactance coils at intervals along the line.

Apart from voltage regulation the introduction of reactance, series or shunted, may be used to increase the efficiency of the line and the maximum amount of power that can be transmitted.

One of the developments that the future may hold is that of a large electrical network interlinked throughout, and fed at numerous points at which opportunities for cheap power development present themselves. Such a system exists to some extent to-day on the north-east coast, and there is every likelihood that in other industrial centres this lead may be followed. In such a scheme, under present conditions, variations in pressure throughout the system are unavoidable.

Proposals have been made for constant-pressure schemes in which, however large and however extensive they may be, the voltage is maintained constant. The theory on which these proposals have been based is that since a leading current flowing through a reactance experiences a rise in pressure, this phenomenon can be utilised to give a constant-potential line by varying the amount of leading current according to the load. This theory premises the inclusion of a considerable reactance—no matter how it may have been obtained—in the line. The source of leading current of adjustable value can only be synchronous condensers, over-excited motor-generators and (but not advisedly) rotary converters situated at various points about the system. Most lines would not possess sufficient reactance, and therefore it would become necessary to add it in the form of series reactance coils.

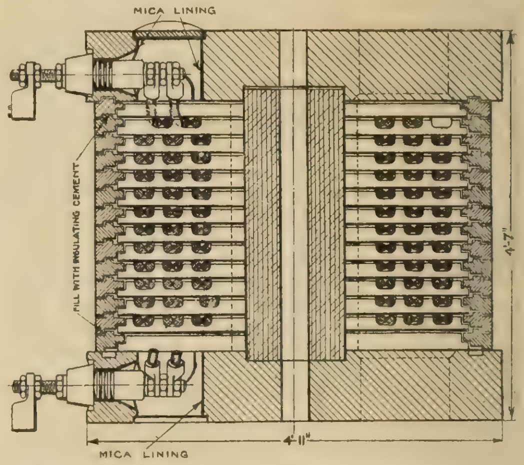
A system designed on these principles would have a number of remarkable operating characteristics. When a short-circuit occurred in any part of the line, in view of the fact that the short-circuit power would be less than the full-load power, there would be no general interference with the system. There would be no diminution of efficiency.

In some instances reactance coils are used to protect the end-turns of high-tension induction motors at the moment of switching on. These coils are often of the ironless pattern, a few turns of copper strip wound in a helix or flat spiral serving the purpose.

The problem of larger adjustable coils is one that will have to be tackled seriously in the future. A continuous-current coil for superposing a continuous flux on an alternating flux might well be used to render the reactance coil adjustable. Without materially affecting the core loss, the continuous current gives the iron a magnetic bias, and the reactance coil takes a higher magnetising current than it would otherwise do.

The construction of current-limiting reactance coils entails a number of difficulties. In addition to the severe mechanical stresses incidental to a short-circuit there are electrical stresses due to transient voltages, and the reactance coils may have to carry the current for many minutes. Iron must be avoided in the construction, and in view of the strong leakage field, all solid metalwork in the coil will be the seat of eddy currents, and may become unduly heated and cause a fire. Steel bolts, for instance, must not be used.

In practice the coil takes several forms. In one, copper cable is wound under tension upon special wood supports which are bolted to a cylindrical concrete core.



Sectional View of a Porcelain-clad Reactance Coil.

Another form of reactance coil is the porcelain-clad coil, the chief characteristics of which are that the pancake instead of the drum winding is adopted. The cable is enclosed in a porcelain case, with the result that the coil is smaller than one with air insulation. The reactances are built up of horizontally-wound spirals (see diagram) supported in recesses formed in the porcelain arms, which radiate from a central core of alberene stone to an outer enclosing well built up of porcelain segments. There are two heavy concrete headers, one at either end, and these are fastened to the wall by a number of mica-insulated brass rods passing through the headers and porcelain segments. The conductors are insulated, and the arrangement of the interior of the coil gives a cellular construction which permits adequate self-ventilation.

A typical coil constructed on this principle was said by the manufacturer to give the following results:—Number of turns, 34; reactance, 4·2 per cent. (20,000 kw., 6,600 volts, 26 cycles); ohmic resistance, 0·00195 ohm; I^2R loss, 6·05 kw.; eddy-current loss, 0·186 kw.; total losses, 6·236 kw. per coil; temperature rise, 33° C.

Discussion.

Mr. P. V. Hunter said that at the commencement of the paper it was stated that recent developments in the design of generators had tended to reduce the self-induction of the armature, but his experience was that the most recent practice was to increase the self-induction of the armature, and during the last year or two designers had endeavoured to increase the self-induction without sacrificing mechanical rigidity. The use of reactance in bus-bar section switches was proposed in power stations, and there were arguments in favour of their use in that position, but there was an important argument to the contrary, namely, that on an ordinary transmission system the bus-bar sections were also connected together through the transmission system in parallel with the bus-bar section switches. A bus-bar reactance having a substantial difference of pressure across its terminals when loaded, would therefore shunt a somewhat heavy current through those feeders in parallel with it, and if to meet this objection the use of such parallel feeders was avoided, a large network then became an uneconomical aggregation of small networks, and the cost would be prohibitive. The author suggested the use of reactance coils in feeder circuits, but his experience was entirely opposed to their use in these circuits; in fact one of the transmission difficulties in the Newcastle district was the reduction of the effective transmission distance of overhead lines as compared with cables, due to the reactive drop. This necessitated considerable expenditure in regulating apparatus. He was unable to agree that voltage variation was unimportant, as it was a matter of some difficulty to keep the consumers' terminal voltage reasonably constant, without incurring expenditure in special voltage regulating apparatus. He had not found it necessary to use reactances in generators. Generally it would be found convenient to step up to a higher voltage through a transformer, and it was very easy to incorporate a reasonable amount of reactance in transformers without additional expense. As regarded the use of reactance coils to protect transformers, the same purpose was served by specially insulating the end turns of the transformer. To specify transformers with high reactance was not the policy of the firm with which he was connected. High reactance in transformers, in order to reduce the short-circuit current and consequent mechanical damage, was both objectionable and unnecessary in power transformers, as they could be constructed without materially increasing the cost, to withstand short-circuit currents of forty times full load. This corresponded to a full load impedance of 2½ per cent., and a regulation on ordinary power factors of the order of 2 per cent., which might be considered satisfactory. The author's suggestion for obtaining a constant potential transmission system was most interesting, but the amount of costly synchronous plant which would have to be installed would be prohibitive. The author suggested the use of reactance coils to protect the end turns of H.T. induction motors, but he would suggest the use of a transformer, as he did not think that the stator of a motor was the place for a high-tension winding, especially on smaller motors where there was an increased probability of shock and breakdown. The suggestion of the use of a continuous-current coil for superimposing a continuous flux on a reactance, to render the reactance adjustable, was most interesting, but it occurred to him that the alternating current through the reactance coil would have dissimilar shapes for each half of the wave.

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[*] In telephone work shunted capacity is compensated by series inductance (loading coils).

Mr. R. W. Gregory hoped that the author would not persuade anyone to fit reactance coils on power station bus-bars; it was an axiom amongst switchgear designers and engineers to keep power station bus-bars as simple as possible, and free from apparatus of any sort.

Mr. J. R. Andrews pointed out that overhead telephone lines in England were not loaded; over ordinary overhead wires, conversation was possible for a distance of some 1,600 miles, whereas the greatest distance of speech for standard underground cables was some 36 miles.

Mr. J. Schuil said that reactance coils were largely used in America, and there was no question about their value. The engineer of one of the Washington stations had told him that, owing to short-circuits, they had had one of their generators burnt out twice, resulting in its being laid off for eight months altogether, but since the introduction of inductances they had had no breakdowns on the machines.

Mr. J. R. Beard said that manufacturers could readily build machines with sufficient internal reactance to limit the maximum momentary short-circuit current to less than 12 times the R.M.S. current at normal load, and on large systems there was, in addition to this, the reactance of the step-up transformers. An extensive series of tests made in the Newcastle district had proved that transformers designed on ordinary commercial lines with a regulation of, say, 2 per cent. or 3 per cent. at 0·8 power factor, could be constructed to stand up to a dead short-circuit on the secondary side with full terminal voltage maintained on the primary side. The indiscriminate use of reactance coils on a 20,000-volt system would, for all practical purposes, reduce the effective voltage to the equivalent of, say, 11,000 volts. As it was uneconomical to tap main feeders near the power station, such feeders were usually of considerable length, and thus had sufficient impedance to prevent excessive current flowing into a short circuit at their far end; a breakdown in the feeder itself was not more probable than a breakdown on the reactance coil, and, in any case, the switchgear at the power station would be designed to meet such a contingency. He agreed, however, that reactance coils should be used on short feeders, especially where the power station was large. In this case the drop of pressure in the reactance was of less importance, ordinary sub-station gear could be used, and the consumer could safely use standard commercial switchgear, whereas if no means were taken to limit the short-circuit current, the supply authority would have to install the power-station type of switchgear at the sub-station, and the consumer would also be called upon to install switchgear of special design. With regard to the author's recommendation that reactance coils should be used for sectioning extensive high-tension networks, this might be advantageous in some cases, but, in the case of the local companies, who were operating a large number of waste-heat stations running at practically constant output, the power flowed in different directions at different times, consequently an arrangement of reactance coils to suit one set of conditions would certainly not suit every set of conditions, without the use of extensive and complicated regulating arrangements.

Mr. W. Baxter said that after reading the author's paper, one was led to believe that there was no electrical trouble which inductance coils could not cure, but the fact that these coils were not used to any extent on the local supply systems, which were admittedly the best engineered in the country indicated that there were other ways of getting over the difficulties mentioned in the paper. He had recently come across a case of two large fan motors at a colliery, which gave continual trouble on a 3,000-volt system due to "potential front," but the trouble was got over entirely by arranging high-resistance nets in the main oil switches, with contacts so designed that the high resistances were momentarily connected in series with the stator winding, and he thought that an arrangement of this sort would be very much cheaper than any type of external reactance, as all that was necessary was to deepen the tanks slightly.

Mr. R. C. Philipp mentioned the use of choke coils for connecting transformers of different regulation, capacity or voltage in parallel in case of emergency.

Mr. C. S. Vesey-Brown said that his experience led him to use reactance coils wherever possible, because a generator was a very expensive thing to repair in the event of a breakdown.

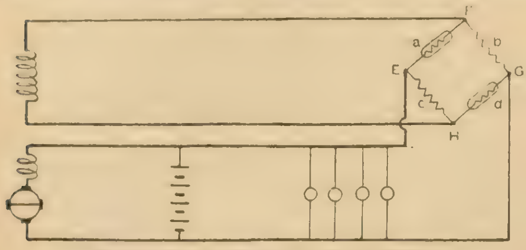
Mr. E. P. Hollis, in reply, said that it had been suggested that the cost of synchronous machinery would be very great; but transmission lines were very costly, and as their capacity would be much increased by the use of synchronous machines, he estimated that a saving could be shown. With regard to the use of reactances for protecting the end turns of motors, the Birmingham Corporation now insisted upon all large motors on their mains being so protected. These reactances were not large, being only about 14 in. long × 8 in. or 9 in. diameter. It was not very easy to run rotaries in parallel with generators, but by using reactances in series with rotary converters the trouble could be overcome. The cost of reactance coils should really be put down as insurance money, because on large systems a shut-down was very costly, and anything which ensured continuity of supply should not be looked upon as unnecessary expenditure.

ELECTRIC TRAIN LIGHTING.

(*Discussion on paper read by* Mr. T. Ferguson *before the* Institution of Electrical Engineers, Manchester Local Section, *on January 27th*, 1914. *For abstract of paper see* Electrical Review, p. 290.)

Dr. E. Rosenberg remarked that electric lighting was incomparably safer than gas lighting, and the tanks of compressed gas carried underneath coaches did not tend to increase the safety of the travelling public. During a discussion arising from the Aisgill disaster, a prominent person stated that from information he had received, there was not a single electrically-lighted coach on the German or Austrian State Railways. The speaker contested this statement, and said that although the majority of coaches were still lit by gas, there were hundreds of electrically-lit coaches on the railways referred to. The French State Railways had also taken up the electric lighting of coaches very actively since the Melun collision in which gas played such a disastrous part. There was no such thing as a strictly constant-voltage system or constant-current system. The system of Stone and the author, for example, were constant-torque systems, and endeavoured to give a current in inverse proportion to the momentary voltage of the battery. In the so-called constant-voltage systems, the voltage had to rise gradually from approximately 2 volts per cell to the charging voltage, *i.e.*, 2·4 volts per cell. It was to be remembered that regulators were not very accurate appliances. A very interesting constant voltage system designed by Mr. Woodridge, of the Electric Battery Co., of America, was specially distinguished by the omission of any kind of lamp regulator or resistance between battery and lamps. A pressure of 2·25 volts per cell was employed, and it was claimed that this was sufficient to keep the battery well charged and in perfect order. Further, the voltage was so low that the gradual increase in the illumination when the battery voltage rose from rest was not felt uncomfortably by the eye. The arrangement, as shown in the diagram (p. 468), consisted of a generator which was a modification of the Rosenberg machine mentioned in Mather & Platt's system. The field winding was composed of a series winding just strong enough compensate the armature reaction, and a shunt winding taking a small current, connected as one diagonal of a Wheatstone bridge arrangement; *a* and *d* in the figure represented bulbs containing iron wire in rarified hydrogen, and *b* and *c* were ordinary resistances. The remaining diagonal of the bridge was connected in parallel with the battery across the generator terminals. It was well known that iron wire when nearing a dull red heat increased enormously in resistance with a slight increase in temperature, and this feature was employed in the system. If the generator voltage was slightly below its normal value, the current through the bridge would drop slightly below its calibration value and the voltage drops between E and F, and G and

H respectively would be very low, also the exciting voltage for the shunt would be much lower than the battery voltage. A slight rise in the battery voltage, however, would reduce this exciting voltage considerably, even down to zero, consequently the machine would not perceptibly change its voltage whatever increase in speed might occur. The system had been employed very successfully in America. The statement that "with most double-battery systems the efficiency is probably not more than about 5 per cent. to 10 per cent. of the current generated" seemed remarkable, and surely could not refer to systems which provided a definite current, independent of belt slipping and a current graduated in accordance with the momentary lighting load. The dynamo efficiency of 65 per cent. seemed a fair figure, provided it included belt losses in systems which worked without belt slipping. The author described an overcharge preventer: did this apply when lights were on? A long non-stop run might cause the battery to reach "gassing" point, even with lights on, and breaking the field might mean that during the remainder of the journey the battery would have to feed the lamps and become discharged again. This would be a disadvantage as compared with systems where the output could be adjusted by changing the excitation, and where the overcharge preventer could be arranged to reduce the excitation to such a value that the dynamo current equalled the lamp current.



Woodbridge Constant-Voltage System.

Mr. J. Denham said that an empty train might stand in a station or siding all night with the switches on, and, in his opinion, some over-discharge prevention should be employed.

Mr. F. E. Cooper referred to the gas lighting of trains as a tremendous danger, and associated himself with a previous speaker in forecasting the abolition of gas before very long.

Mr. A. Pope said that one important system used extensively in America and on the Continent, but not referred to in the paper, was the straight storage system. The system had many advantages, especially as applied to trains running to and fro between towns about 12 miles apart. When facilities could be provided for charging at one or each end, small batteries only were needed. A sulphated cell could not be cured by running in service; the only remedy was complete overhaul in the repair shop.

Mr. McKinnon referred to the difference in the care taken of batteries in Germany and Scandinavia as compared with this country. Whilst working conditions here had greatly improved, they were far from ideal. A recent catalogue stated that "attention at very infrequent intervals only is required to see whether, on the whole, the battery is over or under charged." This could only be construed into an invitation not to trouble about the cells very much. In this country the cells were so placed that access could only be obtained after crawling under the coach and removing very numerous bolts and connections and lids, the whole operation having to be carried out in a kneeling position. In Germany the cells were arranged neatly under the body of the coach, and the footboard in front of the compartment was arranged to swing up, giving easy access for inspection. In Denmark axle-driven systems were not in common use, owing to the number of ferries on the main routes, and straight battery lighting was employed. The author stated that any of the constant-current systems could be maintained by comparatively poor class labour, also that traffic conditions demanded that a poor class of labour should be able to maintain the equipment. This was the keynote to the question of battery depreciation. In England rule-of-thumb method, indifferent attention, and quite crude switchgear were the rule, and if anything went wrong, the battery was blamed. In Germany there was splendid organisation and close attention, and if anything went wrong, the mechanic was blamed. Dr. Rosenberg had referred to Mr. Woodbridge's statement that a voltage of 2·25 would maintain a cell in proper condition in train lighting service. One point had apparently been missed here, namely, that the cell should be kept healthy. Once cells were allowed to become sulphated through standing idle or discharged, for long periods, then such a voltage would not restore the cells to a healthy state, and the system would, therefore, probably be a failure under the ordinary conditions on British railways.

Mr. W. Stansfield said that the author, in referring to Mr. Dalziel's system, recommended the replacement of the special magnetic circuit by differential coils in the exciter circuit, using an iron wire resistance with one coil. The speaker had, in conjunction with Mr. Hatt, developed a train lighting system on somewhat similar lines, and obtained some very promising results with experimental machines. In was found that, by connecting the exciter to the main machine at one pole, and connecting the differential coils so that the one with the iron wire resistance was across the main machine, and the coil without the resistance was across the free ends of the main machine and the exciter, almost any characteristic could be obtained from one rising as the speed was raised, through a level voltage line irrespective of speed (within the limit of the speeds allowed for) even to a characteristic in which the voltage actually fell after rising to a maximum. The speaker had also experimented with the special bridge arrangement referred to by Dr. Rosenberg, and obtained very fair results, although not so good as with the differential coil arrangement.

The Author briefly replied.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Combination Ceiling Rose and Switch.

The General Accessories Co., Ltd., of 70, Worship Street, E.C., have brought out a device intended to supersede the key-holder for pendant lamps, in the shape of a ceiling rose containing a switch, from which a chain hangs alongside of the flexible. The interior of the rose is shown in fig. 1, and the complete device in fig. 2. The light is switched on and off by alternate pulls on the chain, which actuates a ratchet device; the switch contacts are of silver, and the insulation is heavily glazed marmorite. The terminals are of the large loop-in type, and are separated by a bridge with holes for the flexible cord. Obviously the lamp and flexible need not be disturbed in the action of switching, thus avoiding injury to both.

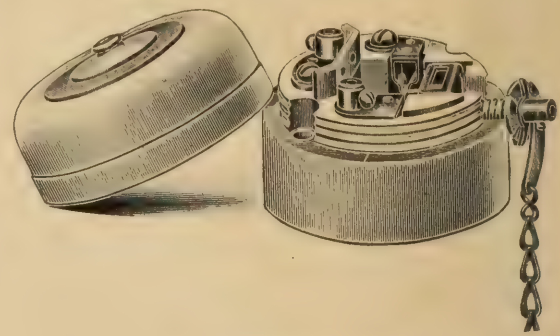


Fig. 1.—Interior of Rose.

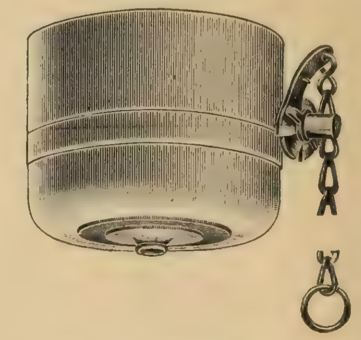


Fig. 2.—Combination Ceiling Rose and Switch.

The "Fyro" Fire Extinguisher.

A fire extinguisher, to be reliable and always ready for instant use in case of emergency, must be simple in construction, have as few working parts as possible, and be capable of being instantly removed from its fastenings and used by those least experienced.

It is claimed that the "Fyro" fire extinguisher fulfills these conditions. It is simple in construction, is light, and can be worked with one hand, if necessary, no mechanical force being required to operate it. There is no waste of extinguishing fluid, as is so often the case with many extinguishers, where the stream has such force that it is shot through the flames. This extinguisher will throw a spray a distance of 10 ft., or by opening the valve an extra half-turn, it will throw a stream 25 ft. The spray is most effective on small fires scattered over a comparatively large area; the stream is usually best for fires concentrated in one spot.

The extinguisher is cylindrical in form, 3 in. in diameter and 14 in. long, and weighs when charged 5½ lb. At the top is the needle valve through which the fire-killing fluid is discharged, and running through the centre from the needle valve almost to the bottom is a siphon tube. The air pressure in the cylinder forces the "Fyro" fluid up this tube, holding it permanently against the valve, thus forming a "liquid seal," which makes impossible any leakage of air pressure and prevents deterioration or loss of strength with age. In the event of the contents being partly used, the extinguisher will be just as effective upon the next fire in proportion to its bulk as it was originally.

Brackets are supplied for supporting "Fyro" fire extinguishers, which are carefully designed with a view of allowing the latter to be instantly removed. "Fyro" fluid is a combination of chemicals in liquid form; it contains neither acids, alkali nor salts; is non-poisonous, free from moisture, non-corrosive, and a positive non-conductor of electricity. When the contents of the extinguisher come in contact with the fire, the fluid volatilises, forming 4,000 cb. ft. of dense combustion arresting gas five times as heavy as air, which quickly envelopes the flames, displacing oxygen and thereby extinguishing the fire. The gas generated can be breathed by the operator without injury.

These extinguishers are easily recharged, the only additional apparatus necessary being a tire inflating pump and gauge. It is claimed that they have successfully extinguished electrical fires caused by short circuits, and owing to the fluid being a non-conductor of electricity, there is no danger to the operator, or harmful results to the plant. The "Fyro" extinguisher is supplied by Messrs. Turners & Manville, Ltd., of 5, Lloyd's Avenue, E.C.

Fig. 3.—"Fyro" Fire Extinguisher.

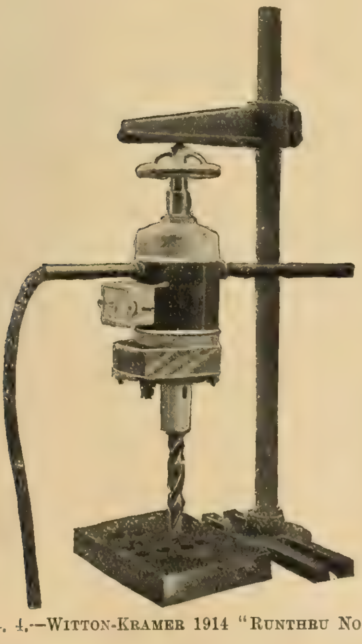


Fig. 4.—Witton-Kramer 1914 "Runthru No. 5" Drill.

Witton-Kramer Electric Drills.

In the "1914 Runthru No. 5" drill, constructed by the Witton-Kramer Electric Tool and Hoist Co. (for whom the General Electric Co., Ltd., 67, Queen Victoria Street, E.C., are the sole selling agents), a considerably more powerful tool has been produced without any increase in the weight, which stands at 57 lb. These improvements have been effected by reducing the waste space in the top cover and gear box, and have not involved a reduction in the strength or efficiency of the mechanical or electrical working parts. This tool will drill a 1¼-in. hole in cast-iron at the rate of 1 in. a minute. As will be seen from the accompanying illustration, the drill is of rugged design, the solidity of the working parts being the outstanding feature of its construction.

Viaco Insulators.

The Electrical Engineering and Equipment Co., Ltd., of 109, New Oxford Street, W.C., send us particulars of their Viaco insulators, which are moulded from a special material, which has been produced with a view to overcoming the disadvantages of porcelain. In particular, these insulators are said to be almost unbreakable, and absolutely weatherproof.

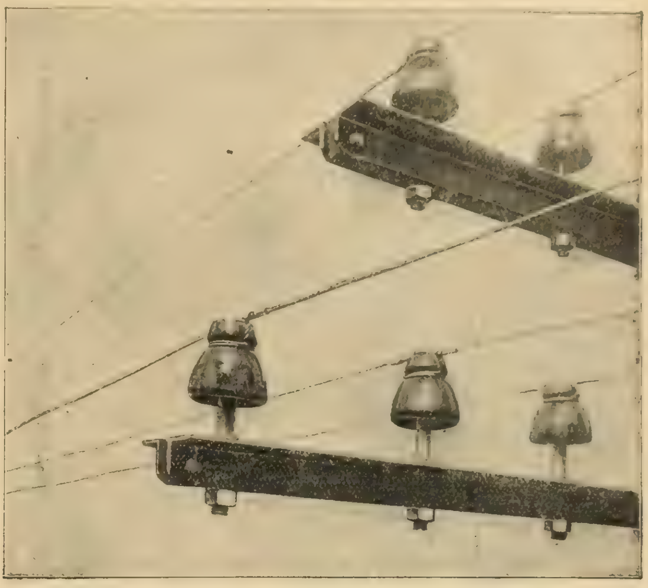


Fig. 5.—Viaco Insulators, showing Effect of Shots.

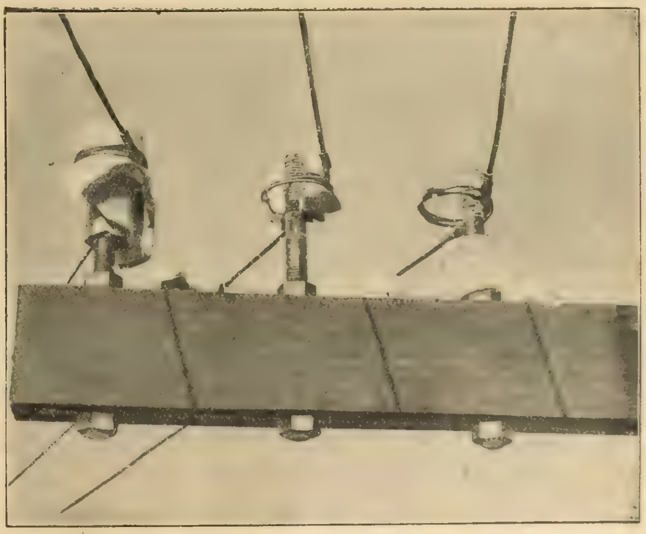


Fig. 6.—Ordinary Porcelain Insulators Shot Away.

The mechanical work required to break a Viaco double-petticoat insulator, as found by a German testing institution, amounted to 1·51 ft.-lb., while ·67 ft.-lb. was sufficient to break a porcelain insulator of equal diameter and equal thickness of petticoat.

Other tests show that Viaco insulators of the smallest type have an insulation resistance of 29,000 megohms on the average, while for double-petticoated insulators the figure given is 60,000 megohms; under equal conditions, porcelain insulators show an insulation resistance of only 1,000 megohms on the average.

These insulators are made normally with ⅜-in. Whitworth or G.P.O. special threads; their mechanical strength is shown by the comparison between our two views of the results of similar treatment meted out to both porcelain and Viaco insulators, and is an obvious advantage for transport purposes.

A Carron Cooker.

The accompanying view (fig. 7) illustrates one of the Carron Co.'s latest pattern cookers, which they make in four sizes, 13 in., 15½ in., 17 in., and 21 in. wide inside the oven.

Every part of the cookers is standardised, and they are arranged for switchboards with one pilot lamp and main switch, or pilot lamp to each element.

The ovens are double-cased and packed, and have porcelain enamelled inner and outer casings of sheet-steel; the heating elements are fixed at the top and bottom, and three-heat regulation is provided.

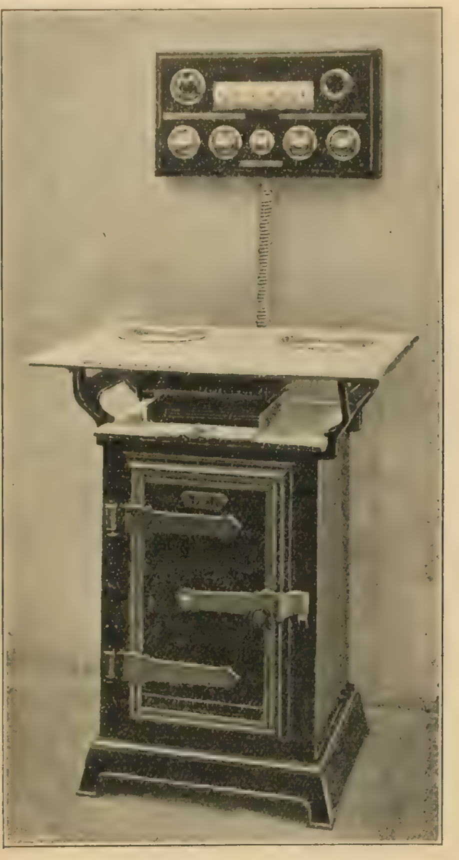


Fig. 7.—Carron Cooker with Switchboard.

The cooker is fitted with a polished hob, grill and boiling plates, which latter vary in size and number according to the size of cooker; a porcelain enamelled crown plate is supplied, which is removable for cleaning.

The 6-in. boiling plates are loaded for 600 watts, and the 8 in. for 1,100 watts—three-heat regulation in each case. The grill, 10 in. wide × 9 in. deep, is loaded for 1,250 watts. These cookers are recommended for hiring out.

Dry Air Filter.

We have received from Messrs. Dryers, Ltd., of 71, Queen Street, E.C., particulars of their dry air filters on the "Bollinger" patent system, for turbo-generators.

Fig. 8 shows two complete filter chambers with intake pipes suitable for small generators or air compressors. For large installations a group of filter screens is employed, the screens usually measuring about 40-in. wide, 50-80 in. high, and 12 in. thick. The chambers are of sheet steel.

The screens consist of pure wool strings stretched in metal frames, arranged so that the strings of one layer cover the spaces of the adjoining ones. The strings are so close that the fibres intermingle forming a loose but efficient filter mesh for dust, offering little resistance to a current of air at moderate speed. Wire screens are also provided on each side of the chamber to prevent anything other than dust passing to the filter. Only one set of spare screens is needed to replace dirty screens, which can be done while the plant is in use.

The "Bollinger" system is claimed to cost no more, and frequently less, than other systems. A special feature is the low resistance to the air and small power requirements. Further figures are given to show that an ordinary cloth filter to deal with 1,800,000 cb. ft. per hour required 1,080 cb. ft. of space, while the Bollinger filter for this duty required only 167 cb. ft.

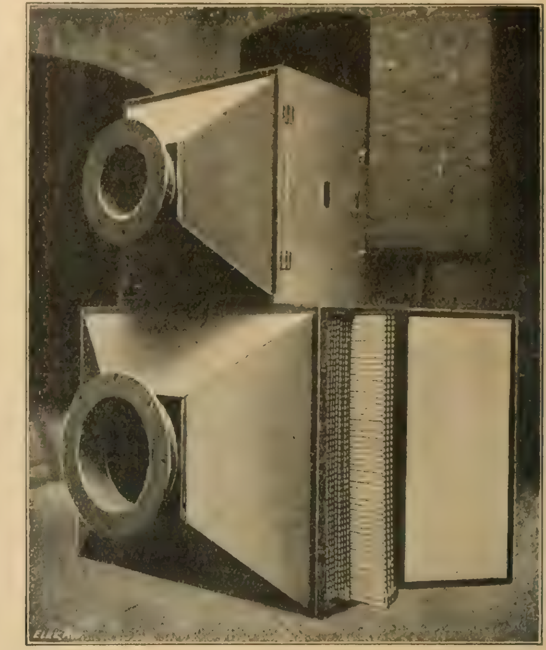


Fig. 8.—Dry-Air Filters on the Bollinger System.

Brooke Semi-Diesel Engine.

Our illustration, fig. 9, shows a 15-h.p. hot-bulb two-stroke engine built for experimental purposes by Messrs. J. W. Brooke and Co., of Lowestoft, whose long experience in the construction of petrol and paraffin motors should enable them to offer a first-class engine of this type.

The design of these hot-bulb motors has now reached a point where even the details have almost become standardised, and, excepting for one or two minor improvements, Messrs. Brooke's model is an embodiment of the best features from other well-known and well-tried makes.

Extreme simplicity is the ruling feature in this type of engine when compared with ordinary oil engines fitted with valves and gear, vaporisers and other complications, while its consumption of cheap, heavy oil is very little higher than in the Diesel engine itself.

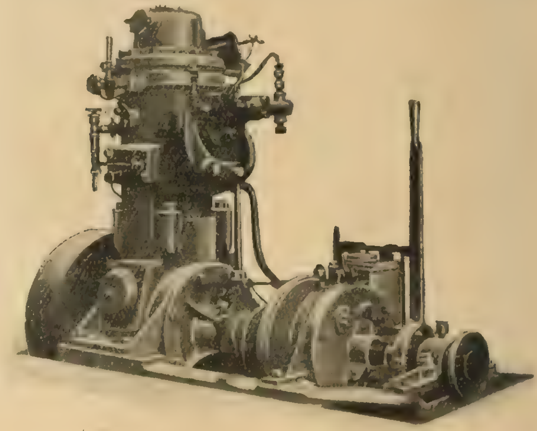


Fig. 9.—Brooke Semi-Diesel Engine.

Excepting for the main moving parts, essential in every engine, there is only a small plunger pump for injecting the oil into the cylinder, and this is driven by an eccentric on the crankshaft.

Messrs. Brooke intend to place a range of hot-bulb engines on the market shortly for both stationary and marine purposes.

LEGAL.

The Shoeburyness Picture Palace Co., Ltd., *v.* The Union Electric Co.

In the Commercial Court of the King's Bench Division, on March 6th, Mr. Justice Pickford heard this action, claiming damages for the alleged failure of the defendants to deliver—under a contract with the plaintiffs— a dynamo for use at their theatre, which, it was said, the defendants knew plaintiffs required to be delivered by May 6th, 1913, in view of their proposed opening of the house on Saturday, May 10th. The defendants admitted that the dynamo was not delivered by May 6th, but they said the plaintiffs accepted their offer to lend a machine temporarily, and that the date of delivery under the original contract was extended.

Mr. Hinde appeared for the plaintiffs, and Mr. Brandon for the defendants.

MR. HINDE said that through the failure of the defendants to deliver the dynamo on May 6th, they were put to expense in buying a machine elsewhere, and suffered serious loss by not being able to open the theatre on the day arranged for. The plaintiff company was incorporated in December, 1912, to open a picture palace at Shoeburyness early in 1913. There were negotiations for the purchase of a dynamo to light the theatre, there being no local supply. Eventually the defendants, about the end of March, wrote to say they could supply a dynamo of the latest design, of good construction, and warranted to give good results, and it would be constructed to meet the requirements of the British Engineering Standards Committee, and they guaranteed it for 12 months from the date of its despatch. The price was subject to 2½ per cent. for cash within 30 days, and it was said that defendants would require for delivery three or four weeks from the receipt of order. The defendants were told that the theatre was to be opened on Saturday, May 10th, and they ordered a dynamo on the understanding that it should be delivered by May 6th. On May 5th the plaintiffs had a telegram from defendants to the effect—"Regret unavoidable delay, impossible to deliver till towards end of week." The defendants wrote to say they regretted the delay, but it was through circumstances outside of their control as there was delay in the test room, and they had had to order certain alterations. Eventually the defendants offered to loan another dynamo temporarily, and this arrived on the morning of May 9th. This dynamo would not generate electricity, and the suggestion made by the defendants (counsel understood) was that the plaintiffs tried to work it in the wrong direction. The result of it all was that the opening of the house did not come off on May 10th, and plaintiffs had to send their electrician to London to get a Crompton dynamo, and with the aid of this they opened the picture palace on the Monday. When they experimented again with the defendants' dynamo, it would not work until they substituted the Crompton resistance that plaintiffs had bought elsewhere. Eventually, counsel added, plaintiffs said they would not have the defendants' dynamo ordered under the contract, but eventually they consented to take delivery. The plaintiffs claimed damages for the expenses to which they had been put, and for loss of takings on the day that they failed to open the theatre as arranged.

MR. HOWARD HALLEY, of the plaintiff company, stated in evidence that there was no electricity available at Shoeburyness, and they had to get a dynamo for their theatre. They ordered the dynamo subject to the condition of delivery by May 6th, and by that date all the arrangements for the opening were well forward. On May 6th witness told defendants over the telephone that they must send a dynamo that was ready for work, and defendants said they would see to that, and all the plaintiffs would have to do would be to attach it to the bed, as it was all ready, and had only recently been running at another picture palace. The dynamo arrived on Friday, May 9th, and it was fixed up for running immediately, but it would not work so as to generate electricity, and the opening on May 10th did not come off, although 600 people had assembled in anticipation of the event—an event that had been widely advertised locally. They sent their engineer to London, and he bought a Crompton dynamo at Hammersmith, that arrived on the Sunday night, and they opened on the Monday. On May 25th the machine supplied by the plaintiffs was tested, and after the defendants' man had practically overhauled it, he managed to get it to excite. He, however, had to use the resistance from the Crompton machine.

MR. ARTHUR MEADOWS, of Cheapside, electrician, of 11 years' experience, said he was employed by the plaintiff company in connection with the installation of electricity at the theatre, and he was of opinion that the defendants' dynamo was not fit for the purpose supplied.

Cross-examined: He did not agree that the trouble was due to the fact that the engine was running in the opposite direction to the dynamo. The machine was "excessively hot," and too hot for proper use.

Counsel: I can tell you that before and after this machine has worked satisfactorily for other cinemas. Does not that suggest to you that you did not know how to use it?—Not a bit.

The JUDGE: What is your explanation of the fact that you and others could not work it on the 10th and their man on the 25th got it to go satisfactorily?—I should say the explanation is that it was a freak, as their man said he had known it to occur before.

Re-examined: Witness said it was impossible to use the machine before the Crompton resistance was put in.

MR. A. S. JONES, electrical engineer, spoke to being engaged by the plaintiffs to do the necessary work when the dynamo was installed at the plaintiffs' establishment. He tried every possible means of getting the dynamo to work, but without success subsequently, he went to London and bought a dynamo for £20, and on Monday they got sufficient current to allow the theatre to be opened.

Cross-examined, Witness said that when the defendants' dynamo did work, it got hot too quickly. He was not personally interested in the plaintiff company.

MR. HAROLD SIMMONS, M.I.E.E., consulting engineer, said it was a simple thing to make cross connections without reversing the direction of rotation of the machine. He had heard the evidence given as to what was done with the dynamo, and in his opinion it was perfectly reasonable and proper. His impression was that when the machine came the field rheostat was faulty, so that whatever they did with the dynamo in regard to direction of rotation, no result could be obtained.

On behalf of the defendants, MR. BRANDON said his case was that the dynamo was a perfectly proper one. The defendants did not undertake to fix it. That was no part of the contract, and they had the right to assume that the plaintiffs would have reasonably competent electricians to fix it for them. This dynamo had been at another cinema before, and had worked perfectly satisfactorily. The fault was entirely due to the plaintiffs. He submitted that in regard to the damages, the only damages the defendants could possibly be held responsible for was the reasonable cost of installing or removing the dynamo which was sent temporarily. Since leaving the plaintiffs' premises the dynamo had gone to another cinema, and no complaint whatever had been received in regard to it.

MR. H. E. MOUL, technical adviser to the defendant company, said he had no plans to show which way the dynamo was to run. When it was found that the machine would not generate it was quite easy to reverse the shunt connections and make it generate in about 10 minutes.

MR. J. POMFREY, another expert, expressed the view that it would have been an easy matter to have made the dynamo work in the first instance.

MR. W. RANDALL, electrical engineer, said that he went down to Shoeburyness and made the dynamo run satisfactorily for two and a-half hours, and it was then giving sufficient power to run both the cinema and the electric lighting. He was satisfied then that the machine would have run right on for a week. There was only a normal amount of heat generated.

MR. A. H. DYKES, M.I.E.E., said he had heard the evidence given, and he was of opinion that if a dynamo failed to excite, the thing to do was to reverse the shunt connections.

If the resistance was too high, was that a difficulty simple to remedy when you only want the machine for a day or two?—A very simple matter; just alter the connections.

MR. JUSTICE PICKFORD, delivering judgment, said that the defendants said that as they were not under contract to fix the dynamo, they thought that the plaintiffs would have obtained the aid of competent people. The temporary dynamo had an imperfect regulator or resistance, and they could not get the machine to excite, although a Mr. Jones, a Mr. Meadows, and a Mr. Holroyd, in the employ of the Government at the local barracks, did all they could. A simple explanation was suggested at first, that they should have changed or reversed the electrical action of the machine as it was running the wrong way, but the plaintiffs' men denied that they neglected any such elementary precaution. A test was held eventually, a man came down, and soon the machine worked better. If the defendants had sent the machine by the quickest possible means and not driven it to the last moment there would have been time for the plaintiffs to have communicated with the defendants and got them to send somebody down. He (the Judge) could not explain why the plaintiffs' men could not get the dynamo to work, but he could not say that it was entirely the fault of the plaintiffs, as if the defendants had taken proper steps they would have got it to work at the required time. He thought, however, it was unreasonable for the plaintiffs to send to London and buy a new one, and he could make no allowance in regard to that. The question only remained what damages should be awarded to the plaintiffs for the failure to open on May 10th as arranged, and he had come to the conclusion that he would award the plaintiffs £20 altogether, and there would be judgment for the plaintiffs for £20 and County Court costs. He was of opinion that the plaintiffs' claim was exorbitant, especially the item of £100 alleged to have been lost by the failure to open on the Saturday.

Judgment accordingly for the plaintiffs for £20 and County Court costs.

Marx *v.* Electric Utility Co., Ltd.

An application was made to Mr. Justice Pickford in the King's Bench Division that this case, at present in the warned list of non-jury actions, should be fixed for hearing on March 30th next.

MR. BERESFORD, on behalf of the plaintiff, made the application, and said that it would be a great convenience to all the parties if his Lordship would assent to this course. The grounds of the application were that a necessary witness was resident in Berlin, and could not conveniently attend before that date.

MR. JUSTICE PICKFORD: Does it take 30 days to get from Berlin?

COUNSEL: No, but at present we are unable to get at him.

MR. JUSTICE PICKFORD said that he could not fix the case for the day mentioned, but he would say that it should not be taken before March 30th, and the parties would have to be subject to the "warned list."

Garrett v. Toseland.

At the Northampton County Court, recently, Messrs. F. T. & A. Garrett and Co., electrical engineers, Northampton, claimed from William Toseland, innkeeper, the Royal Standard Inn, Luton, £11 11s., balance of amount due for work done. The evidence was to the effect that plaintiffs were engaged by defendant to install electric lighting in the public part of the house. While the work was in progress it was suggested the whole of the house should be lighted, it being stated that the brewers would pay part of the cost. The defendant denied liability for this portion of the work, though it was admitted it was satisfactory. The brewers had not paid. The *Northampton Herald* states that judgment was given for plaintiff.

NEW PATENTS APPLIED FOR. 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

4,583. "Metallic conduits for electric conductors." C. F. Burton, Senr., H Burton and C. F. Burton. February 23rd. (Complete).

4,590 "Electric-light bulb" W. C. M. Pettingill. February 23rd.

4,592. "Means whereby the position of a sunken vessel may be located and telephone connection established." A. Butler. February 23rd.

4,616. "Globes and shades for electric, gas, and oil lights and means for ruary 23rd.

4,615. "Globes and shades for electric, gas, and oil lights and means for mounting same." C. E. Storrar, J. H. Storrar and R. A. Storrar. February 23rd.

4,619. "Telephone system." P. Lavery and W. E. Bandlow. February 23rd. (Convention date, February 24th, 1913, United States). (Complete).

4,627. "Reflector-arm for electric lamps." M. Chalier. (Convention date, March 22nd, 1913, France). (Complete). February 23rd.

4,632. "Automatic switch more especially intended for use in connection with flash-light signs illuminated by electricity or gas." F. Jahn and R. P. Myers. February 23rd.

4,655. "Electric light lamps for motor-driven power and motor vehicles." A. Christmas. February 23rd.

4,663. "Circuit interrupters." British Westinghouse Electric and Manufacturing Co., Ltd. February 23rd. (Westinghouse Electric and Manufacturing Co., United States). (Complete).

4,664. "Production of electric waves for wireless telegraphy, telephony and the like." Polyphos Elektrizitats, Ges.m.b.H. February 23rd. (Convention date, February 26th, 1913, Germany). (Complete).

4,666 "System of wireless telegraphy." H. Wade. February 23rd. (Harold Steele Mackaye, United States).

4,681. "Train lighting and similar systems." Vickers, Ltd. _ February 23rd. (Franz Krizik, Austria). (Complete).

4,716. "Telephone receivers." R. Woodland. February 24th.

4,735. "Electrically-operated and other presses." A. H. Railing, A. Peacock and T. H. Hutchinson. February 24th.

4,742. "Electric furnaces." J. L. Dixon. February 24th.

4,751. "Dynamo electrical machines." Hon. Sir Charles Algernon Parsons and A. H. Law. February 24th.

4,758. "Electric-lamp stand." F. W. Golby. February 24th. (Wizard Electric Lamp Co., United States).

4,762. "Electric machines." C. F. Kettering and W. A. Chryst. February 24th. (Convention date, March 7th, 1913, United States). (Complete).

4,766. "Automatic door switch." H. Westcott. February 24th.

4,783. "Electric incandescent lamps." F. Loewenstein. February 24th. (Complete).

4,784. "Process for coating metallic surfaces with brass." S. O. Cowper-Coles. February 24th.

4,785. "Process for coating metallic articles with lead." S. O. Cowper-Coles. February 24th.

4,786. "Electrolytes for the electro-deposition of zinc." S. O. Cowper-Coles. February 24th.

4,787. "Electrolytic process for the production of rustless iron." S. O. Cowper-Coles. February 24th.

4,788. "Electrolytic process for the production of rustless iron alloys." S. O. Cowper-Coles. February 24th.

4,793. "Electricity meters." Electrical Apparatus Co., Ltd., and H. C. Turner. February 24th.

4,803. "Electric motors." Phœnix Dynamo Manufacturing Co., Ltd., and R. Pohl February 24th.

4,813. "Electric lighting systems." British Thomson-Houston Co., Ltd. February 24th. (General Electric Co., United States).

4,815. "Long-stroke electro-magnets and reciprocating electro-magnetic mechanisms and the like." Fitzroy T. Chapman. February 24th.

4,819. "Selectors especially suitable for use with automatic or semi-automatic telephone systems." G. A. Betulander. February 24th. (Convention date, March 1st, 1913, Sweden). (Complete).

4,822. "Method of fixing and preserving metal fence posts, telegraph posts, and the like driven into the ground, and devices therefor." C. A. Denis. February 24th. (Complete).

4,894 "Electric lamp for the forehead, more particularly for use in surgical operations." E. Jungermann. February 25th. (Complete).

4,908. "Electrical hair brushes, massage brushes, and the like." Tokalon, Ltd., and M. F. Pratt. February 25th. (Complete).

4,917. "Electro-magnetic safety and smooth running system to be used on railways, tramways, and the like." T. A. J. Pile. February 25th.

4,929. "Electric battery lamps." S H. G. Stuart. February 25th.

4,931. "Protective devices for electric distribution systems." British Thomson-Houston Co., Ltd. February 25th. (General Electric Co., United States).

4,934. "Incandescent electric lamps and contacts therefor." C. C. Regnart. February 25th.

4,940. "Dynamos." H. Leitner. February 25th.

4,941. "Electric heaters or resistance elements therefor." J. R. Quain February 25th.

4,943. "Electrical heating apparatus." M. A. V. London. February 25th.

4,944. "Plating metals." W. E. Watkins. February 25th. (Convention date, August 21st, 1913, United States). (Complete).

4,957. "Electric heating apparatus." C. R. Belling. February 26th.

4,964 "Locking-devices for the bulbs of incandescent electric lamps." J A Vice February 26th.

4,979 "Electrical machines" F Ljungstrom February 26th (Convention date, April 8th, 1913, Germany). (Complete).

4,985 "Telephone receiver brackets." McIon J. D. Carter. February 26th.

5,012 "Method of enhancing the permeability of magnetic material." E. Wilson February 26th

5,014 "Electric arc lamps." F. Proctor. February 26th.

5,019 "Regulators for systems of electric distribution." British Thomson-Houston Co., Ltd. February 26th. (General Electrical Co., United States).

5,037 "Telegraphy" W. Judd, B. Davies and Eastern Telegraph Co., Ltd February 26th. (Divided Application on 9,768/13, April 25th).

5,040 "Ignition apparatus." R. Varley. February 26th. (Complete).

5,047 "Electricity meters of the mercury motor type." W. Lawson. February 26th.

5,050 "Electric arc lamps." F. W. Sturgess. February 26th.

5,069 "Electric switches" St Helens Cable and Rubber Co., Ltd., and J. C. White. February 27th.

5,070 "Interrupters for electric circuits." A Pollak. February 27th. (Convention date, February 27th, 1913, Austria). (Complete).

5,093 "Construction of dynamo-electric generators of the acyclic type." J. Sinclair February 27th. (Complete).

5,115. "Metering systems for machine switching telephone exchanges." Western Electric Co., Ltd. February 27th. (Franklin Tuthill Woodward, Belgium). (Complete).

5,131. "Appliance for preventing unintentional interruptions on the telephone." R. S. O. Dudfield. February 27th.

5,132. "Automatic safety device (apparatus) preventing fire or explosion from burning gas lamps or escaping gas otherwise ignited from stove fires or short circuit, applicable to all sorts of vehicles." E. Schwyzer. February 27th. (Complete).

5,162. "Application of permanent magnetism to motor power." A. L. S. O'Fflahertie. February 28th.

5,196. "Methods and apparatus for shaping filaments for electric incandescent lamps." J. Findlay. February 28th.

5,225. "Process for the concentration of ores." S. O. Cowper-Coles. February 28th.

5,226. "Anode supports for use in the electro-deposition of metals." S. O. Cowper-Coles. February 28th.

5,227. "Flux for soldering zinc surfaces." S. O. Cowper-Coles. February 28th.

5,228. "Process for obtaining adhesive deposits of lead upon iron and steel surfaces." S. O. Cowper-Coles. February 28th.

5,234. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and J. Hutt. February 28th.

5,236. "Cells of electric batteries." M. E. Feilmann, C. R. Noble and A E. Turnham. February 28th.

5,240. "Means for attaching insulators for electric wires and the like." T. Wittrin. February 28th. (Convention date, March 1st, 1913, Germany). (Complete).

5,246. "Telephone systems." T. Shaw. February 28th. (Convention date, February 28th, 1913, United States). (Complete).

5,247. "Systems for the transmission of electrical energy." T. Shaw. February 28th. (Convention date, February 28th, 1913, United States). (Complete).

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

28,513. Electrical Ignition. F. G. L. Biddlecombe and G. Thomas. December 10th.

1913.

788. Method of and Means for Effecting the Efficient Transmission of Electric Signalling Impulses Through Cables. A. Williams. January 10th.

802. Means for Generating Alternating Electric Currents. G. Marconi. January 10th.

3,249. Electric Control of Alternating Current Motors. Otis Elevator Co. (Otis Elevator Co.). February 7th.

3,271. Manufacture of a Material Suitable for Electrical Insulation and other purposes. British Thomson-Houston Co. (General Electric Co.). February 7th. (Cognate Application, 22,358/13).

3,339. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). February 8th.

3,565. Electric Motor Control Systems. British Thomson-Houston Co. (General Electric Co.). February 11th.

3,566. Manufacture of a Material Suitable for Electric Insulation and other purposes. British Thomson-Houston Co. (General Electric Co.). February 11th.

3,596. Advertising and like Device. W. Balmford and J. McCurrison. February 12th.

3,882. Method and Apparatus for Suppressing the Interruption Arc on Electric Switches. W. Burstyn. February 14th.

4,396. Inter-communication Telephone Systems. Sterling Telephone and Electric Co. and F. G. Bell. February 20th.

4,773. Electric Machines Having Commutators. B. Ljungström and A. D. Widström. February 25th. (February 26th, 1912).

4,869. Controller for Electric Lifts and Hoists. W. J. F. Cooper and F. Barlow. February 26th.

4,927. Electrical Contact Devices Particularly Applicable to Arc Lamps. J. Brockie, and Johnson & Phillips, Ltd. February 26th.

6,861. Magazine Electric Fuse Box. R. Groves. March 20th.

7,286. Electric Lighting of Vehicles. W. G. Lee and P. J. Oldfield. March 27th.

7,853. Prepayment Apparatus for the Supply of Electricity. E. Garside. April 3rd. (Addition to 22,325/12).

8,245. Apparatus for Governing the Speed of Railway-cars or Trains A. E. Alexander (Union Switch & Signal Co.). April 8th.

14,407. Automatic Telegraphic Apparatus. J. Gell. June 21st.

15,179. Telephone Relays. J. Schiessler. July 1st. (July 15th, 1912).

15,579. Automatic Telephone Exchanges F. N. Reeves & A. E. Lundell. July 5th. (July 5th, 1912).

15,697. Dynamo-electric Machines. B. Brooks & W. Holt. July 8th.

19,668. Rectifiers for Alternating Electric Currents. O. W. Richardson August 30th.

21,115. Submarine Electric Lamps. R. H. Davies. September 18th.

27,348. Means for Use in Concurrently Producing upon the same Strip or Chart Records or Diagrams Relating to Several Electric Currents. Hartmann & Braun Akt. Ges. November 27th. (January 17th, 1913).

29,240 Method of and Means for Effecting a Diplex Action in Actuating Electric Apparatus at a Distance by Means of Pulsating Electric Currents Obtained from a Source of Continuous Electric Current. E. H. Widegren and K. A. Widegren. December 18th. (December 30th, 1912).

THE

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1914 EDITION

NOW READY.

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ELECTRICAL INDUSTRY.

As is customary at this period of the year, our pages have to be added to in order to accommodate the large volume of matter of a financial and industrial character that is issued by electrical companies. In the first issue of the year only a general summary of the position is possible, but by the end of March one can review it with more precision by the aid of directors' reports and chairmen's speeches. Nobody wishing to keep himself intelligently informed concerning the state of the electrical industry, either in manufacturing or in electricity supply, can afford to ignore these statements, and we believe that many of our readers make a practice of reading them in full, laborious as that may seem to the non-industrial or non-financial mind. Some may content themselves with making their own selection of what to read, but we are all interested either as workers or investors in the electrical industry in knowing what others have accomplished and are expecting to do. Most business people make a practice of looking upon the affairs of others at times.

So far as manufacturing reports for 1913 are concerned, there is certainly little reason for complaint. Better dividends on ordinary capital and hopeful speeches are fairly general, and the amount of work in hand is gratifying—in some cases, if rumour be correct, it is exceptionally good—promising equally satisfactory returns a year hence.

Hardly less satisfactory have been the statements made by the great electricity supply companies operating in the London area. The ordinary shareholder in many cases has had reason to be more pleased with his rate of interest, which rose in spite of the heavier cost of coal. So far as 1914 has gone, coal prices have fallen, but it is unsafe to say whether the drop is going to continue, for hopes have hardly been expressed when news of serious labour trouble in important coalfield districts comes to hand. The companies in certain cases have made it plain that they fully appreciate the growing importance of heating and cooking business, and the large extent to which they will depend thereon in the future.

The great subject of the year for all the London electric supply companies, however, has been the necessity for doing something to put the whole supply business of the district on to a better basis, giving greater uniformity and efficiency. The matter has been brought into prominence by the promotion of the London Electric Supply Bill concerning which it is unnecessary to say anything here at this juncture, seeing that the different points of view of parties in conflict have been so fully published in our "City Notes." Without discussing the merits of the controversy that has arisen, however, we must express regret that the matter was not so handled as to avoid the exhibition of boards divided. The majority of the companies seem, so far as we can gather, to be opposed to the "holding" company, and it is understood that they are themselves preparing a scheme for which they hope to be able to secure the approval of the London County Council. The Council and Parliament may be trusted to safeguard the interests of the public in respect to deferring the purchase date, and they will decide which, if either, of the rival schemes London shall have; before they do so the question will doubtless be discussed in great detail, and the comparative merits of rival propositions will be examined. All we hope is that the question will not be once again indefinitely shelved. It is in the best interests both of London and of electrical progress that the way should now be freed from every complication that hinders the public from having an efficient, cheap and developing electric supply assured for it in perpetuity.

The I.E.E. Theatre.

More than three years ago, when describing the new home of the Institution of Electrical Engineers, we referred to the lighting of the lecture theatre as "highly effective," and "a typical application of modern scientific methods to the solution of a difficult problem of illumination." We thought so at that time, and we believe that the installation was generally regarded as satisfactory, in respect of intensity of illumination and freedom from objectionable glare.

But in the course of three years changes take place; the novelty has worn off, the candle-power of the lamps has probably decreased somewhat, and above all, the reflecting efficiency of the white frieze appears to have greatly depreciated. At the same time the mahogany panelling has doubtless grown darker. Whether due entirely to such causes as these, or not, we cannot help feeling that there is an indefinable something that is wanting or at fault, an element that militates against the comfort of the audience, and gives one the impression of being seated at the bottom of a mahogany box. It is very difficult to distinguish the features of a friend across the room—almost impossible to say whether his eyes are open or closed. There is a striking lack of contrast, of definiteness; while there is an abundance of light on the horizontal plane, there appears to be too little at an angle with that plane.

Members of Council see things literally from a different point of view, and probably very much better; the cornice over their heads is bright and clean, whilst on the other three sides of the hall it is grey, and they are at the centre of the semicircle; consequently they are unable to realise the appearance of the hall as seen by others less favourably situated.

The direct light given by the mercury vapour lamps adds to the illumination on a horizontal plane, but is mainly tangential to the vertical, to the faces of members, and to the mahogany panels; moreover, the light of the mercury-vapour lamps is practically devoid of the rays that are not absorbed by mahogany, so that the latter, to them, is black. The names of bygone heroes carved on the mahogany cannot be deciphered across the hall, and everything is dull and monotonous in appearance.

A few flame arcs or high-candle-power incandescent lamps above the ceiling would probably make all the difference. The lighting of the King's Hall at the Holborn Restaurant, for example, is excellent, partly no doubt because the reflective power of the walls is enormously greater than in the lecture theatre, but largely due to the more suitable colour and intensity of the flame arcs in the roof. Whether we have voiced the feelings of many members of the Institution we do not know; perhaps they will tell us, by way of our "Correspondence" Columns.

The Rubber Market.

The auction sales in Mincing Lane last week went off remarkably well, especially when it is remembered that a record quantity of the commodity was presented for disposal. For most of the parcels presented firm prices were realised. While pessimistic opinions continue to be ventilated in certain quarters, the general impression is that the market is on a reasonably safe basis at round about current prices, and that at all events there is not likely to be any material deterioration from the present level. The fact that the fortnightly auctions are beginning to deal with rather unwieldy quantities of rubber, has led to suggestions that there should be weekly sales held, but for the present there seems to be rather strong opposition to the proposals in important quarters, and under the circumstances the matter must be deferred till a later date. Eventually, however, there must be some alteration in the existing arrangements, for the growth of the supplies creates a problem which will have to be tackled sooner or later, and the only practicable device appears to be to hold the sales more frequently than is the case at present.

The cost of production is coming down quite fast where the better managed plantation companies are concerned, and the reduction notified by the Batu Caves Co. is little short of astonishing, 6d. a lb. in the year, from 1s. 6½d. a lb. in 1912, to 1s. 0½d. in 1913. Probably, too, this cost will be reduced further, while the crop harvested increased from 370,000 lb. in 1912 to 506,000 lb. in 1913. For the current year the output is estimated at 530,000 lb., but this will probably be exceeded. This is more or less typical of the progressive nature of output, and reduction in cost which are going on amongst the plantation rubber concerns of the Middle East. There are few, indeed, which can match this showing, but the tendency is strongly in the direction indicated, and the next few years will certainly see remarkable progress made along these lines. Ultimately, no doubt, rubber prices will drift to a lower level, but for the present there seems to be no reason to look for any great falling off in values. The official figures of the exports of rubber from the Federated Malay States in January give the total as 2,542 tons, compared with 2,130 tons in January of last year.

Much interest centres upon the efforts made to open up new rubber consuming industries, and the Secretary of the Rubber Growers' Association now announces that the proposal to provide a temporary street covering of rubber to be used in place of straw during cases of illness has been abandoned. Repeated experiments were made with a view of overcoming mechanical difficulties, and these were ultimately successful, but it was found that a satisfactory covering could only be made of a weight that rendered it unwieldy, and this involved a prohibitive cost so far as private enterprise was concerned. That the efforts to discover new uses are being pushed forward, however, is shown by the fact that suggestions to grant a subsidy, payable in rubber, for obtaining trials of the following applications of the material are under consideration—rubber-faced blocks of wood for street paving, and rubber covering for concrete or cement lawn tennis courts for indoor play. It is also proposed that a rubber flooring should be presented to some church in London in which the noise of footsteps during the service is found to cause interruption. Sooner or later, no doubt, rubber will come into general use for such purposes, but the cost is at present pretty high.

British Manufacturers in Australia.

The annual report of the Australian Association of British Manufacturers and their Representatives for 1913, just received, shows that that very useful organisation has made good progress during the third year of its existence. Subscriptions from membership were £368, as compared with £281 in the previous year, showing growing support, and the distribution of the Association's directory of British manufacturers has been actively proceeded with, some 7,000 copies having been circulated. Effort was directed towards obtaining greater uniformity in the general conditions of tenders invited by Government departments, municipalities, &c., a joint committee of this Association and of the Victorian Institute of Electrical Engineers having made suitable representations in the proper quarters through H.M. Trade Commissioner in Australia. It is expected that results of considerable benefit to contractors will be obtained. A large number of applications for investigation of the effect and operation of Tariff Acts has been placed before the Commonwealth Inter-State Commission, urging the necessity for increased preference in favour of British manufacturers, and considerable benefit to British trade is expected to follow. It is considered that the Association is now sufficiently well established to make representation in England desirable. Mr. Percy Rosling, an ex-president of the Association, who, as our readers are aware, is now in this country as right-hand man to Mr. George Sutton, of Henley's, has the matter in hand, and he will recommend a suitable representative. We congratulate this Association on the satisfactory progress so far made, and would urge British electrical and engineering firms still further to strengthen its position in prestige and opportunity of usefulness by authorising their representatives to become members.

AN AMERICAN RAILROAD WIRELESS EQUIPMENT.

In view of the interest which has been taken in this country in the question of communicating by means of wireless signals between a fixed point and a moving railway train, it may be appropriate to give some brief particulars concerning work which has been accomplished in this direction on an American railroad. For the information contained herein we are indebted to Mr. L. B. Foley, the telegraph superintendent of the Delaware, Lackawanna and Western Railroad Co., and also to information which has appeared in the *Scientific American*, the *New York Times* and other American journals. Experiments have been conducted by the Railroad Co. mentioned for some considerable time with a view to effecting communication with moving trains, and wireless stations equipped with aerials supported on high towers have been installed at Scranton, in Pennsylvania, and Binghamton, in New York, with a working radius of about 300 miles. Fig. 1 shows the Binghamton passenger station with its aerial. The means of collecting and transmitting signals on board the Lackawanna limited train is shown in fig. 2. The antenna adopted for this installation consists of a quadrangle of wire placed at a height of 18 in. above the roof of the car, four adjoining cars of the train being used in this way and each quadrangle being connected to the next by a special attaching plug. The wireless apparatus, which is of the regular Marconi type, is attached to the quadrangles at about the middle point of the aerial system thus constructed, the operator's station being placed in a compartment of the third car of the group. Fig. 3 shows the wireless office on board the train. The only difference from the ordinary system of working, apart from the details mentioned above, is that the power is furnished by a special motor generator set driven from the ordinary train-lighting dynamo, while the earth connection is made to the rails by a wire leading to one of the car trucks. The aerial, which is of heavy copper wire, is insulated by large porcelain insulators mounted on iron posts on the corners of the car, so as to withstand the sending voltage of between 8.000 and 9,000 volts. The distance between Scranton and Binghamton is about 65 miles, and we are informed by Mr. Foley that during last December the system of communication between the wireless apparatus at the fixed station and a train moving at 60 to 70 miles an hour was perfected.

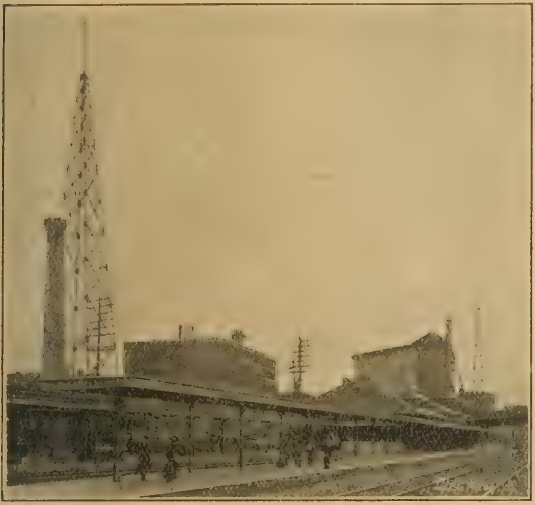


Fig. 1.—Binghamton Wireless Station.

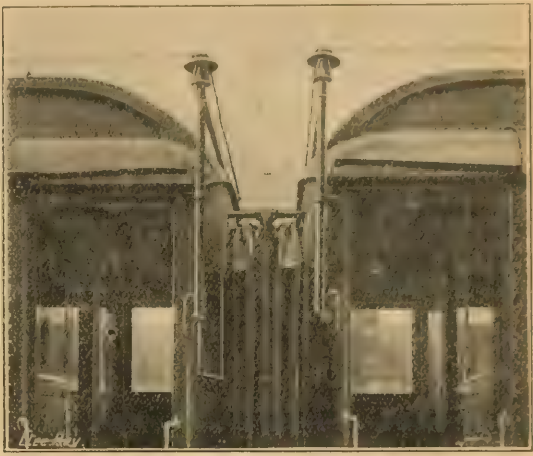


Fig. 2.—Antenna on Passenger Coaches.

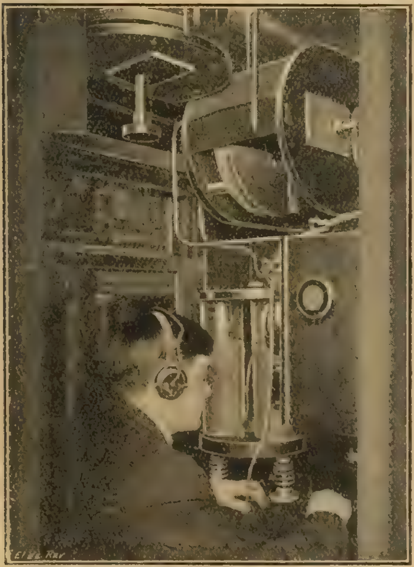


Fig. 3.—Receiving Apparatus on the Train.

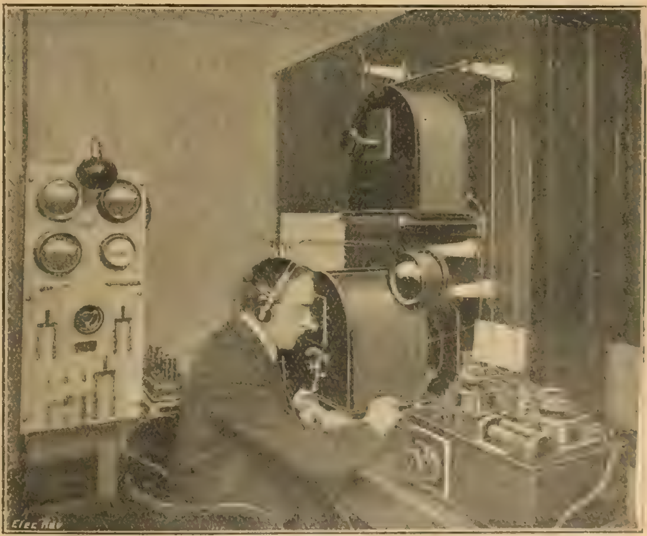


Fig. 4.—Wireless Station at Scranton.

An interesting instance of the usefulness of this device was furnished comparatively early in the practical tests of the apparatus. On one occasion the conductor in charge of the train leaving Hoboken for Buffalo was taken ill whilst the train was running at 50 miles an hour, 30 miles from Scranton. This, under ordinary circumstances, would have entailed a delay in order to send a telegraphic message ahead to obtain a relief conductor, or else a wait at Scranton. With the wireless equipment, however, the conductor notified the wireless operator, and, in spite of the intervention of mountainous country between the train and Scranton, the wireless message was sent forward, with the result that a relief conductor stepped on board as soon as the train pulled up at the station in the ordinary way. It has also proved useful in forwarding instructions for attaching special coaches. Later experiments dealt with the raising and lowering of semaphores from a distant station, and it now appears to be possible to set such signals by wireless from the moving train or from a fixed wireless station. A selective device is used by which the operator can set a signal at any point if has occasion to flag a train. Hence if any mistakes were made in the orders given to drivers and conductors at stations, or should an emergency arise in which the train must be stopped to avert an accident, the station operator could signal the train as certainly as if he had direct wire communication.

Another feature of economy is in connection with freight trains. It is obvious that keeping freight trains in motion for long distances without stops must result in economy of operation, as it is expensive to start and stop heavy freight trains. Having direct communication with a train and with the possibility of setting and releasing signals by wireless, the dispatchers can keep in touch with the conductors and make stops no longer a necessity. Even in the case of wreckage or derailment, unless the damage is very severe it is evident that wireless messages dispatched from the train in question will probably save much property, and very possibly will effect a saving of life. At the time of writing it appears that still further developments may be expected in the application of wireless control to railroad practice, and it will be very interesting to watch the future evolution of this feature on the system of the railroad company that has had the foresight to adopt wireless work in connection with its ordinary commercial operation.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Time Allowed for Tendering.

Will you give space in your columns to draw the attention of municipal engineers generally to a grievance which we ourselves feel, and which must, we think, be generally felt by all firms sending in offers in response to advertisements? We refer to the fact that the applications for specifications are not attended to on Saturdays. Most advertisements of tenders appear in papers issued on Friday, and although cheques are sent so as to reach the proper quarters on Saturday morning, the specification is rarely sent off till Monday, reaching us on Tuesday. Now, it is very seldom that under the best circumstances really sufficient time is given to prepare tenders, so that every day is of importance. We may say that almost all engineers are alike in this respect, as out of over 20 specifications applied for under these circumstances during the last few months, we can only trace two that arrived on the Monday morning, and in two or three cases, special requests for the dispatch of the specification by return, owing to the short time allowed, have been without result.

At the same time, we are convinced that if the attention of the engineers was called to the matter, they would willingly make arrangements to remove this hardship.

Whilst on the subject of tenders, we are inclined to ask if something cannot be done to ensure adequate time being allowed for their preparation. Some engineers, we admit, give sufficient, indeed, ample time for this, but many allow a time which is only just sufficient, while some give so short a notice that it is almost impossible to get together the full details required in the time allowed, and this fact suggests to one the thought that such tenders are cut and dried for special makers. It is interesting to notice that the parties interested will often take six or eight weeks to decide on a tender where the time allowed for preparation has been curtailed (according to the engineer) on the score of urgency.

Surely it would be possible for the I.M.E.A. and B.E.A.M.A. to decide on the minimum time to be allowed for each class of tender, on the understanding that engineers should, in all cases, allow 25 per cent. to 50 per cent. more wherever possible. It would be very interesting to hear the views of other tenderers on this subject—for ourselves we suggest the following minimum :—

Turbo-alternators, four weeks.

Converters, motor-generators, switchboards, three weeks.

Cables, other smaller and simple requirements, two weeks.

These times should be counted from the time when the specifications are ready, or from the date of the advertisement, whichever is latest. We mention the question of the time the specifications are ready, as it is not by any means an unknown circumstance for the issue to be delayed through the specification not being ready when first advertised.

H. W. Butler & Co.

London, *March* 14*th*, 1914.

The B.E.A.M.A. having approached the I.M.E.A. on the above question, the I.M.E.A. Council have resolved that the request of the B.E.A.M.A. "that not less than three weeks be allowed for the preparation of tenders for turbine plant" is reasonable, and they ask their members to act in accordance with this view whenever practicable.

H. Faraday Proctor,
Hon. Sec., I.M.E.A.

Bristol, *March* 12*th*, 1914.

Electric Vehicles—Standard Charging Plug.

In your issue of March 6th you refer to the report of the Electrical Vehicle Committee, and from this report it appears that the Committee have recommended that a certain type of 150-amp. plug be adopted as the standard for Great Britain.

It is stated that it is not considered desirable or necessary that any provision should be made for earthing.

In coming to this conclusion, the Committee appear to be influenced by the fact that electrical vehicle batteries, as generally used, only require about 120 volts for charging, and that under the present Home Office regulations earthing is not considered essential at this voltage. In the majority of cases these vehicles will be charged from the lighting or traction supply, and in order to obtain the highest efficiency possible, reducer type motor-generators will be used in preference to ordinary motor-generators. The Committee appear to have overlooked that in these cases it is possible to get a voltage to earth on the generator cable and battery as great as that in the system from which the reducer set is run; that is to say, on a lighting system 200 to 250 volts to earth, and on a traction system 550 volts to earth.

It is surely therefore advisable that efficient means should be provided on every plug for earthing the flexible cable and the vehicle during charging. It will be much to be regretted if by the omission of this precaution accidents are caused which would have a prejudicial effect on the development of this new and promising opening for the use of electricity.

H. W. Bosworth.

London, S.W., *March* 12*th*, 1914.

[We cordially agree with our correspondent. If an earthing connection is not provided in the first instance, it will certainly have to be adopted eventually, and it would be far better to do it now.—EDS. ELEC. REV.]

Protection or Tyranny?

Thank you for your foot-note to the communication signed "Junius" in your current issue. No such rule exists.

D. N. Dunlop,
Secretary, The British Electrical and Allied Manufacturers' Association.

London, *March 14th*, 1914.

There have appeared recently in your columns, under the heading of "Protection or Tyranny," some letters which I have thought supplied their own condemnation, and I have therefore found it easy, in refraining from any sort of comment or reply, to adhere to the desire of the council of the Manufacturers' Association.

I observe to-day a letter signed "Junius," and therein lies his principal claim to my consideration, concerning which I desire to make this statement. If any such rule, or any semblance of such rule, or any latent desire for anything in the nature of such a rule, existed in the Manufacturers' Association, Lord Ampthill would not be its President, I should not be chairman of the council, nor, I am sure, would any member of the council be content to occupy that position.

No such rule could be desired by any employer, either in or out of the Association, who has understanding of his business. I am distressed that anyone, apparently within the ranks, should so utterly, and so stupidly, misjudge those who are striving to guide a sorely-tried industry into paths of prosperity.

A. Bruce Anderson.

London, *March 16th*, 1914.

Staff engineers in general will thank you for so courageously publishing in your current issue the letter in which "Junius" refers to the alleged rule of the B.E.A.M.A. regarding the interchange of staff members of engineering firms. You will remember that the understanding that such a rule was being enforced was largely responsible for the formation of the Staff Engineers' Association. If the members of the B.E.A.M.A. respond to the call of your Editors either to confirm or refute the suggestion referred to, one might also ask whether the ramifications of the B.E.A.M.A. do not go so far as to forbid even the consideration by certain firms of applications from staff engineers in the employ of competitive firms?

L. H. Fletcher,
Hon. Acting Secretary, Staff Engineers' Association.

London, E.C., *March 16th*, 1914.

Reversing an Interpole Motor.

"Puzzled Winder" will find it quite simple to reverse the direction of rotation of any kind of motor if he realises that all that is required is to change the relation of the armature current to the field current.

The commutating poles should be considered part of the armature circuit, and therefore their relation should never be changed. The series and shunt windings of a compound motor together form the field of that motor, and therefore their relations should remain unaltered. It can now be left to anyone's discretion as to whether they change the armature circuit complete or the field circuit complete.

In a shunt-wound motor with commutating poles, it would certainly seem easier to change the field connections.

F. Gould.

Birmingham, *March 16th*, 1914.

In reply to "Puzzled Winder," interpoles are used to gain good commutation, and as this requires an increasing reversing field as the current through the armature increases, the polarity of the interpoles is important. In the case of a motor, the polarity should be the same as the next main pole behind it in the direction of rotation. To reverse the direction of rotation of the machine, it is not sufficient to reverse the brush leads—*i.e.*, direction of armature current alone, as the sequence of poles would be wrong, with the result that the machine would not come up to speed, and on load would spark vigorously. If the machine has run correctly under load in one direction, then the best and surest method of changing the direction is to change over the interpoles and turn the brush rocker (assuming it is a four-pole machine) through 90°. This is quickly done, and the result is satisfactory. The same applies either to a shunt-wound or a compound-wound motor.

G. N. Hurst.

London, *March 16th*, 1914.

Referring to "Puzzled Winder's" letter, appearing in your issue of the 13th inst., to change the direction of rotation of a shunt interpole motor, it is immaterial whether the field or armature current is reversed. The former may be accomplished by changing over the shunt leads, and the latter by changing over the brush leads. If the field current is reversed, the interpoles must remain the same polarity for either direction of rotation, but if the armature current is reversed, the interpole current must also be reversed (by changing over the + and − terminals instead of the brush leads this action is obtained).

"Puzzled Winder" may find the following useful: Interpoles always "lead" in a motor and "lag" in a generator; that is to say, in the case of a motor the interpole preceding a main pole in the direction of rotation must be of the same polarity as the said main pole, and in a generator the interpole following a main pole in the direction of rotation must be the same polarity as the main pole.

As regards compound interpole motors, care must be taken to reverse the main winding also; otherwise, if the machine is accumulatively wound in the first place, it will run up differentially wound, which may cause it to attain a dangerous speed.

W. D. Lovell.

Middlesbro', *March 16th*, 1914.

[Our thanks are due to many other correspondents for their kind assistance.—Eds. Elec. Rev.]

A Motor Problem.

In this week's Electrical Review a gentleman who signs himself "Perplexed" seeks assistance with a shunt-wound motor where the power required is not proportional to the speed. I beg to offer him the following solution:—

The motor should be of the shunt wound, double armature type; that is to say, having one armature with two distinct but equal armature windings and two commutators.

The motor design should be such that the following outputs are possible with shunt regulation.

1. Armatures coupled in series. 10 b.h.p. with 300 to 350 r.p.m. continuously.

2. Armatures coupled in parallel. 15 b.h.p. with 350 to 400 r.p.m. continuously.

The field must be so constructed that under all normal conditions sparking will not occur.

This class of motor has an excellent efficiency and gives no trouble if the design is correct.

N. H. W.

As it is a characteristic of an electric motor that it only develops the power that is demanded, it is only necessary to consider the maximum power required and the speed.

It appears that what is necessary in this case is a motor of 15 h.p. with a range of speed regulation from 325 to 400 r.p.m. The power developed will depend entirely upon the machine to be driven, and "Perplexed" need not consider the point as to whether the load is proportional to the speed or not.

F. Gould.

Birmingham, *March 16th*, 1914.

Maintaining High Power Factor.

1. Is there any "Regulation" or recognised rule limiting the use of larger transformers than the load requires, or larger motors? In such use, with induction motors, the power factor of the system would be adversely affected.

2. Can a power user be compelled to install plant to maintain his power factor at any fixed minimum?

3. What is the simplest determination of the excess capacity of motor necessary to correct power factor when the required horse-power output is known?

4. Have papers appeared in Institution *Proceedings* dealing with the solution of such problems, or are they included in standard text-books, and in which? **R. E. M.**

The Electric Lighting of Garden Villages.

I have read with interest the various articles and letters upon village lighting which have appeared in your columns, but have seen no mention of the lighting of garden cities and garden suburbs. Considering that there are now over 60 such schemes, with provision for from 20 to 8,400 houses each, this seems passing strange; especially when one considers that the area, roads and positions and number of dwellings, shops, public buildings, &c., are settled before building is started. One would have thought that such places presented ideal conditions for planning the size and position of the central station beforehand. And yet I do not remember having read of any such schemes.

I know a man who has planned a garden village to contain some 300 houses of a superior type. Building started last year, and the place promises to be very successful. When I asked where the central station was to be, my friend said, "Oh, I cannot bother about electric light; the company is sure to run the gas main from ——."

Perhaps the start is the difficulty. It is so in my own case. I am about to put up about a hundred small houses on my own ground, and wish them to have the advantages of electricity. But how are the first few houses to be supplied without sinking a lot of capital in a plant and battery capable of supplying the whole number?

Any suggestions that my fellow readers may have to offer will be esteemed, and will not, I am sure, be without advantage to the industry.

Garden Citizen.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Improved Controller Finger.

We have received from Messrs. Dyer & Young, of Empire Works, Stansted, Essex, particulars of an improved patent controller finger, fig. 1. which they are manufacturing.

The design is intended to get direct contact from terminal to drum segment without the spring carrying any current; also to reduce waste of copper at the contact point of the ordinary finger.

The top of the base A has interlocking teeth engaging with others on the spring holder B, and is screwed to the latter, the interlocking teeth providing adjustment for taking up wear on the contact point C. Adjustment or tension on spiral spring is made with nut D. Plunger E is provided with a pin working in a slot in base A to prevent any turning of the contact. At the end of plunger E ample provision is made for connecting suitable flexible cable with the terminal in controller case. By removing the two screws from the base, the spring holder, together with contact, can be removed at once.

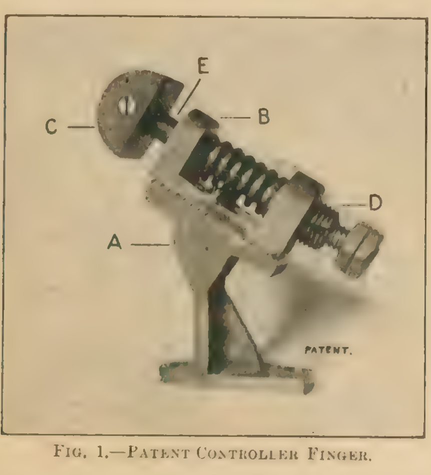


FIG. 1.—PATENT CONTROLLER FINGER.

These controller fingers are designed for use on B.T.H., Dick, Kerr, Westinghouse and Witting controllers.

In order to reduce the cost and number of parts, the base and spring holder have been designed to meet all types of controllers. The contact tips are all made from 1 in. half round H.D. copper, the width varying from $\frac{5}{8}$ in. to 1 in. to work in with standard drum segments.

B.T.H. Switch Plug.

We have received from the British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, E.C., particulars of an ingenious interlocking switch plug for use on heating and cooking circuits. The object aimed at is to make it impossible for the plug to be inserted when the switch is in the "on" position, and to ensure that the circuit is broken before the plug is withdrawn.

The feature of this plug is the method adopted for achieving this object. There is no mechanism at all, the interlocking action being achieved by having the knob of the switch in such a position that it overlaps the plug, so to speak. When the switch is on, the plug cannot be pushed in sufficiently far to make contact, owing to the interposition of this knob. In the same way, on withdrawal the switch is pushed off by the fibre guard of the plug.

This arrangement is explained in the accompanying diagram, fig. 3, which shows the knob (dotted) in the "on" position; it will be seen that the plug cannot be pushed in any further without switching off. The figure also shows in full lines how the knob of the switch is thrown over when the plug is pulled out.

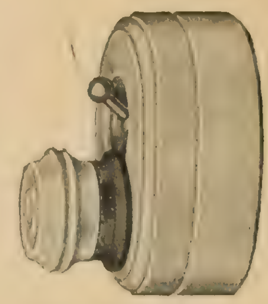


FIG. 2.—B.T.H. INTERLOCKING SWITCH PLUG.

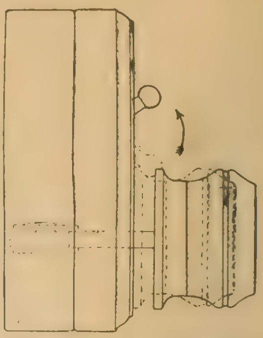


FIG. 3.—DIAGRAM SHOWING OPERATION OF SWITCH PLUG.

The switch is at present made with a carrying capacity of 5 amps. in the pattern illustrated, but there is a 10-amp. size and a flush pattern in preparation.

A Conduit Ceiling Rose.

Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, have introduced a new type of ceiling rose termed the "Condulet," which consists of a specially shaped porcelain, carrying large terminals of special design, and a cover for the conduit box. The porcelain is so arranged that it is firmly fixed in position, so that there is no risk of the terminals accidentally touching the sides of the iron box and causing a short-circuit.

The terminals fitted are of large size, hexagonal in shape, and have a slot in the centre, a portion of the slot being tapped to take a grub screw. With this design of terminal, there is no necessity to sever the conductor when wiring, it being only necessary to bare back a portion of the insulation—say, about ½ in. — place the exposed conductor in the slot, forming an efficient contact, and secure by the grub screw. The terminals are of sufficiently large size to allow of a cheese-head screw being tapped into the side to take the flexible conductor. It will be noticed that with this arrangement it is possible to attach the flexible conductor to the terminals, together with its lampholder at the bench, instead of, as is usual in wiring ceiling roses, having to work in an awkward position on the top of a ladder.

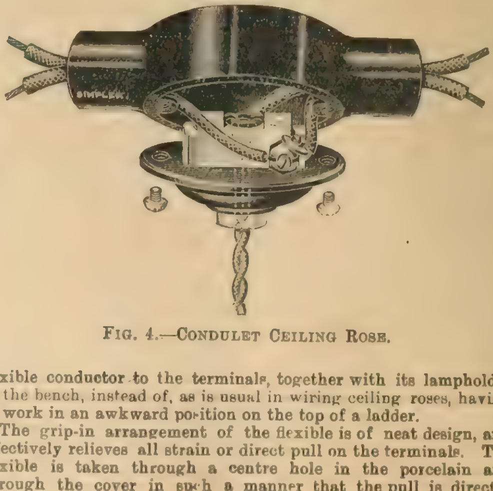


FIG. 4.—CONDULET CEILING ROSE.

The grip-in arrangement of the flexible is of neat design, and effectively relieves all strain or direct pull on the terminals. The flexible is taken through a centre hole in the porcelain and through the cover in such a manner that the pull is directly downwards; but, as a further precaution, a small rubber ring is fitted, which, by the weight of the shade on the end of the flexible, is compressed, and forms an effective grip. This rubber ring has a further advantage in that when compressed it acts as an effective anti-vibrator, prolonging considerably the life of metal-filament lamps. The cover which is fitted is of considerably better appearance than the ordinary white porcelain rose, and with our standard type is of black enamelled iron ; but for use in living rooms, and so forth, where appearance is a consideration, a cover in any finish can be used, so that it is in keeping with the style of fitting installed. The low projection of the whole fitting is a further advantage. The fitting is supplied with the standard type of circular box 2⅜ in. × 1⅛ in. deep, in all the combinations, terminal through centre hole, &c.

Half-Watt Lamps with Holophane Glassware.

We have received from The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., a supplement to their recent price list of fittings for half-watt lamps. This additional leaflet illustrates four new fittings—*i.e.*, "Marquis," "Earl," "Noble" and "Peer," which are specially designed to harmonise with Holophane glassware. Each fitting is listed in two sizes, so that the diameter of the glass is either 14 in. or 16 in., and the half-watt Osram lamps that are recommended for use are 300-500 watts and 500-1,000 watts respectively.

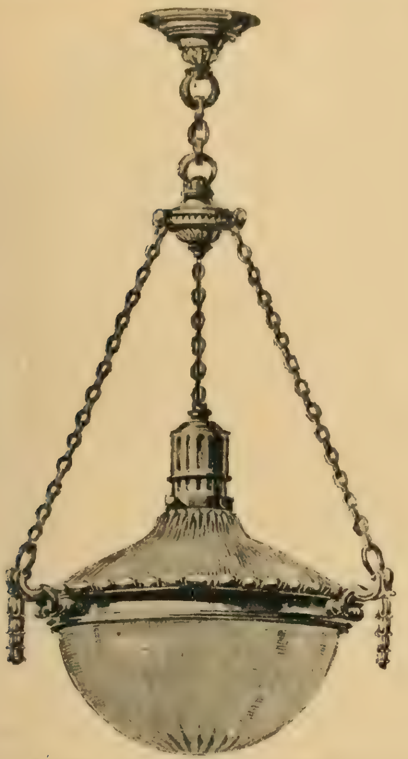


Fig. 5.—Half-watt G.E.C. Holophane Fitting.

Jardine Pulleys.

Messrs. John Jardine, of Deering Street, Nottingham, send us particulars of some new fast and loose pulleys which they have just placed on the market.

The pulleys follow the same general design illustrated by us on May 30th, 1913 ; the loose pulley runs upon a c.i. sleeve fixed to the shaft by a grub screw, and has a recessed boss—the recess forming an oil reservoir. An oiling tube passes into the recess almost up to the shaft, thus preventing the oil from being thrown out by centrifugal action. The oil runs to the bottom of the recess when the pulley is stationary ; drips on to the c.i. sleeve at starting, and is held by centrifugal action in the bottom of the recess when the pulley attains full speed.

Standard sizes vary from 6 in. to 24 in. diameter, with from 3 in. to 4 in. faces.

Small Ventilating Sets.

The Sturtevant Engineering Co., Ltd., of 147, Queen Victoria Street, E.C., have recently introduced a series of small "ready-to-run" self-contained ventilating sets, each consisting of a small motor and enclosed fan.

These are made in three sizes, for 75-150, 150-300 and 300-450 cb. ft. of air per minute ; the motors are wound for any pressure up to 220 volts d.c., and can be connected to any ordinary lampholder, without special switchgear.

They are specially suited for use in small offices, kitchens, smoking rooms and similar situations, where a *positive system* of ventilation is required and where propeller fans cannot be applied.

When desired, the fan inlets and outlets can be furnished with canvas hose connections, and the apparatus can be carried from room to room, being light in weight—from 20 to 40 lb., according to size.

The "ready-to-run" sets were originally designed to meet the requirements of the U.S. Government for use in battleships, but have since found a variety of uses in domestic and business premises.

A New Candle Lamp.

Messrs. Veritys, Ltd., of 31, King Street, Covent Garden, London, W.C., have brought out a new patent candle lamp, to be known as the "Aston" Verilite Candle which we illustrate herewith. It will be seen that a small metallic-filament lamp is used, over which slides a white candle-tube, the whole of which is illuminated ; the tube is easily removed for cleaning without interfering with the lamp, and the latter fits any standard B.C. holder. Ventilation is provided for, and the tube is always vertical.

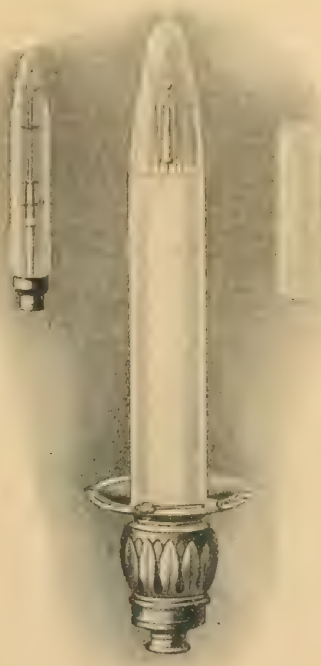


Fig. 6.—"Aston" Verilite Candle Lamp and Parts.

New Belling Griller.

The accompanying illustration shows a new griller which is being put on the market by Messrs. Belling & Co., of Derby Road, Edmonton, N. It is fitted with seven Belling standard fire-bars (all in parallel), having a total loading of 2,300 watts, and three degrees of heat at the "medium." The three centre bars come on only for small work. The top, together with the elements, wire guard and all connections, is removable from the body in a few moments. The cooking space is 15 in. long × 8 in. high × 12 in. deep, and the construction is of sheet-steel with wired edges, making a light portable article. A drip-pan is provided, as well as a loose front plate for converting the griller into a small oven. The three terminals are outside and perfectly cool.

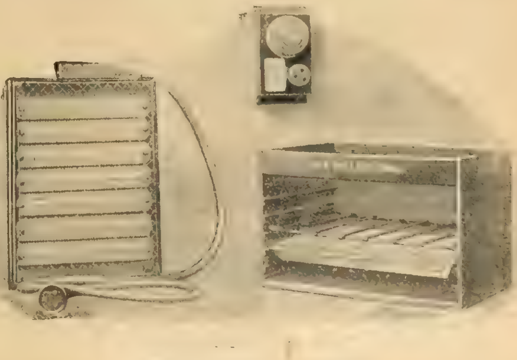


Fig 7.—Belling Griller.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

At the annual meeting held at the Trocadero Restaurant on March 6th, the chairman, the Hon. Arthur Stanley, M.P., in moving the adoption of the report and accounts, said that the revenue from subscriptions amounted to £805, as compared with £734 last year, and an increase of 50 per cent. over 1907, which was the first year of the Association's reconstruction. The expenditure was £657, as against £640. The net result was a surplus of receipts over expenses of £148, against £86 last year. Remembering that some years ago the Association had become almost moribund, the figures reflected very great credit upon the secretary, Mr. de Turckheim. It was unfortunate that the rating appeal case went against the Association in the House of Lords. They deplored the result, but the strong and unanimous judgment in their case in the Court of Appeal justified their taking up the matter. They owed a debt of thanks to those members who assisted financially in fighting the case, and he hoped that if they took up another case in the near future they might be more successful. This time last year the matters of guard wires and Post Office wires were under consideration, and their hopes of arriving at a safety arrangement with the Postmaster-General were duly fulfilled. The council considered that the settlement was a very fair one. The Somerset House authorities informed them that the settlement reached in 1909 with regard to assessment for income-tax purposes for a period of five years was now to continue for a further five years (until the 1917-18 accounts). Two special committees were at present sitting in connection with questions referred to the Association by the Board of Trade, and they would report before long. It was very satisfactory to the Association to have questions referred to it by the Board of Trade. After alluding to the successful Congress at Blackpool, the speaker remarked that they had received an invitation to Newcastle-on-Tyne for their next Congress, and he hoped it might be possible to go there. It had been definitely arranged that the 1915 Congress should be held in London. The report was adopted, and the following were elected to the council:—Mr. F. Bland (Edgar Allen & Co.), Mr. C. W. Mallins (tramway manager, Liverpool), Mr. R. R. Greene (tramway manager, Wallasey), Mr. A. V. Mason (general manager, South Metropolitan Tramways), Mr. R. S. Tresilian (secretary, Dublin United Tramways) and Mr. R. J. Howley (joint manager, B.E.T.).

At the annual dinner and smoking concert of the Association, which followed, Viscount Chilston, President of the Association, was in the chair.

After the usual loyal toasts, Mr. Harry England (vice-president) proposed "Our Guests," and in doing so he offered a welcome to the new president, Viscount Chilston. Their guests were the representatives of the permanent officials of the Board of Trade, of the Municipal Tramways Association, and of their hosts at the Blackpool Conference. During the year the Board of Trade had recognised that the M.T.A. and the T. and L.R.A. were powers in the land, and had consulted them as to the new working regulations that they contemplated making. They hoped that the Board would continue to take them into confidence, and that the present amicable relationship would long continue. The strained feelings between the M.T.A. and the T. and L.R.A. had entirely disappeared, and to-day they were working amicably together on anything affecting their joint interests. The speaker coupled with the toast the names of Alderman Linsley, the President of the M.T.A., and Alderman Rodgers, of Newcastle. Alderman Linsley referred, among other matters, to the desirability of the good relations continuing between the two Associations, and between the Association and the Board of Trade. He had had a good deal to do with Col. von Donop, and if ever there was a point on which the latter could give way, he was always willing to do so. He hoped that the M.T.A. would have the pleasure of seeing some T. and L.R.A. members at the Conference at Salford next September. Alderman Rodgers, in his reply, assured the Association that if they went to Newcastle they should have a hearty Northern welcome.

Mr. J. M. Henderson, M.P., proposed "The Tramways and Light Railways Association." He referred to the objects of the Association, which now had 450 members—a record; he also referred to the capital expended upon, and the receipts of, the 2,626 miles of tramway in the United Kingdom. He amused his hearers with a calculation regarding the period which would be occupied (working an eight-hour day, of course) to count 300 million coppers (one per passenger per annum). There was no enterprise in the kingdom that required more protection than tramways. From the very moment that a tramway enterprise was conceived and brought forth, it met with tribulation at every turn. A Bill first met with opposition in the Houses of Parliament from local authorities, whose object was not far to seek. They wanted the tramway, but, at the same time, a little street lighting and a little road widening at the tramway's expense. He thought, however, there was a better spirit coming over the minds of the public with regard to these public enterprises, and Associations like theirs would help to encourage it and to lead the public to see that it was to their interests to assist and not to obstruct tramway enterprise. Lord Chilston responded to the toast. He said that tramways fulfilled a very necessary and useful purpose. The housing question was much to the fore just now, and the tramway enabled the overcrowded population to seek their homes outside the zone of their work. In regard to the rating test case in the House of Lords, they had got to accept the decision and look forward to finding, at some later date, compensation for the serious setback which that decision carried with it. They hoped that the spirit of loyalty and unanimity displayed by the members, especially in their response to the appeal for financial assistance, would be continued. Crises of such a kind showed the value of such an Association. The speaker briefly referred to the question of road maintenance, which, as tramways owners, they said ought to be paid for more by the motor-'bus and other heavy traffic which used their roads and abused their tracks and setts. Surely settlement of such a question ought not to be outside practical politics.

The Hon. A. Stanley proposed a vote of thanks to the President, who briefly replied.

PARLIAMENTARY.

London Electric Railway Bill.

A Select Committee of the House of Commons, presided over by Sir Luke White, on March 12th considered the Bill promoted by the London Electric Railway Co. for a number of powers, including authority to construct three new subways and an escalator at Tottenham Court Road Station, to connect the Charing Cross, Euston and Hampstead and Central London Railways; a subway and escalator at Piccadilly Circus; an additional subway at Trafalgar Square; and to acquire land in Broadway, Westminster, on which to erect new general offices. The only objection was by the Cannon Brewery Co. to the acquisition of a portion of St. James' Restaurant.

The Committee heard the case for the Brewery Co. in private, and subsequently passed the preamble of the Bill and ordered it to be reported for third reading.

Bonuses to Tramway Employés.—Lord Robert Cecil asked the Chief Secretary to the Lord Lieutenant of Ireland whether the Local Government Board auditor had surcharged the members of the municipal administration of the Belfast tramways the bonus paid to their employés; whether this had put an end to the profit-sharing scheme there in force; under what statute the auditor decided the payments were illegal; and whether the Government contemplated legislation to remedy this state of things. Mr. Birrell said the Local Government Board auditor surcharged salaries and wages to the amount of £2,800, paid on May 4th, 1912, to the staff of the tramways department in anticipation of profits estimated as likely to be earned in respect of the year ended March 31st, 1913. The Board had no official information as to the second paragraph of the question. The auditor's reason for making the surcharge was that the payments in question were not authorised by law. As regarded the last paragraph, it was open to the Corporation to initiate any such legislation if they so desired. The surcharges in question were remitted by the Board on appeal.

Brentford Gas Bill.—Lord Hylton's Committee of the House of Lords has passed the preamble of the Bill of the Brentford Gas Co. Part 10 of the Bill gives the company power to apply for provisional orders to supply electricity.

Ashington Gas Bill.—After considerable opposition, Mr. Mount's Select Committee of the House of Commons passed the preamble of the above Bill, by which the Ashington Urban District Council seeks to acquire the gas undertaking of the Ashington Coal Co. In the course of examination, Mr. E. V. Southern, the agent of the Ashington Colliery, admitted that the company had an understanding with the electrical company not to push the sale of gas in the district. Mr. R. P. Sloan, manager of the Newcastle-on-Tyne Electric Supply Co., gave evidence in opposition to the Bill, and said the company had an agreement to manage the business of the Northern Counties Electricity Co. in the district of Ashington. The latter company had spent £40,000 in the Ashington area recently. His company had spent £3,000 on a new sub-station and other works at Hirst, and the result had been a large improvement in the lighting of the district. The charges compared favourably with those in similar districts. In a short time 70 per cent. of the houses in the district would be wired for electricity. If the Bill were rejected, they were prepared to give a supply to the district on reasonable terms.

Second Reading.—In the House of Commons on Monday, the Oxford and District Tramways Bill was read a second time.

Electric Steering for Petrol Cars.—A recent issue of the *Electrical World* refers to the possibility of the introduction of electric steering on petrol motor-cars, as a means of relieving the excessive muscular effort required with the ordinary steering gear on long journeys over rough roads. It is pointed out that the practicability and reliability of electric steering have been demonstrated on ships. The power demand of a motor-driven steering device is intermittent, and, it is suggested, would not exceed 30 watts, so that battery rating would not be much increased. The substitution of a compact little steering control lever for the present bulky steering column and wheel would give free access to the driver's seat from both sides of the car.

LEGAL.

Handley *v.* West.

In the King's Bench division, Mr. Justice Bailhache sitting without a jury had before him an action brought by Mr. George Douglas Handley, living at Oak Hill, Spring Vale, Isle of Wight, against Mr. Allen West, of Brighton, and Queen Victoria Street, London, claiming to recover a sum of money said to have been paid by the plaintiff for the use of the defendant and at his request, the claim being alternatively based upon a bill of exchange. There were a variety of defences, among which it was pleaded, that the plaintiff could not recover upon the bill, because the claim was barred by the statute of limitations, and it was also contended that under the particular circumstances the money could not be recovered in the action by the plaintiff.

Mr. J. B. Matthews, K.C., and Mr. MacNaghten were counsel for the plaintiff, and the defendant was represented by Mr. Schiller, K.C., and Mr. Douglas Hogg.

Mr. Matthews, K.C., in opening the plaintiff's case, said that his client was a director of a company called Handleys, Ltd., and the defendant, Mr. West, was his cousin, and a director of Allen West, Ltd., an electrical company of Brighton and London. The present claim arose out of a guarantee which the plaintiff, the defendant and a Mr. Wm. Thos. Pressland gave in respect to a loan made by a gentleman named Mr. Paul Speak to a company called the National Provincial Electricity Corporation, Ltd., of which the three guarantors named were directors. The history of the matter opened in the year 1903, when Mr. West, who had been through the war in South Africa, came home to England, and was desirous of getting set on foot a company so as to provide him with some medium of activity, and in this connection he approached the plaintiff and a firm called Cecil Cooper & Co., electrical engineers, with a view to forming such a company, and it was with a view to helping his cousin that the plaintiff interested himself in the matter. On March 27th, 1903, the National Provincial Electricity Corporation, Ltd., was formed, and its objects were in the main to carry out a scheme for electrically lighting certain towns in the West of England, and the original capital was £30,000, divided into 30,000 £1 shares, and at all material times the plaintiff and the defendant and Mr. Pressland were directors. Towards the end of 1905 the company were short of capital, and they borrowed £1,250 from Mr. Paul Speak, and it was agreed that Mr. Speak should be paid a bonus of £300, which was to carry interest at the rate of 24 per cent. About that time all the parties apparently were acting through a Mr. Harper, a solicitor, of the firm of Waterhouse & Co., and for the loan of £1,250 and the £300 bonus, debentures were issued to Mr. Speak, and the £1,250 was also collaterally secured by a bill of exchange drawn by Mr. Speak upon and accepted by the plaintiff, the defendant and Mr. Pressland, which bill was of the date of about November 30th, 1906. When the time came for the payment off under the bill—the due time being in about one year—the position of matters was as follows:—Mr. Speak was properly telling the three directors that they were jointly and severally liable to him; Mr. West's position was that he was not then in a position to pay his contribution of one-third towards the bill; Mr. Pressland's position was similar, and the plaintiff was able to put up the money. As a matter of fact, Mr. Pressland, by means of an arrangement made with the plaintiff's father, did eventually raise about £625, so as to meet his liability under the bill, and in the course of time the plaintiff gave to Mr. Harper, on behalf of Mr. Speak, a cheque for £1,250, which got rid of Mr. Speak, so far as the bill of exchange was concerned. The defendant, Mr. West, then gave to Mr. Handley a bill of exchange for £426 17s. 10d. at three months, this sum representing his third portion of the £1,250, with 10 per cent. interest over a period of three months. This was the bill of exchange upon which plaintiff sought to recover, and counsel added that over various dates Mr. Pressland had by instalments paid off the advance made by the plaintiff's father to him. As an answer to the bill, the defendant had set up the Statute of Limitations, among other defences, the writ having been issued in the action on April 25th, 1913. His client's case was that he could recover on the bill, or was alternatively entitled to sue for the money, as having been paid to the use of the defendant as one of the joint guarantors for the loan to the company.

Mr. Schiller, K.C., on behalf of the defendant, submitted that as a matter of correct law the plaintiff could not recover in the action. Counsel argued that the plaintiff could not go behind the bill and sue for a debt, because while the bill was current that was suspended, and the bill had never been dishonoured. Further, the bill was barred by the Statute of Limitations.

Mr. Justice Bailhache: Do you press the defence of the Statute of Limitations?

Mr. Schiller: Yes, I am bound to say that I do.

Mr. Schiller went on to remark that everybody knew when Mr. West was brought into these transactions he had no means then to meet the liability, but he said he would make arrangements for bearing his share and being able to make good account within a certain time, and the plaintiff's answer to this attitude had been the issuing of a writ.

Counsel was not prepared at the moment to say what the defendant would do now that the action had been pressed against him, but he had always been willing to agree to any reasonable arrangement to meet his liability. Mr. Schiller added that the defendant was a guarantor for the company, and, of course, he had had no benefit from the money which had gone to the company.

Mr. Justice Bailhache: Well! nor has the plaintiff.

His Lordship said he was bound to have regard to the defence of the Statute of Limitations and there must be judgment for the defendant with costs. His Lordship added—"I hope if he (the defendant) is able to pay he will, as it seems to me to be a case where he should do so if he can."

Mr. Schiller said he desired to say now that judgment had been entered for his client, that Mr. West intended to shoulder his fair share of the responsibility.

Mr. Justice Bailhache: Yes, I think it is quite right that he should do so.

Allis Chalmers Co. *v.* The Fidelity and Deposit Co., of Maryland.

In the Court of Appeal on March 12th and 13th, before Lord Sumner, Lord Justice Kennedy, and Mr. Justice Lawrence, this case was heard on the appeal of the defendant company, against a judgment of Mr. Justice Phillimore. The plaintiff company, manufacturers of electrical machinery, carrying on business in the United States, London, Paris, and elsewhere, brought the action claiming a declaration that a fidelity guarantee bond for £1,000 given by the defendant company was a valid and subsisting bond, and that that company was liable to pay thereunder in respect of a loss incurred by the plaintiff company by the defalcations of one A. C. Lochenies, the manager of its Paris office. In December, 1911, negotiations were opened between the parties for insuring the plaintiff company against acts of dishonesty on the part of Lochenies, and an application form was forwarded to them in which, in answer to a question asking from what date the bond was to be in force, and for what amount, the reply was given "From issuance, £1,000." On March 8th, 1912, the bond was duly drawn up, and executed at the defendant company's London office. The premium was to be £6 5s., and the bond was to cover losses within the limits of the amount insured for "during the period from March 8th, 1912, to March 7th, 1913." The premium had not then been paid, nor by the terms of the bond was payment of the premium made a condition precedent to liability upon it, but the document was forwarded that day to the company's French agents, who on March 9th sent it to the plaintiff company's Paris office. The bond was returned by the agent with a request that the defendant company would deliver it at the plaintiff company's London office. This was done on March 18th, with a letter asking for a cheque in exchange for the bond. But as Mr. Keen, the manager of the plaintiffs' London office (who was in control of the European business) was absent in America at the time, it was arranged that the matter should stand over pending his return about April 18th, and the bond remained in a drawer in the defendant company's office. Up to April, 1912, Lochenies had enjoyed an unblemished reputation for honesty and ability, though it was thought desirable to insure him because of the large sums of money passing through his hands. On April 13th, however, he left the Paris office, stating that he was going to the South of France on the plaintiff company's business. He never returned. On April 16th the London office became aware of his absence, and by April 18th were admittedly in a state of anxiety and suspicion, though not sure that his absence was incapable of satisfactory explanation. On that day Mr. Keen returned from America, and he being informed of the facts, sent to the defendant company's London office a messenger, who paid the premium, and brought back the bond in exchange. A few days after the plaintiff company discovered, it was said, defalcations estimated at about £11,000. Claim was thereupon made on the defendant company, which repudiated liability under the bond on the ground that the contract of insurance was not completed till April 18th, and that there had been concealment of material facts. The plaintiff company, on the other hand, while admitting that they could not recover if the contract was not completed till April 18th, maintained that it was concluded on March 9th, or alternatively on March 18th, at which time there was nothing to conceal. At the trial Mr. Justice Phillimore held that the defendant company was liable to pay under the bond, as the date of "issuance" was at the latest March 18th, a date when it was not suggested that the misconduct of Lochenies had begun. He accordingly gave judgment for the plaintiff company, granting the declaration asked for.

Mr. Sanderson, K.C., Mr. McCardie and Mr. E. L. Barnes appeared for the appellant company; and Mr. Sankey, K.C., and Mr. Barnard Lailey for the respondent company.

In support of the appeal, Mr. Sanderson argued that the matter of the bond was only in a state of negotiation till April 18th, when the premium was paid and the bond was handed over.

Mr. Barnes, following on the same side, contended that there was no evidence of any agreement or offer by Mr. Keen prior to April 18th to accept the bond. He further suggested that the correspondence showed that the matter, which was allowed to remain open, was the matter of the insurance, and not the mere payment of the premium.

Mr. Sankey, K.C., for the respondent company, supporting the judgment of the Court below, said that his contention was that by March 9th a contract of insurance had been concluded for a risk to attach from March 8th, the date of "issuance." If he were wrong in that proposition, then he submitted the contract was concluded by March 18th, when application was made to the plaintiff company's London office for the payment of the premium, and the matter of payment stood over till the return of Mr. Keen from America.

Lord Sumner asked if "issuance" was completed when the bond still remained in the possession of the defendant company.

Mr. Sankey said that was his submission, though, having regard to the facts of this case, it was not necessary to go as far as that.

LORD JUSTICE KENNEDY thought that the question was whether the defendant company had done its best in the way intended by both parties to put the bond out of its possession and into the possession of the plaintiff company. Leaving it on a desk or giving it to a servant was not taking any steps to put it out of one's possession.

MR. SANKEY argued that it was sufficient to fix the date. It was only the question of the payment of the premium that remained open.

MR. BARNARD LAILEY, taking up the argument for the respondents, contended that there was a concluded contract, operating from some date before April 18th, binding the plaintiff company, on the one hand, to pay the premium, and binding the defendant company, on the other, to give protection.

MR. SANDERSON, in reply, said that the obvious construction of "issuance" was that it was intended that the insurance contract should not be in force until the actual bond was handed over. Until it was handed over, it was open to either party to withdraw.

Their LORDSHIPS reserved judgment.

SUCCESSFUL APPEAL BY THE LONDON ELECTRIC RAILWAY CO.

THE London Electric Railway Co. and Mr. Hunkley, a builder, were the appellants before the Lord Chief Justice and Lords Justices Swinfen Eady and Phillimore, in the Court of Appeal on Thursday (March 12th) from a judgment entered against them by Mr. Justice Scrutton, following the verdict of the jury in the King's Bench Division in favour of Miss Florence Hurlestone.

MR. ROSSKILL, K.C., who appeared for the appellants, said the lady was awarded damages amounting to £75 for personal injuries received, but the question for the decision of the Court was of great importance to the Railway Co. It appeared that the builder obtained a contract to build premises over the entrance to a tube station in Cranborne Street, and while those operations were in progress a piece of wood fell on the head of Miss Hurlestone who was walking along the pavement.

After argument, the Court allowed the appeal, with costs, the LORD CHIEF JUSTICE remarking that the circumstances revealed the fact that the Railway Co. were the reversioners of the building to the builder, and no authority had been read in which reversioners had been held liable for the negligence of the lessee. Then it had been argued that the Railway Co. had caused a dangerous building to be erected, and that being so, they could not shelve their responsibility because an independent contractor did the work. It was not the Railway Co. that caused the work to be done but the building lessee, and the latter was therefore liable for any accident due to negligence.

Lords Justices Swinfen Eady and Phillimore agreed.

POSTMASTER-GENERAL *v.* MILLER.

AT the Salford County Court on Monday, Judge Stanger heard a case in which the Postmaster-General claimed £6, a year's fees for the use of a telephone, from Fredk. V. Miller, of Browning Street, Salford.

After hearing the evidence, his HONOUR said it would have been very much better if the practice were adopted of fixing the telephone only after the year's fee had been paid. The Post Office were claiming a year's fee in this case after only five weeks' use of the telephone. Though the agreement was signed on September 26th, it was not till November 27th that the telephone was ready for use, and the defendant had meanwhile written to complain that he would have to have the wires removed unless the instrument was put up. Commenting on this delay, the Judge said he thought the defendant would have been quite justified in cancelling the contract on the ground of unreasonable delay. He had accepted the telephone, however, and was therefore bound to pay. The unfortunate part was that, at the outset, the defendant had actually offered to pay for a year's use, but the money not being then due, was not accepted. Meanwhile his circumstances had so changed that he had not only no further use for the instrument, but was unable to pay at once the £6 demanded. According to the terms of their contract, the Post Office had meanwhile disconnected the wires.

An agent for the Postmaster-General said that if the defendant had gone to the Post Office and explained the circumstances, some exception might have been made in his case.

His HONOUR said that, although he was obliged to give judgment, he would make the terms as lenient as he possibly could. He ordered the defendant to pay £1 within six months and the remainder at 1s. per month.

BUSINESS NOTES.

Thermit Welding.—MESSRS. THERMIT, LTD., inform us that they have contracts in hand, or shortly to be commenced, for welding at the following places :—

Bolton, Burnley, Bradford, Bournemouth, Brighton, Dublin, Manchester, Liverpool, Salford, London County Council, London United Tramways, Sheffield, Southend, Rotherham, Northampton, Nottingham, Huddersfield, Shipley, Warrington, &c.

During 1913 the number of joints welded in the United Kingdom amounted to nearly 17,000, and the number welded throughout the world over 108,000.

Bankruptcy Proceedings.—FRANK WEST SUTER, electrical, &c., engineer, 67, St. John's Park, Upper Holloway.—An application for an order of discharge was made last week to Mr. Registrar Linklater, at the London Bankruptcy Court. Mr. Egerton S. Grey, Official Receiver, reported that the debtor filed his petition in December, 1913, with provable claim, £6,428 ; no assets were disclosed, but a small bank balance of 1s. 3d. had been collected. The debtor had stated that in 1908 he and two others who had traded in partnership as Frank Suter & Co., transferred their business which was carried on at 66, Berners Street, W., to a company registered as "Frank Suter & Co., Ltd.," of which he acted as managing director at a weekly salary of £5, subsequently increased to £7. In 1909 the debtor and two others formed a company registered as "Suter's Patents, Ltd.," of which he acted as engineer at the date of the receiving order. He attributed his failure and insolvency to his liability on the debentures issued to Frank Suter & Co., Ltd., he having guaranteed repayment of bonds to the extent of £6,000 in the company. The discharge was suspended for two years.

CHARLES LEWIS, "electrical engineer, lately licensed victualler," Manchester. Trustee, Mr. J. G. Gibson, Bryom Street, Manchester. released February 16th.

THE STOLZ ELECTROPHONE CO., LTD. — First meetings of creditors and contributories will be held on March 24th, at Carey Street, W.C.

W. R. WEDGE, electrical engineer, The Arcade, Northampton.—This debtor should have attended at the County Hall, Northampton, on March 10th, for his adjourned public examination, but the Official Receiver stated that he had received a letter from the debtor who was living at Bury, Lancs., and he gathered that debtor could not afford to come to Northampton. He could not agree to the examination being closed because he believed the statement of affairs and the deficiency account were all wrong. If at any time the debtor was coming to Northampton he could apply for the case to be reopened. It seemed idle to keep it about month after month, and he applied for an adjournment *sine die*. The examination was again adjourned.

W. WADSWORTH, electrical agent and dealer in electrical accessories, Manchester.—Trustee (Mr. J. G. Gibson, Byron Street, Manchester) released February 16th.

Our Cape Town correspondent says :—The *Union Gazette*, published in the week preceding the departure of the mail, contained notices of surrender of following estates as insolvent :—Walter Green, trading as W. Green & Co., electrical engineers, 48, Queen Street, Port Elizabeth ; Marc Justus Brookhurst, electrician, of Oudtshoorn.

A Useful Testimonial.—The following unsolicited testimonial is of interest, and should prove of assistance to electrical contractors in aggressively pushing electrical driving for all industrial purposes :—

"As it is now over 12 months since I had one of your 18-H.P. motors installed at my works (the Southend Machine Joinery Works), I feel it is only due to you to let you know that I am more than satisfied with its working, both in output and economy. It seems to me there is no comparison in the saving from first to last as against gas engines, besides which the motor is so clean and takes up no room, and expense for oil is almost nil. You can make what use you like of this because I am sure it is only by giving the results of practical tests that outsiders will be taught the possibilities of the up-to-date motor.

"(Signed) JOHN C. BEALE."

The motor in question was made by the BRITISH THOMSON-HOUSTON CO., LTD., of Rugby.

Electric Cable Manufacture in Spain. — As was briefly mentioned in a recent issue, the Spanish branch of Messrs. Pirelli & Co., whose works are at Villanueva y Geltru, have recently acquired 20,000 sq. m. of additional land adjacent to their factory. We learn that contracts have now been placed for the erection of two armoured-cement buildings, having an area of about 5,600 sq. m. One will be used as an extension of the company's cable-making plant, while the other will be devoted to the manufacture of new classes of rubber goods, of which the Pirelli Co. are making a speciality. It is stated that so far as electric cables are concerned, only those intended for telephonic purposes need now be imported into Spain.

China.—We have received a photographic reproduction of a Chinese almanac, in the design of which are recognised such familiar lines as an "Osram" lamp, "Freezor" fan, a "Magnet" kettle, &c., all of which go to show that it is a publication of the General Electric Co. of China, Ltd., on behalf of their Chinese friends. The original production is printed in a number of colours, and in such a way as to make a suitable appeal to the Chinese mind.

Condensing Plant Contracts.—THE MIRRLEES WATSON CO., LTD., have recently received orders for condensing plant for the following :—

Leeds Corporation, per Messrs. Willans & Robinson, Ltd.; Haunchwood Colliery and Griff Colliery, per Messrs. Greenwood & Batley, Ltd.; Millom and Askam, Hematite Iron Co., Ltd., per Messrs. Fraser & Chalmers, Ltd.; Langwith Colliery; Enfield Lock, per Messrs. Jas. Howden & Co., Ltd.; Burgh of Kilmarnock, and others.

New Accumulator. — A new non-lead accumulator, known as the "Lux," is attracting attention in electrical circles in Austria. It has been introduced by the Lux Licht Gesellschaft, of Vienna.

Catalogues and Lists.—The Parsons Motor Co., Ltd., Town Quay, Southampton.—76-page illustrated catalogue containing very full descriptive matter regarding their marine and stationary engines, including small petrol and paraffin-electric sets, paraffin engine electric welding sets, motor-van with electric welding equipment, &c. A second publication, of 40 pages, contains an interesting collection of pictures of the various craft into which the firm's installation have been put.

The Edison and Swan United Electric Light Co., Ltd., Ponder's End.—Leaflet No. 3,022 gives some particulars with illustrations and prices of the Ediswan domestic pattern electric flat-iron.

Allgemeine Elektricitats-Gesellschaft, Berlin.—Brochures, admirably illustrated, describing manufacture and adjustment of the A.E.G. supply meters, of which the second million was completed last December, and electric clock installations; also leaflets relating to electrically-driven machine tools and pumps, controllers, regulators, half-watt automobile lamps, and electric floor-polishers.

Schniewindt Electric Co., 40 and 41, Staniforth Street, Birmingham.—A collection of seven leaflets illustrating and giving information and prices respecting their asbestos woven net resistances, electric heating sets, various types of made-up resistances, "Triumph" heating and cooking apparatus, and "Peerless" pipe-cutting pliers and wall-boring tools.

Messrs. Adnil Electric Co., Ltd., Artillery Lane, London, E.C.—Some hints to electricity users issued by the firm give two inducements to the recipient to preserve same—a loop for hanging and a small set of monthly date slips for the year.

Dissolutions and Liquidations. — Grindell-Matthews Wireless Telephone Syndicate, Ltd., Broad Street House, New Broad Street, E.C.—Meetings of the creditors and shareholders were held on March 10th at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C. Mr. H. E. Burgess, Official Receiver, reported that the company was formed in April, 1910, with a nominal capital of £20,000, subsequently increased to £25,000, the object being to acquire, develop and deal with a wireless telephone invention of Mr. H. Grindell-Matthews. The vendors, Messrs. Rouse, Poole & Co., had previously obtained the patents from the inventor for £6,600, which was satisfied by a cash payment of £1,000 and shares to the face value of £5,600. They passed on the option to the company for £13,333, payable as to £1,333 in cash and £12,000 in shares. It was not clear, remarked the Official Receiver, what had been done by the vendors to justify the doubling of the original price paid for the patents, because what work had been expended upon them had been performed by Mr. Grindell-Matthews. A prospectus was issued in April, 1910, in response to which applications were received for 10,569 shares of £1 each, which, with the issue of 12,000 vendors' shares, made a total allotment of 22,569 shares out of the authorised issued of £25,000. Some of the shares were issued at premiums ranging from 3s. to 10s., and in that way the company received an additional £535, but a portion of that amount was paid away as commissions for obtaining subscriptions. The company thus had a working capital of £10,000, after payment of the £1,000 cash portion of the purchase consideration, and the whole of the money had been expended in perfecting and exploiting the invention. A substantial sum had been paid for advertising it, and having regard to the fact that the patents were even now regarded as possessing substantial value, it was quite possible that the sum so expended could have been included in the item of goodwill. The operations had included the erection of stations at Letchworth and Northampton, which were about 40 miles distant from each other, and it was reported that communications between those two stations could be carried on with perfect ease. The capital subscribed by the public not having been sufficient, debentures for £2,500 were issued, and recently Mr. T. D'Arcy Cooper, C.A., George Street, Mansion House, E.C., was appointed as Receiver on behalf of the bondholders and took possession of all the assets. They included the patents, the workshops, and all equipments, the total value of which appeared in the liquidation accounts filed by the directors at £31,000. The liabilities, apart from the debentures, amounted to about £3,500, consequently the realisation should provide not only sufficient to discharge all the debts, but a substantial return to the shareholders. The failure of the company was attributed by its officials to the fact that the completion of the work to perfect the invention occupied much longer time and involved a greater expense than was originally contemplated or provided for; there was consequently a shortness of capital with which to enable the company to meet pressing liabilities and to dispose of the invention when it had been brought to a commercial stage.

Mr. Pitts, the secretary of the company, in moving the appointment of Mr. Wm. McEwen, C.A., to the post of liquidator, stated that negotiations were pending for a reconstruction of the company on lines that would be distinctly beneficial to all concerned. Not only would the debts be paid in full, but the interests of the shareholders would be protected. A gentleman had come forward with an offer of £3,600 for the property, and had paid a deposit of £360 to the Receiver for the debenture-holders. The idea was to promote a new company to deal with the invention after payment of the old company's debts, and to give the old shareholders a substantial interest in the new concern.

A resolution was unanimously passed by the creditors for Mr. McEwan, C.A., to fill the post of liquidator.

The shareholders, at the subsequent meeting, nominated Mr. Harry Wilson, I.A., for the post, and expressed the opinion that any reconstruction negotiations ought to be entrusted to a gentleman who was totally independent of the old board.

Mr. Pitts pointed out that the directors had at heart the best interests of the shareholders as was shown by the fact that they had given their services for three years without asking for, or receiving, one penny in the shape of remuneration. The gentleman who had deposited the £360 on the purchase of the property was thoroughly desirous of acting in the best interests of those people who had invested money in the company, but if the shareholders chose to act in direct antagonism to him and the board, it was clear that the directors would take no further interest in the matter, and the sale would go through without any benefit to the shareholders generally.

After a long and somewhat acrimonious discussion, Mr. McEwan was also nominated as liquidator, and, upon a vote being taken, the chairman declared that his election had been carried by a substantial majority of the shareholders. There was accordingly a difference of opinion between the creditors and the shareholders and the facts would be reported to Mr. Registrar Manson, by whom the appointment would be made in due course. In the meantime, he would appeal to the two opposing sections to smother all feelings of resentment, and combine with a view to a reconstruction of the company and the welfare of all interested in the concern.

As the result of the suggestion, a committee of inspection was formed consisting of three shareholders, at whose request Mr. Pitts consented to also join as a member. Appended is a list of the principal unsecured creditors :—

Brown, S. G.	£25	Phillips & Leigh	£85
Butt, Fredk. R., & Co.	12	Pitts, F. C.	236
Bull, Sir Wm.	73	Poncon, S. P.	33
Cossor, A. C.	120	Pool, F. R.	428
Crompton & Co.	279	Piggott Bros. & Co.	51
Cameron, J.	165	Pullen & Sons, J. G.	156
Mitcham, W. T.	39	Regent Carriage Co.	88
Frankland, Sir Fredk.	275	Robinson, F.	72
Grant, Capt. R. A.	100	Spurling, D.	188
Henke, H.	32	Spa Property Co.	131
Matthews, H. Grindell	324	Whittaker, H. A.	34
Mogridge, B. W. L.	16	Capital and Counties Bank	19
Openshaw & Co.	18		

Hotton & Co., Ltd., 71, Southwark Street, S.E.—Under this compulsory liquidation, the report of Mr. H. E. Burgess, Official Receiver and Liquidator, has been issued to the creditors and shareholders. The accounts filed under the liquidation show liabilities £3,812, against assets valued at £1,265, and a deficiency of £7,098 as regards contributories. The company was registered as a private company on October 20th, 1910, with a nominal capital of £6,000, divided into 4,500 ordinary and 1,500 preference shares, all of £1 each. Its objects were to acquire the lighting engineering business carried on at 21, Charterhouse Buildings, E.C., by William Hotton under the style of the Hotton Lighting Co. In September, 1913, debentures for £1,082 were issued to secure previous advances, and in the following November Mr. F. W. Stephens was appointed Receiver for the bondholders. The Receiver is not carrying on the business, and it is doubtful if there will be any substantial surplus from his realisations. The question of a dividend to unsecured creditors will, therefore, depend upon the validity or otherwise of the debenture charge.

Perfectophone Co., Ltd.—A meeting will be held at the offices of Messrs. Greenhalgh, Sharp & Co., 30, Brown Street, Manchester, to hear an account of the winding up from Mr. W. Adgie (joint liquidator).

Trade Announcements.—The Harland Engineering Co. have removed to larger premises at 196, Greengate, Salford, Manchester, where they have erected new premises, comprising head offices, works and stores.

On March 30th, for the convenience of their West End friends, the Adnil Electric Co., Ltd., are opening a depôt at 25, Victoria Street, S.W., under the management of Mr. W. A. Davis. Firms interested in electrical goods are invited to inspect their showroom at that address, with its stock of samples of the firm's manufactures.

The Pendreich Electrical Firm, 250-251, Dalry Road, Edinburgh, have been appointed sole agents for the Eastern Counties of Scotland by the following firms :—Acton Lamp Co., Ltd., Berry, Skinner & Co., Mickelwright, Ltd., Lionel Robinson, and Steel Tubes and Conduits Co.

Mr. George Ellison, of Birmingham, announces that he has appointed Messrs. Kelsall & Parsons, Caledonian Chambers, 87, Union Street, Glasgow, as his Scotland representative, and also Mr. A. B. Gott, Independent Buildings, Fargate, Sheffield, as his representative for South Yorkshire, Nottinghamshire and Derbyshire.

A partnership has been entered into by Mr. Wm. B. Robertson-Garlick, late assistant engineer under Mr. Albion T. Snell, M.I.C.E., to the Festival of Empire authorities, and Walter Edward King, late of Barnet. The business, which covers all classes of electrical contracting work, is being conducted from 82 Lamb's Conduit Street, W.C.

Mr. Geo. Morrison has removed his business from 4, Birley Street, to more extensive premises at 24, Birley Street, Blackpool.

Mr. L. H. Euler is removing to 3, Broad Street Buildings, E.C.

Mr. Humphrey Wood, who has represented Messrs. Marsh, Son & Co., Ltd., for the past 11 years, has now joined in partnership with Mr. James M. Douglas in the Accessories Manufacturing Co., at 11, Dean Street, Oxford Street, W.

For Sale.—Halifax Corporation Tramways and Electricity Committee has for sale, by tender (April 3rd), one 30 ft. × 9 ft. Lancashire boiler. Particulars of which are given in our advertisement pages to-day.

Netherlands Exhibition.—An Electrical Exhibition is to be held at Deventer, from June 24th to July 8th, on the occasion of the opening of the Yssel Electric Power Station, which will provide the towns of Zwolle, Deventer and Zutphen and the neighbouring villages with electric light and power. The object is to acquaint the population likely to use electric light or power with its advantages, and to render them familiar with the various electrical appliances and their use. The British Consul at Amsterdam advises United Kingdom manufacturers of lamps, motors, accessories, &c., who are represented in the Netherlands, to hire a small stand or space to show their goods. Foreign exhibits will be gladly received and will receive fair treatment. Applications for space must be lodged before May 15th. Some further particulars may be seen at the Commercial Intelligence Branch of the Board of Trade, London, E.C., or at the Exhibitions Branch of the Board of Trade, Westminster, S.W.

LIGHTING and POWER NOTES.

Ardee.—Proposed E.L.—On the Town Commissioners dividing on the question of public lighting, three voted for electricity and three for gas, and, as the chairman declined to vote, the matter has been adjourned.

Argentina.—The works of the Tucuman Hydro-Electric Co. were almost entirely destroyed by the floods last month. The damage is estimated at $1,000,000.—*Review of the River Plate.*

Ashton.—The Health Committee has considered the sterilisation of milk by electricity, and has appointed a Sub-Committee to obtain information as to the Liverpool Corporation's installation.

Barmborough (near Doncaster).—Proposed E.L.—The P.C. is considering the question of having the parish lighted by electricity.

Batley.—Loan Sanction.—The Corporation has received the sanction of the L.G.B. to the borrowing of £8,206, which has been overspent on electric mains, services, meters and arc lighting.

Bury St. Edmunds.—New Battery.—The Electricity Committee has recommended the T.C. to obtain a new storage battery at an estimated cost of £750, and the engineer has been instructed to obtain tenders for the same.

Canada.—The Calgary Council has decided to borrow $600,000 for the improvement of its E.L. equipment.

The Prince Rupert Council is to carry out a $300,000 hydro-electric scheme.

Along the new railway route to Hudson Bay it is calculated that 11 rapids on the Nelson River would furnish 6,800,000 h.p. Three rapids are each estimated to give about a million h.p.

The Welland Canal scheme is expected to generate 224,000 h.p. in addition to the 106,000 h.p. which private interests claim to be able to obtain at the falls.

Clogheen (Munster).—Public Lighting.—At the R.D.C. meeting last week it was stated that a local merchant was investing £1,000 in an electric generating plant, and his offer to supply energy to 50-c.p. street lamps at 30s. each per annum on a ten years' agreement was accepted.

Clun (Salop).—Proposed E.L.—A scheme under consideration for introducing E.L. in the district proposes that Mr. Simons, electrical engineer, of London, shall install the plant, and that a company be formed to take over the concern.

Derby.—New Plant.—The T.C. has decided to obtain new electrical plant as follows:—Turbine plant, £7,290; foundations and flooring, £400; piping, £250; condensing water screen, £300; boiler, brickwork and piping, £2,400; motor and generator, £1,900. It was stated that a saving of £3,000 per year would be effected by the use of the larger turbines.

Douglas.—Promenade Lighting.—A scheme for the decorative illumination of the whole of the seafront by means of electricity has been approved by the authorities, and it is intended that the scheme shall be available by June.

Dublin.—Street Lighting.—A system of centrally suspended electric lamps in some of the streets is to be introduced. The new system is mainly intended for smaller streets where lamp standards might cause inconvenience to traffic.

The Corporation has been granted a locus to oppose the Alliance and Dublin Consumers' Gas (Electricity) Bill.

Durham.—Proposed E.L.—A joint meeting of representatives of the Coxhoe, Cassop and Kelloe parish councils has resolved that the County of Durham E.P.S. Co. be also asked to quote for the E.L. of Cassop, Quarington Hill and Kelloe.

Easington.—Workhouse Lighting.—The B. of G. has appointed a Committee to consider the question of lighting the workhouse and offices by electricity.

Fareham.—As the estimates of the U.D.C. electricity undertaking for the past year, show a deficit of £100, and the estimates for the year ended March 31st, 1915, a further deficit of £250, the Council has decided to increase the price of electricity for private lighting from 6d. to 7d. per unit. The Lighting Committee has deferred the question of public lighting in Catisfield, with a view to considering an electric lighting scheme.

Finland.—Arrangements are in hand for the establishment of a large generating station for the supply of electricity to the sawmills in Riihimaki.

Galashiels.—Prov. Order.—The T.C. has decided to withdraw its opposition to the proposed prov. order of the Galashiels and District E.L. Co., on the conditions that the maximum price is reduced from 13s. 4d. for the first 20 units and 6d. per unit after to 10s. and 4d. respectively and that other protective clauses are inserted. It is stated that the various points have been conceded.

Hove.—The T.C. has decided to arrange for the working of the E.L. undertaking, taken over from the company, "assuming that no other arrangements are made in the meanwhile."

Huddersfield.—The Electricity Committee has informed the Newmill U.D.C. that it cannot see its way to carry out the proposed extension of the mains to Newmill at present.

Inverurie.—Proposed E.L.—The G. N. of Scotland Railway Co., in reply to the application of the T.C. for a supply of electricity, stated that it would prefer to supply the current in bulk, and that the distribution should be carried out by the Council. At present it is proposed to light the streets and public buildings by electricity.

Listowel (Co. Kerry).—Electric Pumping.—The U.D.C. has accepted the tender of the Listowel Electric Lighting Co. to supply 100,000 gallons of water per day for the reservoir, at £247 per annum. The company is to provide an independent plant.

London.—Half-Watt Lamps.—The Kensington B.C. has decided to fix two half-watt lamps in the High Street as an experiment, with a view to extending the system if it proves satisfactory. The St. Pancras B.C. has been recommended by its Electricity Committee to install nine half-watt lamps for experimental purposes.

Marylebone.—The Public Health Committee has accepted the tender of the Electricity Department for converting the heating arrangements at Barrett Street convenience from gas to electricity. The Medical Officer of Health has reported that the installations already made have given satisfaction, and that the cost of electric heating is slightly less than that of gas.

Maidstone.—Mill Driving.—The coating paper mill of Messrs. A. E. Reed & Co., Ltd., one of eight owned by the same firm, were burnt to the ground in August last. This has since been entirely rebuilt, and the whole of the motors and controlling appliances were supplied by the Langdon-Davies Motor Co. The motors have a speed variation of from 500 to 1,200 r.p.m., thereby giving complete control over the drying process for the paper. The original method of driving was by belt transmission from the main engine, by which means it was impossible to get the proper speed at the various changes of the atmosphere for drying the paper. The electrical installation is giving great satisfaction to the management, both in utility and running cost, the saving of the cost of the large belts being a marked feature in the adoption of electrical power.

Midhurst.—E.L. Scheme. — The Governors of the Grammar School have consented to withdraw their opposition to the establishment of electricity works near the school by a company, providing it is not within 100 yd. and that silencers are fitted to the engines.

Newport.—The borough electrical engineer reports that during the past month the erection of the 600-kw. motor-generator set was completed, and that on most days and through a greater portion of the day (now that that plant was installed) the department was able to shut down all the reciprocating plant and put the whole of the supply on to the turbine.

Reading.—The T.C. has appointed a Committee to confer with the Electric Supply Co., with respect to the prov. order being sought to empower the company to supply electricity in bulk to the York Town and Blackwater Gas Co., and to which the Corporation has objected.

Slaithwaite (Yorkshire).—The U.D.C. has received from the B. of T. a copy of an order proposed to be issued conferring on the Council powers with regard to E.L. It was decided to ask for the maximum price to be fixed at 6d. instead of 8d. per unit, and for certain clauses to be deleted from the order.

South Africa.—Ladysmith (Cape Province).—A ballot of municipal ratepayers has resulted in favour of the proposed loan of £7,000 for an electric lighting scheme.

Staines.—Prov. Order.—The R.D.C. has consented to the proposed Feltham and District E.L. Order, subject to certain modifications as to the length of mains to be laid.

Street (Somerset).—E.L. Scheme.—The U.D.C. has decided that in the event of an electric light company being formed, the public lighting will be handed over to it. Mr. F. Christy has informed the Council that a local company could be formed conditionally upon obtaining the public lighting contract. It is estimated that the conversion from gas to electric lighting would save £30 per annum.

Swanage.—The Electricity Supply Co. has decided to extend its mains to the Swanage Bay Estate, which is being developed.

Swansea.—Rate Relief.—The question of allocating electricity profits to rate relief was discussed recently by the Finance Committee (see page 311) which, despite the opposition to its proposals, has decided to recommend the T.C. to allocate £2,200 out of the profits for this purpose. The net profits for the year just ending are expected to be £2,500, and increased capital charges will be incurred next year. The borough treasurer supports the recommendation with the plea that the undertaking is better placed than many similar undertakings.

Swindon.—Annual Estimates.—The estimates for the ensuing year provide for a revenue in the electricity department of £12,290, as against £12,328 last year.

Truro.—E.L. Scheme.—The E.L. Committee has presented to the T.C. the report of the deputation which visited Launceston and Falmouth to ascertain particulars of the electric light undertakings. Consideration has been given to a letter from Dr. Purves. It was resolved that, having regard to the alteration in the site and mains, Dr. Purves be instructed to prepare an amended scheme and detailed estimate.

Virginia (Co. Cavan).—L.G.B. Inquiry.—An inquiry is to be held on the 31st inst. in connection with the proposed public lighting of the town.

Waterford.—B. of T. Inquiry.—Last Friday, Mr. G. B. Deane held an inquiry into the application of the Corporation for a prov. order for E.L. The scheme is estimated to cost £30,000.

Whitstable.—The U.D.C. has given Mr. F. Broad permission to erect overhead wires over Argyle Road for the purpose of supplying electricity to business premises in the district.

Wolverhampton.—Rate Relief.—From the profits of the electricity undertaking £2,125 is to be transferred to the borough improvement fund.

Woodford.—Proposed E.L.—The U.D.C. has decided not to proceed with the agreement with the Walthamstow U.D.C. for a supply of electricity. The prevailing opinion is that the Council should have its own independent supply.

York.—The T.C. has decided, as soon as it obtains the powers, to extend the supply of electricity to the Strensall, Poppleton and Haxy districts.

TRAMWAY and RAILWAY NOTES.

Canada.—The Toronto Suburban Railway Co. has awarded a contract to the Canadian General Electric Co., for sub-station apparatus and car equipments, for the new line from Toronto to Berlin. This will be the first interurban line in Canada to operate at 1,500 volts D.C. The catenary type of overhead construction will be used, and there will be three sub-stations; 1,500-volt rotary converters, each of 500-KW. capacity, will be used, power being transmitted to the sub-stations at 25,000 volts. The cars will operate on a 600-volt line at approximately half normal speed; and changing from 1,500-volt to 600-volt trolley, or *vice versa*, will involve no loss of time in adjustment of control apparatus. The line with 1,500-volt operation will be about 62 miles long.—*Canadian Engineer.*

Continental Notes.—Germany.—A tunnel is to be constructed under the famous avenue Unter den Linden, in Berlin, in order to enable the tramways to cross it without marring the appearance.

The Saxon Government has sent several officials to London to study intra-mural transit systems with special regard to future developments in Dresden, where an electric railway in shallow subways is regarded as the only solution of the traffic difficulties; this scheme would involve a tube under the Elbe.

In order to relieve the congestion at the large main station in Hamburg, a proposal is to be embodied in the next Prussian Railway Budget for the electrification on the single-phase system of the suburban line to Bergedorf and Friedrichsruhe. The work is likely to be completed in two or three years, and will form an extension of the lines already electrified.

Trials of the new single-phase locomotives for the Berlin City and Ring Railways will commence within the next three months on the Dessau-Bitterfeld railway, but the actual work on the Berlin lines has scarcely commenced yet. There will be two generating stations, one in Berlin for emergencies and peak loads and one in the brown coal district, where the Prussian State Railways are purchasing mines; this distant station will carry most of the steady load. The estimates of capital cost are not likely to be exceeded.

Negotiations are proceeding for an extension of the electric service beyond Gross Lichterfelde, the local authorities and land-development companies having declared themselves willing to share the capital cost and also the working losses for the first few years, as the district is not yet thickly populated. This line from Berlin to Gross Lichterfelde was electrified some years ago on the D.C. system as an experiment.

The Kaiser is evincing a lively personal interest in the question of automatic signalling.

Austria.—Some particulars have just come to hand of a new petrol-electric road train, with which some trials are being made by a large brewery undertaking in Vienna. The train, which is intended for a total load of 30 tons, consists of six vehicles, each of which is self-propelled. The first vehicle consists of a self-moving generating plant, comprising a petrol engine of 150 H.P. and dynamo. The following vehicles are connected together by drawbars, and each is fitted with an electric motor geared to the road wheels, current being supplied by the dynamo on the forward vehicle. The trials are stated to have been very satisfactory, and it is reported that the military authorities have expressed their willingness to grant an annual subsidy to any firm adopting it.

The Karlsbad municipal authorities have decided to construct an electric railway from Buschtiehrad railway station to the Kaiser Park, the first section to Neubad being taken in hand this autumn. The capital, 1,400,000 kronen, has been raised.

Halifax.—The Tramways Committee is considering the extension of its tramway system to Elland.

Hove.—Railless Traction.—The Brighton Corporation has informed the Hove Corporation that the over-running system favoured by Hove is unsuitable to Brighton, owing to the necessity of crossing certain tramway tracks, and that as Brighton has decided upon the under-running system, the matter should be referred to arbitration.

Huddersfield.—Rate Relief.—The Tramways Committee has transferred £6,662 to the relief of rates.

Manchester.—A special correspondent, writing in the *Manchester Guardian* on Saturday, outlines a scheme for underground tramways in the centre of the city, and states that this subject will doubtless form one of the most interesting parts of the report which Mr. J. M. McElroy (Manchester Corporation tramways manager) will present in a few days upon the investigations which he has carried out into methods adopted in other cities for dealing with street traffic. The correspondent suggests a mile and a quarter subway, which would cost at least £300,000, and might run up to £500,000. Including the cost of dealing with sewers and street widening it is not unlikely (according to the writer of the article) that the total cost would exceed three-quarters of a million. He says the work seems to be worth the expenditure, and suggests that the soundness of the undertaking would not be seriously affected by utilising part of the accumulated reserve fund for this desirable improvement.

Stirling.—Proposed Tramway Electrification.—The T.C. has decided not to accept the offer of Mr. G. Balfour to take over the electricity works and convert the tramways to electric traction until it has obtained information as to the construction by the T.C. of a tramway system from Bridge of Allan to Bannockburn.

Swansea.—New Tramways.—The B. of T. has, after some demur, consented to the construction by the Corporation of the Mount Pleasant light railway, which will have one of the steepest gradients in the country.

Swindon.—Annual Estimates.—The estimated income for the ensuing year of the Corporation tramways department is £8,938, and the expenditure £10,551.

Wharfedale.—Railless Traction.—The Otley Council is supporting the proposal of the Leeds Corporation to extend its railless traction system to Wharfedale.

Westhoughton.—Suggested New Tramways.—The U.D.C. is considering the securing of a prov. order for the construction of tramways, efforts to induce the Bolton Corporation and the South Lancashire Tramways to carry out the work having proved abortive.

Wolverhampton.—Rate Relief.—It has been decided to transfer £3,777 from the profits of the tramways undertaking to the credit of the borough fund.

TELEGRAPH and TELEPHONE NOTES.

Cable Repairs.—The Anglo-American repairing c.s. *Telcania* had to seek shelter in Cork Harbour recently, being unable to continue her work in the Atlantic in consequence of the very heavy sea running.

Canada.—According to official statistics quoted by the *Canadian Electrical News*, for the year ending June 30th last, there are nine land telegraph companies operating in Canada, and six cable companies, besides one wireless telegraph company. The total wire mileage on land is 152,919 miles, pole mileage 43,048 miles. The wire mileage has fallen from 167,939 in the previous year.

The telephone statistics show a marked increase in the use of the telephone. There is one telephone per 16·2 persons in Canada, and 1.075 organisations reported to the Government, besides over 100 from which reports were not received. There are 1,092,587 miles of wire in use, with 463,671 telephones, of which the majority are on central-battery systems. The capital outlay averages $129.13 per telephone.

France.—Much interest has been aroused by the discovery that a convention, known to but few members of the Chamber of Deputies, was signed in July, 1912, between the Department of Posts and Telegraphs and Mr. R. C. Galletti, entrusting to the latter the development of wireless communication with the French Colonies, and according him various privileges of great value. It is alleged that Mr. Galletti is the founder of an English company known as "Galletti's Wireless Telegraph and Telephone Co.," allied with the Indo-European Co., the Eastern Telegraph Co. and the Eastern Extension Telegraph Co., and that the convention secures the cable companies from effective competition on the part of the wireless service. It is further stated that the matter arises out of the opposition of the Department of Posts, Telegraphs and Telephones to the development of wireless telegraphy by the Colonial authorities, and it is alleged that this opposition is based upon the desire to protect the interests of the British cable companies in the East. An inquiry has been demanded, and the President of the French Budget Commission has, under the circumstances, ordered the matter to be referred back for reconsideration.

Germany.—The German Government has lately proposed to the Government of Sweden to lay a telephone cable from the German coast, at Sassnitz or Arcona or to the north of Zingst, to Trelleborg, in Sweden. The cable will be connected with the German telephone network, and new landlines will afford direct connection with Berlin and Hamburg.—*Zeit. für Schwachstromtechnik.*

On March 14th the messages sent out from Nauen during the daily experimental period were for the first time received at Windhuk, in Damaraland. Hitherto the remotest African station which could be reached was Dualla. The distance traversed by the message was about 6,500 miles, almost entirely overland.

The German Admiralty purpose erecting a wireless station at Pelzerhagen, near Neustadt, in Holstein. The site has already been acquired.

Imperial Wireless System.—On Friday last, at the first public sitting of the Select Committee of the House of Lords, Lord Halsbury, who had been elected chairman, decided that the charges against Lord Murray must be definitely formulated before evidence was called. On Tuesday the charges were presented to the Committee; they alleged that Lord Murray purchased shares regarding which he had special information derived from the managing director of the English Marconi Company, with which the Government of which he was a member was then negotiating a contract, and that those shares were at the time the property of the English company, and within a few days acquired a greatly increased value. A further charge related to the purchase by Lord Murray of British railway stock, for the Liberal Party, at a time when action that was being taken by the Government might have affected the value of the shares.

The Telewriter.—A telewriter exchange has been installed at the Manchester Royal Exchange, by means of which prices are transmitted from the telewriter exchange in Liverpool to the Exchange and other subscribers in Manchester.

The Telephone Service.—In addition to that at Epsom, there are now 11 other automatic exchanges in course of erection or on order. The largest, at Leeds, which will be opened early next year, will be built for 15,000, and equipped for 6,800 lines. The other towns where automatics are being installed are Accrington, Chepstow, Darlington, Dudley, Grimsby, Hereford, Newport (Mon.), Paisley and Portsmouth. Several new manual exchanges are being built in London, for 10,000 lines each.

Time Signals.—The Belgian Minister of Posts and Telegraphs has decided that all official clocks in Belgium in future shall be regulated at midnight by telegraphic messages transmitted from the Eiffel Tower.

Turkey.—The newly-installed telephone service in Constantinople was formally opened for general use on the 28th of last month, but was experimentally in operation from the 4th, when the first subscribers were enrolled. A difficulty of the undertaking has been the instruction of the staff of native women in the duties of telephone operators.

Wireless Telephony.—It is reported that Mr. Marconi, on board the Italian battleship *Augusta*, has succeeded in effecting clear communication with Rome, 300 miles away; Venice, at 600 miles; and Clifden, Ireland, more than 1,700 miles distant. The apparatus employed is said to be of a new and simple type, and the successful trials were conducted in the daytime.

The daily Press has made some sensational comments on the subject, such as the following extracted from the *Standard*:—

"The prophets have set themselves a new task in foretelling the date when all the magnificent new telephone exchanges, on which the Post Office is spending thousands of pounds, will become as antiquated as beacon fires, and their thousands of miles of wire lie as useless in the conduits as the lead in a Roman aqueduct. Already there is sign of alarm among those who are called upon to finance the installation of the present telephone system."

This is absurd; wireless telegraphy has not rendered telegraph wires unnecessary, and although wireless telephony will no doubt be of very great utility at sea, and between ship and shore, there is no reason to suppose that it will become commercially practicable in town service for very many years, if ever. Fortunately, the market appears to have been unaffected by the exaggerated reports that have been going about, for the *Westminster Gazette* on Wednesday said: "A fair amount of attention continues to be given to Marconis, but it is largely of the selling order, and the price is weaker."

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—NEWCASTLE.—April 29th. P.M.G. Electrically-controlled clocks at Post Office, Newcastle, N.S.W. Schedule No. 361. See "Official Notices" to-day.

April 21st. P.M.G. Telephone switchboards. Schedule No. 1,005. See "Official Notices" March 13th.

Bedford.—April 1st. Corporation. 12 months' supply of high and low-tension cables; one-phase A.C. induction house service meters; metal-filament lamps. See "Official Notices" March 13th.

Belgium.—April 14th. The Fonderie Royale de Canons, in Liége (80, Quai Saint Leonard). Supply and installation of the feeders and network of mains required in connection with the supply of current for lighting and power purposes at a number of the buildings at the Camp of Beverloo.

Blackpool.—March 25th. Corporation. For the supply of six new open bogie cars for the Tramways Committee. Particulars from Mr. C. Furness, General Manager, General Offices, West Caroline Street.

Bray.—April 7th. U.D.C. General stores and stores for electric light works. See "Official Notices" March 13th.

Bristol.—23 tons of boiler furnace castings for the electricity department. Particulars from Mr. H. Faraday Proctor, the Exchange, Corn Street.

Carlisle.—April 1st. Ironmongery, packing and jointing materials, oils, &c., for a year, for the Corporation Electricity Department. Mr. F. W. Purse, Electrical Engineer, Victoria Viaduct (returnable deposit of 5s. for each schedule).

Chesterfield.—Steam generating plant, switchgear and overhead crane, for the T.C. Mr. R. L. Acland, Electricity Works.

Devonport.—April 8th. 1,250-KW. turbo-alternator, with condensing plant, two 500-KW. rotary converters and switchgear, for the Borough Electricity Department. See "Official Notices" to-day.

Dublin.—March 30th. G.N.R. of Ireland. Re-plating of electric battery in connection with Hill of Howth electric tramway. See "Official Notices" March 13th.

Edinburgh.—March 28th. Arc lamp globes, pavement boxes and conduits, for the Electricity Supply Department for 12 months. Specifications, &c. (10s. for each specification), obtainable from Mr. F. A. Newington, Engineer, Electricity Supply Station, Dewar Place.

Egypt.—April 8th. Egyptian Ministry of Public Works. 45-KW. crude-oil electric generating set, switchboard, two electric pumps, four motors, overhead cable, &c., for a power station at the Khanka Sewage Farm. Copies of conditions and particulars (£3 1s. 7d., not returnable) from the Controller-General, Main Drainage Department, Cairo. Local representation. See *B. of T. Journal.*

France.—March 31st. French State Railway authorities (Service Electrique, 1^{re} Division), Paris (43, Rue de Rome). Six electrically-operated cranes for service at the maritime station at Dieppe.

March 31st. French State Railway authorities (Service Electrique, 3^{me} Division), Paris (72, Rue de Rome). Equipping 30 railway carriages with electric lighting and heating.

Glasgow.—April 7th. Twelve months' supply of stores, fuel, &c., for the Tramways Department. Specification from Mr. J. Dalrymple, General Manager, 46, Bath Street.

Halifax.—March 24th. Electrical fittings for six months, for the B. of G. Mr. A. T. Longbotham, Clerk, Carlton Street.

Huddersfield.—The Tramways Manager has been instructed to obtain tenders for the covering of 14 cars.

Kirkcaldy.—March 23rd. Corporation. Twelve months' supply of stores for the Electricity and Tramways Committee. Forms of tender from Mr. O. F. Francis, Burgh Electrical Engineer and Tramways Manager.

London.—L.C.C. Tenders are to be invited for the supply of machine tools, &c., for the boiler house workshop at the Greenwich generating station.

April 9th. Installation of 65 wiring points, 85 lights, and two power points, at Moxey Road centres, Woolwich. See "Official Notices" to-day.

Hammersmith.—Tenders are to be invited by the B.C. for the supply of as much cable duct as may be required during the coming financial year.

Oldham.—March 23rd. Corporation. Steam, exhaust and drain pipes, condenser pipes, &c. See "Official Notices" March 13th.

Perth.—March 23rd. Corporation. Supply of 3,750 tons of small coal for electricity station. Form of tender from Mr. J. Lambert, Burgh Electrical Engineer.

Rawtenstall.—March 23rd. Corporation. Boilers, superheaters, mechanical stokers, and steam piping, for the electricity works. Mr. C. L. E. Stewart, Electrical and Tramway Engineer.

Salford.—March 23rd. Two high-tension distribution switchboards, for Park Lane sub-station, and twelve oil-switch cubicles for separate wall-mounting. See "Official Notices" March 6th.

March 23rd. Superheaters, pipes and valves. Specifications, &c., from the Borough Electrical Engineer, Frederick Road, Pendleton.

Swinton and Pendlebury.—March 26th. U.D.C. 12 months' supply of cable, joint-boxes, joint-box compound, bitumen, &c. See "Official Notices" March 6th.

Wallasey.—April 7th. Economisers, extra-high-tension cables, extra-high-tension switchboard, engines, alternators and condensers, hand-power overhead travelling crane, rotary converters, transformers, water-tube boilers, for the Borough Electricity Department. See "Official Notices" March 13th.

Warrington.—March 31st. 750-KW. rotary converter; E.H.T. switchboard panel, for Electricity and Tramways Committee. See "Official Notices" March 6th.

Watford.—March 24th. 14-B.H.P. electric motor, for the Guardians, Watford Union. See "Official Notices" March 13th.

Wimbledon.—March 27th. Corporation. Supply of four lines of 3-in. iron or stoneware conduits for E.H.T. cable; two ·15 sq. in. concentric, 11,000-volt, paper-insulated and lead-covered cables. Forms of tender from Mr. H. Tomlinson-Lee, Borough Electrical Engineer, Electricity Works, Durnsford Road.

CLOSED.

Australia.—Queensland.—P.M.G.'s Department :—

5 000 cordeau insulators, £99.—John Fuller & Son, Ltd.
Fuses, lamp caps, indicators, strips, jacks, microphones, pole-hangers, generators, terminal strips, telephone sets, C.B. telephones and translators.—Western Electric Co. (Aus.), Ltd.
Resistance sounders, receivers, &c.—I.-R., G.-P. and Telegraph Works Co., Ltd.
Relays and sounders.—B.I. and Helsby Cables, Ltd.
80 C.B. cordless switchboards, four lines, £225; 55 ditto, six lines, £332; 80 ditto, ten lines, £485; and other telephone material.—G. Paton & Co.
550 Siemens standard receivers, £124; resistances, &c.—Siemens Bros. Dynamo Works, Ltd.

Victorian Railways Department.—State Coal Mine :—

Two 10-H.P. motors, £56 each.—British G.E. Co., Ltd.

Shire of Tungamah (Vic.).—Cobram Electric Supply :—

Gas engine, £747.—R. Hornsby & Sons.
Electrical equipment, £1,801.—Sutherland & Ashman.
Cables, £435.—Steffens & Noelle.

Shire of Waranga (Vic.).—Rushworth Electric Supply :—

Gas engine and plant, £874.—R. Hornsby & Sons.
Dynamo booster, £419; storage battery, £771; erection of plant, £155; wires, cables, street-lighting fittings, &c., £483.—I.-R., G.-P. and Telegraph Works Co., Ltd.
Wire and cables.—Steffens & Noelle.—*Tenders.*

A contract for transformers for the City of Melbourne has been secured by Messrs. Johnson & Phillips, Ltd.

Belgium.—Three concerns submitted tenders last week to the municipal authorities of Liége for the supply and erection of a new 600-KW. steam engine and dynamo at the municipal central station, the lowest offer (£1,270) being that of the Société International d'Electricitè, of Liége.

Bolton.—A contract for the supply of traction-type tantalum lamps for the Corporation tramways for the ensuing 12 months has been placed with Messrs. Siemens Bros. Dynamo Works, Ltd.

Carlisle.—The T.C. has accepted the following tenders for additional plant :—

Oerlikon Co.—Turbo alternator and condensing plant, £4,908.
British Westinghouse Co., Ltd.—Rotary converters, £2,855; high-tension switchgear and second feeder panel, £975.

Dublin.—The Edison & Swan United E.L. Co., Ltd., has received the contract for the supply of Royal Ediswan lamps for the Dublin United Tramways Co., Ltd.

Glasgow.—The Tramways Committee recommends the acceptance of the following tenders :—

Steel rails and fishplates.—Bolckow, Vaughan & Co.
Steel drop forgings.—John M'Skimming.
Car brake gear.—Dryers, Ltd.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

Admiralty—Contract Department.

Brackets, pendants, &c.—Bulpitt & Sons, Ltd., Hayward, Tyler & Co., Ltd., General Electric Co., W. McGeoch & Co., Player & Mitchell, Ltd.
Circuit-breakers and contactors.—Whipp & Bourne.
Flashing lanterns.—General Electric Co., Ltd.

War Office.

Dynamos.—Electric Construction Co., Ltd.
Installation of electric lighting, Royal Aircraft Factory, Farnborough.—Tredegar & Co.
Wiring of barrack blocks for electric lighting, Netheravon.—G. E. Taylor and Co.

India Office Store Department.

Cells.—Siemens Bros. & Co.

Crown Agents for the Colonies.

Brake fittings.—Westinghouse Brake Co., Ltd.
Cable, &c.—B.I. & Helsby Cables, Ltd.
Electric light equipment.—J. Stone & Co., Ltd.
Telephones.—British L.M. Ericsson Manufacturing Co., Ltd.
Insulated wire.—Hooper's Telegraph & India-Rubber Works, Ltd.

H.M. Office of Works.

Electric wire and cable.—Armorduct Manufacturing Co., Ltd.

Post Office.

Electric lifts (six), N.W. D.O. (London).—Medway's Safety Lift Co.
Laying lines of multiple-way ducts, Leeds—Castleford.—W. Irwin & Co.
Laying lines of multiple-way ducts and pipes, Leeds—Huddersfield (section 1).—Robson, Eckford & Co., Ltd.
Laying lines of multiple-way ducts and pipes, Regent's Park Road, N.W.—Scholey & Co., Ltd.
Laying lines of multiple-way ducts, pipes and U-shaped earthenware troughing, Liscard.—Jowett Bros.
Laying lines of pipes, Bradford.—W. Irwin & Co.
Laying lines of pipes, Dalkey, Killiney and Bray.—J. Ross & Son.
Laying lines of pipes, Dublin (N. and S. City).—J. Ross & Son.
Laying lines of pipes, Dublin, Blackrock and Drumcondra.—W. Dobson.
Laying lines of pipes and U-shaped earthenware troughing, Atherton.—W. Pollitt & Co., Ltd.
Laying lines of pipes, U-shaped earthenware troughing and lead-covered cable, Ilkley.—A. Schofield.
Manufacturing, supplying, drawing-in and jointing lead-covered cables, Swansea—Llanelly.—Johnson & Phillips, Ltd.
Manufacturing, supplying, drawing-in and jointing lead-covered cables, Swansea—Port Talbot.—Callender's Cable Co., Ltd.
Telephone exchange equipment, Birmingham (Central).—Western Electric Co., Ltd.
Telephone exchange equipment, Truro.—Western Electric Co., Ltd.
Protective apparatus.—British L.M. Ericsson Manufacturing Co., Ltd., International Electric Co., Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd., British L.M. Ericsson Manufacturing Co., Ltd., Phœnix Telephone and Electric Works, Ltd., Siemens Bros. & Co., Ltd., Western Electric Co., Ltd.
Wood arms.—British Australian Timber Co., Ltd.
Stoneware bends.—Albion Clay Co., Ltd.
Battery boxes.—Standard Woodwork Co., Ltd.
Telephonic cable.—B.I. & Helsby Cables, Ltd., Callender's Cable Co., Ltd., Connolly Bros., Ltd., Johnson & Phillips, Ltd., Siemens Bros. & Co., Ltd., Western Electric Co., Ltd.
Stoneware ducts.—Doulton & Co., Ltd.
Insulators.—Doulton & Co., Ltd.
Ironwork.—T. Butlin & Co., Ltd., Walls, Ltd., Willetts, Ltd.
Earth plates.—T. & W. Farmiloe, Ltd.
Bronze wire.—T. Bolton & Sons.

Great Yarmouth.—The T.C. has accepted the tender of Messrs. John Baker & Co., Ltd., for 40 steel tires for tramcars, at £1 14s. 6d. each.

Grimsby.—The T.C. has accepted the tender of Messrs. E. Bannister & Co. for a six months' supply of slack coal for the electricity works, at 6s. 4½d. per ton.

Hanley.—The Governors of the new Pottery and Mining School have accepted the tender of the Adnil Electric Co. for a motor-generator for the school, at £116, this being the lowest of four tenders.

London.—L.C.C. The Highways Committee has accepted the tenders of Messrs. Bullers, Ltd., for 12,000 track insulators, at £2,375; of Messrs. Gaskell & Grocott, Ltd., for 5,000 porcelains, at £3 6s. 8d. per 100; and of Messrs. Taylor, Tunnicliff and Co., for 5,000 porcelains, at £3 13s. per 100, for the tramways department.

The Committee reports the receipt of the following tenders for the supply of 150 two-way change-over switches for the tramways :—

Johnson & Phillips	(accepted)	£362
Spagnoletti, Ltd.		871
British Westinghouse Electric and Mftg. Co., Ltd.		484
Brush Electrical Mftg. Co., Ltd.		510

STEPNEY.—The Electricity Committee reports having received the following tenders for four 300-ampere circuit-breakers at the Whitechapel station :—

G.E. Co., Ltd.	(recommended)	£23 each
British Westinghouse Co., Ltd.		33 ,,
,, ,, ,,	alternative.	51 ,,
I.T.E. Electric Co. (1907), Ltd.		43 ,,

HAMMERSMITH.—In connection with the supply to Bensons, Ltd., the following quotations were received for a transformer pillar and switchgear :—

Lucy & Co., Ltd.	(recommended)	£38
B.I. & H. Cables, Ltd.		58
B.E. Transformer Co., Ltd.		62

For the supply of 2,000 yards of single-way ducts in connection with the extension of electricity supply mains, the following tenders were received :—

Doulton & Co.—1s. 0½d. per yard (recommended).
Albion Clay Co., Mr. Mansfield (5-ton lots), J. Knowles, Sutton & Co., all 1s. 0¾d.

FULHAM.—The Electricity Committee recommends the acceptance of the following annual tenders :—

Frames and covers.—W. T. Henley's Tel. Works Co.
Packings, jointings and rubber goods.—Pryke & Palmer, Witty & Wyatt, Ltd., W. H. Wilcox & Co., Ltd., H. Franklin & Co., J. G. Ingram and Co., G. MacLellan & Co., H. Edmonds & Co.
Glass globes.—City Glass Co.
Electrical goods.—G.E. Co., W. Geipel & Co.
House cut-outs and service boxes.—B.I. and Helsby Cables, Ltd., W. T. Henley's Tel. Works Co., Ltd.
Oils.—W. H. Wilcox & Co., Ltd., Alex. Duckham & Co.

BERMONDSEY.—The following tenders have been accepted by the B.C. for annual supplies to the Electric Light Department :—

Arc lamp carbons and brushes.—Engineering and Arc Lamp Co., Ltd.; Slean Electrical Co., Ltd.; Johnson & Phillips, Ltd.; and Morgan Crucible Co., Ltd.
Conduits, &c.—Thos. Wragg & Sons, Ltd., and Young & Son.
Engine oils.—Hy. Clark & Sons, Ltd.; Silvertown Lubricants, Ltd.; and W. B. Dick & Co., Ltd.
Cable and jointing material.—C. Mackintosh & Co.; Watlington & Co.; and Dussek Bitumen Co.
Electricity meters, demand indicators, main fuses and time switches.—Electrical Apparatus Co., Ltd.; Chamberlain & Hookham, Ltd.; Reason Manufacturing Co., Ltd.; General Electric Co., Ltd.; and W. Geipel & Co.
Street frames and covers and joint-boxes.—Sykes & Sugden, Ltd.

New Zealand.—A contract for a 21-panel high-tension switchboard for the City of Wellington has been secured by Messrs. Johnson & Phillips, Ltd., through their New Zealand agents.

Northampton.—The T.C. has accepted the tender of Messrs. Sonster & Son for extensions to the tramcar-sheds, at £1,699.

Norwich.—The T.C. Electricity Committee has accepted the tender of Messrs. Bruce Peebles & Co., Ltd., for a patent Peebles-la Cour motor-converter of 250-KW. capacity, at £844, and one of 300-KW., at £986.

The Borough Education Committee has accepted the tender of Messrs. Crompton & Co., Ltd., for an electric testing set for the Electrical Engineering Classes at the Technical Institute, at £83.

Sunderland.—The T.C. has accepted the tenders of Messrs. Ferranti, Ltd., for meters and oil switches, and Messrs. Siemens Bros. for meters.

Swansea.—The T.C. has accepted the tender of Messrs. J. R. Davies & Co. for a three months' supply of coal to the electricity station, at 12s. 9d. a ton.

Swindon.—The T.C. has accepted the tender of the Building and Public Works Construction Co., at £1,313, for the construction of the foundations and condenser pit for the additional plant at the electricity works.

Tottenham.—The following tenders have been accepted by the U.D.C. for electric lighting at the Central Library :—

H. W. Brown	£176	A. Newman, Ltd.		£94
Linzell, Dickinson & Co.	120	**Keen & Co.**	(accepted)	105
Partington & Co.	153	Reynolds & Co.		99
Lund Bros. & Co.	93	J. H. Wood & Co.		110
Malcolm & Allen, Ltd.	105	Weston & Sons		170
Grant & Taylor	68	Elec. Contracts Co.		185

Trowbridge.—The tender of Messrs. Edwards and Armstrong, of Bristol, has been accepted for installing the electric light at the parish church.

Whitehaven.—The T.C. has accepted the following tenders for a year :—

Vacuum Oil Co., Ltd.—Oils.
Dussek Bitumen Co.—Bitumen.
General Electric Co., Ltd.—Electric lamps.
W. T. Henley's Telegraph Works Co., Ltd.—Tapes.
Ferranti, Ltd., and Chamberlain & Hookham, Ltd.—Electricity meters.
W. Lucy & Co., Ltd.—Fuse boxes.

York.—The T.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for four trailer cars for the tramways, at £1,912.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, March 20th. At 8 p.m. At 39, Victoria Street. Paper on "Aeroplanes as Engineering Structures," by Mr. W. H. Sayers.

(North-Western Section).—Friday, March 20th. At 7.45 p.m. At Municipal School of Technology. Mr. Tookey's paper on "The Running of Gas Engines and Gas Producers."

Royal Institution of Great Britain.—Friday, March 20th. At 9 p.m. Paper on "Fluid Motions," by Lord Rayleigh, F.R.S.

Saturday, March 21st. At 3 p.m. Paper on "Recent Discoveries in Physical Science," by Prof. Sir J. J. Thomson, F.R.S.

Institution of Mechanical Engineers.—Friday, March 20th. At 8 p.m. At Storey's Gate, S.W. Paper on "The Chemical and Mechanical Relations of Iron, Tungsten, and Carbon, and of Iron, Nickel and Carbon," by Dr. J. O. Arnold, F.R.S., and Mr. A. A. Read.

Electro-Harmonic Society.—Friday, March 20th. At 8 p.m. At Holborn Restaurant. Smoking Concert.

Greenock Electrical Society.—Friday, March 20th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Paper on "Sub-station Equipment," by Mr. D. McDougall.

Association of Mining Electrical Engineers.—Friday, March 20th. At 7.30 p.m. At Royal Technical College, Glasgow. Paper on "Rock Drills," by Mr. C. E. Hart.

Manchester Electro-Harmonic Society.—Friday, March 20th. Concert.

Association of Engineers-in-Charge.—Saturday, March 21st. Annual Dinner.

Royal Society of Arts.—Monday, March 23rd. At 8 p.m. At John Street, Adelphi. "Howard" Lecture on "Surface Combustion," by Prof. W. A. Bone, F.R.S.

Institution of Civil Engineers.—Tuesday, March 24th. At 8 p.m. At Great George Street, S.W. Papers on "Some Recent Developments in Commercial Motor-Vehicles," by Mr. T. Clarkson; and "Comparative Economics of Tramways and Railless Electric Traction," by Mr. T. G. Gribble.

Wednesday, March 25th.—Students' visit to widening and other works on the London and North-Western Railway.

Nottingham Society of Engineers.—Wednesday, March 25th. At 8 p.m. At Welbeck Hotel. Paper on "The History and Romance of Steel," by Mr. A. W. Shepherd.

Electrical Trades Benevolent Institution.—Wednesday, March 25th. At 7.30 p.m. At the Trocadero. Annual festival dinner.

Institution of Electrical Engineers.—Thursday, March 26th. At Victoria Embankment, W.C. Paper on "Current-Limiting Reactances on Large Power Systems," by Mr. K. M. Faye-Hansen and Mr. J. S. Peck.

(Birmingham Local Section).—Wednesday, March 25th. At 7.30 p.m. At the University, Edmund Street. Paper on "Static Transformers for the Simultaneous Changing of Frequency and Pressure of Alternating Currents," by Mr. A. M. Taylor.

(Manchester Local Section).—Tuesday, March 24th. At 7.30 p.m. At the University Physical Laboratory. Paper on "Experiments on Air-blast Cooling of Transformers," by Mr. F. J. Teago.

(Scottish Local Section).—Tuesday, March 24th. At 8 p.m. At 207, Bath Street, Glasgow. Discussion on "Electric Battery Vehicles," introduced by Mr. A. Page.

Society of Dyers and Colourists.—Thursday, March 26th. At 8 p.m. At the Dyers' Hall, Dowgate Hill, E.C. Paper on "Illumination in connection with the Textile Industries," by Mr. Leon Gaster.

Junior Institution of Engineers.—Friday, March 27th. At 8 p.m. At 39, Victoria Street. Paper on "Harmonograph as applied to Advertising," by Mr. A. Forbes.

(North-Western Section).—Thursday, March 26th. At 7.45 p.m. At Manchester. Paper on "Power Driving of Small Workshops," by Mr. T. R. Wollaston.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, March 27th. At 7.30 p.m. At Philosophical Society, Westgate Road, Newcastle-upon-Tyne. Paper on "High-Speed Bearings," by Mr. G. Stoney.

Physical Society of London.—Friday, March 27th. At 5 p.m. At Imperial College of Science. Papers on "A New Type of Thermogalvanometer," by Mr. F. W. Jordan; and "An Experiment with an Incandescent Lamp," by Mr. C. W. S. Crawley.

Royal Institution of Great Britain.—Friday, March 27th. At 9 p.m. At Albemarle Street, W. Paper on "Improvements in Long-Distance Telephony," by Prof. J. A. Fleming, F.R.S.

Saturday, March 28th. At 3 p.m. Paper on "Recent Discoveries in Physical Science," by Prof. Sir J. J. Thomson, F.R.S.

Faraday Society.—Friday, March 27th. At 4.30 p.m. At Burlington House. Discussion on "Optical Rotatory Power."

Finsbury Technical College Old Students' Association.—Friday, March 27th. At 8 p.m. At Waldorf Hotel, Aldwych, W.C. Eighth annual smoking concert.

Manchester Association of Engineers.—Saturday, March 28th. At Grand Hotel, Aytoun Street. Annual General Meeting. Address on "The Training of Engineers," by Mr. J. C. Maxwell Garnett.

THE ELECTRICAL ENGINEERS

(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week :—

Monday, March 23rd.—"A" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Tuesday, March 24th.—"B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Wednesday, March 25th.—Recruits. Infantry drill, 7 to 8 p.m. Technical instruction, 8 to 10 p.m. Rating examination for all Companies, 7 to 10 p.m.
Thursday, March 26th.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Friday, March 27th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.
Saturday, March 28th.—Headquarters will be opened for the transaction of regimental business from 10 a.m. till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

A Traffic Regulator for Motor-cars. — Messrs. Simms Motor Units, Ltd., of 191, Wardour Street, W., recently gave a demonstration of new devices intended to simplify traffic movements. The simplest of the two devices, *i.e.*, the arrow regulator, consists of two switches fixed to the spokes of the steering wheel of the motor-car, with a black vulcanite top clearly marked "Right" and "Left" showing, when one or the other switch is pressed, in a neatly finished oblong metal box fixed centrally at the back of the car, a white arrow in a red field. The latter, of course, corresponds with the direction in which the driver of the motor-car intends turning, thus giving ample warning to pedestrians, or the following traffic. Instead of the single regulator, two circular lamp-shaped regulators can be fitted to the hood hinges on the sides at the back of the car.

The other type of Simms patent traffic regulator does even more, for not alone does the instrument show by means of arrows the direction in which the car is going to turn, but it will also show the words "Slow" and "Stop" in white letters in a red field. The word "Slow" appears immediately the foot clutch pedal or the foot brake is applied. The word "Stop" appears in white letters in a red field on the regulator immediately the hand brake is being applied.

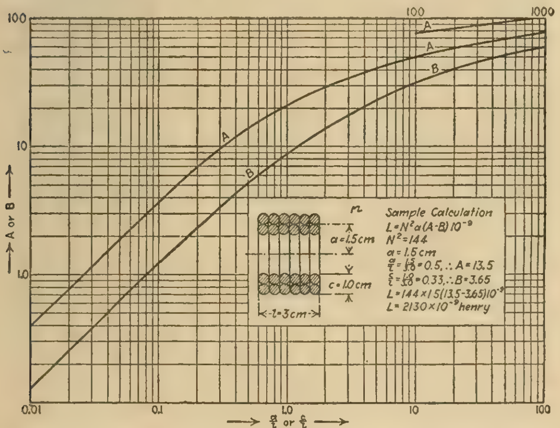
This type of regulator is fixed at the back of the car in place of the red rear light, and is also combined with the red rear light. If desired, the word "Stop" may also be made to appear when applying the foot brake. If required, two extra switches can be fitted at the bottom of the steering pillar operating the arrow regulators automatically, when the steering wheel has been turned through an arc of 20° either side, thus giving an additional automatic indication of the direction of the turning car.

These traffic regulators are fitted with two or four C.P. bulbs, which require very little current, the latter being taken from a dry battery, or from any accumulator. The electric wiring and the arrangement of the switches are extremely simple, and very neat in appearance. Everything is made dust, damp and fool-proof, and there is nothing to get out of order.

The Inductance of Air-Cored Solenoids.—In the *Electrical World* of January 31st, Mr. Leonard A. Doggett presents a universal formula for the inductance of an air-cored solenoid. At the present time air-cored solenoids find application as current-limiting reactances in central station work, and as tuning coils in wireless telegraphy.

The formula offered for the inductance of an air-cored solenoid is—

$L = N^2 a (A - B) \times 10^{-9}$ henries, where N = total number of turns; a = mean radius of coil in centimetres; A = a function of the ratio mean radius/length = a/l, and is given by curve A; B = a function of the ratio winding depth/length = c/l, and is given by curve B.



Curves Giving Ratios of Mean Radius and Winding Depth to Length.

The accompanying curve sheet is self-explanatory, and contains a sample calculation.

In order to test the accuracy of the formula, comparisons were made between the calculated and measured values of the inductance for 50 coils. The average inaccuracy for these cases was about ± 2 per cent.

The foregoing formula will serve for most ordinary cases where the space factor, defined as the ratio of the copper area to the product of the length × the winding depth, is above 35 per cent. For lower values a correction factor needs to be applied which is 1·01 for a space factor of $\frac{1}{3}$, 1·04 for $\frac{1}{4}$, 1·08 for $\frac{1}{5}$, 1·12 for $\frac{1}{6}$, 1·21 for $\frac{1}{8}$, and 1·28 for $\frac{1}{10}$.

Greenwich Power-station Staff.—The *Times* announces that at the joint request of the London County Council and the workmen concerned, Sir George Askwith has appointed the following Court of arbitration to decide a claim for a reduction of hours at the Greenwich electricity generating station:—Mr. E. Moon, K.C. (chairman), Sir A. Kaye Butterworth, Mr. T. L. Devitt, Mr. W. Brace, M.P., and Mr. A. H. Gill, M.P.

A New Association.—At a meeting held in London on Wednesday last week, it was decided to form an "Association of Managers, Supervising Engineers and Permanent Foremen attached to the Electrical Contracting Trades." There was a very large attendance, and every gentleman that attended the meeting enrolled himself as a member of the Association. The preparation of rules for the general working of the Association was left in the hands of a committee, which will report to a general meeting to be held in about a month's time. It was settled however that foremen would have to be employed in the electrical contracting trade for a certain period before being able to become members; in the same way, supervising engineers also must have been employed in the electrical contracting trade for a certain period during part of which they must have been actually supervisors of work.

The objects of the Association are:—

(*a*) To assist members in obtaining information of situations.

(*b*) To form a technical library for the use of members.

(*c*) To form a benevolent fund for the assistance of members in distress.

(*d*) To endeavour, by means of lectures and visits to large works, to maintain a high standard of efficiency of all members.

(*e*) To foster the apprentice system for learners in the electrical trade.

(*f*) To endeavour to extend the attendance of electrical workers at evening schools, both technical and practical.

(*g*) To arrange for the reading of papers on electrical subjects by members or visitors invited from other societies.

(*h*) To arrange periodical social gatherings to promote knowledge and good fellowship amongst members.

The entrance fee is 5s., and the subscription 2s. 6d. per quarter, payable in advance. Applications for membership should be addressed to the hon. secretary, Mr. C. J. Banister, 14, Pulborough Road, Southfields, S.W.

Electricity Supply in China.—At a recent meeting of the Engineering Society of China, it was decided to appoint a committee to consider and discuss the standardisation of system or systems of electricity supply in China, with a view to placing recommendations before the proper Government authorities, officials of foreign settlements, holders (present and prospective) of concessions for the supply of electricity, and the various engineering firms concerned. In view of the multiplicity of voltages, frequencies and systems in use in other countries, it seemed both desirable and possible to choose a single low-tension system for domestic supply and one or a relatively few systems for generation and transmission.

It may possibly be found that a single L.T. system may be too ideal in aim, but it is the object of the Committee to reduce, in any case, the alternatives to the absolute minimum, bearing in mind that the cost of mains should be kept down to the lowest value consistent with efficiency; which means that use must be made of the highest L.T. pressure consistent with safety in operation.

If the Committee succeeds in obtaining official recognition (and there is every prospect that it will) of a single L.T. system, the following advantages will be secured:—

1. Buyers of electrical plant will receive tenders on a comparable basis.
2. The possibility of interconnecting different systems and the consequent use of large bulk supplies, which is almost impossible in many of the larger European cities.
3. Minimising the variety of electrical stock, such as lamps, meters, motors, transformers, and general supplies, kept at the trading centres.
4. The interchangeability of consumers' appliances.

The Committee hopes that the publication of this statement will lead to such discussion and support as will assist it in its work. The Secretary of the Electricity Standardisation Committee, from whom we have received the foregoing particulars, is Mr. R. A. Williams, and his address is the Municipal Electricity Works, Fearon Road, Shanghai.

Copper.—The first fortnight of March sees prices of standard again lower, and a continuation of the steadiness in visible supplies which has been a leading feature of the situation since last September. In the face of the exceptionally high consumption of last month, the maintenance of the visible supply figure is the more remarkable. For mid-March, as shown by Messrs. Merton's circular, European visible supplies stood at 26,755 tons, a decrease of only 198 tons since the end of February. English stocks, at 10 488 tons, show an increase of 89 tons over the figures for the end of last month. With regard to actual supplies for the fortnight, arrivals from North America are lowish, from Spain and Portugal to England and France a very small quantity, Chile being, however, well above average, and Australian shipments nearly up to average.

American stocks for the end of February were given as 34,987 tons, a reduction of 3,984 tons on the quantity for the end of January. The world's supply at the end of February had attained the very respectable figure of 61,940 tons, a reduction of 2,975 tons on the quantity for end of January, or considerably less than the drop in American supplies. The world's visible supplies are now higher than they were last August, though lower than the quantity for the end of December—which is, as being the last item in calculating the figures for the year, likely to include stocks which might otherwise be considered in suspension.

The E.T.B.I.—At the annual dinner of the Electrical Trades Benevolent Institution, on Wednesday next, March 25th, Mr. Wordingham and Mr. Faithfull Begg will be the vice-presidents.

The annual meeting of the Institution was held on Wednesday afternoon, Mr. A. B. Anderson in the chair. The report was adopted. We shall give an account of the proceedings next week.

Electric Interlocking of Motor Operation.—The wiring scheme shown herewith permits of the interlocking of any number of electric motors which are intended to be operated simultaneously, the arrangement being such that if one motor oil switch in the system opens, all the rest will automatically open likewise. This feature of motor control is provided by reconnecting in the manner shown the overload and no-voltage relays which are regularly furnished with oil switches. A, B and C represent the three legs of a three-phase motor circuit. Across one pair of these legs is connected a series circuit consisting of all the relay contactors, a series resistance and the no-voltage coil of the main feeder switch. The no-voltage coils on the motor oil switches are also connected in series with definite resistances as shown, while the overload relay coils are connected in the usual manner. Any relay contactor, upon opening, will thus trip the no-voltage relays of the other motors, either directly or indirectly, by first tripping the main oil switch. The scheme described is in use in the Commercial Milling Co.'s flour mill at Detroit, Mich., where the satisfactory production of flour depends on the simultaneous operation of all the machines in the system. The resistances shown in series with each no-voltage relay coil were inserted in the case mentioned, since these coils were not designed to operate on 440 volts, the difference of potential between the feeder legs. If the scheme shown is applied to a system containing several motors, it will be advisable to connect E, F₁, F₂, &c., to a separate operating bus energised by a small step-down transformer connected across one phase. If this were done, no energy would be wasted in resisters, and the contactors which are exposed on the oil-switch panels would not be carrying a fatal voltage.—*Electrical World.*

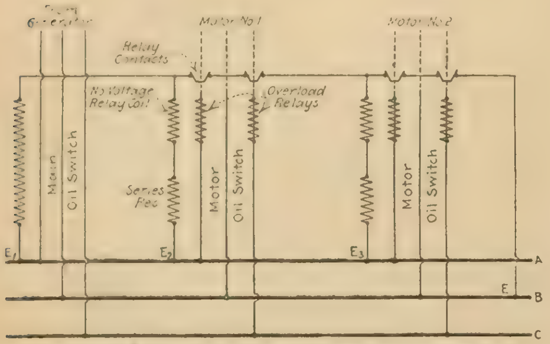


Diagram of Connections for Interlocking Motor Controllers.

A Preliminary Examination.—A correspondent who recently replied to an advertisement in our pages was staggered by the receipt of a long letter in reply, which disclaimed any intention to get information on the cheap, but contained an enclosure posing over 40 questions, mostly of a technical nature, and necessitating an intimate acquaintance with the details of the device to which they related. The questions ranged over the whole subject from the fundamental design, through the workshop organisation to the final installation, and concluded with a number of inquiries of an intimately personal character. We have never before seen anything to compare with this extraordinary catechism, which carries with it no guarantee of engagement or even of a fee for the valuable information that would be received, not only from the successful candidate but also from the many who failed to obtain preferment.

The firm may be acting in perfectly good faith, but such eccentricities are not calculated to inspire confidence in the aspirant to advancement, and we cannot but regard them as objectionable in the extreme.

Improved Glow Lamps.—Nitrogen-filled metallic-filament lamps are now being sold on the Continent for low voltages, down to quite small candle-powers, and are in use on motor-cars in the smallest sizes. It is understood that similar lamps of small candle-power for ordinary lighting voltages will shortly be on the market in Germany. Lamps of 25 watts at 120 volts have an alleged efficiency of ⅝ watt per hefner (0·74 watt per C.P.); 50-watt lamps are sold for voltages up to 260 volts. It is, however, very questionable whether the efficiency of the newer lamps is really much better than that of the ordinary metallic-filament lamps, though the strength of the filaments may be greater, the filaments of the former being shorter and thicker, and run at a higher temperature, than in the case of the latter. The greater downward concentration of the light from the nitrogen-filled lamps gives them an advantage in respect of mean hemispherical C.P., which is not realised in respect of the mean spherical C.P.

Shock by Umbrella.—It is reported from New York that the tip of an open umbrella in the hands of W. H. Heuscher touched a low hanging electric lamp while he was walking through the rain to his home in Jamaica, L.I., and Heuscher was shocked to death by the current which passed down the steel umbrella rod. The New York and Queens Electric Light and Power Co contended that Heuscher's death was due to his own carelessness, but a jury decided otherwise and awarded $7,000 damages to his widow.

Fatalities.—An inquest was held at Tyne Dock, on Friday, touching the death of Samuel Beck, a labourer, who was killed the previous day whilst working on the timber stacks of Messrs. Pyman & Bell.—Henry Bass, labourer, deposed to ascending a stack where he found deceased lying on his left side with an electric wire under his neck and two across his body. Witness pulled him away, but he died a moment later. His right hand was grasping one wire. The wires were used for driving the sawing machines. When standing up Beck would have them 2 or 3 ft. above his head.—John Henry Morley, yard foreman, advanced the theory that deceased overbalanced himself and instinctively clutched at a wire. After the accident one of the poles supporting the wires was found to be leaning towards the timber stacks and to be cracked near the ground.—Robert Harding, in charge of the electrical plant, said that when he was called in after the accident he found the wires sagging to the extent of about 6 ft., and he thought that some weight must have been put upon them to bring them down.—In reply to Mr. W. B. Lauder, H.M. factory inspector, witness said he considered the wires safe, but agreed that there would be less risk if they were insulated or otherwise protected. The jury found that Beck had died of electric shock received while at work, but expressed no opinion as to the manner in which he had come in contact with the wires.

At Skinningrove, on Friday, an inquest was held concerning the death of Jonas Edwards (28), an electric overhead crane driver, who was killed on the previous Wednesday night while following his employment at the Skinningrove Ironworks.—Evidence adduced was to the effect that the crane upon which deceased was working was used to lift steel into trucks from the hot bank. About 5 o'clock on Wednesday there was no response to signals, and upon a workman climbing into the "crab" he saw Edwards lying over the rope drum in an unconscious condition. He had a grease pot in his hand as though he had been greasing the machinery, and his left hand, which was burnt to the bone of the fingers, was near the limit switch. The current was quickly switched off and artificial respiration tried for half an hour without effect.—James Drury, electrician, said the machinery would require greasing about once a day. Before greasing, the main switch should have been knocked off, as it was dangerous to do the greasing with the switch on. He thought deceased realised the danger, as when doing repairs witness always first directed him to knock off the current. Edwards had apparently stumbled and grasped at the switch in falling. Mr. A. F. Dunolly, H.M. factory inspector, said he could suggest nothing to prevent a similar accident. All depended upon the human element.—A verdict of "Death from accidental electrocution" was returned.

A verdict of "Accidental death" was returned at an inquest held at St. Helens (Lancs.), on the body of John Joseph Robinson, aged 30, an electrician at Messrs. Evans's foundry, Haydock. He was assisting in the unloading of a telegraph pole from a lorry when his head was crushed by the pole, death being due to laceration of the brain.

An inquest was held at Manchester on Tuesday, on James Herbert Hepworth (26), of Stretford, who died as the result of an accident on Sunday at the works of the British Westinghouse Co., Trafford Park. From the evidence, it appeared that deceased, who had been employed in the electrical section for two years, was instructed to put a piece of wood on a dead conductor. Hearing a cry, an electrician saw Hepworth holding a live conductor with his left hand, his feet resting on an iron girder 4 ft. from the ground. Mr. Nicholson, chief tester, said Hepworth's instructions were to make a terminal for a part of the test which was dead. The conductor which was dead was the same size as the one which was alive. He could not account for the accident, unless deceased was forgetful, or unless he thought the current was off. He would, of course, know that the current was continually being put on and off. Deceased had no right to be at the place where the accident happened, and there was no reason why he should be there. Medical evidence showed that death was due to paralysis of the heart, which had been greatly distended, and was due to the passage of a strong electric current through the body. A juryman suggested that some means might be used by which a workman would know that the current was on. Mr. Pollard (H.M. Inspector of Factories) said there ought to be something to distinguish the live conductor from the dead, but nobody had found out anything to do that. A verdict of "Accidental Death" was returned.

The Staff Engineers' Association.—The Association has recently published a small pamphlet which gives the objects and rules of the Society, which is being established to further the economic interests of its members, and to promote in public and commercial circles a higher sense of the rank of the engineering profession. The annual subscriptions are 20s. and 15s. respectively for members above and below 30 years of age. Copies of the booklet can be obtained on application to Mr. L. H. Fletcher, hon. secretary, Staff Engineers' Association, 31, Queen Victoria Street, London E.C.

Manchester Electro-Harmonic Society.—This Society will hold its last concert this season in the Marble Hall, Albion Hotel, Piccadilly, Manchester, to-night (Friday). The artistes will be:—Baritone, Mr. L. A. O'Brien; bass, Mr. Frank E. Dyer; entertainers, Mr. J. Foster Kershaw and Madame Helena Cecile; accompanist, Mr. W. J. Smith.

Freemasonry.—A meeting is to be held to-day at Anderton's Hotel, Fleet Street, E.C., at 5 p.m., to discuss a proposal to form a new Lodge confined to the electrical and engineering professions; those who are interested are invited to be present.

The General Electric Co., Ltd.—ANNUAL DINNER.—On Saturday last the twenty-second annual dinner of the General Electric Co., Ltd., took place at the Trocadero; Mr. H. Hirst presided, and there were present some 600 members of the staff and guests, the latter including a large number of representatives of the Oversea Dominions, eminent engineers and contractors, and members of scientific and commercial societies.

After the loyal toasts, the CHAIRMAN proposed "Electrical Industries within the Empire." Remarking that two years had elapsed since their last meeting at dinner (last year the company gave an entertainment in the Opera House), he said that in the interval the General Electric Co. had shared in the general prosperity, and had increased all their works, their staff and the number of their employés, for whom they were erecting very large club buildings; they had also started, in conjunction with friends, a new works at Southampton, to manufacture cables, the only electrical commodity which they had not previously produced themselves, and when these works were finished they would be one of the few firms that made "everything electrical"—the only one in the British Empire. They were not yet as big as their foreign rivals, which had started as great corporations, whereas the English company had begun in a small way, but they looked forward to making up the deficit in the comparative account. They had continued the policy of establishing branches in the Dominions oversea, and had recently started a new organisation in Toronto with a large staff of trained men. They were about to concentrate their London offices in a large building in Kingsway, the erection of which, unfortunately, was delayed by the strike. Looking ahead for 20 years, Mr. Hirst emphasised the importance of the Empire to electrical engineering, and the services rendered by the latter in binding the Empire together with the telegraph cable; he believed that in time the cost of messages by cable to the Colonies would come down to 2s. 6d. or 1s., not per word, but per message, that Dr. Ferranti's ideal would be achieved, and electricity would be supplied to the whole of the kingdom from 20 or 30 large stations at ⅛d. per unit, and that the speeding-up of locomotion would bring Quebec within 3½ days' travel, and Sydney within a fortnight. The only obstacle was the financial one. An Imperial Parliament with representatives from all parts of the Empire would then be possible, and there should be one common law, one patent law, one coinage, and uniform weights and measures throughout the Empire.

Replying to the toast, MR. L. S. AMERY, M.P., humorously drew an analogy between the House of Commons and electrical phenomena, and advocated reform in Parliamentary methods, together with the creation of a Parliament for the Empire. He urged that trade should not be dispersed at random like a wireless message, but should be guided to this country as by a submarine cable.

SIR JOHN MCCALL, Agent-General for Tasmania, also replied, and described the important progress that was being made in developing the natural water-powers with which that State was richly endowed. He then proposed the toast of "The General Electric Co.," which, he said, employed over 10,000 hands, had paid a regular annual dividend, and was the largest purely British company in the United Kingdom. Its success he attributed largely to skilful management, by which the loyal co-operation of the employés was secured; the company took a keen interest in the welfare of its employés, and had not abandoned the "Sick Fund" on the inauguration of the Insurance Act. He urged that the Government should support the company's carbon works—the only one of the kind in the country, on which we should be dependent for the supply of searchlight carbons in time of war. His own instructions were to call for tenders in the United Kingdom when contracts were to be placed, not to go on the Continent. He congratulated the company on the wise policy of starting subsidiary companies in all the Dominions, and pointed out the immense importance of the markets of the Empire to British manufacturers.

MR. M. J. RAILING responded to the toast, and dwelt upon the importance of training men for responsible positions by doing away with watertight compartments between the various departments, and by providing for the interchange of commercial and engineering talent. He advocated the linking-up of the educational institutions throughout the Empire on a co-operative basis, and concluded by proposing the toast of "Scientific Institutions."

MR. W. DUDDELL, President I.E.E., responded, saying that the objects of those institutions were, first, to increase the common store of knowledge; and, secondly, to organise knowledge, to set up a standard of engineering knowledge second to none, so that this country should lead the world in engineering. DR. ALEX. RUSSELL also responded, saying that no one had done more than the chairman for the advancement of scientific training in this country. He (the speaker) sent many students to Witton Works, and they all easily got good posts afterwards.

MR. L. G. BYNG proposed "Our Guests" in a brief speech, to which the HON. J. G. JENKINS and MR. E. MANVILLE replied. Lastly, MR. A. J. WALTERS, K.C., proposed the health of the chairman, referring to the necessity that a business man should have the gift of imagination and a profound knowledge of men—qualities which Mr. Hirst possessed to a marked degree. The toast was accorded musical honours, and MR. HIRST, briefly acknowledging the compliment, invited the guests to drink to the staff of the General Electric Co. and their colleagues in distant lands.

A programme of music was performed by the Blue Austrian Band during dinner, and a concert followed the speeches.

Inquiries.—A correspondent asks:—What is the best material for making the second layer of vulcanised rubber black?

The makers of "Clemitite" insulating material are asked for.

Institution and Lecture Notes.—INSTITUTE OF MARINE ENGINEERS.—On Monday last week a paper was read by Mr. J. Veitch Wilson on "Liquid Fuel."

HEAVY RAILWAY ELECTRIFICATION.—In a lecture delivered before the chairman and officers of the Brighton Railway Co. last week, Mr. Philip Dawson outlined the recent progress in heavy railway electrification in America and Europe. He referred particularly to the electrified freight system of the New York, New Haven and Hartford system, which at Harlem River terminal handled 65,000 freight cars (1,270,000 tons) during November last. Nearly 600 miles of electrical track, 100 locomotives and 7[illegible] motor coaches are in use. The local official opinion was all in favour of electrical in preference to steam working, and one electric locomotive had been at work continuously for 24 hours per day for 16 consecutive days, with three shifts of men. The New York Central also had some 34 miles electrified, and used 63 locomotives, while the Pennsylvania, which owned the Long Island system, had a very extensive electrical system, and was considering the question of electrifying the 230-mile section from New York to Washington. After touching briefly on tunnel electrifications, the speaker referred to the Butte-Anaconda mineral railway electrification and others on the American Continent. In Europe the Prussian State Railways had electrified some 400 miles of main line, while in Austria nearly 250 miles of similar line were in operation. The lecturer, after referring to heavy railway electrification in Switzerland—some 160 miles of line—concluded by an appreciation of the pioneer work of the Italians, who were contemplating electrifying 1,500 miles of the State railways, and reference to the work of the Midi Railway in France, which was converting 500 miles of track.

CAMBRIDGE.—A lecture and demonstration of various processes of electric welding was given at the Engineering Laboratories, Cambridge, on the 12th inst., by Mr. Reginald J. Wallis-Jones, before a large audience of the Cambridge University Engineering Society, Prof. Bertram Hopkinson being in the chair. Some interesting experiments, lantern slides and samples of welding work were shown.

INSTITUTION OF ELECTRICAL ENGINEERS.—At the meeting of the Birmingham Local Section, on Wednesday last, a discussion was held on "Electric Battery Vehicles," the introductory notes being by Mr. F. Ayton.

Appointments Vacant.—Shift engineer (32s. 6d.), engine driver (31s.), for Gillingham (Kent) Electric Light and Power Department; assistant storekeeper for Shanghai Municipal Electricity Department (£20 month); assistant electrical engineer for Worthing Corporation (£140); plumber-jointer for Municipal electricity undertaking, Singapore ($175 per month). Particulars are given in our advertisement pages.

Radium in Canada.—It is reported that pitchblende has been discovered in a mining district of Ontario.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—We referred in our issue of February 20th to a recommendation of the Ipswich E.L. Committee that MR. AYTON should have a bonus of £100 for the past year, and a similar amount for 1914. The Council, however, by a unanimous vote altered the recommendation of the Committee to a permanent increase of salary from £600 to £700 per annum instead of a bonus, the increase to be retrospective to April 1st, 1913.

On Wednesday the Salford Corporation Electricity Committee selected MR. H. RICHARDSON, of Dundee, for the appointment of city electrical engineer, at £1,000 per annum. Mr. Richardson has been at Dundee for ten years.

MR. R. J. B. BENSON has resigned his position of charge engineer at the Swansea generating station.

The Aberdeen Corporation has decided to grant an increase of £50 on the salary of MR. J. A. BELL, the city electrical engineer, whose present salary is £700 per annum.

The Glasgow Electricity Committee has recommended that three of its members, along with the electrical engineer, should represent the department at the Convention of the Incorporated Municipal Electrical Association, in Birmingham, from June 15th to 20th next.

MR. ARCHIBALD PAGE, chief assistant electrical engineer at Glasgow, was on the short leet of applicants for the appointment of electrical engineer for the Burgh of Salford, but the Glasgow Electricity Committee expressed the opinion that in view of the large extension of the generating plant to be undertaken in connection with the new generating station at Dalmarnock, it was very desirable that the services of Mr. Page should in the meantime be retained by the Corporation. The Committee having considered the statements made by the convener and the engineer, as to the necessity of retaining Mr. Page's services, and as to his willingness to remain in the employment of the Corporation for a period of years, recommended the Corporation to increase his salary from £650 to a maximum of £800 per annum by annual increments of £25.

MR. C. E. DAVIS, mains superintendent, at Erith, has been appointed to the position of mains superintendent to the Hammersmith Council, at £150 per annum. There were 35 applicants for the position.

The Shoreditch B.C. Law and Establishment Committee reports that the motion for an increase of the salary of **Mr. Russell**, borough electrical engineer, from £600 to £750 per annum was not carried, in consequence of an equal number of votes being given for and against.

The Stoke Newington General Purposes Committee recommends the following increases of salary to officials of the electricity department:—**Mr. S. Hann**, electrical engineer, £270 to £280 per annum; **Mr. H. Large**, first station assistant, £120 to £130; **Mr. E. G. Mackenzie**, second station assistant, 37s. 6d. per week to £2, **Mr. A. H. Gay**, third station assistant, from 33s. to 35s.

Tramway Officials.—The Colne Corporation has appointed **Mr. T. G. Richardson**, assistant manager of the Bradford city tramways, to the post of tramways manager.

General.—**Mr. Herbert Broadbent**, electrical engineer to the Corporation of Perth, West Australia has just left this country on his return to Australia, having completed the arrangements in connection with the conversion of his undertaking to A.C. supply, in conjunction with the Government of Western Australia.

It is reported that **Mr. H. L. Cooper**, who designed the Mississippi dam at Keokuk, Iowa, has been asked to advise the Egyptian Government regarding the utilisation of the power of the Assouan Dam.

It is stated that the Leeds Corporation Committee, which has been considering the question of municipal labour since the strike of last year, recommends that all committees employing labour shall merge into one, and that the tramways, cleansing and highways departments shall all be controlled by **Mr. J. B. Hamilton**, the Corporation tramways manager, whose salary shall be advanced from £1 000 to £1,500 per annum.

On Saturday last at Glasgow **Sir W. Beardmore** Bart., was presented with an illuminated address by his employés in Parkhead Forge, Dalmuir, and Mossend. Lady Beardmore was presented with an antique silver epergne and a bouquet. It was announced that the King and Queen had arranged to visit the works at Dalmuir and Parkhead in July.

Mr. George Balfour, prospective Unionist candidate for Govan, addressed a crowded meeting in the Cinema Picture House last Friday on the subject of Ulster's resistance to Home Rule.

Mr. Alan Lee, who was engineer-clerk-of-the-works with Messrs. Handcock & Dykes, consulting engineers, has been appointed constructional engineer on the outside staff of the British Insulated and Helsby Cables, Ltd., Prescot.

Mr. W. A Davis is resigning his position with Messrs. Edmundson's Electricity Corporation, Ltd., on the 21st inst., to take up a position as manager for the Adnil Electric Co., Ltd., at their new branch at 25, Victoria Street, Westminster, which will be opened on March 30th. He will also be representing Messrs. Edwards Bros., of Birmingham, fittings makers, at the same address.

The marriage took place at Darlington on March 12th of **Mr. John Leggot**, of Messrs. Merz & McLellan, and Miss Aline Bartlett, youngest daughter of Alderman J. W. Bartlett, J.P., of Darlington.

Mr. J. Arthur Sykes, M.I.E.E., chief electrical engineer to Messrs. Wm. Beardmore & Co., Ltd., Parkhead Forge Steelworks and Ordnance Factories, Glasgow, has received the appointment of assistant to the general manager; and **Mr. J. Prentice**, superintendent of sub-stations, Glasgow Corporation Electricity Department, has been appointed to the vacant post.

Mr. J. J. Chiswell, of the firm of Chiswell & Co., buying agents, Craven House, Kingsway, is shortly leaving London on a business tour through Canada. He would be pleased to hear from manufacturers interested in the Canadian trade.

Mr. W. Vincent Waite has severed his connection as joint managing director with Messrs. Broom & Wade, Ltd., engineers High Wycombe, and requests that all communications be addressed to his private address, "Dunoon," West Wycombe Road, High Wycombe.

The following appointments have been made at the Borough Polytechnic Institute:—Chief assistant in Electrotechnics Department—**Mr. George A. Tomlinson**, B.Sc., vice **H. S. Saunders**, appointed responsible master to a L.C.C. Junior Technical Institute; assistant in Engineering Department—**Mr. George W. Bird**, B.Sc., vice **A. E. Gladwyn**, B.Sc., appointed to West Ham Technical Institute.

Obituary.—**Mr. John Gott.**—In our last issue we were only able to refer very briefly to the work of the late Mr. Gott, who passed away at Brighton on the 8th inst. The death of this gentleman, which followed on an attack of pleurisy and pneumonia, has been heard of with deep sorrow by telegraph engineers and electricians all over the world. Mr. Gott was one of the few remaining pioneer submarine cable engineers, and the value of his work in electrical testing and practical telegraphy is widely known, while his genial disposition endeared him to all who were associated with him. Mr. Gott was born at Kendal, Westmorland, England, in 1840, and entered the telegraph service early in life. His first employment was with the Electric and International Telegraph Co. About the year 1861 he was selected to serve at Naples, Italy, in the supervision of international traffic passing over the Italian Government landlines. In 1863 he went to Tripoli, where he was employed in the operation of the first Mediterranean cable, later going to Malta on the same work. In the year 1864 he was selected to accompany the steamship *Great Eastern* as one of the electrical staff when that vessel made her first attempt to lay a trans-Atlantic cable. In 1869 he accepted the position of superintendent and electrician at St. Pierre, Miquelon, when the cable of the first French Atlantic Cable Co. was laid. Mr. Gott was one of the first men to work the mirror galvanometer for transmitting submarine cable messages and the first to install Lord Kelvin's siphon recorder. In the year 1870 he carried out a unique experiment by which he transmitted wireless signals through a distance of about 3 miles at St. Pierre, Miquelon, using the earth as a conductor. In the same year he invented an instrument which he called a "Fault-Searcher Coil," which has proved extremely useful in the localisation of faults in subterranean lines; this fascinating invention led to devising a means for communicating between ship and shore through a picked-up cable without cutting the cable or disturbing the sheathing wires. In 1877 in a paper to the *Journal* of the Society of Telegraph Engineers, London, he described an ingenious experiment that he had carried out in telephonic transmission by means of a siphon recorder, in support of the theories of Prof. Bell's telephone invention which had only shortly before that been made public. In the year 1881 he introduced an important modification of Lord Kelvin's formula in connection with the measurement of the electrostatic capacity of condensers and cables, and the value of this method has been so well recognised by submarine cable engineers that it is now used as a standard test and is known as "Gott's capacity test." In 1884, upon his retirement from the French Cable Co.'s service, he became chief electrician of the Commercial Cable Co., which position he held until his death. In 1892 he made another important invention, which is known as the "Gott Ratio Arm." His method made it possible to avoid the necessity for temperature corrections for the resistance of Wheatstone bridge coils in tests by introducing coils of manganin for one of the ratio arms. It also made it possible to obtain measurements in modern units by means of a bridge wound to discarded standards. Mr. Gott's crowning success, however, was his recent invention, described in our other pages to-day, whereby he made possible direct communication between the Pacific coast of the United States and Canada, and Europe, without the aid of human retransmission at intermediate stations. This fitting climax to his long career is acknowledged to have been the greatest triumph in telegraphy in the present century: by its means cables and landlines can be linked up together, and the ordinary Morse method of operation used. He also latterly invented a new and improved system of quadruplex working. Being a man of retiring disposition and great modesty, there is not so much on public record of his accomplishments in submarine cable telegraphy as there should be, but he was always ready to assist those who sought his advice, and his advice was always that of a man of sound judgment, ripe experience and kindly purpose. As chief engineer of the Commercial Cable Co., it fell to his lot to examine many proposed improvements and to take part in many expeditions ashore and afloat. He was a deep student of submarine telegraph engineering problems, and had no peer in the testing and localising of faults and breaks in submarine cables. He made some valuable suggestions for extending, in electrical testing, the use of curve sheets in the application of graphic methods to the localisation of cable breaks. These suggestions were adopted and are largely used to day. In the pursuit of his scientific researches he was restless and untiring, and at times he became so absorbed in his work that he often forgot both food and sleep. His death is a great loss to the telegraph profession, as well as to his many personal friends.

Prof. E. J. Houston.—We learn with great regret of the death, which occurred at Philadelphia on March 1st, from heart disease, of Prof. Edwin J. Houston. The name of Houston has long been one of the household words among electrical students and engineers all the world over, as that of an eminent teacher, writer, expert and inventor. He was one of the inventors of the Thomson-Houston arc lighting system, was for three years president of the American Institute of Electrical Engineers, chief electrician to the World's Fair, Chicago, author of a number of text-books, and editor of an electrical dictionary. The American *Electrical Review*, just to hand, in the course of a brief obituary, states that he was Emeritus Professor of Physics at Franklin Institute, Professor of Physics at the Medico-Chirurgical College, and a member of the American Institute of Mining Engineers and the American Philosophical Society. For many years Prof. Houston occupied the chair of Natural Philosophy and Physical Geography in the Central High School of Philadelphia. He was in his 68th year.

Mr. Samuel Hartford.—We deeply regret to record the death, which occurred in the General Hospital in Montreal on February 3rd, after a short illness from bronchial pneumonia, of Mr. Samuel Hartford, who was well known to many men in the cable section of the electrical trade. For many years the deceased gentleman was in the employ of Messrs. W. T. Glover & Co., Ltd., as traveller and secretary. Later he was connected with the formation of the Liverpool Electric Cable Co., Ltd., and Samuel Hartford & Co., Ltd., cable manufacturers, of Liverpool. It was after the last-named company went into liquidation that Mr. Hartford went to Canada in May last year. He leaves a widow, and three children all under five years of age, and his death was quite unexpected.

Mr. George Westinghouse—By the death of Mr. George Westinghouse we have lost one of the great world leaders of the electrical industry. On both sides of the Atlantic he was well known by reason of his large interests in electrical manufacturing, and his inventions in electrical, gas engine, air-brake, railway signalling and other departments. He was born in Schenectady 68 years ago, and he passed away suddenly in New York on March 12th. For several years, it will be remembered, he presided in London over the annual meetings of the British Westinghouse Electric and Manufacturing Co., of which he was chairman. We hope to refer to his life and career more fully in a later issue.

Mr. W. Chipper.—An inquest was held at York on March 11th into the cause of death of Mr. Walter Chipper, traffic manager of the city tramways. Mr. Chipper, who had generally enjoyed good health, awoke on the previous morning and complained of pains in his head. A doctor was sent for, but in the meanwhile Mr. Chipper died. The medical evidence attributed death to heart disease, and a verdict was given to that effect. Since the installation of the electric tramways in the city Mr. Chipper had been traffic manager, having been previously manager of the horse tramways. He was a native of Woolwich, where for some years he was manager of the tramways.

Wills.—The late Mr. Salomon Falk, managing director of Messrs. Falk, Stadelmann & Co., Ltd., left estate valued at £122,133 gross.

The late Mr. Marcus Zambra (of Negretti & Zambra) left £81,609 gross and £80,197 net personalty.

NEW COMPANIES REGISTERED.

Bishop's Castle Electric Light and Power Co., Ltd. (134,515).—This company was registered on March 13th, with a capital of £2 500 in £1 shares, to carry on at Bishop's Castle and elsewhere in the county of Shropshire, the business of an electric supply company, to take a transfer of the rights, privileges, liabilities and obligations conferred or imposed upon H. O. H. Wenman by an agreement between himself and the Corporation of Bishop's Castle. The subscribers (with one share each) are:—G. W. Summers, Penn Fields, Wolverhampton, gentleman; F. S. Turner, Woodlands, Dudley, manufacturer; F. H. Hendle, Oaks Crescent, Wolverhampton, printer; H. Donaldson, Heath Hayes, Cannock, secretary; H. O. H. Wenman, 42, Lichfield Street, Wolverhampton, consulting engineer; D. E. Campbell, 79, Lichfield Street, Wolverhampton, incorporated accountant; F. R. W. Hayward, 65 Lichfield Street, Wolverhampton, solicitor. Minimum cash subscription, 700 shares; the number of directors is not to be less than three or more than seven; the first are G. W. Summers, F. S. Turner, F. H. Hendle, H. Donaldson and H. O. H. Wenman; qualification, £25. Registered office, 79, Lichfield Street, Wolverhampton.

Frederick Hillier, Ltd. (134,553)—This company was registered on March 13th, with a capital of £500 in £1 shares, to carry on the business of electrical engineers, exhibition show-case fitters and general contractors. The subscribers are:—F. Hillier, 89, Malvern Road, Kilburn, N.W., builder, &c., 100 shares; L. Franklin, 11, Belfast Chambers, Regent Street, W., merchant, 25 shares; J. Bruce, 11, Southampton Row, W.C., accountant, 10 shares. Private company. Table "A" mainly applies. Secretary, J. Bruce. Registered office, 11, Southampton Row, Holborn, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

City of Oxford Electric Tramways, Ltd.—A memorandum of satisfaction in full on February 23rd, 1914, of debenture dated February 18th, 1910, securing £55,000, has been filed.

British and Colonial Lighting Co., Ltd.—A memorandum of satisfaction in full on February 26th, 1914, of debentures dated May 12th, 1909, June 25th, 1912, and February 14th, 1913, securing £7,000, has been filed.

Electro-Flex Steel Co., Ltd.—Issue on March 7th, 1914, of £7,000 debs., part of a series of which particulars have already been filed.

Pernambuco Tramways and Power Co., Ltd.—Issue on February 26th, 1914, of £100,000 debs., part of a series of which particulars have already been filed.

Church Stretton Electric Supply Co., Ltd.—Mortgage dated March 5th, 1914, to secure £550, charged on land with generating works thereon at Crossways, Church Stretton, and a Provisional Order. Holder: E. Bond, 43, Thorloe Square, South Kensington.

Wellingborough Electric Supply Co., Ltd.—Issue on March 3rd, 1914, of £1,000 debs., part of a series of which particulars have already been filed.

CITY NOTES.

Jarrow and District Electric Traction Co., Ltd.

The directors' report for 1913 shows a total revenue of £7,733, an increase of £501. After deducting all expenses chargeable to revenue, including interest on debentures and loans, and making a provision of £800 for renewals, there remains a surplus of £2,458, plus £843 brought forward. There is placed to reserve £1,025, a dividend on the ordinary shares at the rate of 2½ per cent. for the year absorbs £1,249, and £1,028 is carried forward. The shipbuilding industry in the district was satisfactory during the year, and the traffic receipts consequently show a gratifying increase.

The Northern General Transport Co., Ltd., which was formed with the object (*inter alia*) of carrying on and developing in the Northern Counties transport business in all its branches, made an offer to all the Shareholders of the Gateshead and District Tramways Co., the Tynemouth and District Electric Traction Co., Ltd., and this Company respectively, to exchange their holdings for fully paid holdings in the Transport Co. on the terms contained in a letter dated 12th December, 1913, from the Transport Co.

Holders of 99 per cent. of the total issued share capital of this Company have accepted the Transport Co.'s offer to exchange shares.

The annual meeting was held on Thursday last week at the Electrical Federation Offices, Kingsway, Mr. Geo. J. Somerville presiding. In moving the adoption of the report the Chairman said the total revenue for the year had amounted to £7,733, which was an increase of £501 over that of the previous year. They had made provision amounting to £800 for renewals, which compared with [illegible] a year ago, and they proposed that the balance, amounting to £3,301, should be applied as follows: £1,025 to the reserve fund, £1,249 in payment of a dividend on the ordinary shares at the rate of 2½ per cent. for the year, leaving £1,028 to be carried forward. The dividend was ½ per cent. in excess of that paid last year, and the amount carried forward was £185 more. The company was in a very sound position, and it was to be hoped that the increases made last year would be continued in the future.

Mr. H. S. Day seconded the motion, and the report was adopted.

Oxford Electric Co., Ltd.

The annual meeting was held on March 6th at Oxford. Sir Henry Mance, in his financial memorandum, read by the Secretary, said that the capital expenditure under the heading engines and boilers was chiefly due to the two new Babcock boilers and steam piping, which cost about £1,500; 150 services to new consumers cost nearly £1,000; moving the substation from George Street to Red Lion Square cost £415 for mains, and the duplicate h.t. mains to Walton Street substation cost £632. Nearly 40 new consumers were on a hire-purchase arrangement. The total capital expenditure of the year was £8,400, and as there was no finality in the capital account of an electric light undertaking it would be necessary to create fresh capital to meet or partially meet the expenditure of the next few years. At present, after allowing for the writing off of obsolete plant, the capital account was overdrawn to the extent of £16,817. As regards revenue account, thanks to the Diesel engine, the increase in the fuel bill was trifling, although coal was higher, and they had generated an additional 70,000 units.

Mr. Francis, the Chief Engineer, then gave an account of the engineering work done during the year. The new substation had been designed to accommodate all reasonable extensions that might be expected in the future, and would accommodate the Broad Street battery, which would be transferred as soon as the lease of the Broad Street premises expired. Two new boilers, while occupying the same space, were nearly double the capacity of those displaced. The average price of coal per ton during 1913 was 8.9 per cent. over that of the preceding year. The cost of fuel oil had increased 55 per cent., but this did not affect the fuel figures for 1913 as they were still using oil obtained under the old contract at a much more favourable price. They endeavoured to hold a stock of coal which, with all supplies cut off, would last about one month in the winter and two and a-half months in the summer. In addition, a stock of fuel oil was carried for the Diesel engine which would enable the winter stock of coal to last about a further three weeks and extend the summer period to about four months. The final test of the Diesel engine was taken in April, 1913, the result being quite satisfactory. Since that date till the end of the year, the engine ran a total of 2,544 hours. It generated during the year 26.6 per cent. of the total units, a lower percentage than would have been the case but for the curtailing of the running of the engine on account of the high price of fuel oil. In July, the engine generated 96 per cent. of the total units for the month. In some respects, the year 1913 has been a record one, more kilowatts having been demanded than during any previous year. This had been chiefly required for motive power, 33 motors equalling 153 h.p. having been added. The total number of motors now on the system was 249, equalling 709 h.p. A satisfactory feature was the more extended use of motive power by builders for mortar mills, concrete mixing, stone-cutting and hoists. The number of heating appliances (radiators, kettles and irons) added was 59, as against 54 in 1912, bringing the total number of heating appliances up to 274. The number of new services during the year was 162, as against 146 in 1912.

The Chairman said that the most satisfactory feature in the report was the increase in the revenue from the sale of current during the year, some £700 or £800, because this improvement had taken place notwithstanding the much larger use of lamps of lower c.p. Notwithstanding the higher price of coal and fuel oil, the cost per unit generated was slightly less than it was in the previous year. Of course their Diesel engine helped a little—not so much as they had hoped when they first made up their minds to obtain this unit. When the tremendous rise in the price of oil took place he told the manager of one of the leading oil companies that if they persisted in this high price they would temporarily kill the Diesel engine industry. They might take their own case as exemplifying the truth of that. Had the oil remained at the price they at first paid, they would certainly have ordered another Diesel engine, but as it had turned out they had obtained two Babcock boilers. There was one advantage in the Diesel engine. If one or more of the steam units broke down, the Diesel engine could be started up in about two minutes. This was a very great advantage, and he believed when oil fell to a more reasonable price they would have every reason to congratulate themselves on having obtained one of these engines. Another satisfactory figure in the accounts was the reserve, which now amounted to over £20,000. They were constantly asked to make extensions which were remunerative and the increased demand for current, which would go on, would make it necessary from time to time to instal additional units to increase the capacity of the plant. It was to meet that kind of expenditure that they asked them to provide sufficient capital, £25,000, to be issued gradually as occasion required. He had been asked whether they were likely to require any of this new capital this year. He was doubtful. It would be only a small amount late in the year. The question of the electrification of the Oxford trams seemed to be postponed indefinitely.

Sir Robert Buckell seconded the resolution.

An extraordinary general meeting followed at which a resolution was passed to increase the capital of the company to £175,000 by the creation of five thousand new shares of £5 each (preference shares five per cent).

Harrow Electric Light and Power Co., Ltd.

The directors report that 119 new installations, representing 275 k.w. additional demand, were connected to the mains during 1913. At the end of the year there were 1,629 consumers with aggregate requirements amounting to 1,567 k.w. The output for the year was 526,201 units. The balance to the credit of the net revenue account, after deducting debenture interest and the interim dividend on the preference shares, was £2,340. The directors recommended the final dividend on the preference shares requiring £375, a dividend on the ordinary shares at the rate of 5 per cent. per annum absorbing £1,667, carrying forward £298. The new offices and showrooms in College Road have now been completed.

The annual meeting was held on March 5th. Mr. J. N. Stuart, who presided, said that the increase in lighting, as well as the greater extension of heating and cooking by electricity, had given a rise in consumption of 64,000 units, or 14 per cent. This was the largest increase in consumption they had ever had, and the sales for the year were 526,201. The tariff based on the assessed value of premises had been taken up by about 10 per cent. of the consumers, who were thoroughly satisfied with this system of charging. Heaters had been taken up encouragingly, and although the charge was low, it helped revenue, being mostly a day load. The electrical industry was always advancing and they now had on the market a half-watt lamp of 500 c.p. and upwards. They already had a fair number of cookers out on hire, and expected many more to be put in use as the summer approached. The gross profit, £6,337, was considerably in excess of the best year that they had previously had. The cost per unit, 2.24d., was the lowest they had yet reached. With the £2,600 put to depreciation, that account now stood at £27,300. The installation account showed a small profit.

The report was adopted.

Madras Electric Tramways, Ltd.

The annual general meeting was held on March 12th, at the offices, Dashwood House, E.C. Mr. Arthur Maxwell Quill presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev. p. 460), said the accounts again showed an improvement upon the preceding year, their profit from running, after providing for all expenses in Madras, having increased from £20,010 in 1912 to £20,975, or about 5 per cent. Adding interest from investments, etc., they had a total gross profit of £21,345. As he anticipated last year, the option which they had granted on 8,500 preference shares was fully exercised, and the total number of shares of that class now allotted was 20,000. The only other item in the balance sheet to which he need refer particularly was the depreciation and renewal fund. During the year they relaid a considerable portion of their track with 90lb. rails, the total amount chargeable to the fund being £6,545. They had, however, porvided a sum of £7,000 out of profits, thus increasing the amount at the credit of the fund to £8,100. Although the latter amount might not appear large, it must be remembered that they had during the last few years relaid practically the whole of the track, and rebuilt the whole of their old type of cars. The present renewals would be completed this year, and the expenditure thereon should during the next 10 or 12 years, therefore, be greatly reduced. Their traffic receipts during 1913 amounted to Rs. 644,201, being an increase of 7.71 per cent. on 1912, and the number of passengers carried was 16,747,853, an increase of 5.36 per cent. That improvement was due entirely to natural growth, which he was pleased to say was being maintained this year, the increase in traffic receipts for the first two months being at the rate of 9.3 per cent. on 1913. The opinion expressed by him at their last general meeting that they could hardly look for any marked improvement from the existing lines was therefore over-conservative. They had, however, last year a considerable increase in operating expenses, due to the congestion in the district of Chuitadripet, where a single line only was practicable. As he told them at their last general meeting, negotiations had been proceeding for a long time, for a diversion of this line along Mount Road, but he was sorry to say that no settlement had yet been arrived at. The proposal to lay a line along Mount Road and Body Guard Road over Government House Bridge and St. Mary's Bridge was not favourably received, and they concurred, as an alternative, in a proposal made by the corporation to lay a double line through Napier Park. Government, however, had now suggested a scheme of road widening in Chiutadripet which would permit of a double line of rails through that area. It was proposed that the cost of the road widening should be borne by Government, the Madras Corporation, and themselves, and as soon as estimates of the cost were obtained, they would give the proposal their careful consideration. Meantime any extension of their undertaking was impossible, as they could not handle further traffic until the difficulty in Chiutadripet was overcome. Their costs of operation had been increased by higher rates of wages to their employees and by the provision of uniforms to drivers and conductors. Their managers in Madras had always shown a deep interest in the welfare of the men, and they were glad to encourage it, as they felt that the employés should participate in the improved position of the undertaking, and also because they recognised that the interests of the shareholders were best served by having a body of contented workpeople. An increase was also shown in rates and taxes. Close working arrangements having existed between the company and the Madras Electric Supply Corporation for some time, it was considered advisable that the management in Madras should be merged, and that arrangement took effect on December 1st last.

Mr. James Gray seconded the motion, and the report was adopted.

Salisbury Electric Light and Supply Co., Ltd.

The report of the year ended 31st December, 1913, states that the generating plant has been sufficient to meet the output and the whole of the plant is in thorough working order and capable of dealing with a considerably increased demand. The profit on the year's working, including £1,004 brought forward, amounts to £6,788, and after paying £1,189 interest on debentures and an interim dividend at the rate of 4 per cent for the half-year, amounting to £700, there remains £4,898. The directors recommend a further dividend at the rate of 8 per cent. for the half-year, making with the interim dividend, 6 per cent. for the year, £2,400 being carried to reserve, leaving £1,098 to be carried forward.

The Chairman (Mr. W. M. Hammick), in the course of some remarks, expressed the regret of the directors and shareholders at the death of Mr. A. R. Malden, who had been secretary of the company from the beginning. Mr. A. B. Randall, who had been manager, had been appointed Mr. Malden's successor, and Mr. E. C. L. Parker had been appointed legal adviser to the company. The year, the chairman said, had been an anxious one for the company, and one cause for this had been because the contract with their largest consumer, the London and South Western Railway Co., was approaching the end of the five years for which it was made. The company had renewed the contract, but at a reduced figure, caused by the company substituting for the ordinary lamps the arc burners. The Osram burner was finding great favour with all the private consumers, for it gave more light and consumed less electricity. In 1903 they supplied 397,611 units, and the number of consumers at that date was 446. They had steadily worked on, and in 1913 they sold 586,352 units, and their consumers had increased from 446 to 1,128. Since the company had started they had put £22,000 to the reserve.

Midland Electric Corporation for Power Distribution, Ltd.

The directors' report for the year ended 31st December, 1913, which we referred to briefly last week, shows a further improvement in the company's business. The comparative figures for the past two years are as follows:—

	1912	1913
Trading Revenue	£53,450	£63,903
Trading Profit	£30,943	£38,062
Consumers connected	2,330	2,920
H.P. connected	17,603	20,822

In June last an issue of £100,000 5 per cent. first mortgage stock was issued and allotted. From the proceeds, the debentures issued in 1903, amounting to £250,000, were repaid. The balance is being used for the capital requirements of the company. The capital expenditure during the year was £37,101. Owing to the continued growth of the company's business, further plant is required at the generating station, and an order for a 3,000 k.w. turbine set has been placed, with the object of the set being ready in ample time to deal with the next winter load.

The meeting was held at Liverpool on March 9th.

Hove Electric Lighting Co., Ltd.

The twenty-second annual meeting was held on March 10th, at Salisbury House, E.C., Mr. F. Tutnell presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev., p. 402), said there had been a reduction in the revenue, due no doubt to the more general use of metal filament lamps. He thought this falling off was only temporary, and that the cheapening of the light would cause a more extended use of electricity, and probably a general adoption of increased illumination. Unfortunately this was a matter which had little interest for any of them at the moment seeing that, after they had built up a sound and profitable business, the Hove Corporation had decided to acquire the undertaking, as they had a perfect right to do. The Corporation had notified their intention to complete the purchase very shortly, and he believed it was intended to pay the money on 26th instant, when it would be necessary to convene two extraordinary general meetings for the purpose of passing the resolution for the voluntary liquidation of the company. There would be some necessary formalities to be observed by the liquidator, in accordance with the requirements of the Companies' Act, after which the creditors of the company would be first paid, then the debenture-holders, and after them would come the preference shareholders, and lastly the ordinary shareholders. It was not without a sense of sadness that he addressed them at this, the last general meeting of the company. They would be called together very shortly to perform the last rites in connection with the business, a business which he thought they would all agree had been an eminently successful and satisfactory one in every way. The speaker proceeded to refer in detail to the initiation difficulties, personnel and general history of the company. He said that they were now in a position to arrive at some fairly accurate idea of the probable distribution to the ordinary shareholders. There was, of course, still some element of uncertainty as to the result of the realisation of the investments. Still, making every allowance, and providing for the costs of liquidation, bonuses, etc., there should be not less than £10 per £5 share to be returned in cash to the holders of the ordinary shares, which he thought, looking at the excellent dividends paid during all these years, must be considered a satisfactory result.

Col. Wood seconded the motion, which was adopted, after several shareholders had spoken in appreciative terms of the work of the board and the staff.

The Chairman proposed a resolution to the effect that a sum of £2,200 be paid to the staff at Hove as a bonus, in recognition of their services, the money to be apportioned in such manner as the chairman and managing director thought fit. He remarked that in addition to Mr. Smith, the resident engineer, there were five other engineers and a staff of over thirty. The bonus which the board proposed was a handsome one, but it was well deserved.

Mr. F. R. Reeves seconded the motion, which was carried.

Mr. Bernard Gibson next moved "That as compensation to the directors for loss of office there be paid to the board a sum equal to five years' fees."

Mr. F. Korner seconded the motion, and it was carried.

The Chairman said that the proposal would come up for confirmation at the extraordinary meeting which would shortly be held in connection with the winding up.

City of London Electric Lighting Co., Ltd.

The annual meeting was held on March 11th, at Salisbury House, E.C., Mr. J. B. Braithwaite presiding.

In proposing the adoption of the report (see Elec. Rev. p. 414), the Chairman said he had again to congratulate the shareholders on a fairly satisfactory year. The progress of the company was somewhat slow because its area was a very restricted one, but they were making continuous progress year by year in the number of works connected, in the gross earnings, and in the net earnings. The gross capital expenditure up to the end of 1913 was £2,560,873, while the capital actually received only amounted to £1,805,950, so that they had provided £754,923 from other sources. With regard to the demolition account, they had written off a total of £566,984. When they were running a business of that kind they could only put in the best plant available at the time it was purchased. That the directors had always done; and whenever improved plant had been introduced, which gave greater economy in generation, they had unhesitatingly scrapped the old plant although it might not have been worn out. The £566,000 written off was a payment legitimately made in building up the goodwill. As an illustration of the economy introduced by improved plant, this year the company had generated 33½ million units, and they had burned 40,520 tons of coal, or 2,000 tons more than in 1904 when they generated only 20 million units. The various reserve funds showed an increase of £2,087 as compared with a year ago, even after using £53,890 for writing off; so that practically the total appropriation to reserves last year was £56,000. With regard to the revenue, there was an increase of £13,694 in the gross receipts as against an increase of £9,035 in 1912, and of £9,455 in 1911. A still more satisfactory feature was the fact that £10,909 had been retained as profit, which compared with only £1,815 in 1912 and £9,111 in 1911. The total working expenses for the year had increased by £3,765, of which the increased cost of coal represented £[illegible]. Coal had cost them £[illegible] more although they had actually used [illegible] tons less, due to the fact that it increased in price 2s. 0½d. per ton. The gross profit for the year had increased by £[illegible], and the extra dividend would absorb £[illegible]. The balance would be provided by again reducing the balance carried forward from £[illegible], to £[illegible], which they considered the normal carry forward, and they had added to that the balance of the dividend equalization fund amounting to £[illegible], bringing the total carry forward to £27,836. As many of them would remember, the dividend equalization fund was created to provide against the possible loss of revenue owing to the use of the metallic filament lamps. The figures for last year showed an increase in connections of 2,552 k.w., and for the first time for many years they were able to report a slight increase in their net lighting connections, thus marking the end of the depression caused by the metal filament lamp. A new contract for public lighting had been entered into with the City Corporation, and a new system of overhead street lighting was now in course of installation. So far as the work had proceeded it had met with great appreciation and success. The Corporation had the right to purchase the company any time within six months of the 18th of August next. At the moment the City authorities had made no overtures of any kind, and as far as he knew there was no intention on their part to exercise their power. Proceeding, the Chairman said the most important event affecting their interests was the renewed effort to improve the electric supply of London. The London electric supply was at present drawn from about 29 power houses, 15 belonging to the Borough Councils and 14 to the companies, each serving its own restricted area, each with its engineers, etc., its own sets of generating plant, and its own reserves of spare plant, involving a large amount of useless capital expenditure. In addition to this, the system on which the current was supplied was very far from being uniform, and the result was that, at the present moment, a serious accident in any one of the power houses might easily result in a considerable area of London being deprived of light and power. What was the remedy? The unification of the London electric supply by the inter-connecting of the existing power houses. But this would involve a considerable capital outlay, and, in view of the powers which the London County Council possessed to purchase the whole of the companies' undertakings in 1931, no one was disposed to spend the necessary money. If the terms of purchase in 1931 were known, it might be possible to devise a scheme, but the terms were quite indefinite and opinions differed very widely as to their probable effect. In 1908 several of the London companies approached Parliament with a view to remedying this state of things, and proposed to establish a Statutory Joint Committee, which would have had power to issue capital for this purpose under the joint guarantee of the various companies concerned. Had this power been granted, long before this, the companies' power houses would probably have been linked up and things would have been in a more satisfactory position than they were to-day. Parliament, however, in its wisdom, struck out the clauses creating a joint committee and providing security for raising the new money, leaving the Bill, as he told the then President of the Board of Trade, merely a domestic linking-up scheme. The result had been as might have been expected, and nothing had been done under it except a little domestic linking-up, and the general position of London's electric supply stood to-day very much where it did in 1908. It was obvious that, with every year that passed, the difficulty of raising capital, even for the ordinary development of their business, would increase, and that, when the London County Council came to buy in 1931, they would buy a museum instead of a properly co-ordinated system of electric supply, and would, as in the recent case of the telephone purchase, acquire a series of undertakings which had been stinted for some years as regards capital expenditure, and upon which they would at once have to spend a very large sum of money in order to bring them up-to-date. It was therefore in the interests of the London County Council, as the purchasing authority, as much as in the interests of the companies, that something should be done, and, in his opinion, what was needed was the granting to the companies of an extension of their tenure and defining the terms of purchase, the companies in exchange to undertake the capital expenditure necessary for the co-ordination and linking up of the existing supply and making provision on a comprehensive scale for the future increase in the demand. It was with a view to such a comprehensive plan as he had outlined that important financial interests, comprising Messrs. J. H. Schroeder & Co., Messrs. Morgan Grenfell & Co., and Messrs. W. Greenwell & Co., were promoting the "London Electric Supply Bill, 1914," through the County of London Electric Supply Co., on behalf of themselves and such other of the London electric supply companies as might wish to join. The Bill proposed to give power to the London electric supply companies and the London County Council to enter into an agreement for postponing the date of purchase of the undertakings, for the variation of the terms and conditions upon which such undertakings might be purchased, and for making new provisions with regard to such purchase. At the present time, the London County Council had a special committee sitting to look into the question of improving the electric supply of London, so that all the means existed for the carrying on of immediate negotiations. One might have supposed that the London electric supply companies would have welcomed such an opportunity, but, he was sorry to say, everyone of them, including their own company, had petitioned against the Bill. So far as their own company was concerned, he need hardly say that he was no party to the action which was being taken on their behalf, and dissociated himself from the action of some of his colleagues in the matter. In his opinion, unless something was done, and that promptly, the County Council itself would put forward a scheme of its own. The plan, as outlined by the bankers, had two sides to it—the engineering side and the financial side. On the engineering side, the bankers were being advised by Dr. Parshall, and it was proposed in the first instance to link up the existing power houses, thus at once setting free the large surplus store of generating plant which was already installed, and secondly, to erect one or more large power houses placed in localities where the greatest possible facilities existed for the cheap generation of electricity, so that they would be in a position to give a supply in bulk in all cases where it might be found economical to do so. In the case of their own power house at Bankside, that was one of the most favourably situated for economical generation, and it was probable that, should the scheme be adopted and the holding company formed, their power house would continue to be used for the generation of electricity for many years to come. Should this plan be carried out, the electric supply of London would be placed upon a secure basis and its future development provided for at the least possible cost. Such a plan could only be carried out through the formation of a holding company having a controlling interest in the shares of the existing companies and using its own securities for the fresh capital required, and this brought him to the second part of the plan, namely the financial part, which, perhaps, would be of the most immediate interest to them. It was estimated by Dr. Parshall that a total sum of 4½ millions would gradually be required and that this sum would provide for the linking up of the existing power houses, which he estimated could be completed in one year from the time the works were commenced, and the provision of one or more bulk supply stations with a combined capacity of 160,000 KW., together with the necessary transmission mains and transforming apparatus. In order to provide this capital, it was proposed that the holding company should issue a 4½ per cent. "A" Debenture Stock which would be secured on the bulk stations and, being a joint charge on the shares acquired, the interest on such "A" debenture stock to be charged to capital account during the period of construction. The existing debenture stocks of the various companies would be left undisturbed for the present. The preference shares would be capitalised at the rate of 4½ per cent. in 5 per cent. "B" Debenture Stock. The ordinary shares would be capitalised on the basis of 5 per cent. in 6 per cent. Cumulative Preference shares of the holding company. In addition, it was proposed to give the ordinary shares of all the companies a bonus of 30 per cent., and, further, they would receive an additional amount of ordinary shares which would be determined by a chartered accountant to be selected by the board of the companies whose shareholders deposited their shares under the scheme, or, failing an agreement, by a chartered accountant to be selected by the Board of Trade, who would apportion the amount of shares to be allotted to each company in accordance with their respective claims thereto, based on their reserves and the respective earnings and growth as evidenced by their accounts for the three years ending 31st December, 1913, and any special purchase clauses applicable to any one or more of the companies. Should this plan be adopted, the holder of each £10 preference share in their company would receive £13 6s. 8d. in 5 per cent. debenture stock of the holding company, and, as their preference shares ranked equally with the ordinary shares in any ultimate return of capital, it would be necessary for them to receive in addition some such amount of ordinary stock of the new holding company as might be deemed to be fair. On the basis of their dividend for 1913, each of their £10 ordinary shares would receive £20 of 6 per cent. cumulative preference in the new company, and, in addition, £3 6s. 8d. of ordinary stock, plus such additional amount of ordinary stock as might be awarded to them under the provision he had already alluded to. With regard to the remuneration that was to go to the bankers, if the scheme was carried through, at the present early stage of the negotiations no money had been suggested, but it must necessarily depend on the number of companies agreeing to the proposals, and in any agreement come to the bankers would only look for such reward as was usual and reasonable, and any such remuneration would be a matter of agreement between the contracting parties. Further, the intention of the bankers was to ask for their remuneration only in deferred shares of the holding company ranking for dividend after the existing shareholders had received at least £150,000 more in dividends than they had last year. They would see from this that the bankers were prepared to demonstrate their faith in the financial soundness of the scheme by postponing their chance of reward until after the present shareholders had received very substantial dividends from the holding companies. He could only renew his expression of regret that the London companies had received the plan in such a hostile spirit and that a majority of his colleagues on the Board should have insisted on their company petitioning against the Bill.

Mr. F. W. Reynolds seconded the motion.

Mr. Wilkinson and other shareholders expressed their regret that the Board should be divided in regard to their attitude towards the bulk supply scheme, and asked whether there was any possibility of the Chairman ultimately agreeing with his colleagues.

Mr. P. D. Tuckett said that as one member of the Board who could not see eye to eye with Mr. Braithwaite in this matter, he wished to make it perfectly clear that their objection to the bulk supply scheme was not one of principle. In principle most of the Board were just as much in favour of amalgamation as the Chairman, but as guardians of the shareholders' interests they were not prepared to accept a scheme which they knew in some particulars to be unsound without being given full opportunity to examine it.

Sir David Salomons said that as far as he was concerned he had no strong feelings in regard to the scheme one way or the other, and he had taken no side because he had not had an opportunity of carefully studying the particulars. The view he held was, that quite apart from any merits which the scheme might possess, they in that company had got a very good bit of meat and they must do everything in their power not to drop it for the shadow.

The Chairman, in reply, said he hoped it might be possible for the Board to agree on the matter of the bulk supply scheme —what he rather objected to was that his colleagues should pre-judge it before they had examined the Bill. Up to the present they had not had an opportunity of discussing the matter at the Board.

The report was adopted.

Brompton and Kensington Electricity Supply Co., Ltd.

Mr. H. R. Beeton (Chairman) presided on March 12th, at the offices, Earls Court Road, over the annual meeting.

The Chairman, in moving the adoption of the report (see Elec. Rev., p. 448), said the growth of the business whether estimated in new customers, or new lamps connected, continued to be satisfactory. The number of new customers connected though not quite so large as last year was, with that exception, the largest connected for the past ten years, and the number of 8 C.P. lamps connected was also with one exception the largest in the company's history. The sales of current, however, showed only a slight increase—about 2½ per cent. over last year; and as much of that increase was in low-priced units—the average price obtained being the lowest recorded—the gross receipts were only £56,484 as compared with £56,348, or £136 more. The expenses, owing to extensive alterations and improvements at the works which would not recur, to higher coal cost amounting to an average of 1s. 6d. per ton more, and to an accession of rates and taxes, were £1,800 in excess of the previous year, so that the net revenue as compared with 1912 was £1,678 less. He might add, however, that owing to contractors' delay they had only had the benefit of their second turbo set during the last quarter. With the use of it for this limited period they were able to supply the larger output for the year from practically the same coal tonnage, so that they might safely predict that, if there were no further rise in the price of coal, they would enjoy a reduced works cost in future. The sales of current so far this year showed a good improvement, and with a saving in works-cost and the prospect of small capital expenditure, they looked forward, barring unforeseen contingencies, to a better year in 1914. The fact that every year they must be drawing nearer to the point of saturation in lighting and the likelihood that with the progress of invention lamps would become every year more economical in the use of current, obliged them to look for future development to the growth of cooking and heating by electricity. This being so, they had for some years past realised that, in order to safeguard the future of their business in an essentially residential area such as theirs, it was incumbent upon them to cultivate this accessory load, and they believed that as pioneers in such development they might reasonably hope to reap a reward beyond that of which their statutory limitations in lighting permitted. The Accessories Company was the means they had planned to this end, and they had asked them to meet them there that day in order that they might see something of its premises. They had acted on the conviction that the best way to find out how to ority a new appliance was to use it. Great as was the superiority of a non-combustive cooking agent, its general adoption would only be effectually promoted by perfecting the design with reference to the many small conveniences and efficiencies the absence of which was revealed by constant use, and the degree of perfection which by general consent their domestic cookers had achieved was due to the fact that their engineers had had their kitchen under their constant observation. By this means they had been able to effect improvements before placing their goods on the market, and so to obviate the necessity of remedying defects afterwards. The possibilities of the business which revealed themselves to them in consequence of this unique combination of resources confirmed their confidence in the future. Of course, they were only in process of founding this branch of the business, and the considerable capital they had sunk in it was at present unproductive, but they looked forward to earning good profits in the future in this portion of their enterprise. The small loss which the restaurant had so far incidentally entailed they had met out of surplus profits, and such as it was they regarded it as by no means an excessive price to pay for the assistance which it had afforded to their general business. In conclusion, the Chairman said: "You will have noticed from the newspapers during the last few days that the scheme promoted by certain responsible financiers for the amalgamation of the interests of the London companies has met with an emphatic rejection, and in this your directors have concurred. I will not enter into the nature of this scheme further than to say that the London companies may be roughly divided into two classes those which provide adequate reserves before deciding what amount is available for dividend, and those which do not do so—and that as the proposed amalgamation was on the basis of dividends only, and irrespective of total profits, the companies which are prudently managed in this respect, among which ours, happily, finds itself, saw no particular inducement to enter into the combination, whatever general problematic benefits it might have promised. The Joint Committee which now represents all the London companies is taking steps to formulate a scheme for unification on co-operative lines which, if successful, will certainly be more economical, and as such will be entitled to more favourable consideration at the hands of the London County Council in any mutual adjustment of interests."

Mr. W. R. Davies seconded the motion.

Mr. Page asked if the balance-sheet of the Accessories Company was published.

The Chairman said it was on the table and was open to the shareholders.

Dr. Clowes pointed out that they had written £4,576 off the Accessories Co., which was a very small company, and it seemed rather a large sum. He would like to know if it was the intention of the Board to add to the capital of the Accessories Co. to the same extent, because if so then other investments would soon disappear.

Mr. Page asked how long the Board were going on nursing the reserves. The position of the company now, if they did no better, was that they could pay 15 per cent. on their capital at the end of their Order. He thought there should be some limit to the building up of their reserves for outside speculation.

The Auditor pointed out that had it not been for the reserves they would have had to raise more capital.

Mr. Pfungst asked if the Chairman could give any idea of how much more money they were going to put into the Accessories Co., and also how the £22,000 odd invested in that company was represented.

The Chairman said the capital expended in the Accessories Co. was represented as to £12,000 in premises which they thought ought to be a good investment on its merits, and the balance was represented by machinery necessary for the assembling of parts of their apparatus and stock in hand and works in progress, the appointments in the restaurant, and so on. He thought so far as it was possible to anticipate the course of the business of the Accessories Co., that the further expenditure of capital was likely to be quite small. He hoped they would be able to earn a good profit this year, for the actual loss on the restaurant was getting smaller by degrees. They recognised very fully that the departure they had entered on was speculative, but they entered on it after very full and deliberate consideration, and believed it to be necessary in order to safeguard the future of their undertaking. Their appliances were undoubtedly the best in the market, and they were supplying them not only in this country but abroad. They looked for a larger sale abroad than at home, especially in tropical climates, where coal was dear, and with steamship and railway companies, where space was a consideration in the kitchen.

The report was adopted.

Bournemouth and Poole Electricity Supply Co., Ltd.

The annual meeting was held on March 12th at the offices, Moorgate Court, E.C., under the chairmanship of Mr. A. H. Sanderson.

In proposing the adoption of the report (see Elec. Rev. p. 459) the Chairman said he was able to speak with greater confidence than usual as to the future prospects because the metallic filament lamp no longer had any fears for them. The total capital expenditure had reached £473,396, £3,819 of which was expended last year. The larger portion of expenditure had been devoted to mains extensions. The company's extensive area of supply was an advantageous one, because new districts were continually being opened up and new houses built, a large portion of which would be likely to require electric light. A further £9,500 had been advanced to the Richmond Co. on loan. They had taken up 2,570 £1 ordinary shares in the County of Dorset Electric Supply Co. upon which 17s. 6d. per share had been paid up. The revenue account showed an increase of £3,247 in the receipts from the sale of current and meter rentals. They had an increased return on their holding in the Richmond Co., which was a very satisfactory feature. The total gross revenue from all sources showed an increase of £3,958 over the previous year. Coal, oil, etc., showed an increase of £1,421, but they generated 700,000 more units than in the preceding year. There was a prospect of relief in respect to coal prices, as already the price was about 1s. 6d. or 1s. 9d. per ton less than when they placed their last contract, and he had every reason to believe that when they next went into the market they would be able to place their coal contract at a considerably lower figure. Rates and taxes showed an increase of £220, the item now amounted to £[illegible], which was equivalent to 2¼ per cent. on their ordinary share capital, and he must again protest against such a very heavy burden of excessive taxation being placed upon their undertaking. They were more heavily assessed than other electrical undertakings in similar towns, but although they had done all they could to impress upon the authorities the unfair manner in which they were assessed, so far they had not been able to get any relief. They had written off out of revenue for the past year £1,828 in respect of leaseholds and special redemption funds, £358 off suspense account and £6,000 for depreciation, making a total of £8,187, which was equal to 5.46 per cent. on the ordinary share capital, which he thought should be considered quite satisfactory. The total sum written off out of revenue for the year in respect of reserves of one kind and another was £788 more than in the previous year, and the balance to the credit of depreciation account now stood at £38,284 as against £31,703. The dividend on the ordinary shares was at the rate of 7 per cent. for the year as compared with 6 per cent. for 1912, and 5½ per cent for the three previous years. The total profits of the trading department had increased from £351 in 1912 to £687 last year. The total applications for supply received up to 31st December last amounted to 8,790 K.W., being an increase of 545 K.W. notwithstanding the slackness which had prevailed in the building trade of Bournemouth during the year; while the total connections amounted to 680 K.W. compared with 556 K.W. for the previous year. The total number of units sold in 1913 was 3,668,007, showing an increase of nearly 10 per cent. over the previous year. Since the 31st December they had connected to their mains 92 new consumers, taking an equivalent of 110 K.W. as compared with 76 K.W. for the same period last year. Of the 110 K.W., 39 K.W. were in respect of lighting supply and 71 K.W. in respect of power and heating. The consumers to date numbered 7,054. Very considerable additions to their machinery and plant were being installed at their principal lighting station. The directors decided on that policy, not only from the point of view of meeting the increased demand which they knew the future had in store for them, but also because of the reduction in cost which they could secure. The new plant was of the most economical and efficient character, and it was estimated that in coal costs alone it would enable them to make a saving of 25 per cent. or more, and seeing that the coal bill was the principal item in their works costs, that was a point which would be appreciated by shareholders. He hoped that the new plant would be ready for use next August. Of course, it was very difficult in a place like Bournemouth, where there were very few manufacturers, to obtain much business in the day time, but he was pleased to say that they were gradually increasing their day load by the extended use of electricity for heating and cooking purposes. As to the Richmond Co., the prospects there were very encouraging. That company had made a departure which they all felt was likely to lead to increased profits being earned —it had recently taken the enterprising course of changing over from generating its own current to taking a bulk supply from a neighbouring company on terms which, after providing for the necessary sinking fund to redeem the plant put out of use, showed considerable saving.

Dr. J. A. Hosker (the Vice-Chairman) seconded the motion and the report was adopted without discussion.

Chelsea Electricity Supply Co., Ltd.

Mr. W. R. Davies (Chairman) presided on March 12th at Winchester House, E.C., over the annual meeting. The year had been uneventful. The gross receipts had increased by over £2,000, but, unfortunately the debit side of the account was also £2,000 greater, and the amount they had to carry to net revenue account was only £90 more than a year ago. Coal was the item principally responsible for the increased expenditure, being £900 more. This was partly due to the larger number of units sold, and partly to the higher price of the fuel. They had bought current from the Central Co. to an amount of £640 as against £69 last year. The capital account showed that out of an expenditure of £12,700, £11,265 was for generating machinery. This was expenditure on the new Diesel plant. He could not say that the year's results were as satisfactory as they could have hoped, as they did not anticipate that the increase in the cost of fuel would be so great. There was no doubt that their plant at the present time was uneconomical, as their coal cost was 0.63d. per unit sold, which was a great deal too high. As he told them last year, the position of the station prevented them using the most economical form of steam plant, viz.: turbine engines, and they decided to install Diesel plant to generate the more considerable portion of the current. When he addressed them a year ago, there was reason to believe that the new plant would be running by the end of last year. Unfortunately many delays had occurred—partly due to the necessity for heavier foundations than were at first thought necessary, and partly to contractors' delays—but he was glad to say the erection of the first three units was practically completed, and although the plant was still in the hands of the contractors, they hoped to have it at work at an early date. The increase in the 30 watt (8 c.-p.) connections during the year was 12,449, which was the largest they had had for some years, while the total of units sold was also the largest in the history of the company. Regarding the prospects for the current year, he thought they must look forward, in the absence of the unexpected, to better results than for the year under review, as by means of the Diesel plant they ought to get their works' cost down to a more reasonable figure, and they would also have the general increase of business which went on from year to year.

The London Electric Supply Bill proposals had been exhaustively and sympathetically considered at meetings of the chairmen of the whole of the Electricity Supply Companies for London. The figures on which the estimates of the promoters were based were most carefully gone into by a committee of engineers of the companies, headed by Sir Alexander Kennedy, and they came to the conclusion, after exhaustive examination, that the estimated results could not be justified. Acting on this advice the directors of all the companies had almost unanimously decided not to give their support to the scheme. That the unification of London's electricity supply was the proper solution for the economical conduct of the business was to his mind undoubted, and he thought they might still hope that the companies themselves might be able to put forward a scheme which would achieve the results aimed at by the promoters with a very much reduced capital expenditure, and be one that would meet with the approval of the London County Council, without whose good-will and assent to an extension of the term of occupation by the companies nothing could be done.

Major Woods seconded the motion.

Mr. R. C. Parton said that with regard to the proposed scheme, it seemed to him that there would be no harm in getting the London County Council to extend the term of exercising their option to purchase. If the promoters of the Bill did nothing themselves, it looked as if they would be the means of bringing the various companies together and getting them to step along.

The Chairman said the companies would be very glad to get an extension of their term on equitable terms.

Mr. R. H. Beeton (a director), said he thought the London County Council would be more likely to give extended terms to a more economical unification than that proposed by the financiers. He wanted the shareholders to understand that the board unanimously considered it would be disadvantageous to them to have accepted the scheme put forward.

The motion was carried.

Metropolitan Electric Supply Co., Ltd.

Mr. W. Harrison Cripps presided on March 10th, at Winchester House, E.C., over the annual meeting.

The Chairman, in moving the adoption of the report (see Electrical Review, p. 415), said the capital expenditure now amounted to £2,172,336, or an increase of £68,339 on the year. The gross revenue was £217,605, an increase of £15,422 during the year. The working expenses were £111,316, or an increase of £12,230. The balance to the credit of the revenue account was £106,288, and from this the directors had set aside £22,000 for the reserve and depreciation fund, which now amounted to £319,000. On the whole they regarded the report with satisfaction. They showed an increased dividend. The increase in the gross revenue showed the vitality of the business and that it was an increasing one. It was true that a large amount of the gross increase was absorbed in expenses, but one of the chief items in the expenses was the cost of generation, and that showed itself in two ways. A great deal of their new gross revenue came from their new western areas which had only been opened up in the last two or three years. When they opened up a new area they started with a considerable capital expenditure and a considerable amount of plant which at first earned no dividend at all. As years went by the standing charges altered very little, and therefore the relative proportion between the costs and receipts was constantly getting in favour of the receipts. Then, in addition, the coal question was very important. Last year they were paying 15s. 1d. per ton for coal, but if they had paid the same price as in 1912 they would have saved £4,000, and as against the price paid in 1911 they would have saved £8,000. So far as they could see the price of coal was not likely to advance this year. Another item giving reason for hope was that on January 1st they installed a new turbine of 4,000 k.w. They were advised by their engineer that the capital expenditure on that turbine would soon bring itself back again by diminished works costs. Although the turbine had only been in operation two months the Board had every reason to be satisfied. The depreciation and the reserve fund was a very handsome one—£319,000. A part of that was invested in their business, but a considerable proportion was invested in outside securities. It had been their custom to put the investments down in the balance sheet at cost, but they thought it right that their securities should be valued by the auditors, and they would be pleased to know there was no grave depreciation in those securities. The depreciation a month ago on the cost price was only £289. Their Kingsway site, which had been on their hands so long, had been let on a 99 years' building lease on very advantageous terms. In regard to the London Electric Supply Scheme the Board had not arrived at their conclusion in a hurry, but the whole scheme had been considered in great detail, with the result that they had decided to oppose it. To understand the matter it was necessary to go into past history, and he proceeded to explain the position of the electric light companies in 1908, when they formed a committee with a view to getting an Act of Parliament for better working. They applied to Parliament for several things, one of which was that they might be allowed to combine for working, and another most important thing, that the term of the purchase clause should be altered. At the same time the London County Council promoted a Bill to make that body the purchasing authority in 1931, instead of the Borough Councils. The companies agreed to the L.C.C. proposal, but on the condition that when 1931 arrived the County Council should be bound to purchase all the companies, and this the County Council agreed to do. Before the Parliamentary Committee it was pointed out that a difficulty would arise in raising capital unless some security could be given to investors, and the Committee agreed to a clause by which it was provided that at the time of purchase the arbitration should take into account what money had been expended for a particular purpose and how much of it was still remaining for the purpose of profit. Unfortunately, when they got to the House of Commons this clause was knocked out. They did, however, get the right to combine, and also the proviso that the County Council should purchase all the companies. With regard to the so-called new scheme which had been promoted, it was proposed that there should be an immediate expenditure of £4,000,000 on the erection of a new station at the mouth of the river, and that in the course of a few years all the present generating stations should be scrapped; and it was said this would result in considerable profit. It was further proposed that the promoters should be a holding company and should take over the whole of the existing shares of the different companies. A further proposal was that the preference shares should be converted into debentures, and the ordinary shares into preference shares, and it was stated that by such an arrangement shareholders would get bigger dividends than they now obtained. The question at once arose in their minds: "Where is this money to come from to pay extra dividends on the shares, and also interest on the £4,000,000 for the new station?" A committee of engineers was appointed, and they reported that they considered the promoters were too sanguine with regard to increased revenue and diminished expenses. Therefore the Board came to the conclusion that such an interchange of shares would be very precarious and they considered the whole basis so insecure that they had decided to oppose the Bill. It had to be remembered that one of the objects of the Bill was to revoke the Act which the companies had striven for in 1908. It might be that shareholders would be approached to exchange their shares for those of the promoting company if the scheme went on, but, if so, he advised each one of them to go very carefully into the matter and not act without having all the facts before them. None of them would say that the electric light business could not be improved, but the idea of the Board as to the expenditure of capital was not to scrap all the stations and build a new one. Their idea was to develop the present stations up to their utmost economic capacity and, when that was done, then to build an auxiliary station to give additional supply. This agitation had been going on for some years, but he said deliberately, with a large knowledge, that there was nothing wrong with the electric supply of London and both in efficiency and price it beat other cities of the world. If they did go forward with an scheme for an auxiliary station as he had suggested, it would be no good unless they had the warm concurrence of the London County Council. Their interests were not antagonistic, but were identical, and when interests were identical they almost invariably worked together. In conclusion, the Chairman referred in high terms to the work of the staff.

Sir J. Pender seconded the motion.

Mr. H. L. Cripps spoke at some length on the question of the electric lighting business of London, and said he was mainly responsible for the appointment of the committee of the London County Council which had considered the future of the industry. He believed that any attempt to manage the electric light business of London as a colossal municipal enterprise was not only objectionable but impossible. He considered the existing conditions as to purchase very undesirable, and believed the whole subject had to be looked at from the political and administrative point of view, and not the engineering. He thought the Bill promoted ought to have the serious consideration of a strong Committee of Parliament.

Mr. Gardman congratulated the Board on paying an increased dividend.

Mr. W. J. Fisher asked who were the real promoters of the Bill, and how it came about that any private promoters could bring in a measure for the expropriation of the electric light companies without their consent. He could not understand why the electric lighting companies had not been able to exert pressure to bring some combination amongst themselves.

The Chairman said there seemed to be some misapprehension as to who the promoters of the Bill were, and it took them some months of careful investigation to find out, and even now he was not quite clear. He understood that Mr.

H. L. Cripps was the promoter, and he certainly knew more about it than he (the Chairman) did.

Mr. H. L. Cripps: The Bill is simply a proposition put before Parliament by someone responsible for it on petition, and that is the County of London Electric Supply Co. They are the promoters technically.

The Chairman said he had explained how the companies came together in 1908, and they were considering as to further action when there had been an attempt to jockey them. The County of London Co. had brought a Bill before Parliament which asked that the company or any other company should be able to make an arrangement with the London County Council. That was exactly the thing they were opposing. They said that it must not be one, but all. In the Bill the County of London Co. did not ask for powers to exterminate the other companies, but they asked for power to make arrangements with the County Council. When they had made an arrangement with the County Council they would ask shareholders to exchange their shares and they would manage the concern. He thought when the promoters knew their attitude they would drop their bill.

The report was then adopted.

County of London Electric Supply Co., Ltd.

The annual meeting was held on Monday at Winchester House, E.C., Mr. J. B. Braithwaite presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, p. 445), said that the year had again been a most satisfactory one. There had been no change in the capital, although in order to provide for future developments it would be necessary to make a further issue immediately. To summarise the report, the gross earnings had increased by £24,570, an increase of 10½ per cent. The working expenses, including the increased cost of coal of £8,464, had increased by £10,840, so that, apart from the enhanced cost of coal, the expenses had only increased by £2,000, with an increase of £24,570 in the gross revenue. The result was that the net earnings had increased £13,730, an increase of 10¼ per cent., or very nearly the same amount as the increase of the gross earnings. The number of consumers had increased by 2,069, which was by far the largest increase of any London electric supply company. The applications had increased by 4,137 k.w. The units sold had increased by 3,230,845, and from every point of view the report was satisfactory. Their investment in the Bournemouth Co. had paid them an extra 1 per cent., while at Coatbridge, which had been a source of some anxiety to them in the past, they were now experiencing the benefit of a bulk supply. Some people seemed to think that a bulk supply was a "Will-o'-th'-wisp" which had no material value. Since they had had a bulk supply at Coatbridge they had not only been able to raise a sinking fund to replace the cost of the plant scrapped, but they had also received a steadily increasing interest on their investment. With regard to the demolition account, they had written off this year some £20,000. The result was that the plant now stood on a very modern basis in their books. Instead of building up a large reserve fund and renewing plant which was uneconomical they had preferred to scrap their uneconomical plant and use the reserve fund in putting in up-to-date and economical plant. They had written off and extinguished £95,000 from that account, and at the present time their plant stood at £334,000, and they had put £33,000 to the depreciation account this year, which was almost exactly at the rate of 10 per cent., which he thought was a very handsome allowance. The Royal Assent had been given to their Romford order last year, which gave them another 129½ square miles of district to operate in, which was not purchaseable by the L.C.C. There were very great possibilities in the district provided they could supply really cheap power. Many industries had been driven out of London because of the want of cheap electrical power, and if they could supply that want in Romford and attract industries there, it would be a benefit not only to the shareholders but to London generally. Including the area of their Romford Order, the company now held powers for 190.72 square miles, which was by far the largest area that any London company held rights over. Regarding the outlook for the present year, he could say that it was extremely satisfactory. Of course, they could not argue from what had taken place in two months as to what was going to take place throughout the year, but it would interest them to know that up to date the applications showed an increase of 90 per cent. over the same period last year; the units sold showed an increase of 8 per cent.; their estimated gross revenue showed an increase of 15 per cent., and the estimated net revenue an increase of 12 per cent., so that, apparently, the prosperity which had existed in the past few years was still continuing in the present year. With regard to the issue of new capital, they proposed to bring the amount of their ordinary shares and preference shares to an equal figure. At present they had 59,000 ordinary shares and 55,000 preference. They proposed to raise both classes to 65,000. That would enable them to allot 10,000 preference and 6,000 ordinary, which, including the premiums, would give them approximately £175,000 for future capital expenditure. They recognised that the shareholders who had been with them through their days of comparative adversity were entitled to any benefits which might accrue from the issue of the new shares, and they proposed to offer them to the old shareholders at prices which would give a substantial bonus. The capital expenditure during the past year amounted to £[illegible], and of that nearly [illegible] per cent. was on mains which, as he had already pointed out, were not of a seriously depreciating character. Proceeding to deal with the Bill now before the House of Commons for obtaining a bulk supply of electricity, he said he regarded that effort on the part of a certain number of London companies to do something towards establishing the electric supply of London on something like a sound commercial basis, as one of the most important events that had taken place in the electrical industry last year. [The speaker went on to refer in detail to the history of events which had brought London electric supply matters to the present position. His remarks were in the main the same as those given in our report of the meeting of the City of London Co.—Eds., E.R.] They wanted to provide what London had never yet had up to the present, and that was an adequate source of bulk supply. They looked at Berlin and Paris and Chicago and found that they were solving the problem, and was London to wait until 1931 before doing anything in the matter? He believed that the L.C.C. at the present time were very much disposed to accept the scheme which had been suggested, and it was really more in the interests of the L.C.C. as the purchasing authority than it was in the interests of the companies. They might have supposed that an offer of that kind would have been welcomed by the London electric supply companies, and he was more than surprised at the treatment which the scheme had met with. They had doubtless seen in the papers the way in which it had been emphatically rejected without ever having been examined. At the conference which considered the scheme the Chairman himself made a motion that the report of their own engineers on the subject should not be considered until they had had an opportunity of confering with the promoters of the Bill, and at the very next meeting of the Committee he repudiated all he had said, and by a large majority the conference "turned the scheme down" without ever having looked at it. There were two sides to the scheme: one was the engineering side and the other was the financial. With regard to the engineering side, the promoters were being advised by Dr. Parshall, who perhaps had had as much, if not more, experience in large bulk supply station work as any engineer that he (the speaker) knew. On the financial side the promoters had been advised by two very eminent firms of accountants, Messrs. Deloitte, Plender, Griffiths & Co., and Messrs. G. A. Touche & Co., so it would be seen that they had spared no pains to make their scheme perfectly sound both technically and financially. Yet, despite that, the chairmen of the London companies, with only two or three exceptions, would not even deign to look at it. Having given details of the proposed scheme similar to those which he gave at the meeting of the City of London Co., Mr. Braithwaite proceeded to explain how the scheme would affect the shareholders of the County of London Co. The suggestion was, he said, that the debenture stocks should remain exactly where they were, and the preference shares of all companies should be funded on a basis of 4½ per cent. into a 5 per cent. debenture stock, behind which would be placed a sinking fund sufficient to redeem it before the expiry of the extended tenure that would presumably be granted by the L.C.C. With regard to the ordinary shares, the proposal was to fund them on the basis of 5 per cent. into 6 per cent. cumulative preference stock, and then, in addition, to give all round as a first instalment a bonus of 30 per cent. in ordinary stock of the new holding company. It was also proposed to give to the ordinary shareholders of all the companies such an additional amount of ordinary shares as was to be determined by a chartered accountant, based on their reserve funds and their respective earnings and growth. Should the scheme be adopted, the effect on their own shares would be that the holders of every 10 preference shares—that was £100—would receive £133 6s. 8d in 5 per cent. debenture stock, and the holder of every 10 ordinary shares would receive £140 of 6 per cent. accumulative preference stock, and the 30 per cent. bonus in ordinary stock to which he had referred, and in addition such an amount as might be awarded for the reserve. As to why the County of London Co. was promoting the Bill, he said it was necessary it should be put forward in the name of one of the existing companies because they were the only people who had a *locus standi* for making agreements with the L.C.C. They readily lent their name on two conditions—first that they should not pay any of the costs of promoting the Bill, and secondly, that before they lent their name they took counsel's opinion on the point that the Bill as drafted would not be in any way inimical to the interests of any of the London electric supply companies. The Bill was put forward quite as much in the interests of the other London companies as in the interests of the County of London Co.; in fact, the other companies had more to gain from the Bill, as the County of London Co. was a strong and a prosperous company with a big future, and could afford to stand alone, which did not apply to all the companies. He could only say that he was sorry that the companies had treated the Bill in such a hostile manner and had "turned it down" so emphatically as one of the chairmen said the other day. The Bill was not dead, and his own opinion was that the companies would have to come to something of the kind if the present Bill was rejected, and possibly they would have to come to something which would not be so favourable to them as the present proposal.

Mr. R. PERCY SELLON, in seconding the motion, said he wished the shareholders to understand that the Board were unanimous in endorsing the things which the Chairman had put before the meeting. They were all of opinion that it was only by some such scheme based on broad lines that a solution of the present problem of the London electric supply could be found.

Mr. H. L. CRIPPS and Mr W. J. FISHER having spoken in support of the scheme,

The CHAIRMAN, in reply to questions, said the promoters had not overlooked the question of vested interests, and their suggestion was that Water Board terms should be given to directors and officials who would be required to retire should the scheme mature.

The report was then adopted, and subsequently a resolution was agreed to approving of the scheme on the part of the shareholders.

South London Electric Supply Corporation, Ltd.

THE annual meeting was held on Monday at the Cannon Street Hotel, E.C., Mr. J. ATHERTON preseding.

In proposing the adoption of the report (see ELECTRICAL REVIEW, p. 457) the CHAIRMAN said that the number of lamps added during the year had been the equivalent of 28,818 35-watt lamps, and exceeded those connected during 1912, which was the largest increase they had had since the year 1908. The total connections at the end of the year amounted to 302,124 (since increased to over 311,000), and although this increase was very satisfactory, it was largely due to the connection of additional motors to the circuits, the increase in H.P. having been 820, making the total connected 5,384, but instead of the units for motive power being about equal to the units for lighting, as was the case in 1912, the units sold during 1913 for power were nearly 900,000 greater than those for lighting purposes, with the consequence that although the receipts per unit for lighting and power purposes respectively had been maintained, the average per unit sold for all purposes had declined owing to the predominance of the supply for power over that for lighting. The revenue obtained for lighting purposes was a little in excess of that for the previous year. For the purpose of increasing and popularising the use of electric light and the many useful and economical domestic electric appliances now on the market, they had carried into effect their decision to open central showrooms in one of the main thoroughfares in their area of supply, and they would be opened in a week or two. Notwithstanding the additional cost, they felt sure that by a judicious display of lighting and other accessories in the ample window space provided, and also within the showroom itself, together with the assiduous attention of their representatives, there must be a beneficial effect shortly felt in the sale of energy for lighting and other domestic purposes, there still being a large undeveloped field upon which to concentrate their efforts. The units sold had increased by nearly three-quarters of a million, from 5,118,000 to 5,741,226, or 14.8 per cent., and the gross receipts increased by £3,256; but as nearly all these additional units were sold at power rates, and they had to pay and were still paying abnormal prices for coal, coupled with the increased cost of labour, and, in fact, for all commodities, the amount retained out of the increased revenue as gross profit had been reduced accordingly. Taking, however, all the items of expenditure in the revenue account, the total was £23,475, which worked out at the very satisfactory figure of .98d. per unit sold as compared with 1d. in the previous year, this result again being one of the best obtained by any of the companies supplying electricity in the Metropolis. The capital expenditure amcunted to £7,888, the greater portion of which was for extensions to mains, additional transformers, and for the connecting up of new consumers. This year they would have to meet the cost of the new showrooms at Brixton, also additional mechanical stokers and coal-handling plant at the generating station, and further extensions to the mains and the connecting up of new consumers. In regard to the change of generation from the single to the two-phase system, this had continued to operate very satisfactorily throughout the year, and had been the means of bringing several important consumers on to the mains, and further consumers had been booked for two-phase supply; these would be connected up as soon as they had completed the electrification of their works. Proceeding to deal with the Bill of the County of London Company, the Chairman said the representative committee of the various other London companies arrived at the conclusion that the scheme put forward did not commend itself as one desirable for adoption. At the same time, it was recognised by the committee that the principle of co-operation was a sound one, though they felt themselves unable to support the scheme put forward. With the view of giving effect to this, the Engineers' Committee had been requested to prepare a comprehensive scheme to provide for the electrical requirements of London, based on the joint working of the companies' undertakings and on a satisfactory arrangement being come to with the London County Council in regard to purchase. Whether anything would come of this or not they were unable at this moment to express any opinion. Meanwhile their company was in a position to satisfy all the requirements for electric energy within its statutory area at a reasonable price, and they had no reason to feel apprehensive or anxious as to the future prosperity of their business. They might rely upon the Board to safeguard their interests in this matter, but should any scheme be presented to them which they considered satisfactory in the interests of the company generally, they would then, of course, call the shareholders together so that they might express their opinion on the proposals. The returns of the new consumers booked, of work in the sales department, and of the output since the commencement of this year showed a gratifying increase over the figures for the corresponding period of last year, and although, as he said before, they were still paying an exceedingly high price for coal, they hoped that the results for the present year would show a considerable improvement upon those of last year.

Mr. BUSH seconded the motion, and after a short discussion of a complimentary nature the report was adopted.

The CHAIRMAN then moved a resolution giving the Board power to issue 10,000 preference shares of £5 each. He explained that the Board only intended to issue 6,000 of the shares, as they anticipated that this amount with the reserve would be sufficient to enable them to meet all their requirements during the next three or four years. Should, however, the business increase very rapidly they might have to issue the remaining 4,000 shares.

The resolution was carried.

Windermere and District Electric Supply Co., Ltd.

THE directors' report for the year ended 31st December, 1913, states that the Diesel oil plant has not yet been installed owing to delay on the part of the contractors, but it is hoped it will be at work in the course of the next two or three months. Owing to this delay the unissued debenture stock has not yet been offered for subscription, but it is proposed to make the offer of the stock shortly.

The Directors, after full consideration, decided to extend the service to Grasmere, and the necessary cable has been laid, and there is every reason to believe that the Company will receive enough revenue from the new connections in Rydal and Grasmere to give a fair remuneration on the capital cost of the cable.

The profits during the year have been adversely affected by the remarkably dry summer, which resulted in a large additional expenditure on coal, the extra cost being £363. The sales of current show an increase of £62, and the increase in the Gross Revenue is £88. 45 new consumers have been obtained, making with the additions to existing installations an equivalent of about 1700 30 Watt Lamps. A payment of 5 per cent. on account of arrears of interest has been received on the Keswick Electric Co.'s Debentures, and from this source the old balance of interest accrued from the Keswick Co. of £377 has been extinguished, and the Net Revenue Account has been credited with £94. In future the Revenue Account will be credited with the whole of the profits received from the Keswick Company.

The amount spent on capital account for new mains, transformers and meters has been £446. The expenditure on revenue account for the year has been £2,199, an increase of £316. The balance of revenue account for the year is £1,719 plus interest on Keswick debentures £94, and brought forward £40, making £1,853. Out of this has been paid debenture interest, bankers' charges, &c. £841, interim dividend of 1 per cent. on preference shares £250, cost of extending period for repayment of debenture stock £21, written off free wiring installations £88, transferred to depreciation reserve account £400, leaving for disposal £253. The directors recommend that a further dividend of 1 per cent. be paid on the preference shares which will absorb £250, and make 2 per cent. for the year, leaving £3 6s. 9d. to be carried forward.

Folkestone Electric Supply Co., Ltd.

THE directors' report to Dec. 31st last shows continued satisfactory progress. The equivalent of 139,100 eight c.p. lamps was being supplied, an increase of 7,847 eight c.p. lamps. The accounts showed that including the receipts from hired installations, the profit on the revenue accounts for the three undertakings amounted to £17,611, plus £354 brought forward, and interest and installation profits, and after allowing for interest on debenture stock and dividend on preference shares, there was a balance of £11,348. Out of this an interim dividend at the rate of 6 per cent. per annum had been paid on the ordinary shares, and the directors had carried £4,810 to the depreciation fund, making it £32,753 net, and £2,500 to the reserve fund, increasing it to £6,600. They recommended a dividend at the rate of 8 per cent. per annum on the ordinary shares for the half-year (making 7 per cent. for the year), requiring £2,000, and leaving a balance of £538 to be carried forward.

Units generated ...	2,244,907
Units sold - Public lamps ...	78,506
By contract ...	474,596
Private consumers by meter ...	1,184,448
Total sold ...	1,737,550
Units used on works ...	30,874
Total accounted for ...	1,768,424
Not accounted for ...	476,483
Public lamps ... Arcs 88	Incandescent 493 (M.F.)
Maximum supply demanded ...	1,313 KW.

Liverpool District Lighting Co., Ltd.—The directors, after transferring £900 to reserve fund, recommend a dividend at the rate of 4 per cent. per annum for the last half of 1913.

British Insulated and Helsby Cables, Ltd.

The directors' report for the year ended December 31st, 1913, states that the profit amounts to £217,351 plus £74 231 brought forward, making £321,582. The following are deducted :—Directors' and debenture trustees' fees, and remuneration to Works Committee, £5,315 ; interest on first debenture stock, £22,500 ; interest on second debenture stock, £10,000 ; depreciation on buildings, plant, machinery, &c., £22,000 ; transfer to reserve account, £20,000 ; transfer to special reserve account, £8,500 ; transfer to first mortgage debenture stock redemption account, £5,000 ; written off patents and goodwill, £35,000 ; dividend on preference shares to December, 1913, £30,000 ; interim dividend on ordinary shares to June, 1913, £20,000 = £178,315, leaving available for dividend £143,267. The directors recommend a further dividend of 9s. per share on the ordinary shares, making with the interim dividend already paid a total of 13 per cent. for the year requiring £45,000, carrying forward £98,267. It is gratifying to report an increase in the volume of trade compared with last year, resulting in an additional profit of £28,956. £35,000 has been written off patents and goodwill : this item, which originally stood at £251,672, is now eliminated as an asset from the balance-sheet. In addition, a sum of £8,500 has been transferred to special reserve account, a further £5,000 to first mortgage debenture stock redemption account, £20,000 to reserve account, and £22,000 applied to depreciation on buildings, plant and machinery. After deducting the afore-mentioned sums, the balance to be carried forward is £98,267.

The meeting is to be held at Liverpool on March 23rd.

Davis & Timmins, Ltd.

Sir Henry Mance, presiding at the annual meeting, held on March 12th, at King's Cross, said that the report gave them unqualified satisfaction ; it was a credit to the staff, and justified the board's policy of bygone years. Everything was going on well with the works at Wood Green. There had been considerable additions to plant, additions absolutely necessary to enable them to cope with the increased volume of business. They were beginning to feel a little cramped for space. The change in the arrangement for the supply of power would help in this respect, as they would be able to make use of a well-built and commodious engine house, and so postpone the necessity for building operations for another year.

Mr. G. E. Davis, the managing director, said that, from a business point of view, 1913 was an exceptional year, and they had handled a large volume of work, though they had been hard pushed at times to satisfy all demands. By installing an entirely new and unlimited supply of power from an outside source they would be helped in that respect henceforth. Now that motive power was assured they were enabled to put down additional machines as necessary. They had no cause to complain of 1914 as far as it had gone.

Sunderland District Electric Tramways, Ltd.—On Tuesday, March 17th, Mr. Justice Eve had before him in the Chancery Division the petition of this company for sanction of a resolution reducing the capital of the company from £170,485 to £51,500. Mr. Wright, for the company, said they had carried on business without success since their formation in 1903. His Lordship : They seem to have got through £120,000 very quickly. —Counsel : Yes, in 10 years. His Lordship sanctioned the reduction and ordered the words "and reduced" to be used for a month.

The Belgian Congo.—La Société Belge de Cables Télégraphiques is the name of a new company which has just been registered in Antwerp under British auspices, with a capital of £160,000. The object of the new concern is to secure from the Belgian Government a concession for the laying and working during a period of 50 years of a telegraph cable between the Belgian Congo and the English coast. The capital is divided into 4,000 shares of £40 each, of which the Eastern Telegraph Co. has subscribed 3,000, the Telegraph Construction and Maintenance Co. 100, Sir J. D. Pender, K.C.M.G., 200, Mr. F. R. Lucas 200, and Mr. W. Hibberdine 100, all of London, M. P. Cramer, of Overeen-lez-Haarlem, 200, and M. X. Moeus, of Antwerp, 200.

London United Tramways, Ltd.—In their annual report the directors recommend a dividend of 1 per cent. on the preference shares for the year 1913. £20,000 is put to reserve for reconstruction and renewals, and £2,101 is carried forward.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended January 30th, 1914, amounted to 1,242,997, compared with 1,021,662 units in the corresponding five weeks of 1913.

Prospectuses.—*South Metropolitan Electric Light and Power Co., Ltd.*—The directors have issued a circular to the shareholders and debenture stockholders, offering 25,000 6 per cent. cumulative second preference shares of £1 each at par, less an allotment commission of 1s. per share.

London and Suburban Traction Co., Ltd.—The list was to close yesterday, Thursday, in an offer for sale of £350,000 5 per cent. "A" debenture stock at the price of 92 per cent. The issue has been made for the purpose of repaying temporary loans.

Toronto Power Co., Ltd.—This week there has been offered for sale £523,655 4½ per cent. consolidated guaranteed debenture stock of the Toronto Power Co., Ltd., guaranteed by the Toronto Railway Co. The sale price was 96, and the list was to close on Wednesday. The prospectus mentioned that 100,000 B.H.P. of plant had already been installed at Niagara Falls and three additional units now installing will bring the total up to 11 units 10 of which have an aggregate capacity of 125,000 B.H.P. The eleventh unit has a capacity of 15,000 B.H.P., and will be held in reserve in case of accidents. The above issue has been made to provide the cost of these works and to meet general power and light extensions.

Automatic Telephone Manufacturing Co., Ltd.—The directors' report for the year ended December 31st, 1913, states that the profit for the year was £21,167 plus £370 brought forward, making £21,537. The following are deducted :—Directors' fees, £1,225 ; depreciation on patents, goodwill, buildings, plant and machinery, £4,000 ; written off underwriting commission on shares, £3,000 ; written off preliminary expenses, £1,093 ; dividend on preference shares, £12,000 ; leaving to be carried forward £3,219. The business in ordinary telephone and telegraph equipment continues satisfactory, but although good orders for automatic equipment were received, it was not found possible to complete during the year any substantial amount of this class of work.

Topsham Electricity Supply Co., Ltd.—The annual meeting was held on Saturday. The chairman (Mr. A. A. Amos), in moving the adoption of the report, congratulated the shareholders upon a very successful year. The business of the company had materially increased, and the output of current had been the largest on record. The trading account showed an income of over £500 per annum, and the net profit amounted to £219. The directors proposed to divide £72 in dividends, the balance, £147, being carried to depreciation account. A dividend of 5 per cent. on all shares was approved.

Vickers, Ltd.—The directors have decided to place £300,000 to general reserve and to recommend a final dividend of 1s. 6d. per share (free of income-tax) on the ordinary shares, making 2s. 6d. per share, or 12½ per cent. for the year. The amount carried forward is £222,811. Owing to the continued rapid and profitable expansion of the business, the directors will propose to the shareholders an increase in the ordinary share capital of £1,110 000, or of one share in four of the present capital. These shares will be offered to the shareholders at 28s. per share.

Stock Exchange Notices.—The Committee has ordered the following to be quoted in the Official List :—

Hong Kong Tramways Co., Ltd.—325,000 shares of 5s., fully paid, Nos. 1 to 325,000.

Singapore Electric Tramways, Ltd.—400,000 shares of 5s., fully paid, Nos. 1 to 400,000.

Montana Power Co.—A quarterly dividend of ½ per cent. on the common shares is announced.

Metropolitan Electric Tramways, Ltd.—The revenue for 1913 was £539,246. After charging all expenses, the available balance is £52,282, out of which £12,000 is put to reserve, £25,000 is required for preference dividend, 3 per cent. is to be paid on the ordinary shares, and £1,052 carried forward.

North Metropolitan Electric Power Supply Co.—A dividend of 6 per cent. per annum and a bonus of 12s. per fully-paid ordinary share are to be paid for 1913.

Braunton Electric Light and Power Co., Ltd.—The directors report a very satisfactory year's working. The net revenue account showed a balance of £136, out of which a dividend of 5 per cent. is to be paid on the cumulative preference shares, amounting to £23 ; £30 is to be written off formation expenses, and £50 for depreciation, £32 being carried forward. The receipts from private lighting were £199 ; power and heating supplies £13 ; contract lighting £73 ; contract pumping £50 ; rental of meters and services £20. Generation of electricity cost £176 ; rent, rates and taxes £21 ; management expenses £20 ; and special charges £25. The report was passed at the annual meeting.

STOCKS AND SHARES.

Tuesday Evening.

There remains still much perplexity and confusion in the money markets, which are reflected in prices and in the irregularity of the movements that occur from day to day in the barometer stocks. Everyone is expecting money to get patently cheaper at the beginning of April ; building hopes, too, upon this anticipation, though, at the same time, political factors are working in the other direction, which have the effect of depressing the prices of Consols and foreign Government bonds. Affairs in Brazil and in Mexico are chaotic enough to restrain business in the stocks and shares of either country. At home, one of the most interesting events of the present week was the meeting of the County of London Electric Supply Company, held last Monday.

Notwithstanding the badness of the times, new issues continue to appear. In the Electrical section, the London and Suburban Traction Company has this week offered £350,000 of 5 per cent. "A" Debenture stock at 92 per cent., at which the return is nearly 5½ per cent. on the money, while the security is good of its class, The Toronto Power Company, Ltd., has been making an issue of half-a-million pounds 4 per cent Consolidated Guaranteed Debenture stock, guaranteed unconditionally by the Toronto Railway Company, and statistics were given in the prospectus of five years' working, each year showing a steady and substantial progress. The stock is well covered. London and Suburban Ordinary shares went $\frac{1}{32}$ lower, but the existing Toronto issues did not change.

Home Railway stocks move in manner most disappointing to their supporters. Week after week falls have to be recorded. This time Metropolitans are 1⅜ lower, Districts losing a like amount. The falls in City and South London Junior Preference stocks have not been recovered. It is difficult to sell the 1903 issue, to pay the full dividend in respect of 1913 on which the sum of £7,400 had to be debited to capital account, while the carry-forward of the railway was but £700.

Metropolitan Electric Tramways Debenture stocks of both classes are again noticeably lower, and the market is a dull one. Underground Electric Railway shares fell ⅛ to 3⅛, the Income bonds also receding. No further changes have occurred in British Electric Tractions, but we notice that our suggestion last week as to the advisability of consolidating the various classes of the company's stocks into some less unwieldy proportions has aroused a good deal of interest. Yorkshire West Riding Preference again rose ⅛, which took the price to 4¼, and the Debenture stock gained 2 points.

The County of London Electric meeting produced a speech from the chairman which is worth studying as a comprehensive statement of what has come to be known as the "super-company" scheme. The shareholders unanimously passed a resolution giving their adhesion to the proposals. It was declared by one of the speakers that the interests of engineers and directors might conceivably, in certain circumstances, conflict with those of shareholders, and the formation of a Shareholders' Committee was proposed that should embrace representatives from all the various electric lighting companies.

Mr. H. B. Renwick, the managing director of the County of London Electric Supply Company, may fairly be congratulated upon having produced a scheme which appears to be workable and practical. The magnitude of the task which he took up can best be measured by remembrance of the failure which has attended every effort made up to the present to bring into line the different London electric supply undertakers; and it is only by the exercise of indefatigable toil and a great deal of tact, that Mr. Renwick has succeeded in forcing the matter to its present stage.

Prices in this department are not much changed on balance, allowing for the various dividend deductions. These latter have the effect of making yields look very attractive. County of London were quoted *ex* rights on Wednesday last week. Westminster Preference are a shade easier, South Metropolitan Preference $\frac{1}{32}$ higher. This company, as well as the South London, is about to raise fresh capital.

Details have been in private circulation of a new electric supply company to deal with the Hendon district, and a public issue of Preference shares or stock may be expected before long.

Amongst Mexicans and Brazilians there are this week no sensational movements. Mexican Light and Power shares of both classes are a point down. Mexico Trams have similarly suffered. Para Electric Railways are about the same as they were, having regard to the fact that the shares are quoted *ex* dividend. What the investor should notice, however, is the flatness of Rio de Janeiro first bonds and of San Paulo First Debenture stock, both of which have dropped below par. The margin of security in each case is ample, and the yields produce an average of 5⅛ per cent. Rio 5 per cent. Mortgage bonds fell to 88, but these, of course, rank below the Firsts. Brazilian Tractions dropped 3½ to 83½, this raising the yield on the shares to 7 per cent. on the money. However, with the incessant shrinkage in the prices of Brazilian Government, municipal and similar securities, it is obvious that uneasiness must be aroused with regard to all the industrials connected with the Republic.

Shawinigan Water is 4 down on the decision to issue $1,375,000 new Common stock, to be offered at 120 to existing holders in the proportion of one new for eight old shares.

The Telegraph market is quiet. Westerns are ¼ higher, and Anglo-American Deferred at 24 shows an equal advance. Except for these, the movements are insignificant. Reuters remain at 8⅞. Marconis are weak, the Preference and Ordinary shares both losing the gains of last week, and the market being dull once more on the assumption that the new House of Lords inquiry will simply mean that nobody will want to take an interest in the shares, from the Stock Exchange point of view, until it is over.

In the Manufacturing division, small rises occurred in British Aluminium Preference, British Westinghouse Debenture and Dick, Kerr Ordinary shares. The death of Mr. George Westinghouse would some years ago have had a marked effect upon Stock Exchange prices, but of late his name has ceased to be a power in the financial world, and the Preference shares of the British Company retain all their recent advance at 30s. Aron Ordinary are $\frac{1}{32}$ lower, and Castner-Kellners continue to droop. Rubber shares have been affected by general market conditions, otherwise the rise in the price of the raw material to nearly half-a-crown per lb. would probably have had a stimulating effect upon Stock Exchange quotations. As things are, however, the public no more interest themselves in rubber than they do in most other stocks and shares at the present time.

The National Telephone holders are to receive a further distribution of 1¼ per cent. or thereabouts, raising their full return to about 105¼. Allowing for interest on the money, the price paid to the proprietors works out to very little above 100, and the people who gave 160 for their stock are best left alone just now.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, March 18th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2⅞d.	..
a ,, Sulphuric	per cwt.	0/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£80 10	..
a Bleaching powder	,,	£6 5	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£17 10	..
a Copper Sulphate	,,	£22 10	..
a Lead, Nitrate	,,	£30 10	..
a ,, White Sugar	,,	£28	..
a ,, Peroxide	,,	£82	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	[illegible] 10	..
a ,, Chlorate	per lb.	8¼d.	..
a ,, Perchlorate	,,	8¾d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	,,	£8 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70/72 %) ..	,,	£10	..
a ,, Chlorate	per lb.	8⅝d.	..
a ,, Crystals	per ton	£2 5	..
a Sodium Bichromate, casks ..	per lb.	8d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	[illegible]	..
b ,, Wire, in ton lots (1 to 14 B.W.G.)	,,	£112	..
b ,, Sheet, in ton lots ..	,,	£112	..
p Babbitt's metal ingots	,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c ,, Tube (brazed)	,,	9⅝d.	..
c ,, ,, (solid drawn) ..	,,	7⅞d.	½d. dec.
c ,, Wire, basis	,,	7⅞d.	..
c Copper Tubes (brazed)	,,	9⅞d.	½d. dec.
c ,, ,, (solid drawn) ..	,,	9⅞d.	½d. dec.
g ,, Bars (best selected) ..	per ton	£79	£2 dec.
g ,, Sheet	,,	£79	£2 dec.
g ,, Rod	,,	£79	£2 dec.
d ,, (Electrolytic) Bars ..	,,	£66	£1 10 dec.
d ,, ,, Sheets ..	,,	£84	£1 10 dec.
d ,, ,, Rods ..	,,	£71 10	£1 10 dec.
d ,, ,, H.C. Wire	per lb.	8⅝d.	..
f Ebonite Rod	,,	4/6	..
f ,, Sheet	,,	4/-	..
n German Silver Wire	,,	1/10	..
h Gutta-percha, fine	,,	7/-	..
h India-rubber, Para fine	,,	8/0¼	8½d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	51/6	..
,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£20 7 6 to £20 10	2/6 to 5/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	,,	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/8½	..
p ,, ,, rolled bars & rods	,,	1/0¾ to 1/2	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10⅝d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£175 to £176	£1 5 inc
n ,, Wire, Nos. 1 to 16	per lb.	2/4	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£25 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

International Engineering Congress, 1915.—Rapid progress is being made in working out the final programme of papers for the International Engineering Congress to be held in San Francisco in 1915. The first volume of the publication of the Congress will consist of a series of articles descriptive of the various technical features of the design and construction of the Panama Canal, and will constitute an official technical record of the gigantic engineering feat which is just nearing completion. The programme of papers for the various sections of the Congress is practically completed, and notices of them will be published in the near future. Subscriptions to the Congress are being received daily, and on March 1st the number of enrolments was slightly over 1,200. It is hoped that all engineers interested in the success of the Congress will send in their subscriptions as early as possible.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share. *	Dividends for 1912.	Dividends for 1913.	Closing Quotations March 17th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	$\frac{3}{16}$— $\frac{5}{16}$	..	Nil
Do. 5 % Pref.	1	5	5	½— ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	15½— 17½	..	..
Do. Do. Deferred ..	100	..	..	6½— 8½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	8	..	56 — 59	..	5 1 8
Do. 5 % Perp. Deb. ..	100	5	5	95 — 98	..	5 2 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 85	..	5 8 5
Central London Railway, Ord. ..	100	8	8	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 5
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 8
Do. Def.	100	2	2	57 — 62	..	3 4 6
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	95 — 97	..	5 3 1
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1903	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½— ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	67 — 72	..	6 5 0
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 3
Lancashire United, 5 % Deb. ..	100	5	5	86 — 88	+1	5 13 8
London and Suburban, Ord. ..	1	..	..	$\frac{7}{32}$— $\frac{9}{32}$	—$\frac{1}{32}$	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅝— ¾	..	6 13 4
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	79 — 84	..	5 7 2

NAME.	Stock or Share. *	Dividends for 1912.	Dividends for 1913.	Closing Quotations March 17th.	Rise + or Fall —	Present Yield p.c. £ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	63 — 67	..	5 19 5
Metropolitan Railway Consol. ..	100	1⅝	1⅝	40¼— 41½	—1¾	3 [illegible] 9
Do. Surplus Lands	100	2¾	2¾†	62 — 64	—1	4 6 0
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82 xd	..	4 5 4
Metropolitan District Ord. ..	100	Nil	..	28 — 28½	—1¾	Nil
Do. 6 % Deb.	100	6	6	138 —141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 1 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	85 — 88	—1	5 2 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	.	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	89 — 92	—2	4 17 9
Do. 5 % Deb.	100	5	5	88 — 91	—1	5 10 0
Potteries, Ord.	1	3½	..	⅜— ½	..	..
Do. 5 % Pref.	1	5	5	[illegible]	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝— ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	8 — 8½	— ⅛	Nil
Do. "A"	1/-	..	..	⅜— $\frac{7}{16}$	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 —114	..	5 5 3
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 0
Do. 6 % Income	100	6	6	88 — 89	—1	6 14 10
Yorkshire (West Riding), Ord. ..	5	Nil	..	$\frac{5}{16}$— $\frac{9}{16}$	..	Nil
Do. 6 % Pref.	5	3	4	4 — 4½	+ ⅛	4 9 0
Do. 4½ % Deb.	100	4½	4½	83 — 86	+2	5 1 [illegible]

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations March 17th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	$4\frac{13}{16}$— $5\frac{1}{16}$	..	5 8 7
Do. 2nd Pref.	5	5½	5½	$4\frac{5}{16}$— $4\frac{9}{16}$	..	6 0 7
Do. 4 % Deb.	100	4	4	92½— 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
Do. 5 % Deb.	100	5	5	96½— 98½	..	5 1 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 —106	..	4 14 3
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾— 11¼	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½— 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	82½— 84½	—3½	7 2 0
Brisbane Trams Invt., Ord. ..	5	8	8	7⅝— 8⅛	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞— 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	113 —117	..	6 16 9
Do. Pref. Ord.	100	6	6	105 —109	..	5 10 1
Do. 5 % Pref.	100	5	5	101 —104	..	4 16 2
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	93½— 95½ xd	..	4 9 0
Calcutta Trams, Ord.	5	7½	5†	6¼— 6¾	..	5 11 1
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝— ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5¼— 6¼ xd	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½— 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — $\frac{1}{16}$	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations March 17th.	Rise + or Fall —	Present Yield p.c. £ s. d.
La Plata Elec. Trams, Ord. ..	1	..	..	⅜— ½	..	..
Do. Pref.	1	4⅜d.	6	⅞— 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1⅛— 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	$\frac{15}{16}$— $1\frac{3}{16}$	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	5 — 5⅜	..	5 11 7
„ Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½—100½	+ ½	4 19 6
Mexico Trams Com	$100	7	7	69 — 72	—1	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	80 — 84	..	5 19 1
Do. 6 % Bonds	100	6	6	81 — 85	..	7 1 2
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	4½— 5 xd	..	10 0 0
Do. 6 % Pref.	5	6	6	4⅛— 4⅝ xd	..	6 9 9
Do. 5 % 1st Deb.	100	5	5	92 — 94	—1	5 [illegible] 5
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	95 — 97	—2	5 3 0
Do. 5 % Mort. Bonds	100	5	5	87 — 89	—1	5 12 5
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	96 — 99	—3	5 1 0
Singapore Trams, 5 % Deb. ..	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	— ½	5 3 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅝— 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞— 6¼	..	5 14 8
Do. 5 % 1st Deb.	100	5	5	95 — 98	..	5 2 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93 — 95 xd	..	4 14 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations March 17th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	8½— 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 97	..	4 12 9
Brompton & Kensington, Ord. ..	5	10	10†	9 — 9½	..	5 4 0
Do. 7 % Cum. Pref.	5	7	7	8⅝— 9⅛	..	3 16 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91½— 94½	+ ½	4 4 8
Charing Cross, West End & City	5	5	5	$4\frac{9}{16}$— $5\frac{1}{16}$ xd	..	5 18 5
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜— 4⅞	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞— 4⅜	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4⅞— 5⅜	..	4 13 0
Do. 4½ % Deb.	Stock	4½	4½	97 - 100	..	4 10 0
City of London, Ord.	10	9	10	17½ - 18½ xd	..	5 9 7
Do. 6 % Cum. Pref.	10	6	6	12¾ - 13¾ xd	..	4 7 3
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 7 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 —103	..	4 8 1
County of London, Ord.	10	6	7	12½— 13	..	5 7 8
Do. 6 % Pref.	10	6	6	11¾— 12¼	..	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	102 —105	..	4 5 9
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	£3	..	..	⅜— ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞— 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝— 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 8 6
Folkestone	5	6	6	4½— 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅜— 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations March 17th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Hove	5	8	9	8½— 9 xd	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½— 8 xd	..	5 12 6
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	$1\frac{7}{16}$— $1\frac{15}{16}$ xd	..	4 12 8
Do. 6 % Pref.	5	6	6	4⅞— 5¼ xd	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4¼	4½	3½— 4 xd	..	5 6 3
Do. 4½ % Cum. Pref.	5	4½	4½	4½— 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾— 10½	..	5 14 3
Oxford	5	7	7	$5\frac{13}{16}$ - $6\frac{5}{16}$ xd	..	5 11 0
St. James' and Pall Mall, Ord. ..	5	10	12	9½— 10 xd	..	6 0 0
Do. 7 % Pref	5	7	7	6½— 7 xd	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 3 [illegible]
South London, Ord.	4	5½	5½	3 — 3⅜	..	6 10 4
Do. 5 % First Mort. Deb. ..	100	5	5	98 - 101	..	4 19 0
South Metropolitan, 7 % Pref. ..	1	7	7	$1\frac{5}{32}$— $1\frac{9}{32}$	+$\frac{1}{32}$	5 9 2
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 - 100	..	4 10 0
Urban, Ord.	£3	Nil	..	⅜— ⅝	..	
Do. 5 % Cum Pref.	5	3‡	..	2⅝— 3⅛	..	4 12 0
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86 — 89	..	5 1 3
Westminster, Ord.	5	10	10	8½— 9	..	5 11
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5½	—$\frac{1}{16}$	4 5 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 3s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 17th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations March 17th.	Rise + or Fall	Present Yield p.c.
								*	1912.	1913.			£ s. d.
Adelaide, 6 % Pref.	5	6	6	5 — 5½	..	5 14 3	Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	54 — 59	..	..
Calcutta, Ord.	5	8½	6†	7⅞— 8	..	5 6 3							
Do. 5 % Pref.	5	5	5	5⅛— 5⅜	..	4 13 0	Montreal, Lt., H. and Power ..	$100	9	10†	230 —235	..	4 5 0
Calgary Power, 1st Mort. Bds. ..	100	5	5	90 — 92	..	5 8 8	Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
Canadian Gen. El. Com.	$100	7	8	113 —117	..	6 16 9							
Do. 7 % Pref.	$100	7	7	123 —128	..	5 9 5	River Plate, Ord.	Stock	10	..	235 —245	..	4 1 8
Cordoba Lt., Power and T., Ord.	1	5	..	$\frac{7}{16}$— ⅝	..	7 13 0	Do. 6 % Non-Cum. Pref. ..	Do.	6	6	103 —108	..	5 11 1
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6	Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88 — 90	..	6 13 4	Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	102 —104	..	4 6 7
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5	Shawinigan Water, Capital ..	$100	5½	6†	138 —142	—4	4 4 6
							Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 7
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	..	5 5 3	Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	..	4 8 8
							Toronto Power, 4½ % Deb. ..	Do.	4½	4½	96 — 99	..	4 11 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	$\frac{1}{32}$— $\frac{3}{32}$	..	Nil	Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Do. 6 % Pref.	1	6	6†	$\frac{15}{32}$— $\frac{17}{32}$	..	10 11 10							
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2	Victoria Falls Power, Pref. ..	1	6	6	$\frac{23}{32}$— $\frac{25}{32}$	..	7 13 4
Madras, Ord.	5	Nil	..	1¼— 1½	..	..	West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	100 —102 xd	..	5 17 8
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103½—106½	..	4 14 0							
Mexican El. Lt., 5 % 1st M. Bds.	.	5	5	67 — 72	..	6 19 0							
Mexican Lt. & Power, Common	$100	4	4†	40 — 43	—1	..							
Do. 7 % Cum. Pref.	$100	7	7	76 — 82	—1½	8 10 8							
Do. 5 % 1st Mort. Gold Bds.	..	5	5	80 — 84	..	5 19 1							
Do. 5 % 2nd Mort. Bonds ..	100	5	5	65 — 69	..	7 4 11							

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	$\frac{23}{32}$— $\frac{27}{32}$	—$\frac{1}{32}$	8 5 0	Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Do. 6 % Pref.	1	6	6	¾— ⅞	..	6 17 2	Dick, Kerr	1	Nil	..	⅜— ⅝	+$\frac{1}{16}$	..
Babcock & Wilcox	1	16	14†	3⅛— 3¼	..	5 18 6	Do. Pref.	1	6	6	$\frac{23}{32}$— $\frac{27}{32}$	..	7 2 2
Do. Pref.	1	6	6	1$\frac{5}{16}$— 1$\frac{7}{16}$	..	4 8 6	Edison & Swan, A, £2 paid ..	5	Nil	..	$\frac{1}{16}$— $\frac{3}{16}$	..	Nil
British Aluminium, Ord. ..	1	..	..	1⅛— 1¼	..	..	Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 6 % Cum. Pref.	1	6	6	$\frac{27}{32}$— $\frac{31}{32}$	+$\frac{1}{32}$	6 3 10	Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Prior Liens Debs. ..	100	5	5	96 — 99	..	5 1 0	Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Do. Deb. Stk.	100	5	5	88 — 93	..	5 7 6	Electric Construction	1	5	..	$\frac{17}{32}$— $\frac{21}{32}$	..	7 12 6
B.I. & Helsby Cables	5	10	13	9⅝— 10⅛	..	4 19 1	Do. Pref.	1	7	7	$\frac{15}{16}$— 1$\frac{1}{16}$	..	6 11 7
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1	Greenwood & Batley, Pref. ..	10	7	7	6¾— 7¼	..	9 13 2
Do. Deb.	100	4½	4½	102 —105	..	4 5 9	Do. Deb.	100	5	5	92 — 94	..	5 6 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9	General Electric, 6 % Pref. ..	10	6	6	10¼— 10½	..	5 14 3
British Westinghouse, Pref. ..	2	Nil	..	1$\frac{7}{16}$— 1$\frac{9}{16}$	..	Nil	Do. Deb.	100	4	4	86 — 90	..	4 9 0
Do. Deb.	100	4	4	68½— 71½	+ ½	5 11 11	Henley's, Ord.	5	15	20	13¾— 14½ xd	— ½	6 17 11
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 6	Do. Pref.	5	4½	4½	4¾— 5 xd	..	4 10 0
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil	Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Do. Pref.	1	..	..	8/- —8/6	..	Nil	India-Rubber, G. & T.	10	7½	7½	10½— 11½	..	6 10 5
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil	Do. Pref.	10	5	5	8¾— 9½	..	5 5 8
Do. 5 % Prior Lien Deb. ..	100	5	5	80 — 85	..	5 17 8	Telegraph Construction	10	20	20	37½— 39½ xd	..	6 1 7
Do. 4½ % Deb.	100	4½	4½	39 — 43	..	10 9 6	Do. Deb.	100	4	4	98 —100	..	4 0 0
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 13 4	Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Callender's Cable	5	15	5†	11¾— 12¼	..	6 2 4							
Do. Pref.	5	5	5	4$\frac{15}{16}$— 5$\frac{3}{16}$	..	4 16 5	Do. B 4 % Cum. Pref. ..	100	..	..	50 — 55	..	..
Do. Deb.	100	4½	4½	97 —100	..	4 10 0							
Castner-Kellner	1	20	22½	2½— 2¾	—$\frac{3}{32}$	..							
Do. Deb.	100	4½	4½	103 —106	..	4 5 1							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	4½	6¼— 6¾	..	6 13 4	Marconi's Wireless Telegraph ..	1	20	20	3¼— 3⅝	— ⅛	5 10 4
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0	Do. 7 % Cum. Partic. Pref. ..	1	17	..	2$\frac{13}{16}$— 3$\frac{1}{16}$	—$\frac{3}{16}$	5 10 9
American Telep. & Teleg., Cap.	$100	8	8	123 —126	..	6 7 0	Monte Video Telephone, Ord. ..	1	6	6	$\frac{13}{16}$— $\frac{15}{16}$	..	6 8 0
Do. Collat. Trust	$1000	4	4	91 — 94	..	4 5 3	Do. 5 % Pref.	1	5	5	¾— ⅞	..	5 14 3
Anglo-American Telegraph ..	Stock	3	3	64 — 67	..	4 9 7	New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99¾—100¼	..	4 9 0
Do. 6 % Pref.	Do.	6	6	108½—109½	..	5 9 4	Oriental Telep. and Elec. ..	1	10	10†	2 — 2¼	..	4 9 0
Do. Def.	Do.	30/-	30/-	23¾— 24¼	+ ¼	6 3 9	Do. 6 % Cum. Pref.	1	6	6	1⅛— 1¼	..	4 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104 xd	..	4 16 2	Do. 4 % Red. Deb.	Stock	4	4	87½— 89½	..	4 9 5
Chili Telephone	5	8	..	7⅜— 7⅝	..	5 5 0	Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	4 0 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	81¼— 83¼	..	4 16 0	Reuter's	10	10	10†	8¾— 9¼	..	10 16 2
Cuba Telegraph	10	6	6†	8¾— 9⅜	..	6 8 1	Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 0
Do. 10 % Pref.	10	10	10	15¾— 16¾	..	5 19 5	Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½— 98½	..	4 11 5
Direct Spanish Telegraph, Ord.	5	4	4	3½— 4	..	5 0 0							
Do. 10 % Cum. Pref.	5	10	..	7½— 8	..	6 5 0	United River Plate Telephone	5	8	6†	6⅜— 6⅞	..	5 16 5
Direct United States Cable ..	10	4	4†	6¾— 7¼	..	5 10 4	Do. 5 % Cum. Pref.	5	5	5	5⅛— 5⅝	..	4 9 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10	West Coast of America	2½	2½	..	1$\frac{5}{16}$— 1$\frac{7}{16}$	..	4 8 0
Eastern Telegraph, Ord. Stock	Stock	7	7	133 —136	..	5 3 0	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
Do. 3½ % Pref. Stock	Do.	3½	3½	78 — 80	..	4 7 6	West India and Panama Teleg.	10	1¼	1½	2$\frac{7}{16}$— 2$\frac{11}{16}$	..	4 13 0
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	..	4 2 4	Do. 6 % Cum. 1st Pref. ..	10	6	6	9¾— 10¼	..	5 17 0
Eastern Extension	10	7	7	12⅜— 12⅞	..	5 8 9	Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9½	..	6 6 4
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4	Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Globe Telegraph and Trust ..	10	6	6†	11⅜— 11⅞	..	5 1 1	Western Telegraph, Ltd. ..	10	7†	7	13⅜— 13⅞	+ ¼	5 0 11
Do. 6 % Pref.	10	6	6	12½— 13	..	4 12 4	Do. 4 % Debs.	Stock	4	4	95 — 97	..	4 2 8
Great Northern Telegraph ..	10	20	6†	32 — 34	— ½	5 17 8	Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 — 98	..	4 11 1
Indo-European Telegraph ..	25	13	6†	58 — 60	..	5 8 4							
Mackay Companies Common ..	$100	5	5	85 — 89 xd	..	5 12 4							
Do. 4 % Cum. Pref.	$100	4	4	70 — 73 xd	+1	5 9 7							

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Swiss Trade in 1913.—Uniform development was far from being the characteristic of the Swiss machinery industry in 1913, says a report of the Schweizer Kreditanstalt. While some works were well, and others even over-employed, the majority, and especially those connected with the building trades, felt the effects of the prevailing economic depression. Export figures showed few important alterations as compared with those of the previous year, but new business was hard of arrangement, and old connections were adversely influenced by restrictions and postponements. Notwithstanding that raw materials and partly manufactured articles were a trifle lower in price, exporting firms found it difficult to secure prices for their products on the world-market corresponding to their value. Manufacturers in the electrical industry in 1913 were well employed. Towards the close of the year a certain shrinkage in the orders from Germany was apparent, synchronising with declining prices. The latter tendency has not hitherto been felt in Switzerland, and possibly would not have been, had not the slump in Germany lasted so long. Great anticipations continue to be entertained in connection with the introduction of electric working on the Swiss railways.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING FEBRUARY, 1914.

The electrical export business during February last makes a poor showing in comparison with the January figures, the February total of £439,241 being about £115,000 down.

This result is traceable almost entirely to the falling-off in electrical machinery exports, which, it may be remembered, reached a record value in January, for in other directions the export returns show an improvement on the whole.

The machinery exports, despite their fall, are but slightly under last year's average; the cable, telephonic material and lamp exports reached higher values, and telegraphic and fittings exports lower values, than in the previous month.

The February imports reached a total of £270,944, which compares with £258,175 in the previous month, the increase in the total being due to somewhat higher values in the goods, cable, lamp, machinery and carbon sections, which were accompanied by a comparatively small falling-off in other directions.

The re-export total, £25,297, was nearly £3,000 lower than the previous month's figure.

As in the previous month, India was by far the best customer of this country, while business with our colonies, as usual, and with Japan, Argentina, Brazil and France reached satisfactory proportions. German imports were on a higher scale than in January, while the other prominent importer, the U.S.A., showed a falling-off in business.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,766	149	537	47	3,002	1,029	5,256	79	521	15	7	2,581	14,989
Germany	1,169	851	73	...	490	53	2,545	...	67	...	108	351	5,707
Netherlands, Java and Dutch Indies ...	925	825	247	12	...	...	556	...	26	28	1,536	251	4,406
Belgium	1,332	219	220	...	335	118	1,201	...	173	...	2,160	89	5,847
France	956	...	4,254	26	...	...	12,641	4,346	10	126	31	14	22,404
Portugal	33	10	...	...	...	16	31	5,474	12	2	2,467	155	8,200
Spain, Canary Isles and Spanish N. Africa...	1,546	125	60	10	...	399	3,263	...	4	...	299	2,274	7,980
Switzerland, Italy and Austria-Hungary ...	378	86	262	...	167	400	2,294	670	...	417	12	263	4,949
Greece, Roumania, Turkey and Bulgaria ...	367	...	93	26	...	...	622	...	...	...	934	202	2,244
Channel Isles, Gibraltar, Malta and Cyprus...	45	...	53	49	32	...	60	...	...	...	6	15,600	15,845
U.S.A., Philippines and Cuba	902	102	...	671	203	...	1,130	64	3	...	...	2,338	5,413
Canada and Newfoundland	640	542	551	459	13	2,034	7,067	537	190	21	108	265	12,427
British West Indies and British Guiana ...	71	...	266	141	...	63	100	...	13	...	123	49	826
Mexico and Central America	16	228	...	107	...	...	264	1,350	...	...	124	82	2,171
Peru and Uruguay	176	119	39	203	...	154	1,021	...	80	...	3	213	2,008
Chile	733	33	131	122	...	...	706	2	5	3	60	44	1,839
Brazil	1,779	128	753	13	...	35	10,521	2,837	1,243	6	3,049	1,169	21,533
Argentina	3,025	11,063	906	1,611	1,048	526	7,892	16	1,674	6	3,074	1,419	32,260
Colombia, Venezuela, Ecuador and Bolivia...	59	...	...	...	...	...	877	...	...	3	99	...	1,038
Egypt, Tunis and Morocco	458	1,168	56	27	...	139	1,054	114	71	...	490	1,031	4,608
British West Africa	21	200	89	52	...	22	705	5	103	...	280	28	1,505
Rhodesia, O.R.C. and Transvaal	731	622	1,266	227	...	160	3,561	...	62	17	51	135	6,832
Cape of Good Hope	1,348	1,894	848	230	...	357	4,501	210	851	7	2,228	1,255	13,729
Natal	602	5,085	95	440	...	7	1,484	...	59	10	722	666	9,170
Zanzibar, Brit. E. Africa, Mauritius & Aden	621	469	29	180	...	38	510	398	80	...	509	1,524	4,378
Azores, Madeira and Portuguese Africa ...	228	188	76	53	...	195	1,864	17	137	16	...	30	2,804
French African Colonies and Madagascar ...	74	...	...	...	...	...	...	...	...	...	...	...	74
China and Siam	884	8,025	1,770	109	...	370	4,726	...	455	...	394	67	16,800
Japan and Korea	2,536	...	...	...	12	33	21,894	...	202	24	129	...	24,830
India	6,613	13,607	2,711	2,784	200	2,462	32.100	5,609	3,219	289	4,890	1,477	75,961
Ceylon	225	260	117	29	...	48	629	484	94	...	262	122	2,270
Straits Settlements, Fed. Malay States and Sarawak	311	217	516	79	87	149	3,019	1,336	96	...	810	1,390	8,010
Hong Kong	444	399	237	18	30	11	1,341	...	63	...	...	...	2,543
West Australia	238	797	111	36	...	208	1,000	47	5	...	3,180	101	5,723
South Australia	558	242	49	64	12	1,158	737	9	2	...	429	723	3,983
Victoria	2,213	5,792	484	1,241	178	1,157	3,336	652	445	...	2,241	481	18.220
New South Wales	1,832	4,013	1,626	1,039	570	1,396	15,118	446	1,916	33	3,719	2,049	33,757
Queensland	348	2,394	95	155	...	55	404	25	54	...	69	3,176	6,775
Tasmania	...	...	...	82	404	...	43	...	...	...	85	...	614
New Zealand and Fiji Islands	733	8,575	564	623	259	686	1,987	...	757	14	9,962	432	24,592
Total, £	36,936	68,427	19,184	10,965	7,042	13,478	158,054	24,727	12,692	1,037	44,650	42,049	439,241

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	7,045	...	24	...	...	...	4,009	5	818	38	10,844		22,783
Germany	4,115	25,505	1,648	14,670	8,659	4,377	72,589	1,228	5.343	12,910	8,590		159,634
Holland	...	53	...	624	409	...	77	...	...	34	14		1,211
Belgium	326	5,631	...	105	53	50	3,645	...	264	49	5,548		15,671
France	1,074	4,595	58	1,940	265	1,751	1,882	...	800	3,723	1,529		17,608
Switzerland	426	916	23	10	...	625	1,958	40	...	115	183		4,296
Italy	...	3,781	...	219	...	...	144	...	...	206	17		4,367
Austria-Hungary	4	1,087	...	...	16	...	321	...	90	...	...		1,518
United States	11,130	112	1,736	...	245	...	12,594	14,477	711	189	1,750		42,944
Total, £	24,120	41,680	3,489	17,568	9,647	6,803	97,219	15.750	8,026	17,264	28,466		270,032

Additional imports: Spain, carbons, £662; Canada, electrical goods, £250.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above ...	11,047	1,736	...	1,243	205	...	6,306	...	200	543	814		25.297

Total Exports: £439,241. **Total Re-Exports: £25,297.** **Total Imports: £270,944.**

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE ALL-ELECTRICAL OPERATION OF THE PANAMA CANAL.

By JOHN GEO. LEIGH.

(*Concluded from page* 366.)

I am acquainted with no engineering or, indeed, other enterprise which, considered as a whole, can compare with the Panama Canal in well-justified claims to lively and world-wide interest. This is not merely because of the immensity of the undertaking and its far-reaching commercial and other material influences, but also by reason of the opportunities it presents to men of all sorts and conditions for valuable study and instruction. To no department connected with the constructive work or the use of the completed highway can this last remark be applied with greater truth than the electrical; and pre-eminently is this the case in respect of the specification, design and manufacture of the centralised control, interlocking and indicating systems to which I invited particular attention in a recent issue of the Electrical Review. If, as may be confidently anticipated, these systems prove helpful to the safe and expeditious navigation of the Canal, everyone concerned in their production and installation may point to the result with pardonable pride, and say: "I helped to make this possible."

Put briefly, the systems are a triumph of co-ordination, mental no less than mechanical. Both in part and as a whole, they present startling departures from long-established practice, and cannot fail to serve for many years to come as models of painstaking engineering, thoughtful of every detail, and comprehending every safeguard and contingency which expert knowledge can suggest. The specifications for them, and generally for the generation and distribution of energy, were prepared under the supervision of Mr. Edward Schildhauer, the Canal Commission's electrical and mechanical engineer, assisted by a staff of accomplished electrical engineers, including Mr. C. B. Larzelere, who was closely identified with lock control problems, and Mr. W. R. McCann, who devoted himself especially to power generation and distribution. While necessarily exacting as to the high quality of the work demanded, and explicit concerning the results to be accomplished, the specifications gave unusual opportunities for the exercise of individual ingenuity and the adoption of well-considered modifications.

The General Electric Co., of Schenectady, N.Y., may well be proud of the large percentage of contracts awarded to it. By this company have been manufactured all the lock machinery motors, control panels, centralised control boards, power-station generating apparatus, switchboards, transmission line sub-station equipments, electrical machinery for the Cristobal and Balboa coaling stations, and practically the entire electrical equipment for the wharf terminal cranes and for the extensive permanent machine shops now in course of completion at the Pacific entrance to the Canal.

After the award of contracts, conferences took place between the engineers of the Commission and of the manufacturers, and, because of the absence of previous experience as a guide in the selection of designs, these were continued until there was a full understanding of the requirements, conditions and possible alternatives. Associated with or following these conferences were numerous departmental consultations, at which factory foremen, designers and engineers were represented, facilities were discussed and special tools were considered.

Preliminary plans and models were then prepared, to be modified from time to time, since no part was considered complete until the model had been critically inspected and tested by the engineers, both of the Commission and of the manufacturers, and there was a consensus of opinion that the design and operation met every condition foreseen at the time the specifications were written or subsequently revealed. A co-ordinating engineer was appointed to settle the innumerable questions arising in respect of construction, design and delivery and, generally, to relieve the departments of those complications liable to occur through long-distance correspondence. A separate manufacturing department was also organised, so arranged that its members would not be hampered by other work, and the Canal Commission was kept in touch with the progress of production by its own inspectors resident at the factory. Sufficient proofs of the value of this co-operation will be found in the expedition and close accord with the spirit of the specifications with which the contracts have been fulfilled.

The following classified summary of the various apparatus employed in the control system described in the preceding article—towards the preparation of which the General Electric Co. contributed much information and most of the illustrations—may be of interest:—

Control Switchboards.

One each, with control switches and interlocks, for the locks at Gatun, Pedro Miguel and Miraflores and the Gatun and Miraflores dams.

Starting Panels.

One hundred and sixteen for rising-stem gate-valve motors, one starting and one running point both forward and reverse; 116 similar panels for use with motors on 92 mitre-gate moving machines and 18 guard gates; 280, with one point forward and one point reverse, for use with motors on 120 cylindrical valves, 12 auxiliary culvert valves, 46 mitre-forcing machines, 80 mitre-gate handrails and 22 spillway gates.

Limit, Commutating, Overload Cut-Out, Indicator and Handrail Control Switches.

One hundred and ten limit switches for use with 92 mitre-gate moving motors and 18 guard valves; 22 limit switches, with indicator switch attachment, for spillway gates; 58 similar switches for use with 46 mitre-forcing machines and 12 auxiliary culvert valves; 80 limit switches for use with handrail motors on mitreing lock gates; 92 commutating switches, half for use with right hand and half with left hand mitre-gate moving machines; 92 auxiliary cut-off switches for mitre-gate struts, right hand and left hand; 200 indicator switches for attachment to limit switches on 120 cylindrical valve machines, 46 mitre-forcing machines, 12 auxiliary culvert valve machines and 22 spillway gate machines; 80 handrail controllers, foot-operated.

Fender Chain Control Apparatus.

Forty-eight starting panels for 50-h.p. pump motors operating fender chains; 48 operating valve control equipments; 48 limit switches; 48 indicating devices for showing position of chain to those in vicinity of the chain itself; 46 indicating devices for showing on the control switchboard at all times the position of chain.

Miscellaneous Remote Indicators.

Two hundred red and green lamp indicators, mounted on control board and operated by switches; 226 indicators, giving progressive or synchronous indication—92 for mitre-gate moving machines, 116 for rising-stem gate valves and 18 for guard valves; 46 float well indicators, including float and machinery at well and indicator mounted on switchboard.

It is interesting to note that in the course of manufacturing operations the General Electric Co. made no fewer than 1,750 special drawings, and that into its work there entered in various quantities over 22,000 individual parts. Up to November 1st, 1913, 73 carloads of switchboard material alone had been shipped to Panama. The following list of approximate quantities will give some idea of the extent of the undertaking:—

Special slate bases	1,300
Small castings	160 000
Screw machine parts	1,200,000
Copper rod and bar	58,000 ft.
Asbestos lumber	9,000 sq. ft.
New patterns	650
New jigs, templates, tools, &c....	625
Porcelain parts	18,000
Special bus supports	6,800
Gal. pipe (framework)	21,000 ft.
Special gears	2,300
Special indicator motors	730
Special instruments	642
Miscellaneous sherardised pieces	300,000
Cases for boxing	4,150

The combined weight of the centralised control boards at Gatun, Pedro Miguel and Miraflores locks is about 89 tons, and in their construction there were employed more than two miles of interlocking rod, about 6,000,000 ft. of control leads, 732 indicator motors and 464 control switches.

The 246 miles of lead-covered cables required for the control and power systems of the locks, and the 112 miles of wire of miscellaneous sizes used for the lighting system, are carried in vitrified clay ducts through tunnels in the lock walls provided for the purpose. By employing electric winches and by greasing the cable at three points to reduce friction, it was found possible to pull at one time 900-ft. lengths of the lead-covered line, and thus reduce greatly the time demanded for the operation. One of the "records" established was that reported from Miraflores in July last, when, in a single working day of eight hours, there were pulled into the ducts of one of the lock walls 7,444 ft. of 5-conductor and 10,000 ft. of 8-conductor cable. This, however, was beaten two months later by a cable gang working at Gatun, who succeeded in pulling a total of 22,128 ft. during a working day marked by incessant rain. The best record for any one month is 113,002 ft.

As the motors applied to the machinery in the locks require electrical service at 240 volts, transformer units are needed, possessing a 9 to 1 ratio, to link the power circuits from the generating station to the mains feeding the motors. The feeders entering a lock at either extremity are equipped with transfer switches to admit of isolation, and so provide separate service to the machinery of any of the lock chambers or any of the lock walls. In each of the latter, duplicate feeders are run to the different transformer rooms, the high-tension buses of which are looped into the feeders and provided with sectionalising switches to permit of the cutting-out of all high-voltage conductors from a seat of trouble between any two rooms.

Each of the transformer rooms is practically a self-contained sub-station (fig. 23). In all the locks there are 36 such rooms—16 at Gatun, 8 at Pedro and 12 at Miraflores. At Gatun, for example, there are four rooms in each of the side walls and eight in the centre wall, these last being so arranged as to separate the equipment required for one lock chamber from that of the other. In each of the walls, the transformer rooms are grouped near the centres of power distribution adjacent to the great mitreing gates at each end of a lock, the result being minimum energy losses in the low-tension mains.

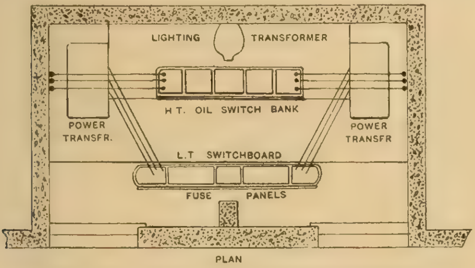


Fig. 23.—Lay-Out of Transformer Room.

The transformer-room equipment includes duplicate power transformers, each of approximately 200 kw. capacity; a single lighting transformer, of 25 kw. capacity; an oil-switch bank, containing ten single-throw oil switches; a seven-panel distribution switchboard, containing 12 power switches, and a panel of lighting equipment.

The power transformer is of the air-cooled, oil-insulated type, designed to operate upon a three-phase, 25-cycle circuit, and furnishing a normal pressure transformation of 2,200 volts to 240 volts. The case is of corrugated steel sheet, with cast-iron base, top rim and cover, the core and windings being immersed in a freely circulating oil. The rating is such that either of the units is capable of carrying the entire load on the transformer room, the second transformer being a duplicate and in reserve. In normal operation, however, the mains connected to the locomotive track will be loaded probably upon one transformer, while those to the machinery motors will be connected to the second. In the event of a breakdown of either transformer or feeder, the mains can be transferred quickly to the alternative transformer. The lighting transformer is very similar to the power transformer, but of smaller capacity and single-phase instead of three-phase. The purpose of this transformer is to take single-phase energy from the primary feeders at 2,200 volts between wires and transform it to energy at 220-110 volts for the three-wire Edison service to about 7,000 lamps distributed throughout the locks.

The oil-switch bank (fig. 24) consists of 10 single-throw oil switches mounted upon a rigid pipe framework, the oil switches being connected to the transformers and the feeders. Three-pole switches are required for power purposes, and two-pole for lighting. Double-throw switches on the transformers are obtained by connecting a common lead to two adjacent studs of single-throw switches. Overload protection is provided for by means of current transformers, inverse time-limit relays and tripping coils; and, in order to protect attendants against accidental contact with dangerous potentials, special pains have been taken to make the equipment safe and "fool-proof." All conductors are well-insulated, and screens surround them and the buses as protection against mechanical injury.

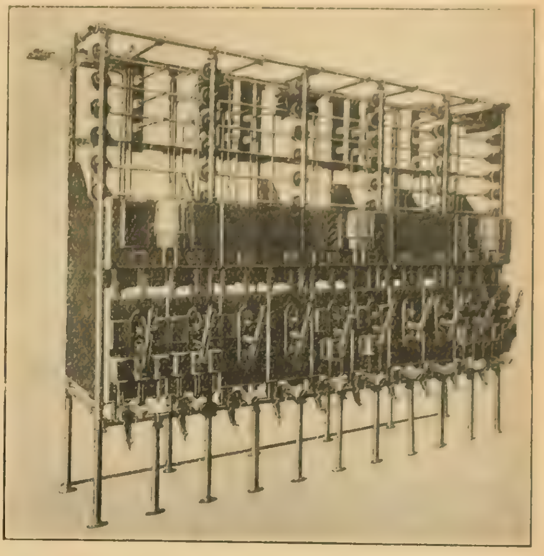


Fig. 24.—2,300-volt Transformer Switchboard for Canal Locks, showing Oil-Switch Disconnecting Switches, and Oil-Switch Panels.

To overcome one particularly dangerous operating feature, a special design has been resorted to. In the maintenance of oil switches it is necessary at intervals to clean out the oil and inspect the contents. Owing to methods of construction, it is then often possible that the contact studs are charged to an unsafe potential. The usual practice of inserting knife-blade disconnecting links in each of the leads to the oil switches is satisfactory where the installation is isolated, and the inspection and repairs occur at rare intervals. In the limited space of the lock transformer rooms, however, the large number of knives necessary assumes cumbersome dimensions. A one-link lever attachment has accordingly been adopted to drop and disconnect the entire switch—can, insulators, studs, slate and handle—from stationary contacts rigidly secured to the pipe framework. The operation of this device, which may serve as the solution to a knotty problem to many central-station designers and engineers, is illustrated in figs. 25 and 26, p. 508.

These show a manually-controlled oil switch, A being the pot containing oil, in which are immersed the contact studs (B) and the contact blade (C). The electric current ordinarily passes from one external conductor (D) through the contact studs and blade, and out by the other conductor (E). To interrupt the flow of current, the blade is lowered by means of the operating levers (F), which are controlled by the handle (G), mounted upon a slate panel (H) in front of the switch, the entire unit being supported upon a pipe framework (J). When it is necessary to inspect the switch, the pot is dropped, and the contacts are exposed. Should, however, these contacts be "alive," the attendant is obviously unable to make the repairs with safety, and it is to ensure knowledge that they are "dead" that the new disconnecting device has been provided.

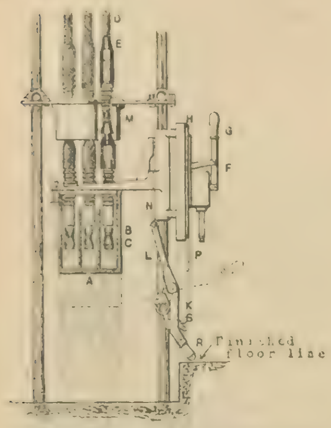


FIG. 25.—DETAILS OF DISCONNECTING DEVICE.

A, Oil pot; B, Contact studs; C, Contact blade; D, E, External conductors; F, Operating levers; G, handle; H, Slate panel; J, Pipe framework; K, Disconnecting lever; L, Link; M, Stationary contact studs; N, Cross-head; P, Brass guides; R, Handle; S, Wing nut.

As already stated, this contemplates a dropping of the entire switch by means of the lever K, which is connected through a link (L) to the bracket carrying all parts of the switch. Stationary contact studs are provided on the conductors at M, and the oil-switch studs are made double-ended so as to make contact at both the lower and upper ends. The oil-switch bracket is bolted to a cross-head (N), which rides vertically upon brass guides (P). By raising the handle (R), the entire oil-switch and operating mechanism are lowered bodily away from the stationary studs and the circuit at M is broken. When once the switch is dropped, the attendant may repair or renew any part without danger to his person. Though the opening of the switch under oil is a frequent operation, the dropping of the entire can will be required comparatively seldom, and there will be consequently little need of renewals at the stationary contacts. Adjustments for alignment are provided in the brass guides, in the plate supporting the stationary studs and in the individual switch contact studs. The disconnecting lever, when not in use, is maintained in position by a wing nut (S), the handle being removable.

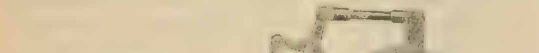


FIG. 26.—TRIPLE-POLE, 2,200-VOLT, 300-AMP. OIL-SWITCH, WITH SOLENOID OPERATING MECHANISM AND DISCONNECTING DEVICE; CIRCUIT OPEN.

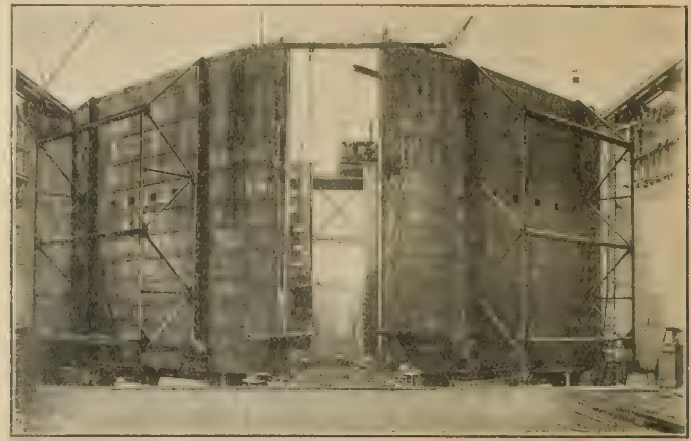


FIG. 27.—UPPER GUARD GATES AT PEDRO MIGUEL LOCKS.

There will be in all the locks 372 oil switches, their rating being 300 amperes at 2,200 volts and 25 cycles. As the oil to be used is to serve as an insulating medium and to quench arcing at contacts, the requirements of break-down voltage are somewhat severe. For this reason, the specifications covering the oil and the method to be adopted in testing it are exceptionally rigorous.

The distributing switchboard consists of seven panels of 2-in. slate, six panels being used for mounting 12 power switches and one for lighting switches and circuit breakers. The power switches are of a three-pole, double-throw, double-blade, back-connected lever type, rated at 600 amperes. The switchboard is built upon a pipe framework, each switch being fused upon small panels mounted upon the framework in the rear of the board proper. From the fuses, copper bar connections are provided to the cable terminals. The distributing mains consist principally of No. 0000 B. & S. gauge, three-conductor, lead-covered cable.

The following are among the more important contracts awarded by the Canal Commission in connection with the electrical operation of the Canal :—

General Electric Co.—118 motors for rising-stem valve machines	$78,425
122 motors for cylindrical valve machines	42,991
12 motors for auxiliary culvert valve machines ...	4,234
92 motors for mitre-gate moving machines ...	46,422
46 motors for mitre forcing machines	13,569
Steel rail, &c.	73,639
40 towing locomotives	528,680
Starting panels, limit switches, commutating switches, &c., indicators for control machinery, switchboards and control switchboards, starting panels for chain fenders	199,631
Motors	110,260
60 pumps (Cameron)	26,921
308 float switches and starters	13,822
170,000 ft. insulated cable	132,028
Generators, exciters, &c., for Gatun hydro-electric station	54,599
Cutler-Hammer Manufacturing Co.—116 limit switches for rising-stem valve machines	5,684
120 limit switches for cylindrical valve machines...	5,880
Westinghouse Electric and Manufacturing Co.—Porcelain insulators...	5,858
Roller trains, sealing devices, rocker bearings, rollers, &c., at locks and spillway dams	177,147
Shawmut Clay Manufacturing Co.—Vitrified tiles, mandrels, &c....	85,350
Wheeling Mold and Foundry Co.—Copper conductor rails and bars...	168,123
Pelton Water-Wheel Co.—Penstocks for hydro-electric station	24,530
Turbines, governors, headgates, &c.	70,012
U.S. Steel Products Co.—Cross-bonds, punches, riveting hammers, locknuts, &c.	2,014
Crossovers and turnouts	44,142

National Electric Supply Co.—Galvanised conduit, bushings, &c....	$2,055
Pennsylvania Flexible Metal Co.—Flexible conduit and couplings	4,166
Union Switch and Signal Co.—Local indicating devices for fender chains	10,800
Alberger Pump Co.—147 pumps	21,860

Brief reference should be made here to the electric towing locomotives which will be employed to control and hold steady, between four lines of taut hawsers, all vessels during their passage through the locks. In the ELECTRICAL REVIEW of February 9th, 1912, there appeared an illustrated description of the locomotive designed for the Canal Commission, followed by an announcement that the latter had accepted the tender of the General Electric Co. for the supply of 40 such locomotives—one sample and 39 others if the first proved satisfactory. Tests conducted at Gatun Locks during the early part of last year having demonstrated that the sample machine failed to realise all the expectations of its designer, the Commission decided to abandon the proposed double truck, and accept an alternative single-truck design submitted by the contractors, subject to the following modifications, which the tests showed to be desirable:—Omission of solenoid operating clutches and friction gear, addition of hand-operating clutches and equalised hand-brakes, the fitting of springs to the thrust guide-wheel, and a change in the windlass. These modifications have resulted in a net addition to the cost of each locomotive of about £318, making the total cost of the 40 machines £109,000.

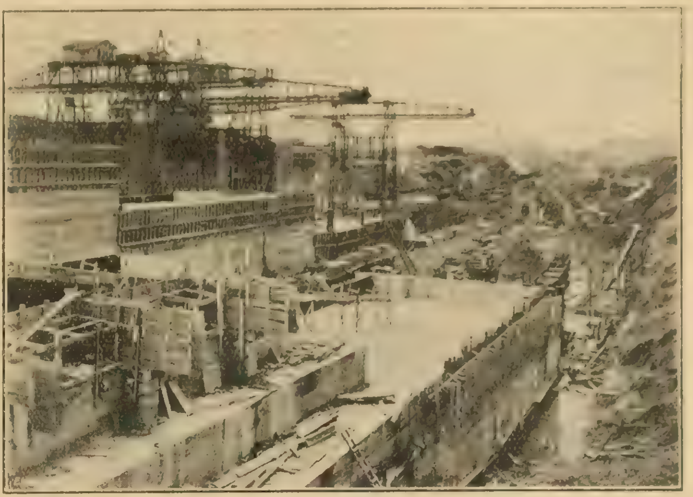


FIG. 28.—ELECTRIC CRANES AT MIRAFLORES LOWER DOCKS.

THE GOTT SYSTEM OF TELEGRAPHING THROUGH LONG SUBMARINE CABLES.

JUST over a year ago, the announcement was made in our columns that Mr. John Gott, chief electrician of the Commercial Cable Co., to whose decease we refer elsewhere in this issue, had succeeded in solving a problem of the utmost importance to cable telegraphy—namely, that of sending Morse signals through long submarine cables with some approach to the facility enjoyed in transmission over land circuits.

In the *Scientific American* of November 22nd, 1913, Mr. H. T. Wade gave a full description of the Gott system, which promises to produce radical changes in handling the ever-growing traffic carried over the cables of the world. We are indebted to this article for the following particulars.

By the new method manual re-transmission at the cable or land ends is obviated; the siphon recorder gives place to an ordinary Morse recorder or sounder, with a corresponding increase of accuracy in transmission and saving of time in deciphering the received message; and a number of short cables can be linked up for direct working, while long landlines can be connected directly to a cable system, all messages being automatically relayed to practically any distance. The sending of signals over long cables can be effected by an ordinary telegraphist with a single Morse key, instead of the double key of manual cable working, and a Wheatstone or other similar automatic transmitter may be introduced in case increased speed is desired. Consequently the new method establishes uniformity of operation between land and submarine lines, and makes possible the fullest and most rapid interchange of traffic.

The invention was the result of many years of experimentation on the part of Mr. Gott. In addition to daily use between London and New York, special demonstrations were made of direct communication between San Francisco and London, as well as between the latter city and Montreal, Toronto, Winnipeg, Victoria and Bamfield, B.C., on the coast of Vancouver. Although the new method is one of extreme simplicity, and requires no other apparatus or instruments than may be found at any cable terminal or testing station, it affords the solution of a problem that has held the attention of cable electricians for many years.

Hitherto, even using the most sensitive instruments, it has not been possible with a long cable so to interrupt the electric current as to form signal impulses of greater or less length, such as the dash and the dot, but it has been found necessary to distinguish the two elements of the signals by the direction of the current. Thus, in ordinary cable working the letter *e*, indicated in the Morse code by a dot, would be signified by a + impulse, while *t*, represented by a dash, would be a — impulse, the galvanometer or siphon recorder at the receiving station indicating such impulses by an appropriate deflection of the mirror or moving coil in one direction or the other. This, of course, would be in response to the signals of the sending operator made by depressing one or the other of two levers of the transmitting key, depending upon whether he wished to join the positive pole of the battery to the cable and the negative to the earth, or *vice versa*. In fig. 1, on page 510, we give a diagram of the ordinary method of working with the siphon recorder on the duplex system, sending and receiving at both ends of the cable simultaneously.

In essence Mr. Gott's method is exceedingly simple. The direction of the current is changed after each signal by means of a polarised relay, through which the cable is discharged. The polarised relay consists of a permanent horseshoe magnet with one of its poles divided into pole pieces, around which are fitted coils of fine copper wire. Between the pole-pieces is poised a soft-iron needle or tongue, free to move, but normally at rest. If a current passes through the coils it will strengthen the magnetism in one of the two pole pieces, depending, of course, upon the direction of its flow, causing the arm or tongue to be attracted to one side or the other. In so moving it comes into contact with one or the other of two stops and completes a local circuit, in which the direction of the current depends upon the direction of the current flowing through the coils of the relay. The application of the polarised relay in the Gott method will appear on reference to the accompanying diagram (fig. 2), which shows a cable arranged for duplex working. The cable itself is shown at *a*, and the artificial cable at *b* with its unconnected end earthed. Between the real and the artificial cable is inserted the receiving instrument V, as in the ordinary duplex system. The transmitting key *d*, however, is arranged so as to connect *e* either with *g*, as when at rest, or when depressed at *f* with *j*, as when sending a signal. Both these connections lead to the polarised relay *h*. On pressing the key the cable is put into connection with the movable tongue h'', and through it with one of the stops h', each of which is connected with one pole of the split battery at *l* or

l', the centre of the battery being earthed at M. Thus depressing the key charges the cable with a polarity depending upon which of the stops h' the movable tongue h'' is touching. On permitting the key to return to its normal position contact is made at g, causing the cable to discharge through the polarised relay, and the direction of the current is always such that it causes the movable tongue to pass from one stop to the other, reversing the polarity of the battery connection in readiness for the next signal. Thus successive signals are always of different polarity, and the discharge from the cable is utilised to effect this reversal, at the same time restoring the cable to a neutral condition, so that rapid signalling is possible.

A modification of the sending method involves the use of a transformer in connection with the polarised relay, as shown in fig. 3. The condenser and cable are earthed directly at g' after each signal, and while the key is open. The split battery is earthed at E through the primary coil P of the transformer. The coils of the polarised relay are in connection with the secondary of the transformer S, and the contact point of the key f is connected through the movable tongue h'' with the stops that in turn are connected with the split battery. The function of the transformer is to induce in the secondary coil, which is connected with the coils of the relay, a current that will send the tongue over against one of the stops and hold it there. Releasing the key will cause a current of opposite polarity to flow through the relay, sending the tongue over against the opposite stop, as described above. An advantage claimed for this method is that on making contact with the key to charge the cable, the battery contact in the relay is reinforced at the moment the key is depressed, thus ensuring perfect transmission. To substitute for the hand key the tongue of the relay of a land line is very simple, as is shown in the diagram (fig. 4), where T takes the place of the key d. Automatic transmission is also possible, using the Wheatstone transmitter.

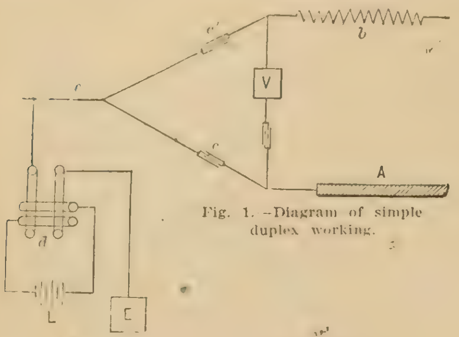


Fig. 1.—Diagram of simple duplex working.

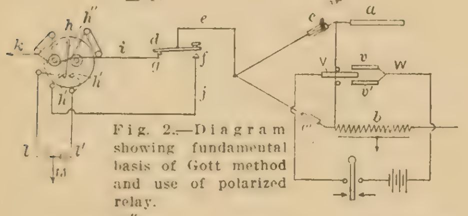


Fig. 2.—Diagram showing fundamental basis of Gott method and use of polarized relay.

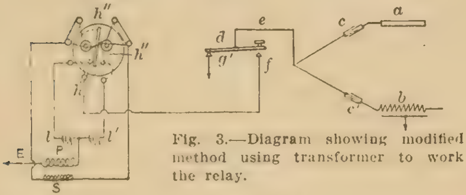


Fig. 3.—Diagram showing modified method using transformer to work the relay.

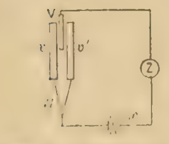


Fig. 5.—Diagram of receiving instrument and circuit.

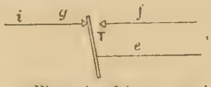


Fig. 4.—Diagram showing transmission from relay of a land line or automatic transmission.

To understand the receiving system the diagram (fig. 5) should be examined in connection with that of the sending station. At V, where the siphon recorder ordinarily is placed, a similar instrument provided with a contact-making tongue attached to the moving coil is used. This tongue or arm makes contact with either v or v', depending upon the polarity of the current coming through the cable. These plates in the instrument are connected at W and are in circuit with the local battery x, and a sounder or recorder at Z, which, however, may be a relay or any desired instrument. While the contact piece at V will move from one side to the other depending upon the polarity of the arriving current, the effect on the local circuit will be the same in either case, and the dot or dash is sounded or recorded just as in ordinary Morse working.

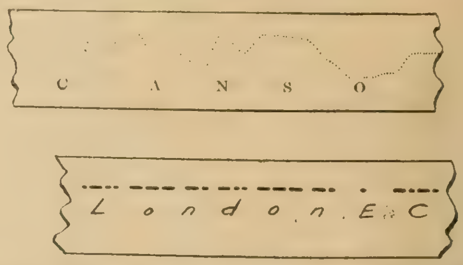

C A N S O
L o n d o n . E . C

Fig. 6.—Tape of Siphon Recorder compared with Morse Tape

From this outline description it will be evident that these various arrangements can be combined practically indefinitely. Relays from land lines can be used to work sections of ocean cables, and the signals from one section may be transmitted to the next and finally to a relay working a land system of practically any length. Thus, when the operator at San Francisco was communicating direct with London, his message was relayed across the United States by nine relays working over as many sections into the cable office in New York. Here the receiving relay automatically gave its message to the Gott arrangement, and the electrical signal impulses were sent on their 1,000-mile journey to Canso, Nova Scotia, there to be received and automatically sent on the long section of 2,565 miles across the Atlantic to Weston-super-Mare, where a similar retransmission through 146 miles of subterranean line took place to London, and the message from the Pacific Coast was heard in that city with the familiar click as if it were but from Manchester. Clearly a point has now been reached where no limit can be put upon the interchange of traffic up to the capacity of the individual lines and cables making up a system.

The new method affords much greater facility of working, and while it will not phenomenally increase the actual speed of transmission, it will, as in fact it has done, make submarine telegraphy more effective, accurate and uniform.

A New Cinema Target.—In recent years the cinematograph has been pressed into service with a view to introducing a certain amount of realism into low powered rifle shooting, which is obviously lacking in the stationary target, particularly that of the bull's-eye type. It is not denied that the latter plays an essential part in the training of the rifleman, but his education is by no means complete until he has acquired the mental and physical nimbleness in handling a rifle, which is acquired by snap shooting at ever-changing targets. The cinema target is an antidote to the complaint of exaggerated deliberateness; its only drawback has been the difficulty of ascertaining under normal conditions the accuracy of the shooting.

In the new system of cinema target shooting introduced by Sporting and Military Targets, Ltd., of 25, Oxford Street, W., an endeavour has been made to meet approximately the conditions outlined. Shooting takes place at a moving picture—preferably a military one—thrown on to a steel target screen; bullets capped with explosive are used; and the flashes which occur on impact, which may be of various colours to differentiate between different men, indicate approximately the correctness of the aim. The picture never stops during the length of the film, and therefore conforms to actual conditions. The apparatus is comparatively simple and inexpensive

SOME RAILWAY CONDITIONS GOVERNING ELECTRIFICATION.

(*For abstract of paper read before the* Institution of Electrical Engineers, *by* Mr. Roger T. Smith, *see* Elec. Rev., p. 335.)

Discussion at Manchester.

Dr. E. Rosenberg said that it was necessary to show that electric locomotives could do what steam locomotives did. The author was not to be taken too literally in stating that electric locomotives had not yet been built to take the maximum load conditions; the speaker thought that if a railway company asked for tenders for such an electric locomotive, many firm quotations would be received. As far back as 1900 the problem of running electric trains at 130 miles per hour had been solved. At that time it was thought that only motors without commutators could be relied upon for such a service, but nowadays no one would hesitate to do the same service with commutator motors, using either D.C. or single-phase motors. Rotary converters of 50 periods were run with a commutator speed of 60 miles per hour. It was true that the plain series motor had only one speed at a given voltage, but the shunting of the series field had been used extensively; on the large Pennsylvania locomotives, 50 per cent. of the armature current was shunted. An extra heavy field was used at starting, and after reaching a certain speed normal field was used. If this was done in two or three steps, various economical speeds could be obtained. The motor had commutating poles, the commutating conditions were good, and not the slightest difficulty had been experienced. It had been suggested that a compound motor should be used instead of a series motor; this would not be practicable with a plain externally excited motor, and every endeavour to get speed regulation would be in the direction of compound excitation which would miss entirely the extremely good qualities of the plain series motor. It was doubtful whether anything would ever supplant the series motor. It was strange that such a line as the Manchester-Altrincham Railway should still be in the hands of the steam locomotive; no line appeared better adapted to electrification.

Mr. E. Rothwell said that if it were necessary to bring power down to ⅛d. per unit there was very little hope for railway electrification. He considered that in the case of electrification the railway company were the people to deal with the generation of power and not a separate supply company.

Prof. E. W. Marchant said that on the Mersey Railway, Liverpool, after 10 years, the passenger traffic had increased about five times, and this was by no means a constant quantity. A very large percentage of the soot and smoke in large towns was due to the steam railways, and electrification would do an enormous amount of good in cleansing cities. On the North-Eastern Railway the maximum acceleration at starting was 1·5 ft. per sec.^{2}, falling off to 1 ft. per sec.^{2} steady value. The braking effort observed was 300 lb. per ton, corresponding to a deceleration of 4 ft. per sec.^{2} In the case of the Lancashire and Yorkshire Railway (Southport line) the maximum acceleration was 2 ft. per sec.^{2}, normally 1·5, and falling off to ·5 ft. per sec.^{2} The deceleration was 200 lb. per ton, representing 3·2 ft. per sec.^{2} The Liverpool Overhead Railway showed a maximum acceleration of 2·7 ft. per sec.^{2}, dropping to a steady 1·5 ft. per sec.^{2} Motors had been tried giving an acceleration of 4 ft. per sec.^{2}, but as passengers had difficulty in retaining their seats, this was reduced to the figure quoted. The maximum braking effort was about 300 lb. per ton corresponding to 4 ft. per sec.^{2}, although normally this value was about 200 lb. per ton.

Mr. Moffet said that when making comparisons of steam and electric traction care should be taken to have the same conditions in both cases. Where lines were electrified the schedules were usually made much harder, and in a paper read by Mr. Aspinall, of the Lancashire and Yorkshire Railway, it was stated that a steam engine, which normally burned about 60 lb. of coal per train-mile, consumed about 2½ to 3 times that quantity when run on an electrified line. The question arose whether an electric locomotive could be built to give service over such a wide range as the steam locomotive, which allowed great flexibility by alteration of the cut off, although sacrificing efficiency. An important factor in favour of electrification was the saving in coal, and as coal increased in price this saving would be more pronounced. In the case of the Lancashire and Yorkshire Railway, the increase in price paid for coal during last year was £90,000, and when it was stated that the usual coal bill was about £300,000, it would be realised how the price of coal was advancing.

Mr. R. Smith, in reply, said he agreed with Dr. Rosenberg that it was essential that the electric locomotive should fulfil all the conditions met by the steam locomotive. One case to which the electric locomotive was better adapted was in connection with the daily mineral traffic, of which there was a considerable amount in this country. Minerals were brought down to the sea from a considerable height above sea level, and whilst it was easy for a steam locomotive to take down a very heavy train, it was necessary to divide the empty trucks into two trains for the return journey. In a particular case where there was a run of 18 miles, and a drop of about 400 ft. to sea level, electric locomotives were replacing steam locomotives, in order that the full train of empty trucks might be returned in one journey. Regarding the motors on electric locomotives, he thought it advisable to reduce the number of types, and produce some modification of the simple series motor, which would give a wider range of operation. Suburban traffic was not profitable, and the effort of every railway was to get out to the country. The Mersey Railway was probably the most signal instance of the complete success of electrification. In the London Underground tubes, the general acceleration was 1·5 to 1·7 ft. per sec.^{2}, but the deceleration was about double that figure. The great advantage of interchange of drivers on electric locomotives was exemplified during the North East Coast strike, when men were drawn from the sub-stations to maintain a [illegible] hour service. The question of the price of coal was certainly very important, but it was well to remember that whilst electrical engineers were improving matters, steam engineers were not standing still.

Discussion at Glasgow.

Mr. W. W. Lackie (Glasgow) hoped the Glasgow Subway Co. would take to heart Mr. Smith's contention that all underground passenger traffic should be by means of electrically operated traction. As to the author's suggestion that electric tramways competed directly with railway services in many large towns, he thought it was quite agreed that a tramway undertaking was a distinct benefit to a railway company, in so far as it acted as a feeder to the railway company and increased its traffic. It struck him that instead of increasing the tramway fares, the fares ought to be reduced. He cited the case of Glasgow, where, instead of carrying a passenger half a mile for ½d., the T.C. increased the distance to 1⅛ miles for ½d. The increase in revenue from that reduction more than covered the cost of the reduction. Would it not pay the railway companies to reduce the first-class fares, and so increase the traffic in first-class compartments? In the Glasgow electricity department when there was a deficit of £4,000 on a year's working, they reduced the rates, and so turned the deficit into a surplus the following year. The author argued that cheap coal was a hindrance to the electrification of railways, but the price of coal in America, where electrification had been adopted, was half the price of coal in this country. It was stated that the percentage of the heat value in the coal in the bunkers returned as work done at the drawbar of the electric locomotive was only 6 per cent.; he did not see why this should not be 12 per cent., or even 15 per cent.

Mr. C. E. Cockburn, general manager of the Glasgow and South-Western Railway, pointed out that they did not in a tramway car come to a dead stop in a big station, whereas, with a railway, they had not only to bring the people in, but to take the empties out, and that made a serious difference so far as the financial side of traffic handling was concerned. He would not deny that the tramways were an adjunct to railways, for it should not be difficult to convince railways when tramway companies converted horse into electric traction and took away £500 or more of the former's weekly revenue. He was a great believer in electricity, but they had to convey large numbers of people to the coast on Saturdays, and if electric trains carried 500 persons, and the steam trains carried 1,000, they would require twice as many electric trains as the present number of steam trains, and on the present system of block sections they would be faced with a serious traffic problem. The electric railways of the metropolis were nothing else than glorified tramways. In Glasgow they had a somewhat similar problem, because they could not afford to crowd their streets with further cars.

Mr. J. M. Scott Maxwell was of opinion that the engineering profession was to blame for the lack of progress. They ought to seize every opportunity which would enable them to make a little headway against the inherent conservatism of the travelling public and more especially of the railway directors. They all knew the Board of Trade standards were, in a great measure, stumbling blocks to progress. It was up to the electrical profession to educate the Government and the people to a better sense of proportion. American engineers seemed to have reached the decision that railways should no longer generate their own power, but purchase it from power companies. That had been the evolution of electric power in the industrial world, and it seemed natural that it should also apply to the railways and especially to the electrification of terminals. This did away with the greatest part of the new capital expenditure, and should do much to lessen the fears of the directors. They were forced to accept the small headway and clearances on British railways as a serious handicap, and it seemed all the more essential that they should have stronger draw gear than the Americans, so that they might have longer trains. As to haulage, it looked as if the D.C. advocates would win. This would mean three-phase transmission to rotary converter sub-stations, where in the future economies might be effected by the substitution of mercury-arc rectifiers in place of rotaries.

Mr. Sam. Mavor (Glasgow) asked how the draw-bar pull required in long trains was affected in going round curves, and whether in the case of a long goods train, Mr. Smith would not suggest instead of one powerful leading locomotive, two or more locomotives distributed through the load, and controlled through the leading locomotive.

The **Chairman** (Mr. J. A. Robertson) pointed out that Mr. Smith in making the comparison between the steam locomotive and the electric locomotive, gave the relative cost of 10½d. per train-mile for steam, and 7½d. for electric locomotives, assuming the energy at one-third of a penny per unit, and then he went on to show that the difference between those two figures would not be sufficient to pay the standing charges on the cost of electrical equipment. He asked how the 10½d. and 7½d. were made up, for they knew that the cost of coal and water in the production of steam was 3d., and electrical energy was placed at the same figure, assuming it to cost ⅓d. per unit. Mr. Smith mentioned again that the overall efficiency of the energy delivered at the axles of the locomotives was nearly 4 per cent. of the energy contained in the coal as burned in the fires. Did he know that the modern power station equipped with steam turbines and using all the latest appliances to effect economy could give an efficiency of some 16 per cent. or even higher? He believed they had one case where 18½ per cent. efficiency was claimed. If they were only getting an efficiency of 4 per cent. on the railway system they were losing an enormous amount of energy between the switchboard in the power house and the train axle. He would like to know if there was no possibility of improving upon that figure. Mr. Smith dealt almost entirely with the limitations of electricity for railway purposes, but the speaker pointed out that these limitations were existing limitations. They should really look at this question a little more from the point of view of future requirements than in consideration of what was actually necessary to-day. Within the last few years the habits of the people in their large towns had completely changed in regard to transit. At the present time the inhabitants of London made six times as many journeys as they did 10 years ago. It was also a fact that since the Brighton Co.'s suburban line was electrified the traffic upon that section had increased enormously—so much so that he believed the directors had practically decided to extend the system to Brighton. That gave an idea of what they considered were the prospects of an electric railway. While the railway companies might have been handicapped, he agreed with Mr. Lackie that the companies had themselves to blame in some ways for being in such a position that they could not face the expense of electrification. The case for the elctrification of railways must rest largely upon the density of traffic and the frequency of trains. If they could run 12 trains an hour over a given length of railway with the same capital charges on rails and overhead equipments, it stood to reason that the cost per train-mile would be cheaper than for running one train in every 70 minutes.

In the course of his reply, Mr. Smith held that where tramways ran alongside railways they did take away the traffic. In Glasgow it might be better to leave suburban traffic to the tramways as much as possible. In America electrification was forced on the railways by public demand, and it was only now beginning to be considered there in its economic aspect. As to railways reducing their fares to get more traffic, he contended that the chief difficulty was that railways were at the end of their tether for accommodation, particularly for terminal accommodation. The difficulties in range of speed became more and more marked as electrification was required for longer distances, and he thought designers should try to improve the single-phase locomotive. He could not give the chairman the details of how the 10½d. and 7½d. per train-mile were arrived at, as these had been given him on the understanding that he would not give full details. His calculations on the efficiency between the coach and the axle of the steam locomotive were based on a paper read by Mr. Hobart. He did not think it quite right to take anything more than 11 or 12 per cent. In the matter of speeds, he thought designers ought to be more alive to the disabilities of the series characteristic, and he suggested that they might with advantage study the shunt characteristic.

THE DESIGN OF ROLLING STOCK FOR ELECTRIC RAILWAYS.

By H. E. O'BRIEN, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *March 12th*, 1914).

Railways engaged in electrification of large suburban areas find that the cost of operation of the electrical services is an important proportion of their total expenditure; and bearing in mind the large addition to their original capital expenditure involved by electrification, every means of reducing both the capital cost and the cost of operation becomes a matter of serious importance, and worth the minutest investigation.

A time limit of 45 minutes for suburban journeys represents a a radius of 22 miles at a schedule speed of 30 miles per hour. With stops one mile apart, such a schedule is practically the highest attainable with any type of train or motor.

It will often happen that a profitable electrification will involve runs with very short distances between the stops in the vicinity of a large town, and with much longer distances between the stops as the train gets farther from the urban area; very possibly at the extremity of the electrification a secondary urban area is approached, necessitating a number of stops in close proximity to each other.

The most remunerative traffic will be that between the extremities of the electrification; consequently the equipments will have to be designed so as to make a journey of this length a reasonable one. The gradients also vary, and expresses as well as stopping trains will be required; as in most cases the setting aside of special stock for express services would involve extra capital expenditure, a compromise has to be accepted both in the motor characteristic and in the gear ratio. In consequence the equipments will normally run in such a way as to require a high energy consumption. This energy consumption is the sum of that wasted in the resistances and motors, of that wasted in the brakes, and of that utilised in overcoming train resistance. The first two of these losses are directly proportional to the weight, and the third —the train resistance—is so nearly proportional to the train weight that it may be taken as being so for practical purposes.

Fig. 1 shows the resistance of the Lancashire and Yorkshire Railway Co.'s trains as actually obtained by the coasting method.

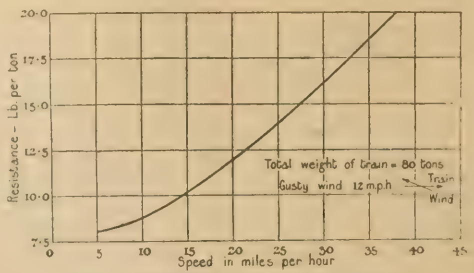


Fig. 1.—Resistance of Two-Car Train.

Fig. 2 shows the approximate division of the total energy between its various components.

The curve in fig. 3 shows the percentage of the whole used for acceleration for runs of half a mile and upwards. This curve emphasises the enormous importance of light rolling stock on high schedule short-distance suburban services. It is therefore very important to consider in detail how rolling stock may be built so as to give a maximum value to the ratio—number of seats provided per ton weight of train.

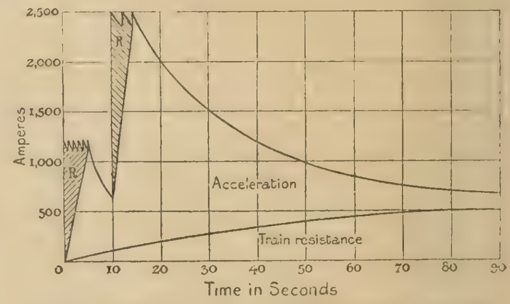


Fig. 2.—Typical Curves showing Energy Losses.

The necessary protection against the possible effects of collision and fire must be provided, but such protection is not necessarily obtained by extra weight. The disastrous effects of collisions are mainly due to the frame of one coach over-riding the frame of another and the bogies being packed together under the coaches. It is not a difficult matter so to design the ends of the underframe as to prevent over-riding of one underframe upon another, and in the United States it is proposed that the bogies should be anchored more securely to the bodies in order to throw more of the energy lost by the collision into the bogies and to use them as stops to prevent over-riding. Non-inflammability has hitherto been secured by the extensive use of steel instead of wood, but there is no reason why a lighter metal should not be used.

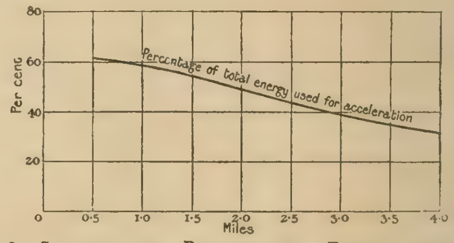


Fig. 3.—Curve showing Percentage of Energy input for Acceleration for Runs of Half-Mile and upwards.

Lightness of construction may be obtained either by using reduced scantlings, which is undesirable as involving a reduction in the factor of safety, or by using lighter materials, or by using materials of greater intrinsic strength, thus enabling the scantlings to be reduced without sacrificing the strength of the whole structure.

Assuming 100 watt-hours per ton-mile at the ends of the high-tension feeders as a typical energy consumption in the near future, and 60,000 miles per annum as a probable mileage per car per annum, then every ton of motor-car involves a consumption of 6,000 kw.-hours per annum. This is equivalent to an annual expenditure of £12·5 per annum per ton for energy if a total cost of 0·5d. per unit is assumed.

The cost of repairs to each ton of rolling stock will amount to about £5 per annum for a high-speed service; and its passage over the rails will probably involve repairs to the track equivalent to another £1 per annum, or a total cost per ton of motor-car of £18·5 per annum. On similar lines the cost per ton of trailer-car will be about £14·5 per annum, the energy charge remaining constant and the other charges being smaller. The capital cost per ton of motor-car will be approximately £70, and per ton of trailer £45. Hence every ton of weight saved represents (taking interest and depreciation on capital at 10 per cent.) a total saving per annum of £25·5 per ton of motor-car and £19 per trailer-car per ton per annum. It becomes, therefore, a commercial proposition to spend as much as £185 per motor and £145 per trailer in labour and material in order to save a ton in weight on the particular service chosen for this illustration. The smaller the system and the severer the schedule, the more important is the weight of the train.

Extra seats can be given by extra width, with a smaller increase in weight than by extra length. It does not appear necessary or desirable to make suburban stock of such dimensions that it will conform to the minimum loading gauge for the whole of the system. If 60-ft. coaches are used, an extra 12 in. in width will give 15 more seats on a basis of 4 sq. ft. per passenger; five seats can be given crosswise instead of four. If the average coach seats 100, 10 more seats per car will result in a 10 per cent. decreased capital expenditure on rolling stock. The additional seats gained by the extra width represents 1 cwt. per seat. If this extra seating is provided by extra coaches, an extra weight of about 5 cwt. per seat is involved.

The comfort of the corridor coach is greater than that of the side-door coach, and the possibility of moving along a train in search of a seat or of friends is much appreciated. The absence of doors decreases the cost of maintenance, and appreciably increases the strength of the body, while ventilation and heating can be carried out more uniformly and efficiently. The ventilation of the cars has considerable influence on the energy consumption of the coaches, because the heating load becomes very appreciable in cold weather. On interurban railways in the English climate it may be estimated that there will be at least an increase of 9 per cent. in the load in the winter months due to heating only. It is most important to secure a minimum weight for the heating equipment, and it would pay so to arrange it that it could be entirely removed when not required.

Ventilation can be effected on the elliptical type of roof by means of fans or by a set of torpedo extractors. The result of adopting the corridor coach with an efficient system of ventilation and heating is a uniformly warm and comfortable coach—a result which cannot possibly be obtained with side-doors. The absence of doors which may fly open and foul trains on an adjacent track enables the maximum width of coach to be used, with a consequent increase of earning capacity, and also does away with the possible danger of trains leaving a platform with the doors adjacent to the seats in an open position.

A light body with weights distributed to the best advantage permits the use of a lighter underframe, and this in its turn reduces the rated horse-power of the motors for a given schedule. The reduction in the rated horse-power of the motors permits of lighter bogie scantlings, and also in many cases of a lighter design of control apparatus. The influence of the weight of the body is therefore progressive throughout the whole car, and for every ton of weight saved in the body it is probable that another ton can be saved in the bogies and motors.

The elliptical roof is lighter than the clerestory type, and also enables a coach to be more uniformly lighted, owing to the superior reflecting qualities of the smooth surface of the elliptical roof. The clerestory roof is inherently weak, and is specially unsuitable where bows have to be supported on the roof.

Very little difference is made in the weight by the use of any material other that wood for the roof sticks and pillars. There is little object in using steel for the pillars, as some of the Australian hard woods are practically as non-inflammable as metal.

There is practically no difference between the weight of the roofing in a wood or aluminium roof, but approximately half a ton in weight can be saved on a 60-ft. car by the use of an aluminium roof instead of a steel roof. Aluminium, in addition to its extremely light weight, has the advantage of being non-corrodible, and therefore requires very much less painting than either steel or wood. By the use of aluminium for the outside panels a saving of nearly half a ton can again be effected as compared with steel.

The weight of the glass in a modern coach is a very considerable item, amounting to 7 cwt., or 1·4 per cent. of the weight of the whole coach.

It is also possible to effect economies in the seats. Fixed seats should always be used. Fig. 4 shows how fixed seats provide increased seating accommodation.

It would seem probable that the floor of the future would consist of corrugated aluminium plates filled in with some form of composition, such as treated cork, to a sufficient depth to cover the crests of the corrugations by about ½ in.

Up to now the use of a high-tensile steel has not been sufficiently considered in the construction of underframes; such steels have been extensively used in motor-car construction and in bridge building.

Nickel and vanadium steels are nearly twice as strong as the steel usually employed to-day, and in consequence the scantlings can be reduced. The weight of an underframe for a 60-ft. trailer coach is approximately 5 tons. Nearly a ton of this weight might be saved by the use of suitable material.

As the first cost of underframe material is low and will never exceed more than £7 10s. per ton, any saving in weight made by the use of more expensive material will easily pay for itself.

The disposition of the weights of the apparatus attached to the underframe has a considerable effect on its design; the weight per foot-run, and the brake, resistances, and control apparatus of the motor-cars should be distributed as far as possible along the length of the body, even if it involves some slight increase in the cost of cabling.

There is a considerable field for a high-speed vacuum pump of light weight. The reservoirs which are essential to the vacuum brake should be made of aluminium. In connection with the contactors, wherever possible aluminium should be used rather than copper.

The equalising type of bogie is quite unsuitable for English railways with their excellent permanent way. The ordinary type of bogie used for carriages on the steam railways of this country may be built with elliptical or spiral bolster springs, either outside or inside the wheels. There is a considerable advantage in putting the springs inside the frames, as this enables the bolster to be made wider and the bolster spring to be put farther away from the centre-pin of the bogie, thus tending to diminish rolling.

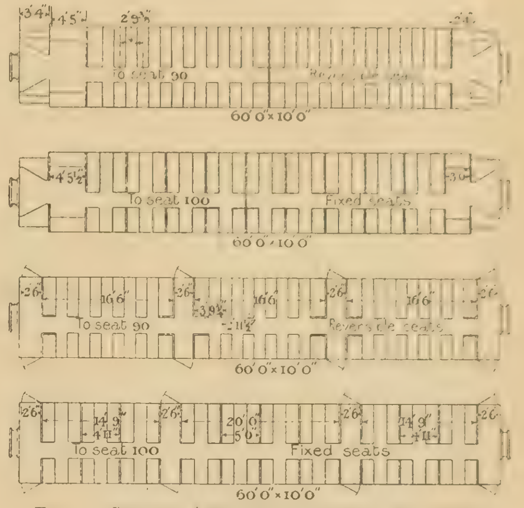


Fig. 4.—Seating Accommodation with Fixed and Reversible Seats.

There is a considerable saving by using spiral bolster springs instead of elliptical bolster springs; nearly 0·75 ton per coach can be saved in this way. The best results are obtained by having short, stiff semi-elliptical springs over the axle-boxes with assistant helical springs at their ends, and helical springs on the bolster. The wide frame involves an increase in weight; but on account of the steadier riding obtained by the wider centres of the bolster springs it is worth having.

Cast-iron is very usually used for axle-boxes, but cast-steel axle-boxes and cast-steel axle-box slides will enable the weight of these parts to be reduced by 22 per cent.

The totally enclosed railway motor has not been found really necessary in this country. The motors operated by the Lancashire and Yorkshire Railway Co. are run continuously with as many ventilating openings as possible, and no trouble has been experienced, except on one occasion when very fine snow was being blown horizontally in large quantities, and even in this case the trouble arose more with the resistances than with the motors. In order to get a light motor it should be of the self-ventilating type, and the movement of the armature should produce a powerful draught through the motor.

Better results can be obtained with independent blower sets, but the complication of having an additional small motor to maintain, and the necessary air ducts, does not compensate for the saving effected. Generally speaking, a light motor means a high-speed motor, and a large gear ratio; but it will be found cheaper to renew gears than to carry a standing charge for moving an unnecessary weight.

Discussion.

Mr. W. Casson, in opening the discussion, said he thought the author had gone a little too far in estimating the probable saving due to small savings in weight. On the Central London Railway the stock was lighter, but the costs of maintenance were much more than with the heavier stock of the London Electric Railways. This was also the case as between the old and new types of District Railway stock; he found on comparison that more room was given to the passenger in the District coaches than in the new Lancashire and Yorkshire coaches described in the paper. He agreed that the automatic vacuum brake was a simpler apparatus than the air brake, but could not call to mind any railway like the District using it. In regard to the design of truck shown, some of the trucks used on the District trains dispensed with elliptical springs, using helical springs throughout. In the building of motor-trucks a lesson could be learnt from steam locomotive practice; the motor bogie had, proportionately, much more work to do than the locomotive bogie. As the result of experience on the District Railway, cast-steel axle boxes had been superseded by cast-iron boxes.

Mr. H. W. Firth said he noticed that the author emphasised the importance of variable motor characteristics, even for suburban work. Judging by the remarks on weight disposition, it seemed that single-phase equipment would be worse than direct-current, owing to its greater work on the underframe. The new type of coach referred to by the author, with its extra width would only accommodate 1·6 seats per ft. of train, as against 1·8 in the case of side-door trains, and he thought the latter could be emptied in less time. He asked what was the limit of weight with a side-door car as compared with the author's corridor type of car, and whether rail wear had any influence in the choice of a 10-ft. wheel base bogie. The very wide coaches would not be practicable on many of the London suburban lines.

Mr. J. B. Sparks criticised the author's conclusions regarding expenditure with a view to saving weight, pointing out that experience in electric tramway and railway working had resulted in the use of heavier rolling stock and decreased maintenance. He also submitted that it was quite wrong to estimate the cost of energy, repairs, &c., on a pro-rata basis with the weight of the coach.

Mr. R. H. Burnett urged that railway experience showed the necessity of making motor bogies strong, and certainly not saving weight there. He was also satisfied that long-wheel base was the correct thing, resulting in a reduction of flange wear and easier riding on curves. Large diameter wheels were also preferable, if the conditions allowed of their use.

Mr. C. L. Mason said the trend of modern coach design was all towards heavier vehicles, and this was due to the greater comfort demanded, the more strenuous conditions of use and the steadier riding qualities of the heavier vehicle. Maintenance charges were the real index to the value of the proposed saving in weight, because such costs made a greater impression in the balance-sheet than occasional extra capital expenditure.

Mr. Bowden said several speakers appeared to be against the saving in weight, but he thought they omitted consideration of rational design and that weight reduction in materials need not imply reduction in strength.

It was necessary to consider truck design from the locomotive point of view—the two motors would probably develop as much as 750 H.P. Retardation was as important as acceleration in suburban service, and he questioned whether the vacuum brake would secure this so well as the quick-acting air brake. He suggested that if a split gear wheel were used instead of the type shown on the author's truck, it would save pulling off the adjacent wheel each time the gear was changed.

As regarded the question of side door and corridor construction, experience on the Metropolitan Railway showed that the compartment coach was better appreciated by both the public and the traffic staff.

Dr. S. P. Smith, speaking on the question of motor characteristics, referred to the necessity of obtaining more elasticity of speed control—some improvement on the series-parallel arrangement. A form of field control placing the poles in parallel or diverting some of the field current appeared to be a possible method of obtaining wider characteristics. Greater advantage could also be taken of interpole construction.

Mr. F. W. Carter pointed out that train resistance when running was not so great as when coasting, when the friction of the motors was added. At 20 M.P.H. coasting speed motor friction had been found to amount to about 4 lb. per ton, and the resistance curve given in the paper evidently included this, and appeared above the normal. He agreed that a saving in weight was worth obtaining in suburban stock where there was frequent starting and stopping, though this did not apply to main line working. The only saving resulting from weight reduction would probably be in energy cost. He agreed with the author that the ventilated motor was quite suitable for use in English work.

The **Author**, in replying, said that with 56 trains on the line the load was largely evened up, though not necessarily level. Experience in the North showed that repairs were largely proportionate to tonnage, and the light cars had shown themselves to be cheap in repairs. He thought that repair costs were very nearly proportional to the weight of the cars. He did not see why the vacuum brake should not give as good retardation as the air brake; the question of rapid production of the vacuum was a difficulty, but it was possible to get the vacuum on a five-car train in 15 seconds. High-speed collisions would inevitably cause telescoping, but it was possible to diminish this by strengthening the ends of the coaches and fastening the bogies to the underframes, thus providing additional weight to be lifted.

The side-door coach gave about 20 per cent. extra seating capacity over the corridor coach, but it was not so suited to the requirements in Lancashire. It required more platform staff, and, in any case, the corridor train would empty itself in the time it took for the driver to change ends. Rail and tire wear had not been decreased by the introduction of the long-wheel base bogie as expected. The motor-car was more expensive to build than the trailer car, because provision had to be made to accommodate the electrical contactors, rheostats, &c., involving changes in the framing; otherwise the cost was much the same as for the trailer car. Dr. Smith's suggestion to strengthen the field with the aid of the interpoles would need consideration. In lightening the construction it was not his intention to diminish the strength of the car, but to dispense with *unnecessary* weight only. This could be done. Putting steel panels and roofs on coaches was throwing money away. The gross weight of the car body reacted on every detail of the construction.

GAS POWER PRODUCTION AT COLLIERIES.

The *Gas World*, of March 7th, reproduces in abstract two papers that were read at a recent meeting of the Midland Institution of Mining Engineers—"The Development of the Gas Engine in England, and its Adaptation to the Generation of Power at Collieries and Iron Works," by Mr. T. C. Wild, and "Modern Gas Engine Practice for Collieries," by Mr. A. T. Cocking. In both cases reference was made to the waste entailed by the manufacture of coke in beehive ovens.

Mr. Wild said that blast-furnace gas was undoubtedly one of the best for use with large gas engines, producer gas coming next, and then coke-oven gas. The main difficulty with coke-oven gas had been in many cases its high sulphur content, which caused corrosion in the cylinders. This defect should be removed by passing the gas through purifiers. The second objection was its high percentage of hydrogen; this, whilst giving a high calorific value, also gave a strong tendency to pre-ignite when under compression.

Mr. Cocking dealt especially with the use of low-grade fuel for power raising purposes, and with the choice of engine units.

He said that the possibility of generating gas from waste fuel must now be recognised as a means of supplying most, if not all, the power required for the work of a colliery, and this source of power, added to that recoverable by utilising the gases generated in coking coal, pointed to the probability that, in the near future, a modern colliery would be in a position not only to generate its own power without using its saleable fuel, but also from the same source to supply electrical current to neighbouring factories for power, or to townships for light; taking into consideration the unique advantages which a colliery possessed in having its saleable fuel at first cost, it was not an extravagant prediction to say that, in the future, by means of judicious blending of the cheaper kinds of its saleable fuel with its available waste, and by the full use of the products of its coking plant, an up-to-date colliery would become a great power-generating centre, the revenue from which would be the predominating factor in its profits. He strongly preferred the horizontal to the vertical type of gas engine.

For use in colliery gas engines, regularity in the composition of the gas was more important than a high thermal value, and it would be necessary either to allocate a separate power system to coke-oven gas and producer gas, or to blend them in fixed proportions by means of gas holders. A battery of 100 modern regenerative coke ovens would carbonise, approximately, 150,000 tons of coal per annum, with a gross yield of 10 000 cb. ft. of gas per ton, which would allow about 5,000 cb. ft. per ton available for the generation of power. If the mean lower calorific value were taken as 400 B.TH.U. per cb. ft., this would develop approximately 5,000 H.P. continuously during a year of 300 working days. This would require augmenting by 15,000 continuous H.P. generated by a mixture of slack with as much batt and other colliery waste as might be available, all of which would be gasified in a power producer. The average thermal value of this mixed gas would be about 225 B.TH.U. Gas generated from colliery waste would contain more sulphur than that obtained from good coal, owing to the decomposition of the pyrites always present in the waste; therefore gas obtained from this source, and also from coke ovens, should be purified from sulphur (the recovery of which would always pay for the operation). The effect of the sulphuric acid resulting from the combustion of the sulphur products in the cylinder of a gas engine was very injurious, by its corrosive action on the metallic surfaces.

It was fair to assume that the value of the coke and ammonium sulphate would pay for the cost of coking the coal and allow a sufficient margin of profit on that operation without placing a specific value on the recovered gases. With such a combination the total cost of producing power, harnessing it, and converting it into electrical current, including wages, stores, repairs and all dead charges, with an allowance for the added fuel, should result in the generation of electric power at the exceedingly low rate of approximately 0 18d. per Board of Trade unit.

Concert.—The staffs of Messrs. Siemens's departments at Upper Thames Street and Dalston combined to spend a most enjoyable evening last Friday at their Bohemian Concert. The dining hall at Anderton's Hotel, Fleet Street, was filled with about 300 people, all in the best of Siemens spirits. Mr. A. H. Bate took the chair for the first half of the programme, and Mr. W. Le Marechal for the second. Both gentlemen delivered short speeches, expressing great pleasure at the very amicable relations existing between the two departments. Judging from the response to the toast of the respective departments, the two sections appear to work in that complete unison so greatly to be desired in all large firms. Mr. E. C. Laughton, in replying to the toast to the Dalston staff, also emphasised the good relationship between the two departments, which, he pointed out, must necessarily tend to efficient working. An excellent programme was provided. Two of the artistes are on the staff, Miss Ruby Newton delighting the company with many charming songs, and Mr. J. A. Sloane also receiving a great ovation. Among other artistes were Miss Christine Hicks, L.R.A.M. (violin solos), Miss Nellie Perryer (humorous songs), Messrs. Leonard Harris, Ben Osborne and George Blackmore (humorous sketches and songs).

BRITISH ENGINEERS AND CHINESE TRADE.

A report has been furnished to us of the proceedings at the second annual dinner of the British Engineers' Association, held at the Hotel Metropole, on March 6th. Mr. Douglas Vickers, the president of the Association, was in the chair, and in proposing "Anglo-Chinese Relations," he welcomed H.E. Dr. Chin-Tao Chen, the Commissioner for Finance, and expressed the good wishes of every Englishman towards the endeavours of the Chinese Government to establish popular rule. He proceeded to deal more particularly with the relations between the two peoples, and the relations of trade and commerce which touched them as members of the Association. The times had changed, and their competitors no longer went forth as individualists, but as compact bands, backed by their respective governments, making a combined attempt to wrest from them the trade which they had come to look upon as their own. They had not been able to follow these methods quite so much as they should have done, but this Association was a step in the right direction. They wanted to put the case of the British engineering manufacturer before the Eastern Powers as a whole. They wished to organise like their competitors, though, as an association, they were not intending to get orders direct, but to work by influence. They had to some extent been successful. "During the year we have caused the equipment to be supplied to the mechanical laboratory of the University of Hong Kong." The rising generation in China should be educated by British ideas, by British methods, and perhaps by the English tongue, and then it would come to England for supplies. It was quite natural that the British Government should not think it right to help an individual manufacturer, but they could certainly help an association without giving cause for complaint.

H.E. Dr. Chin-Tao Chen, responding, said that it appeared that the association had a very worthy and noble object—to protect British manufacturers and Chinese consumers. It sought to further British trade by fair dealing, by enlightening and educating the Chinese people to appreciate the quality and value of British goods, and to cultivate friendly relations and goodwill between the two nations. "The British nation possesses the lion's share of China's foreign trade, and, from recent investigations by an expert, it appears that you have also the greatest amount of capital invested in my country. In round figures, you have about £40,000,000 invested in the Republic of China to-day—almost three times as much as the French, who are reputed to have the greatest amount of surplus capital for foreign investment. If China is prosperous, British trade is bound to flourish; British manufacturers will be busy, and Chinese bonds happy. Thus the interests of Great Britain and China are common. China now regrets that she is not in a more favourable position to render you as much help as she desires. She is bound hand and foot—in her early years of ignorance and indiscretion—by treaties. Now she has learnt that machinery and commodities such as are manufactured by the members of this association are productive agents whose importation should be encouraged. She has also learnt that revenue must be regularly found to maintain the organisation of the Government, but by treaties China is not allowed to increase the taxation on luxuries in order to give greater freedom and encouragement to productive agents." In regard to "fair dealing," many of the co-called "unfair dealings" and subsequent disputes in foreign trade in China were caused by misunderstanding and ignorance of the laws and customs of the nations. Such was more often the case than real intention to deal unfairly. The various Consular Courts and the Mixed Courts might settle some of the difficulties, but they could not solve the whole question. "In these courts cases are tried under the law of the nation to which the defendant belongs, and there exists therefore an element of uncertainty in every contract made between a Chinese and a foreigner. For instance, if a Briton and a Chinese make a contract, neither knows which one might be the defendant in court, and consequently no one knows at the time a contract is made what the construction of it may be. This uncertainty, you can readily see, cannot but hinder trade and produce bad feeling and trouble. The only final solution is for China to frame her laws as nearly as possible like those of the nations of Europe. and to compel all nationals residing in the country to abide by these laws." The speaker next referred to some of the reasons for the decline of British trade and prestige in China mentioned in the report of the association. "You complain of the lack of support given to British loans for industrial purposes in China, and also of the dishonourable means by which competitors of Great Britain seek to obtain business and concessions to the exclusion of the British manufacturers. Such things are always regrettable, but I believe the accounts of them are more exaggerated than otherwise. . . . . . . China is perfectly solvent under normal conditions, but has incurred heavy and unusual liabilities during the revolution. At such a time she ought to be accorded all possible aid by friendly nations until such a time as it is possible for her to put her house in order. To restrict her in her hour of necessity from freely borrowing may be good in theory, but the pressure of want will compel her to turn to those who are willing to advance her funds. The result, I am sorry to say, operates against the good intentions of British interest."

Mr. R. S. Lloyd proposed "Our Guests," and Sir Walter Langley responded.

Mr. Wilfrid Stokes, chairman of the association, proposing "The British Engineers' Association," mentioned that whereas a year ago their membership was only [illegible], it was now [illegible]. Last year it represented a capital of about [illegible], and to-day £50,000,000. They had sent out to China their Chief Commissioner, his assistant, and their engineers, and upwards of £10,000 worth of machinery had been supplied by their members to the University of Hong Kong. They had appointed a strong committee to deal with the important question of finance, in the hope of making such arrangements in the near future with regard to finance as would allow their members to shoulder contracts that otherwise it would have been impossible to contemplate.

The President and Mr. Stafford Ransome, the secretary, responded.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

AUSTRALIA.—Applications have been received by the Inter-State Commission, which is investigating the working of the tariff, for further tariff assistance in the following cases, the duties quoted are those now levied under the preferential tariff for British goods where preferential treatment exists:

Electric radiators; gas and electric fittings ...	25 p.c. ad. val.
Electric radiator fittings	10 p.c. ad. val.

An application has also been received in opposition to the extension of the preference to British goods in the case of telephones, telephone switchboards and appliances. Consideration of these applications and evidence in their support will take place in due course.

HOLLAND.—The Dutch Customs authorities have issued the following decisions concerning the tariff treatment of certain electrical goods:

Apparatus for receiving submarine bell signals (consisting principally of two cast-iron tanks fixed to the ship's side, each tank containing a microphone connected by an electric cable with a telephone on board the ship) if the component parts are imported together ...	Free.
Stretching slide rails generally used for moving dynamos or motors erected on them in order to tighten slack driving belts	Free.

FRANCE AND ALGERIA.—A circular issued by the French Customs authorities prohibits the importation into France and Algeria of goods marked with a red cross on a white ground and the words "Red Cross" or "Geneva Cross," or of which the papers, wrappings or packings are so marked, and directs the Customs officers to cause such goods to be re-exported to the place from which they were sent.

GRENADA.—Regulations and forms of certificates of origin to be complied with in order to secure admission for British goods into Grenada, which is made possible in view of the accession of Grenada to the terms of the Canada-West Indies Treaty.—These regulations and certificates are in the main similar to those for the other West Indian Islands, already in force, but they are printed in detail in the Board of Trade Journal of March 12th.

ITALY.—The Italian Customs Authorities have decided that insulating cords of a thickness greater than 2 m/m. composed of a plaited tubular covering of jute yarn filled with a certain flour (farina fossile) shall be dutiable at the rate of 14 lire per 100 kilogs.

RUSSIA.—In a recent dispatch to the Board of Trade the British Consul at Warsaw points out that samples which are liable to Customs duty on entry into Russia should be sent by parcel post, and not by sample post, since in the latter case they are returned to the sender.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed

5,263. "Means of securing electric lamps to the holders." J. W. Gregg and A. Gregg. March 2nd.

5,281. "Wireless oscillator." H. P. Dwyer. March 2nd. (Complete)

5,294. "Telegraphy." W. Judd, A. Fraser, K. L. Wood and Eastern Telegraph Co., Ltd. March 2nd.

5,315. "Automatic device for the lubrication under pressure of trolley wheels and the like." J. Drapier & F. Gillet. March 2nd.

5,345. "Reflector for arc lamps." H. E. Moul (Korting and Mathiesen Akt.-Ges., Germany). March 2nd. (Complete).

5,346. "Electric horns or signal alarms." W. W. Dean. March 2nd. (Convention date, March 15th, 1913, United States). (Complete).

5,347. "Electric horns or alarms." W. W. Dean. March 2nd. (Convention date, October 15th, 1913, United States). (Complete).

5,351. "Electrical train controlling systems for railroads." H. J. Warthen. March 2nd. (Complete).

5,354. "Electrically controlled locks." L. Cadenel. March 2nd. (Complete).

5,359. "Electrical fuse boxes." P. Rosling, W. H. Nichols and W. T. Henley's Telegraph Works Co., Ltd. March 2nd.

5,360. "Electrical switches." B. D. Horton. March 2nd. (Complete).

5,365. "Electricity meters." J. Fister. March 2nd. (Divided Application on 5,157/13. February 28th). (Complete).

5,370. "Apparatus for radiating or receiving electromagnetic waves on aeroplanes, airships and the like." H. Fothergill. March 3rd.

5,380. "Electric re-lighting apparatus for safety lamps, as used in mines." J. J. Pugh. March 3rd.

5,394. "Electric generators." A. Kenyon and W. Torrance. March 3rd.

5,414. "Electrode holders for electric furnaces." Fried. Krupp Akt.-Ges. March 3rd. (Convention date, December 13th, 1913, Germany). (Complete).

5,431. "Electrical switches." B. D. Horton. March 3rd. (Complete).

5,439. "Artificial candle fittings for electric light and other means of illumination." F. R. Wade. March 3rd.

5,454. "Marine mines." E. Senger and R. Sauter. March 3rd.

5,455. "Protective devices for alternating-current electric generators." British Thomson-Houston Co., Ltd. & E. B. Wedmore. March 3rd.

5,456. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States). March 3rd.

5,459. "Manufacture of plastic masses particularly suitable for insulating purposes." A. Regal. March 3rd. (Convention date, March 7th, 1913, Austria). (Complete).

5,467. "Switchgear for a plurality of conductors, machines, or apparatus to be connected with the same busbar." Allgemeine Elektricitats-Ges. March 3rd. (Convention date, March 4th, 1913, Germany). (Complete).

5,491. "Electric lanterns and the like." M. A. Codd. March 4th.

5,501. "Means for operating upon earthenware chiefly in the production of electric insulators and the like." H. L. Doulton and H. Morris. March 4th. (Divided Application on 6,421/13. March 15th).

5,505. "Electric regulating switches." L. Miller and L. Boothman. March 4th. (Divided Application on 6,371/13. September 13th): (Complete).

5,506. "Casing for portable electric battery lamps." B. Pordes. March 4th. (Complete).

5,509. "Alternating current motors." L. J. Hunt and Sandycroft, Ltd. March 4th.

5,510. "Machine telephone switching systems." Western Electric Co., Ltd. (Franklin Tuthill Woodward, Belgium). March 4th. (Divided Application on 5,653/13. March 6th).

5,511. "Electric compound transformers." Briger Holm-Hansen. March 4th. (Convention date, March 5th, 1913, Norway). (Complete).

5,513. "Electro-magnets and their application to brakes, clutches and the like." J. P. Hall & Co., Ltd., and A. Nield. March 4th. (Complete).

5,514. "Starters for electric motors." Siemens Bros. Dynamo Works, Ltd. and E. Schupp. March 4th. (Complete).

5,515. "Automatic current interrupter for high-tension overhead lines." W. Lehmann and H. Thomas. March 4th. (Complete).

5,521. "Electrical control systems and switch mechanism therefor." R. Amberton. March 4th.

5,523. "Dynamo electric machines and the like." J. E. Westlake. March 4th.

5,535. "Wireless telegraphy." G. Leimbach. March 4th. (Convention date, March 4th, 1913, Germany). (Complete).

5,542. "Protective devices for electric distribution systems." E. E. Creighton. March 4th. (Convention date, March 19th, 1913, United States). (Complete).

5,544. "Method of interconnecting lines by electromechanically-controlled switches." F. Aldendorff. March 4th.

5,556. "Generation of electric power." E. W. S. Bailey and H. Parker. March 5th.

5,561. "Electrical wiring-systems and junction-pieces therefor." Anderson and Munro, Ltd. and A. W. Brown. March 5th.

5,583. "Method of making electrostatic condensers." G. B. Burnside and Glasgow Scientific Instrument Co. March 5th. (Complete).

5,587. "Means for use in supporting separator diaphragms used in storage batteries." Electrical Power Storage Co., Ltd., and R. Rankin. March 5th. (Complete).

5,604. "Electro-magnets." W. J. Branson. March 5th.

5,605. "Apparatus for controlling the rotation of engines, motors, or machines, so that rotation shall be prevented except when in accordance with the direction indicated by an order, telegraph or the like." E. S. Vincent. March 5th

5,611. "Fluorescence tube." M. Schmierer. March 5th. (Convention date, March 5th, 1913, Germany). (Complete).

5,616. "Make-and-break switches." R. Hacking and C. F. Hamley. March 5th.

5,630. "Manufacture of electric lamp filaments, electric resistances and the like." F. Harrison. March 5th.

5,639. "Electric current relays." British Thomson-Houston Co., Ltd. (General Electric Co., United States). March 5th.

5,640. "Telephone instruments." Compagnie Francaise pour l'Exploitation des Procedes Thomson-Houston. March 5th. (Convention date, April 4th, 1913, France). (Complete).

5,662. "Suspension of electric and other lamps and other articles." G. A. Hughes (trading as London Electric Firm). March 5th.

5,663. "Electric lighting systems." G. S. Strahan and F. J. Harris. March 5th.

5,673. "Sparking-plugs." F. A. L. Johnson. March 6th.

5,691. "Voltage regulator or alternating-current generator of the low-tension magnetic type." G. E. Carr. March 6th.

5,693. "Electric arc lamps and electrical apparatus utilising a variable resistance." A. T. Dowdell. March 6th

5,701. "Moving-coil galvanometers and the like." J. H. Carr and L. W. Smith. March 6th.

5,718. "Spark gaps for radio-telegraphy and radio-telephony." W. T. Ditcham. March 6th.

5,725. "Electric lamp-holders." W. C. Hands. March 6th.

5,731. "Gas, water, electrical energy, or the like meters." J. Heussler. March 6th. (Complete).

5,767. "Means for regulating the voltage of direct current delivered by a rotary converter in conjunction with a high speed alternating current generator." E. E. Grover. March 6th.

5,776. "Contact-making volt-meters." British Thomson-Houston Co., Ltd. (General Electric Company, United States). March 6th.

5,779. "Transformer for transforming alternating current into continuous current." J. Herman and A. Riss. March 7th. (Convention date, March 7th, 1913, Germany). (Complete).

5,788. "Electric billiard-marking indicators." R. T. Malony. March 7th.

5,828. "Rotors for dynamo-electric machinery, and cooling arrangements for the same." Siemens-Schuckertwerke G.m.b.H. March 7th. (Convention date, March 10th, 1913, Germany). (Complete).

5,829. "Electrolytic detectors for use in wireless telegraphy or telephony." E. Howl and F. Perry. March 7th.

5,831. "Telegraphy." W. Judd, B. Davies and Eastern Telegraph Co., Ltd. March 7th. (Divided Application on 9,768/13. April 25th).

5,841. "Circuit arrangements for semi-automatic telephone systems." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt-Ges., Germany). March 7th. (Complete).

5,844. "Enhancing the permeability of magnetic material." E. Wilson. March 7th.

5,861. "Device for producing warning sound from electric energy taken from magneto as fitted to motor vehicles or internal combustion engines." A. Christmas. March 7th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

26,430. Electric Hauling Plant. Akt. Ges. Brown, Boveri, et Cie. November 18th. (November 17th, 1911.)

1913.

1,066. Electrical Accumulators. De Sedneff. (Patent of Addition not granted). January 14th.

1,413. Automatic Electric Supply Systems. H. Leitner. January 17th.

3,111. Fuses for Use in Electric Circuits. Spagnoletti, Ltd. and V. E. Joyce. February 6th. (July 25th, 1913).

4,164. Order Telegraphs. A. H. Pollen and H. Isherwood. February 18th.

4,618. Selective Signalling Systems. Western Electric Co. (Western Electric Co.). February 24th.

4,671. Electric Tachometers. N. M. Hopkins. February 24th.

4,723. Electrodes for Electric Furnaces for the Fixation of Nitrogen. E. K. Scott. February 24th.

4,724. Electrodes for Electric Furnaces. E. K. Scott. February 24th.

4,725. Means for Regulating Arc Furnaces. E. K. Scott. February 24th.

4,777. Apparatus Employed for Wireless Telegraphy and the like. F. J. Chambers. February 25th.

4,829. Electrical Order--Transmitting Systems and the like. E. A. Graham and W. J. Rickets. February 25th.

5,014. Dynamo-Electric Machines, and more particularly Commutating Arrangements therefor. C. A. Vandervell and A. H. Midgley. February 27th.

5,250. Submarine Signalling Apparatus. E. C. R. Marks (Submarine Wireless Co.). March 1st.

6,341. Safety Signalling Arrangements, particularly applicable for use on Board Ship. R. W. Williams. March 14th.

6,462. Secondary Electric Batteries. B. Heap & Chloride Electrical Storage Co. March 15th.

6,880. Fuses for Electric Circuits. Siemens Schuckertwerke Ges. March 20th. (March 21st, 1912).

7,085. Electric Switches. A. P. Lundberg, G. C. Lundberg, P. A. Lundberg and G. Pegg. March 25th.

7,585. Signal Systems for Railways and Apparatus for use therewith. E. C. R. Marks (Gilman). March 31st.

8,417. Manufacture of Material Suitable for Electrical Insulation and other purposes. British Thomson-Houston Co. (General Electric Co.). April 19th.

8,561. Electric Contact-makers. G. W. Black. April 11th.

8,568. Incandescent Electric Lamp. C. Giusti. April 11th.

8,615. Prepayment Automatic Telephones. L. Breguet and Freres Breguet et Cie. April 12th.

8,741. Electric Contact and Fire-alarm Device. A. V. Clorius and O. T. Clorius. April 14th.

9,009. Apparatus for Electric Lighting, Heating, and Ventilating of Railway Carriages or other Moving Vehicles. T. Ferguson and J. R. Johnstone. April 17th.

10,098. Lighting Operating or like Tables. H. Wade (Schneider and Naujoks Elektrizitäts Ges.). April 29th.

11,278. Electrolytic Process and Apparatus for Manufacture of Sodium and other Alkali Metals. E. Marguet. May 14th. (April 9th, 1913).

13,844. Electric Measuring Instruments of the Moving Coil Type. W. Phillips and L. W. Smith. June 16th.

14,816. Electric Switches. M. S. Conner and A. R. Kahl. June 27th.

14,927. Arrangements for Producing Electro-magnetic Oscillations Particularly for Use in Radio Telephony. W. T. Ditcham and Grindell-Matthews Wireless Telephone Syndicate, Ltd. June 28th.

15,576. Locking Electric Lamps. H. Hubbell. July 5th. (April 9th, 1913).

17,126. Measuring Instruments for High Frequency Currents. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). July 25th.

17,514. Sparking Plugs. E. C. R. Marks (Siemens & Halske Akt. Ges.). July 30th.

17,816. Mine Signalling Apparatus. R. Nicholas. August 5th.

18,252. Electric Starting-device for Internal Combustion Engines. L. Renault. August 11th. (August 12th, 1912).

19,512. Electric Transformers and Welding, Smelting and like Apparatus. R. Mack. August 28th.

19,648. Polyphase Current Motor Starters. Voigt & Haeffner Akt. Ges. August 30th. (December 23rd, 1912).

21,766. Circuit Arrangement for Semi-automatic Telephone Systems. Siemens & Halske Akt. Ges. September 26th. (September 26th, 1912. Addition to 6,664/13)

23,739. Contact-breaker for Magneto-electric Ignition Apparatus. Unionwerke Mea Ges. Elektrotechnische Fabrik Eisenwerk. October 20th. (December 5th, 1912)

25,141. Electrical Connectors for Electro-medical Apparatus. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). November 4th.

25,163. Automatic Regulating Devices for Electric Distribution Systems. British Thomson-Houston Co. & C. McCarthy-Jones. November 4th. (Divided Application on 25,286/12. May 5th, 1913).

25,207. Submarine Signal-receiving Apparatus. C. Berger. November 4th. (November 4th, 1912).

26,913. Arc Lamps. A. W. Penrose & Co. & M. Owen. November 22nd.

27,754. Telephone Exchange Switchboards. E. A. Graham. December 2nd.

27,878. Arc Lamps. Korting & Mathiesen Akt. Ges. December 4th. (December 21st, 1912).

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ROAD TRANSPORT.

ONE of the most important subjects on the electrical table at the moment is undoubtedly that of road transport and the conditions under which it is carried on. The three chief factors in this business, so far as we are concerned, are the tramcar, the independent motor-'bus, and the railless trolley 'bus: to these in the not distant future may be added the electric battery omnibus, but we need not take it into consideration at the moment. These three types of vehicle make use of the public roads, in common with the great mass of private pleasure and commercial vehicles, and those belonging to the Government or local authorities; and the use of the roads in common is the crux of the problem which must be faced and solved.

The roads must be maintained in good and serviceable condition, by someone—at present, the local county and borough authorities; who shall bear the cost of their upkeep? The roads, no doubt, were made and are maintained for the public benefit, and so far as their use is merely incidental to the affairs of the various users, it appears just and reasonable that the cost should be borne by public funds; such funds are best administered by the local governing bodies, and provided that the local community makes the greatest use of the roads, the funds should equitably be derived from local sources. Modern motor traffic, however, extends far beyond the confines of the districts within which it originates, and in many cases roads have to be maintained by a locality through which they pass, mainly for the benefit of users who contribute nothing to the local exchequer. Such cases can fairly be met by taxation of motor vehicles capable of travelling for long distances and grants by the central government to the localities concerned.

But the three classes of transport vehicle that we have mentioned above come under an entirely different category. Their range is restricted within quite definite bounds, and, moreover, their use of the roads is not merely incidental to their business—it is essential to it, the fundamental reason for their existence. These vehicles use the roads as part of their plant or stock-in-trade, for the purpose of performing a public service and reaping a corresponding profit. Clearly, therefore, all these vehicular undertakings ought to contribute to the upkeep of the roads in proportion to their user. The same applies, of course, to all vehicles which ply for hire, and to public carriers who convey goods or passengers by road from place to place.

Confining our attention to the three classes, what is the present situation? The tramways pay rates upon the track and bear the cost of maintaining not only their track—which is worn by other vehicles besides their own—but also the pavement between and alongside of the rails, from which they derive no benefit whatever. Now that horse traction is obsolete, they are physically unable to use the pavement, which they therefore maintain wholly for the benefit of the public—and of their competitors.

The motor-omnibuses pay a tax on petrol to the central government, but when they do not use petrol they are, of course, exempt from this tax. The funds raised in this way, however, are not applied at all to the maintenance of the roads which the 'buses use, or even of necessity to the locality in which the 'buses ply. Moreover, the tax is a light one compared with the burden unjustly laid upon the successors of the horse tramways. The trolley omnibus is subject to the payment of rates upon the overhead equipment, and it escapes the petrol tax. It has been usual, however, for Parliament to lay a charge upon it for road maintenance amounting to about ⅜d. per 'bus-mile, which represents a contribution of something like £100 per annum per 'bus per mile of road, with a fairly frequent service.

The inference from this comparison is obvious. We have drawn attention to the gross injustice obtaining under the present system on previous occasions, but that is no reason why we should relax our efforts to secure reform in this matter. We have not here referred to the additional burden imposed upon tramway authorities in the shape of the obligation to carry workmen at fares which cannot possibly be made remunerative, a system which, in plain words, constitutes a subsidy to the working class, and through them to their employers, who are thereby enabled to obtain their services more cheaply. Probably this evil is past mending, in view of the political exigencies of municipal control. Dealing only with the road maintenance question, therefore, we repeat that the tramcar and the railless trolley 'bus are most unfairly handicapped by statutory burdens in their competition with the independent motor-'bus, which in point of fact, owing to its great weight, does twice as much damage to the road surface as the trolley 'bus, breaks down the foundations of the roads, and cynically wears out the pavements which the tramway altruistically repairs—under compulsion.

Moreover, while the tramways and trolley 'buses are in most cases operated by public authorities, the motor-'buses are usually in private ownership, so that the latter really are subsidised by the public purse. We have no prejudice against private enterprise—quite the contrary—but we cannot regard this state of affairs as salutary or beneficial to the community.

We note with pleasure that strong representations have recently been made to the Chancellor of the Exchequer on this subject by Mr. T. B. Goodyer, the energetic manager of the Croydon Corporation tramways and the hon. secretary of the Metropolitan Association of Electric Tramway Managers, who points out that of the 10 municipal authorities operating tramways in the metropolitan area, with a capital of over 14 millions sterling invested in their undertakings, no fewer than eight last year made deficits aggregating nearly £20,000, and only two showed a surplus after paying capital charges—namely, the London County Council (with a capital of over 12 millions), £497, and the Croydon Corporation, £10,586. The latter, we may point out, had not during the year been seriously affected by 'bus competition, but this happy state no longer prevails. The same 10 authorities expended £186,697 on repairs to the tracks, and paid rates and taxes to the amount of £146,000 on their tracks and buildings. Still worse results are foreshadowed for the current year, and Mr. Goodyer emphasises the need for "such legislation as will place motor-omnibus operators on terms of equality with the municipal tramways authorities in the metropolitan area, with regard to the public burdens the latter now have to bear." A Governmental Committee has for some time been considering the subject of local taxation, and the moment is timely for the utmost efforts to be made to secure impartial and exhaustive consideration of the situation of the tramways and motor-omnibuses.

We cordially endorse the statements of Mr. Goodyer, and wish him success in his praiseworthy endeavours. How serious the matter is may be gathered from the fact that the L.C.C. not only failed to provide a due allocation to the reserve and renewals fund, but actually drew upon that fund to the amount of £37,334! So that, in point of fact, the Council's tramways made no profit but a heavy loss upon the year's working.

CO-OPERATIVE ELECTRIC OWNERSHIP.

Some months ago a good deal of attention was given in our pages to the question of co-operative municipal and company ownership and control of electric supply undertakings. The subject has been studied from the technical standpoint by engineers of broad and unbiased views, and from the general standpoint by men of affairs capable of impartially handling public questions. In the opinion of many observers in this and other countries, the policy of municipalisation of electrical facilities has so repeatedly revealed its limitations, that the time cannot be far off when there will be a widespread desire to vary it by procedure based upon combined or co-operative principles. According to a recent report, to which we have already fully referred, the tendency in that direction is very pronounced in Germany, and at the root of all proposals that have been made in this country in recent days concerning the great strides that electricity supply business should make in the coming years, there lies the same conviction that the giving of the amplest possible facilities should not be hindered by the restrictions inherent to municipalisation. To our minds it is inevitable for the matter to be very much under discussion here in the near future.

But the problem is not one merely for England or for Germany. We have before us now a series of reports that have been prepared at Shanghai, in which the same question is closely studied in relation to the very successful electrical undertaking that has been in operation there as a publicly-owned concern for 21 years. Some ten months ago the municipal Council appointed a special Committee to report in reply to four questions. One of these asked whether a further immediate extension of the plant was necessary or desirable, and the reporters had no difficulty in replying that whatever else happened this was imperatively necessary in order to keep pace with the ever-increasing demand, and that two 5,000-KW. turbo-alternators would meet the case. The other questions were :—Does the connection of the electrical undertaking with the Council adversely affect either the Council's credit or financial facilities, or the prosperity and development of the undertaking, or is there any probability of its doing so in the future? If these questions were answered in the affirmative, the Committee were to say "what steps are desirable with a view to counteracting the effect."

It appears that the total loan which has been issued in respect of the electricity department has actually exceeded the general municipal loan, and while the department is in an eminently sound and satisfactory position, and is an advantage to the credit of the Council on that account, "there can be no doubt that the necessary extensive borrowings for the account of the department tend to fetter the issue of municipal loans for general purposes, and that this tendency is likely to be emphasised in the future." "The marketability of municipal debentures is to some extent prejudiced by the fact that no provision is being made for the redemption of those which pertain to the department." The electrical undertaking is indisputably prosperous, and its present position is largely due to its connection with the Council, "but the balance-sheet and prospects at present indicate that the department is now better financially fitted to stand by itself." Further, the activities of the department have been lessened by objections to wiring and sale of fittings and to municipal trading in general. As the growth of the business continues, it is believed that the effect of these hampering restrictions will grow too.

Though these answers to the questions are not completely in the affirmative, the committee considered it desirable to investigate whether alternative management would be advantageous, and while a unanimous opinion is given that a department of such value to the community should "not be handed over to outside concessionaires or financiers under any circumstances," the suggestion is made that the "ratepayers, through their representatives, the Council, might float and register a company for working the undertaking, retaining such sufficient number of shares therein as would ensure control of the management by the Council." It is believed that a reasonable dividend on such holding of shares would provide a very much larger sum in relief of rates than is at present contributed by the department. As the result of an exhaustive consideration, a number of proposals to this end are advanced. These we reprint on another page. The estimated contribution from the electricity department to municipal income during 1914 is Tls. 30,255 without any provision made for the repayment of the Electricity Loans, but on the assumption that the Council would receive a dividend of 8 per cent. from the proposed company, there would be an income of Tls. 280,000, and after deduction of interest and redemption there would be a balance of Tls. 82,500 per annum for transfer to municipal income. The Committee's recommendation, which, we believe, was to come before a ratepayers' meeting held on Friday last, was based largely upon financial considerations, but they add: "Their proposal would carry with it the additional advantage of relieving the members of Council of a considerable part of their present multifarious responsibilities."

It will be interesting to learn the attitude of the Shanghai public toward such a proposal, but whether they have given their approval or not, the full ventilation of the subject can only do good. The discussion of such a question in many a centre in the British Isles would have the effect of bringing the public more closely into touch with electrical questions, in which they are less interested than they should be. At present too often it is thought that if a man advances what are described as anti-municipal views, he is interested in some ulterior way in advancing the interests of private parties; but we believe it will be found that among those behind the scenes in municipal life there exist convictions, based upon knowledge and experience of practical working, that what has been proposed at Shanghai should also be considered in England.

Copper.

There has lately been a decided improvement in the demand from consumers of copper, but to a large extent the development of activity in this direction has been at the expense of prices, for producers, unable to market their product at the ruling rates, set about reducing them to a level which would prove attractive, the result being a drop in prices to not far short of £66 a ton for electro. Round this figure some business was attracted, and with an improving sentiment in the general market, prices then took an upward course, and at the moment the position seems to have cleared up a little, and a more confident tone prevails. While there are certainly conditions which are actually pretty favourable for copper, there are yet a number of points of weakness which cannot be disregarded. On the strong side it must be conceded that, as far as can be ascertained, there is a considerable excess even yet of consumption over supply.

The European statistics continue to be uniformly favourable to holders of copper, and after the deplorably bad American figures issued for the month of December, there has been a steady improvement across the Atlantic. On the other hand, there is a strong suspicion that the European statistics do not actually portray the position. It is argued that the consumption has really undergone a reduction in Europe, and it is pointed out that in face of this the deliveries have increased.

For this state of things there are two explanations put forward, one that consumers have let their stocks run down to starvation point, and are now engaged in putting a little on their shelves, and the other that there is a process of secret storing going on in Europe. There have been some rather persistent rumours to this effect in circulation for several weeks, and efforts have been made by leading parties to run them down to something definite and concrete, but without effect. On the whole, it seems probable that consumers have been taking copper into their yards with greater liberality than before, on the assumption that the metal was really cheap round its present price, and, acting upon this theory, they have a good deal in their favour, for copper at £65 is really not dear, though it has on many occasions been cheaper. In 1907, for instance, it stood at £55 10s., in 1908 at £56 2s. 6d., in 1909 at £54 10s., in 1910 at £52 15s., in 1911 at £53 7s. 6d., and in 1912 was at one time below £61 for cash standard, so that there would not be anything phenomenal in the price again dropping to something like that seen in some of the recent years, should demands not keep pace with production. On the other hand, the cost of production has become greater, and, indeed, is said to have been permanently increased as regards labour charges, while the increasing depth of mines adds to the cost of winning the ore, and in many cases the ores recovered are leaner in yield.

On the whole, it is probable that the older mines are more costly to run now than they were five years ago, and this may make some difference, but too much stress should not be laid on this aspect of the copper situation. Certainly the world's resources should be fully ample to meet the comparatively reduced demand for the metal likely to be met with during a period of trade reaction, and probably if things get worse, and prices fall further, the time will come when the more costly mines will restrict their production. This has been the way in which relief has been found on previous occasions, and there is no reason why the same should not be seen again.

According to reports to hand from Germany, the electrical trades there are beginning to feel the need of new orders. Already some of the largest firms in the industry find that new work is reaching them with much less force than has been the case for many months past, and some difficulty is reported in finding employment for plants. Under these circumstances the statements met with that certain of the larger German copper consumers are forced to ask for the postponement of deliveries seems to receive confirmation.

So far as Great Britain is concerned, however, there is still a fair amount of orders to be dealt with, and given a resumption of political confidence and a mitigation of the financial unsettlement on the Continent and in South America, matters should improve moderately.

The Electric Vehicle.

Last week's discussion on the electric vehicle before the I.E.E., despite the lengthy list of speakers, cannot be said to have added greatly to the sum total of our knowledge of this subject, although indicative of the interest which has been aroused.

We are, of course, still practically dependent on the operating data of our American and Continental friends, and this, although sufficiently satisfying to the average engineer, is not nearly so convincing to the potential user in this country as facts and figures obtained from British sources and the possibility of seeing the vehicles in actual use.

The pressing need, which Mr. Beauchamp emphasised, is to get the vehicles on the road in convincing numbers, and this is, as he pointed out, a commercial and financial problem. He suggested the feasibility of contract haulage schemes, with this end in view, which reminds us that we have ourselves repeatedly urged the necessity of evolving hire and hire-purchase schemes, with a view to overcoming the difficulty which first cost must present to many potential users.

Another speaker touched on the congested state of the London streets, and the peculiar fitness of the electric vehicle to replace the slow-moving horse-drawn traffic which is mostly held responsible for this condition of things. Where power-driven vehicles form any considerable percentage of crowded traffic, the horse is obviously out-of-date. Every form of power vehicle in London at the present time is more or less penalised, and compelled to operate inefficiently, in order that the horse may retain a place in the streets, and unless it is speedily eliminated the ratepayers will also be mulcted to provide wider roads for its accommodation.

An obvious remedy for this state of affairs, and one which would bring to a head the question of the most suitable type of power-driven vehicle for our streets, would be the enforcement of higher speed requirements on all the present slow-moving vehicles on our streets. We prosecute a man for exceeding the legal speed limit on a lonely country road, but the sluggard can hold up the traffic in a crowded street with impunity. In this connection a factor which is likely to be of great importance where many types of vehicle operate on the same road, is speed regulation, and no vehicle provides such a complete speed range as the electric; furthermore, it is the only vehicle which does not waste fuel when held up by traffic, and given some form of automatic controller, it will be ideal for the unskilled driver.

THE GOVERNMENT AND MONOPOLY PROBLEMS IN GERMANY.

The question of the adoption by the Government of measures to counteract the monopolistic tendency in the German electrical industry in the matter of the supply of plant and materials and the execution of installation work, has just been raised in the Lower House of the Prussian Diet. In reply, Herr Sydow, Minister of Commerce, stated that the increasing use of electrical energy had led to efforts in the direction of concentration, and to the accumulation, in the case of the great undertakings, of powerful forces, which had an immense influence on the economic life of the country. The Minister admitted that under the existing legal situation nothing could be done to cope with the tendency, and he added that new means must be provided for the purpose, either by the introduction of an obligation to obtain Government concessions or in some other way. This statement is peculiar when applied to the supply of plant and materials, and the carrying out of installation work in contradistinction to the generation and distribution of energy from electricity works, but the basis of the success of the great firms in the former respect is very largely founded upon the monopolistic movements which have taken place and are still proceeding in the latter direction, which the Minister is understood to have also had in mind when replying to the interrogation brought forward by members.

It is only the monopoly in the supply of current through subsidiary undertakings—which the great electrical firms have endeavoured to obtain from the beginning, and which they have partly secured without detriment to many efforts put forth by municipal authorities to gain and maintain their independence—that has afforded them the possibility of getting a greater and increasing measure of control over contracts for the delivery of plant and materials and installation work, and of diverting this business from the manufacturing firms of lesser importance and the contractors. Certain it is that the three or four great firms do not dominate the construction of machinery and apparatus to such an extent that they can be said to possess a monopoly in these manufacturing departments, as numerous other firms exist in almost all branches—the special electrical firms as they are generally termed—and these are claimed to be equally as efficient as the great firms. The reason for the predominance of the latter lies in the fact that they hold an almost uninterrupted monopoly in the construction and equipment of electricity works, overland central stations, railways, and tramways, &c., and the initial stages of this development extend back to the commencement of the supply business many years ago. At that time the municipal and other local authorities were unable to decide at first upon the establishment of electricity works on their own account as the latter seemed to involve too complicated problems for local government, and at the same time threatened to open up competition with the gas works owned by the local authorities.

It was under these circumstances that the private firms felt compelled to proceed with the erection of electricity works at their own financial risk and thus create a consuming public, and the system of amalgamation and participation in subsidiary companies was a direct result of this enterprising and profitable policy of the great firms. The advantages devolving upon the latter from the combination of manufacturing, construction, and installation work were, and still are to a large extent, that the electricity works and tramways which they were interested in financing became fixed or definite customers who were in a certain measure not accessible to competitive firms.

On the other hand, the disadvantages to these particular customers were that, being dependent upon the manufacturing firms, they were unable to purchase their plant and materials in the cheapest market, and were consequently compelled to pay prices over which they could exercise no control whatever. In addition, the firms associated with these supply works obtained possession of the installation contracts at prices which, temporarily at all events, prevented any possibility of outside competition being successful, whilst the withdrawal of rivalry subsequently enabled recoupment to be secured by the introduction of higher prices for further work.

It is well known, as has been mentioned in former issues of this journal, that efforts have been put forth both by municipal or communal authorities and by the Federal Governments, to place a check on these disadvantages of the growing private monopoly. The Governments of Prussia, Saxony, Baden, and Wurtemberg, for instance, have at various times in the past few years instructed their provincial and district representatives to pay attention, in the grant of concessions for electricity works, to the circumstance that equality of conditions should be observed between the contracting manufacturers, and the special works and installation contractors. The orders issued to this effect have probably been given legal effect, but in fact the great firms still remain at an advantage. As they erected the works, they were more familiar with the machinery and plant and the requirements in general, and as they were earlier informed than the outside firms, they were also able to work up the installation business all the sooner, and thus further extend their scope. The counteracting measures have, consequently, been of very little avail. Not only so, but the municipalisation of electricity works is now proceeding at a slower rate than formerly, owing to the disadvantages arising from the growth of communal bureaucracy, labour troubles, the difficulty of raising loans for purposes other than those for absolutely indispensable works, and technical considerations. The latter observation applies to the possible expansion of supply works beyond the limits of the town or commune concerned, and this has led to the manifestation of the desire for the combination of various districts in one single supply system. As a result, the form of "mixed undertakings" has been selected in a number of cases, private enterprise co-operating with municipal authorities in the establishment of a company in which both parties are financially interested and have representatives on the board. It has, however, been found in many cases that the control of these undertakings has not been more efficacious than in the case of a municipal system. In view of the present interest in the subject in England and Shanghai, this circumstance should be noted.

If now the Minister of Public Works has referred to the possible introduction of compulsory State concessions for electricity works—assuming that his observations really applied to supply works and not merely to plant and materials and installation work — he probably proceeded from the standpoint that combined private and municipal undertakings require to be supplemented by the creation of a higher concession authority, meaning the State, for the adequate preservation of the public interests. This point of view may seem plausible from a theoretical standpoint—but the *Berliner Tageblatt* states that it is defective on a practical basis, as it would establish a higher authority both for private supply companies and the local authorities, and thus place the latter still further under the guardianship of the State, and interfere with their freedom of local government. For these reasons it is contended that serious doubts arise against the introduction of State concessions; especially as such a system would guarantee no absolute remedy for existing conditions, and would produce dangers which, under certain circumstances, would be not less detrimental than the disadvantages which are to be removed by it. The legislative interference with the freedom of activity, it is held, would only have as its object the nationalisation of the generating systems, leaving the distribution to the companies and the local authorities. The price would be regulated in a more uniform manner and be lower than at present on the concentration of production in a few large modern works.

The introduction of a State monopoly of production in Germany is a question which, in the opinion of the Berlin newspaper, requires further discussion from the standpoint of proceeding by Imperial or Federal State legislation, and in this connection it has to be remembered that the most important water-powers are situated in the South, although Federal agreements with private companies could be better dealt with by Imperial than by independent Federal action. It is, however, well not to underestimate the difficulties which would beset a State monopoly. The latter would have to come to an agreement with the owners of many old stations or take over these at a price at which they could not be advantageously used under the suggested new conditions. This question and other problems require a fundamental statistical investigation, which the newspaper states ought to be begun without delay. In any case, the principle of a current production monopoly is held to be more sensible than a petroleum monopoly, as the former would regulate the output of energy produced and consumed in the country itself, and would hold out the prospect, it is submitted, of a cheaper supply to consumers in general, whereas the supply of petroleum is mainly dependent upon deliveries from other countries.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Reversing an Interpole Motor.

In reversing a shunt interpole motor, the armature and interpole coils should be regarded as one winding, and may be connected up to the reversing drum of a barrel-type controller. A change of rotation in a motor of this type may be brought about by changing over the shunt leads, but this is an objectionable practice and should be avoided.

When reversing a compound interpole machine, the armature and interpole coils should, as in the former case, be regarded as one winding, but in this case the polarity of the load coils on the main poles must be left unchanged in order to retain the cumulative effect of the shunt and series windings.

A common characteristic of a shunt interpole motor is a tendency to "hunt" on the occurrence of an overload, and in this connection it may be interesting to quote a case which recently came under my notice.

A liberally-rated 15-B.H.P. shunt interpole machine by a well-known maker operated quite satisfactorily under its rated full load, but immediately upon the occurrence of a 10 per cent. overload to which it was occasionally subjected would commence to "hunt" badly, the station ammeter showing a perfectly regular "beat" from 10 to 100 amperes (the working current was 70 amperes).

The maximum speed attained during this period of hunting was such as to endanger the gear of the drive, and until the motor was replaced with a new and larger machine it was found necessary to alter the lead of the brushes each time it was reversed. The neutral position of the brushes would not allow the machine to take anything over its normal full load without this hunting being set up.

I should much like to read the experience of others upon this subject.

H. C. Widlake.

Plymouth, *March* 17*th*, 1914.

Nitrates from Peat.

On December 19th, 1913, there appeared in your columns an article by Georges Dary on "The Production of Nitrates by the Direct Electrolysis of Peat Deposits."

Being engaged at the present time in making a thorough investigation into the various methods which are employed for the production of nitrates and other fertilisers by electrical means, this article was of special interest to me, and I had hoped that it would draw forth some discussion.

Since the manufacture of nitrates by means of the fixation of atmospheric nitrogen by the well-known Birkeland-Eyde and Schönherr processes, and the production of calcium cyanamide by the Franke-Caro method, are taking place on such a large scale, it is evident that the market for these products is very large. Any new process promising to compete with the existing ones is, therefore, of considerable interest.

Mr. Dary, in his article, gives a rosy view of the profits which could be obtained from a large installation working on the system described.

Unless my information and conclusions are all wrong, however, I find it impossible to agree with him, and shall be very glad if he can prove the correctness of his statements in view of the following:—

The article refers to the electrolytic extraction of *100,000 tons* of nitrates *per annum* from a peat deposit of *370 acres* (italics are mine).

Assuming such a deposit to have an average depth of 6½ ft., which is a fair figure to take, and is used elsewhere by the author of the article, and taking the nitrogen content at 2 per cent., it seems to be a fairly simple calculation to work out to show that the *maximum possible* production of nitrates (assuming $CaNO_3$ to be intended) which could be made from such a bog would be 48,100 tons. This, too, is the theoretical figure, which would certainly be impossible of attainment in practice. At the rate at which Mr. Dary proposes to produce nitrates, the whole bog would therefore be completely exhausted in less than six months.

Again, in speaking of the energy required "under the best conditions of efficiency of output" (to quote the article), it is stated that about 950 lb. of nitric acid per hectare (= 385 lb. per acre) can be produced per 24 hours; for 370 acres this equals about 23,200 tons in one year, assuming the process to be in continuous operation the whole time.

The weight of nitrogen contained in 23,200 tons of nitric acid would be about 22 per cent. of this, or, say, 5,100 tons, which would suffice for the manufacture of some 36,500 tons of $CaNO_3$; yet Mr. Dary speaks of the production of 100,000 tons in the same period, viz., one year, from such a bog. How can the production of the smaller quantity be said to be "under the best conditions of efficiency of output," if it be possible to extract it at three times the rate, and still make the handsome net profit of £707,500 per annum? Does the author mean that at the lower rate a still higher profit could be made, and is he thus giving the readers of the REVIEW a conservative estimate? Still another point may be criticised, but this must be the last, although there are several others, such as the loose phraseology employed (notably where electrical matters are dealt with), and the reference to nitric acid as "NH_2O_3."

The article says that "a deposit of peat, having a depth of 6½ ft. and an average richness in nitrogen of 2 per cent., can produce between 800 and 900 tons of pure nitrates per year." Puzzle: Find the area of the bog!

It would seem that British investors ready to put any money into a scheme for developing this process, which, we are told, "has recently been patented in the United Kingdom," would be well advised to look a little closer into it before parting with their capital, and that electrical engineers who are fortunate enough to have a station located in the vicinity of a peat bog, and are considering the nice profit which could be made in off-peak hours, might very well follow their example.

Alfred S. L. Barnes.

Toronto, Canada, *March* 11*th*, 1914.

Protection or Tyranny?

I am gratified to find that the chairman of the council of the B.E.A.M.A. has honoured me with his attention, for whatever reason—but I certainly am curious to know why my pen-name should give me any claim to his consideration. It is gratifying, too, to have an explicit statement that no such rule exists—by which, I take it to be meant that no such *formulated* rule exists—and to have the chairman's wider denial, though I feel that, if confusion of diction implies confusion of thought, the mental processes of a writer who can use words implying the knowledge of a *latent* desire in others, are certainly in need of checking.

But a wide question still demands attention. Rightly or wrongly, large numbers of all grades of workers are deeply dissatisfied with the workings of the B.E.A.M.A. Mr. Fletcher's letter and very pertinent question should show the Association that I am very far from being alone in voicing these feelings, though it may be that these other workers, like myself, "stupidly misjudge"—to quote the chairman's courteous phrase—the Association's policy.

If the Association will seriously inquire into the reasons for these grave discontents, and will do its utmost to remove them, it will earn the gratitude of all workers in the electrical trades, and will truly accomplish much towards guiding "a sorely-tried industry into paths of prosperity."

Junius.

[Another letter appears in our "Notes" pages.—Eds. Elec. Rev.]

The Lighting of the I.E.E. Lecture Theatre.

In reply to your invitation for observations on the lighting of the lecture theatre of the Institution of Electrical Engineers, I think that the opinion which you expressed more than three years ago, that the lighting was "highly effective," and "a typical application of modern scientific methods," is one with which many members cannot agree. It was novel and interesting, and is carried out in a pleasing manner, but the general opinion seems to be that the effect is dull and depressing.

The illumination was good. I have not any recent information, but Mr. J. S. Dow informs me that measurements made by him and Mr. V. H. Mackinney gave the illumination as 2 ft.-candles, about one-quarter of which was due to the mercury arcs. This is more than double the illumination in the old theatre of the Institution of Civil Engineers when I measured it in 1892.

The reason for the monotonous appearance seems to be that we are accustomed, in cases of brilliant and cheerful lighting, to see the lamps or their shades, that is, points or patches of considerable brightness. If these are absent, cheerfulness cannot be produced unless strong illumination is used.

The lecture theatre at the Institution of Civil Engineers is lighted on exactly the same principle; the illumination is practically the same, but the general effect is much better, because the cove is far brighter, and there is no mahogany strip below it. In both cases the colour of the walls simply mops up light like a sponge, and the problem at the I.E.E. is rendered more difficult by reason of the large area of glass.

An invalid wearies of "slops," however nourishing, and longs for something to bite. I believe that a few lamps judiciously placed, and contributing but little to the illumination, would have the desired effect.

A. P. Trotter.

London, S.W., *March 21st*, 1914.

Your leaderette on the subject of the Institution lighting will be read with interest by all those who have been handicapped by the position you have hitherto taken up in the matter of shadowless lighting. Those of us who have had experience in factory lighting know that the shadowless method of lighting was tried at least 20 years ago, and found to be unsatisfactory. The original claim for it, when open type arc lamps and top reflectors were used, was that it was the nearest approach to daylight; and the fact that this fallacy was accepted as truth by many people is, perhaps, characteristic of the modern tendency of the great mass of the public to allow a few people to do the thinking for them. It requires very little consideration indeed to appreciate that natural daylight is very far from being shadowless. After the novelty of the thing had worn off, and the inefficiency of the system from a commercial point of view had been demonstrated, the users—I almost said "dupes"—realised its efficiency from the point of view of illumination, and the system died out.

Later on, the mercury-vapour lamp made its appearance, and for some purposes there is no doubt a field for it; but it would never have made even the little progress it has made in the direction of interior lighting but for the fact that a representative of the Electrical Review visited a certain office lighted by this means in October, 1907, and after a pleasant chat with a pretty typist, came back and wrote a glowing testimonial, which appeared in your issue of October 18th, 1907. This testimonial has since been worked for all it is worth, and one got very tired of having it thrown at us by clients who thought we were behind the times in not recommending mercury-vapour lamps in preference to more efficient and more appropriate methods of illumination.

There is a possibility that the designers of the installation for the Institution were influenced by your testimonial, and it serves you right that now, after describing the I.E.E. theatre installation as "highly effective" about three years ago, you now find you were mistaken, and have to admit that it is anything but effective.

It is, I think, the general impression among members that it is about the worst lighted public meeting room in existence, the effect being funereal and most depressing.

Those of us who have for years fought against the method of shadowless illumination are delighted to find that at last you have seen the error of your ways, and it is to be hoped that the kick you have now administered to it will be its deathblow. Shadowless lighting is a most unnatural light, and instead of being restful as is claimed by its advocates, is just the opposite, as there is no rest for the eyes at all, except by closing them or shading them in some way. What is wanted in the lecture theatre is light and shade, which can be obtained by obvious means.

Frank Broadbent.

London, E.C., *March 24th*, 1914.

[Our correspondent appears to hold us responsible for the lighting of the theatre, and implies that we have been strenuous supporters of shadowless illumination. The former was arranged under the supervision of Members of the Council, who, no doubt, acted according to their lights; as regards indirect illumination, it is very satisfactory in some cases, but when did we advocate "shadowless" illumination?

We would gladly have published Mr. Broadbent's views on the subject had he given them expression at any time during the period to which he refers. It is significant that both he and Mr. Trotter agree with us that the lighting *is now* unsatisfactory, but neither condemns it *as it was* three years ago; nor did anyone at that time find fault with it, so far as we are aware. We do not say that it was not good then, but that it is not good now.—Eds. Elec. Rev.]

A Motor Problem.

The horse-power exerted by a motor is proportional to its torque and to the speed at which that torque is exerted. The conditions required by "Perplexed" may be arrived at by two methods:—

1. A shunt motor having in its field circuit a resistance of such a value as to allow it to carry its maximum load of 15 h.p. at 400 r.p.m., but which, when cut out of circuit, permits the speed to drop to the required 325 r.p.m.

2. These conditions may be partially—if not wholly—attained by means of a reversed series winding on the main poles.

The method used is a question which concerns the makers, but "Perplexed" should have no difficulty in getting a machine to suit his particular requirements.

H. C. Widlake.

Plymouth, *March 17th*, 1914.

THE CASCADE INDUCTION MOTOR.

(*For abstract of paper read by* Mr. L. J. Hunt *before the* Institution of Electrical Engineers, *see* Electrical Review, *page* 378.)

Discussion at Manchester.

Dr. E. Rosenberg complimented the author on his work in developing one of the most fascinating problems of electrical machine design, viz., the superposition of currents in the same winding. The author's machine seemed very little more complicated than the ordinary induction motor, but it appeared difficult, even impossible, to use liquid control for these motors; also, they could not be wound for such high voltages as ordinary induction motors. There was no difficulty in winding ordinary motors of a few hundred horse-power for 3,000 or 6,000 volts, but it was questionable whether the cascade motor could be wound to suit these high voltages.

Mr. W. Cramp said it was well known that alternating current problems might frequently be simplified by substituting for the actual, an equivalent circuit made up of resistances and reactances, with variables to represent the variable factors in the original circuit. Such a plan might be pursued in the case of the cascade motor and resulted in presenting the problem in a simple manner. From his diagram he drew certain conclusions and compared them with the statements made by Mr. Hunt.

In order that the cascade motor might compare with the ordinary induction motor, it was clear that the resistances, reactances and admittances of the cascade pair must not exceed the corresponding values of the ordinary machine. It was in this direction that Mr. Hunt had been so successful, and the combined windings which he had developed had in this their chief importance. The statement made by the author to the effect that the cascade connection of motors was the same as cascade connection of transformers was seen to be untrue, for the frequency throughout both transformers was identical, but in the second motor it was lower than in the first. The fact that the first motor developed part of the mechanical power was another cause of difference in the analogy. Some five years ago certain machines were put into operation by the speaker, and he had figures to show the results obtained on test as compared with the ordinary slip-ring motors supplied by other firms :—

6-*H.P. motor.*	*Slip-ring type.*	*Slip-ring type.*	*Cascade type.*
Speed	480	1,420	500
Efficiency	80 %	82 %	83 %
Power factor	69 %	85 %	78 %
12-*H.P. motor.*			
Speed	570	570	500
Efficiency	82 %	85 %	83 %
Power factor	76 %	82 %	83 %

The prices were practically equal when switchgear was included, so that the superiority of the cascade motor for low speeds was very obvious. The author stated that there was no objection to the increased number of leads ; as long as the starting switch could be fixed on the motor, well and good, but if it must be mounted away from the motor, then the cost of the cables was a distinct objection. With series motors and proper resistances on cranes, very slow movement of the motor with light loads might be obtained, but what happened with the induction motor and the cascade motor was that when there was a large resistance in the rotor so as to get "inching" with heavy loads, the motor ran away if the load fell. However, the operation would be better with the cascade motor than with the ordinary induction motor. He asked Mr. Hunt whether it was not true that on this principle the La Cour converter could be made with its two windings on the rotor together, so that its two machines would be merged into one, and the stator would then become like the stator of the ordinary series-wound alternating-current commutator motor.

Mr. F. C. Aldous said the improvement in power factor of cascade motors due to rotor resistance was obtained at the expense of efficiency, and would be smaller for machines of greater output. A highly saturated cascade motor would, under certain conditions, actually take practically constant current at all loads up to full load. Whereas in the ordinary slip-ring motor the whole of the tooth flux, and the whole of the ampere wires in the slot, acted upon one another, in the cascade motor two fluxes existed in the tooth, and in effect two sets of ampere wires in the windings, and each flux acted upon one set of currents only. In this feature the cascade motor was analogous to a two-speed induction motor with two separate windings. In this case one complete winding was always idle, but the whole of the tooth was utilised with the active winding, in other words, no flux space was ever wasted. As a result of the superposed fluxes, the D^2L of the cascade motor would be greater than that of a normal induction motor of the same output and built under similar conditions. A further disadvantage was the small choice of speed, the possible speeds on 50 cycles being 500, 333 and 250, whereas, with the normal induction motor the speeds over the same range would be 500, 428, 375, 333, 300, 273 and 250 R.P.M. From a manufacturing point of view the small range of speeds might be an advantage, if the machine to be driven could always be adapted to one of the available speeds. A well-designed slip-ring motor gave a very even turning moment at low speeds, and it was doubtful if anything better was needed. The application of the two-speed cascade motor to the driving of winding engines was of great interest, and, if possible, should result in a considerable saving in power. The saving could never be quite as great as shown, since the cascade connection could never take the motor up to cascade speed, owing to the slip and to the fact that resistances were always in the circuit. A disadvantage was the high tapping voltage ; the control gear would also be complicated, and it was doubtful whether mining engineers would be prepared to sacrifice the simplicity of the slip-ring motor for a slight reduction in power consumption.

Mr. W. Bolton Shaw said there were a great many advantages in being able to run cascade motors at two speeds. One application not mentioned in the paper was the driving of large dock pumps. The advantage of getting rid of slip-rings in mining work was obvious, and if the speed of cascade motors could be increased considerably beyond the present 500 R.P.M. they should have a good field of application in the case of high-speed mining pumps.

The Author, in reply to Dr. Rosenberg, said that liquid controllers were practically standard practice in connection with cascade motors. They had been used with motors up to 2,200 volts, and no trouble had been experienced. Three or four resistances insulated from earth by means of porcelain were usually employed. Regarding voltage suitable for the windings, 3,300 volts was the maximum which had been used. In a great many instances, two-speed motors were required, and it was not necessary, unless it was required to work under cascade speed, to connect the resistances to the stator tappings at all. The starting of the motor was effected by means of a resistance connected to the rotor resistance in the ordinary way, and a tachometer was used. The motor having been brought up to cascade speed, the short-circuiting switch was closed, and the rotor resistance lever allowed to fall back to the off position thereby enabling a switch to be used, and the difficulty of high voltage insulation avoided. This did not apply in the case of winding engines, and on the score of simplicity it was quite likely to be found advisable to go back to two windings on the stator leaving one winding on the rotor. In the case of a 3,000-volt machine, the increase in cost would be 20 per cent. to 25 per cent., and the efficiency of a large motor would be reduced from 93 per cent. to 91 per cent. Mr. Cramp had referred to two transformers in cascade not being equivalent ; that was so, but the author referred rather to the similarity of the motors when standing. Mr. Cramp had referred to the question of combining the two machines of a La Cour converter into a single machine. Patents had been in existence covering this scheme for about eight years but the opportunity had not arisen to investigate the problem. Mr. Aldous had referred to the effect of resistance losses on efficiency, but if the machine could be kept cool by reducing the amount of copper in the stator to one-half, and putting the equivalent in the rotor, the power factor would be considerably increased without affecting the efficiency. In comparing the cascade motors with the ordinary induction motors made by one of the largest manufacturers in the country, the cascade motor was on the average found to be 10 per cent. larger than the ordinary motor. Regarding the space required for the second flux, it was found in practice that the depth of iron was only required to be increased by about 20 per cent. or 25 per cent. The choice of speed was limited in this type of motor ; in fact, these motors were not intended to be suitable for all purposes, but for cases where slip-rings were objectionable, and where two or three speeds were required. The variation in torque was very much smaller in this machine than in one of ordinary construction. The machine had been found very serviceable for winding engines, the control being very satisfactory. Motors were being used successfully to drive large dock pumps. The application to high-speed pumps was a very different problem.

A TWO-RATE TARIFF SYSTEM WITHOUT TIME-OPERATED CONTROL.

(*For abstract of the paper read before the* Institution of Electrical Engineers *by* Mr. H. H. Perry, *see* Electrical Review, *Vol.* 73, *page* 821.)

Discussion at Manchester.

Mr. J. Frith said the first thing about a tariff was that it should be understandable by the consumer ; he should be able to predict what the supply was going to cost him. The next point was that the tariff should encourage the free use of electricity. It would be interesting to hear how consumers liked the author's system.

Mr. S. J. Watson said the maximum-demand system failed because it was not understandable by the consumer. In principle it was quite correct, but different classes of consumers could not understand why one should pay a higher rate than another. For general supplies for domestic and similar purposes some method whereby only one circuit inside the house and one meter were employed would be the simplest and the best that could be adopted. People knew that their town rates were based on the rateable value of their property, they knew the rent they had to pay, and they could see at once what their liability was if a standing charge was made, and a small price per unit charged at the quarter end.

Mr. E. M. Hollingsworth said the author put forward a very ingenious and simple device, but it had arrived rather too late. The general adoption of the contract system showed that engineers had been trying to get away from the two-rate system. In considering different tariffs, consumers asked not so much the price per unit, but what it was going to cost per quarter or per year. They had to get down to a price which would bring in the comparatively small consumer, and had to prove to him that they could give advantages over the power or light at present in use.

Mr. J. S. Peck said that the author showed an arrangement by which the greater the power load the greater the lighting load which could be obtained at the low rate. This seemed to him to be wrong in principle, for if it was desired to keep down the peak load, the arrangement should be reversed so that the greater the power load at any time the less the lighting load which could be taken at the same time and at the low rate. Regarding the construction of the instrument itself, he anticipated trouble due to burning at the contacts ; the switch in its present form would only be suitable for handling very small currents. If the loss on alternating current was 8 to 10 watts, the volt-amperes across the switch would be several times this on account of the poor power factor, so that the voltage drop would be very considerable.

Mr. H. T. Wilkinson said he found it a great mistake to talk to consumers in terms of units. In one case an engineer was trying to convince a consumer that 0·8d. per unit was the correct charge to pay ; he could not drive this home, so he told him that in some places 5d. or 6d. was charged. The consumer replied that he did not know what a unit was, but 5d. or 6d. seemed a lot to pay for it. He had charged some consumers at so much per loom per annum, and found this was readily understood and worked out satisfactorily, the price, of course, varying with the different looms.

Mr. W. Cramp said that with the apparatus described in the paper, the less a consumer used the less he paid ; if the consumer used lights only, and those only for a short period, he received a distinct advantage. It meant that if this system were adopted, a bill would be received of the following character: For a few lights, a low rate; for more lights, a higher rate; and for lights plus power, a lower rate again. The rate for electricity should be put into a unit which consumers could understand, not an electrical unit. In the case of a flour mill, for instance, if they charged for electricity at so much per sack, the miller knew just what was meant. All one had to do was to find out how many units were required in the making of a sack of flour. He thought there would be trouble with this type of apparatus, with any self-induction in circuit.

Mr. Barlow asked the author if at the end of a quarter a check could be taken on the readings for the preceding quarter; if not, how was it possible to be in a position to enforce the charges, should the consumer dispute them?

Prof. E. W. Marchant had doubts as to how the working of the switch was to be checked. If the switch stuck, it seemed that there would be a very heavy charge on the high-rate meter, and he would like to know whether there were any devices on the switch which would take care of such a contingency.

Mr. H. H. Perry, in reply, said emphasis had been laid on the fact that whatever system was chosen, it should be understandable by the consumer. He was perfectly in agreement on this point, and if a flat-rate system could be fixed up, by all means let them have it, one meter would then register the double supply. The switch contacts were amply large enough to carry a supply of 25 amperes. The instrument would only have to carry a quarter of 25 amperes, and he thought there was not the least chance of any trouble. Mr. Peck had raised a point regarding the means described by which the customer was given the same rate for lighting as for heating. The greater the load taken for heating, the less the amount charged for his lighting. The switch had not actually been working in practice. The switch had been tried with large self-induction in circuit, and found to work very satisfactorily. If large radiators or heaters were going to be used, it invariably meant new circuits; it was one of their greatest troubles to persuade people to add to their existing circuits.

Discussion at Leeds.

Mr. T. Roles agreed that in the past heating and cooking apparatus had been untrustworthy. He thought, however, that supply authorities must take some part of the blame for that, inasmuch as until quite recently they had charged such prices for current for heating and cooking that there had been no demand for these purposes, and therefore it had not been a business proposition for manufacturers to go into the question very thoroughly. In Bradford the power load was so large that it was impossible to notice any difference in peaks through the heating and cooking load. He thought that the need which led to Mr. Perry's proposition was met in Bradford by the domestic service system there, which, he thought, was better than the two-rate system proposed by him. The evil of the author's system was that it did not take into account the load factor of the lighting installation. The system also failed in the respect that they could not set the meter to read at the particular time of the peak load. So far as cooking was concerned, he agreed with the author's statement that it was a *sine quâ non* that a hiring department must be inaugurated if it was to be made familiar and profitable, but with radiators at so low a price as they were at present, heating could get along fairly well without any hiring department.

Mr. Perry, replying to Mr. Roles, said the rateable value system was the easiest way to get over the trouble of complex charges, and probably in the course of a few years, if heating and cooking became a very big thing, as he expected they would, this system of charging for domestic use would become almost universal. But there was this disadvantage in it—that it directly encouraged the consumer to use a very high peak. It was in the direction of the cooking that they ought to increase their business enormously, because it was folly to pretend that they could give heat in a house any more economically than the gas people could.

Mr. Burnand said that there was such a large proportion of the time when the valuable station plant was standing practically idle, that any increased revenue was worth getting hold of, even if it was at a low rate. Any device which would conduce to increase of the revenue at the time of the day when otherwise it would not exist was worth experimenting with. The great objection to it was that the system tended to restrict the load many times when the restriction would not be of any use whatever to the supply authorities. Another ground of objection was the high charge as applied to the lighting. The improvement in lighting—especially incandescent lighting—was such that in a few years lighting would lose altogether its present relative value as a determining factor in the cost of electrical supply. In regard to the author's view that the diversity factor is large enough to allow the coincidence of double peaks to be ignored, he felt that a very great saving in outlay on plant could be effected if they could only get rid of the coinciding double peaks. The two-rate system recently developed by Messrs. Handcock & Dykes, which was controlled from the generating station, gave great advantages over any maximum-demand system.

Mr. Thackeray said that he thought the system at Bradford, whereby power users were allowed to have a certain portion of their lighting supply reckoned at the power rate, was a means of getting over the difficulty which Mr. Perry was trying to obviate. He gathered from the paper that by this system it was quite possible to run an ordinary house at the low rate all the time. Taking it all round, the surest way for electrical development was to have a flat rate right through and a cheaper rate.

Mr. Wilson Hartnell said it appeared to him that the system of charging described in the paper was not a very rational way of doing things. He knew many instances now in which people were charged at the same rate whether for lighting or power. What did it matter what the supply was used for, so far as the peak load was concerned? Whether they were large users or domestic users, the simplest and most satisfactory thing was the flat rate.

Mr. Perry, in reply, said that members had not quite realised that the paper was dealing chiefly with domestic consumers, and did not really relate to persons taking a great amount of power. That observation applied to all the criticism. The whole object of the paper was to encourage a load resulting from heating and cooking apparatus. He did not suppose that that had so much importance in the North as it had in the South. Lighting was an absolute necessity, whereas power was not so, and if they cut down the lighting charge to the same rate as the power charge, he was afraid it would spell bankruptcy. Messrs. Handcock & Dykes's method was particularly ingenious, but he very much questioned whether it was legal. He did not think Mr. Thackeray's suggestion that a consumer could, by this two-rate system of his, obtain the low rate charge on the normal number of lights in the house was well founded. The provision of a daytime load was the only way to bring down the cost of production.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Hope's Fuse Arc Arrester.

Tubular fuses, when used in earthed iron cases, are open to one very serious objection—*i.e.*, the gases are driven out of the tubes with great force on a heavy overload, and not infrequently an arc to the case is set up, or the arc rebounds from the case and burns the contents of the box. With the object of overcoming this objection, Messrs. Parmiter, Hope & Sugden, of Hulme Electrical Works, Manchester, have introduced a new arc arrester, and have applied for letters patent thereon.

The arc arrester is a china receptacle which, when placed opposite to the ends of the tubular fuse, takes up practically the whole of the volatilised metal on the fuse being subjected to a short circuit, and prevents any danger of an arc being set up to the case. Fig. 1 shows a view of the standard form of arc arrester, and figs. 2 and 3 show the two parts, whilst figs. 4 and 5 show the same parts after a severe short circuit.

It will be noticed that the arc arrester has a "bell-mouthed" opening, that there are two rows of small holes in the piece shown in fig. 2, whilst in the centre of fig. 3 there is a round knob. The two parts, figs. 2 and 3, screw together, and are made in two parts merely for cleaning purposes.

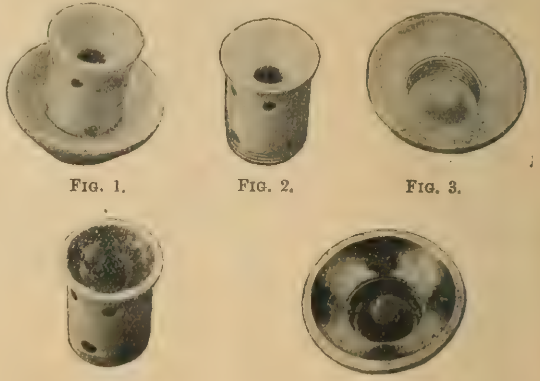


Fig. 1. Fig. 2. Fig. 3.

Fig. 4. Fig. 5.

Fuse Arc Arrester and Parts.

The arc arrester is fixed in position opposite the fuse ends, and the gases, when the fuse blows, are driven through the "bell-mouthed" opening, and impinge on the round knob above-mentioned. They are sprayed round the shaped interior, and are driven out of the lower row of small holes, whilst cool air is drawn in through the top row of holes. The gases are greatly cooled by coming in contact with the cool china knob, and practically the whole of the volatilised copper is retained in the arc arrester.

In order to test the real effectiveness of the arc arrester, two identical fuse boxes were compared, differing only in that one was fitted with arc arresters, fig. 6, and the other was a standard box (fig. 7). The fuses were wired for 100 amperes and connected in series directly across a 460-volt, 150-kw., d.c. motor generator, with the cases of the boxes in each case earthed, and practically no cable in circuit.

The box without arc arresters (see fig. 7) went to earth with considerable damage to the contacts and interior, whilst in the box fitted with arc arresters the asbestos lining was not even discoloured. This test was carried out more than once, with the same results, and recently this was demonstrated before a number of leading engineers. The tests were carried out by the Manchester Corporation electricity department.

The principal use of the arc arrester is in connection with iron-cased distribution fuse-boxes, and a number of the firm's standard forms of distribution board for three-phase work, fitted with arc arresters, have recently been supplied. It can also be used with great advantage for switchboard work. Valuable instruments, &c., have frequently been damaged by fuses blowing upon them. A special adjustable form is made for switchboard use, to suit fuses of various distances from the base. The device can be used with almost any make of tubular fuse, and can generally be fitted to existing boxes of any make when the clearances allowed are sufficient. The china has a tapped hole in the centre of the back for fixing purposes, and the arc arrester can be fixed to the iron case, or the dividing fillets, by this means.

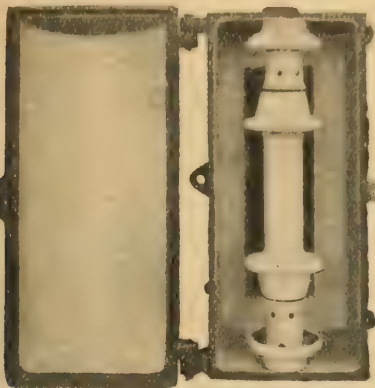


Fig. 6.—Fuse-Box Fitted with Arc Arresters; after Test.

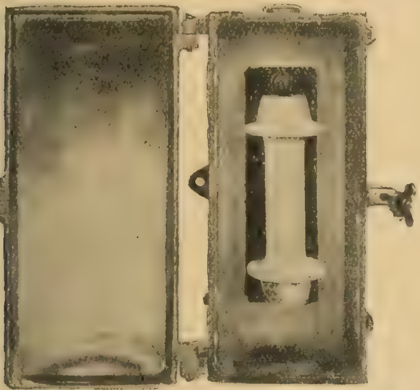


Fig. 7.—Standard Fuse-Box Used in Tests, showing Effects of Short-Circuit.

Some new "Semi-Indirect" Fittings.

The British Thomson-Houston Co., of Mazda House, Upper Thames Street, E.C., have recently introduced a new luminous bowl "Eye-Rest" fitting. It is an indirect fitting in which a small portion of the light (about 10 per cent.) is diffused through a translucent bowl, while the remaining 90 per cent. is reflected on to the ceiling by opaque X-ray reflectors. The bowl is formed of a delicately tinted glass dish, or of panels of tinted glass let into a composition framework. Below the X-ray reflector units is suspended a low-wattage Mazda lamp enclosed in an Alba glass ball. This lamp, which need not be larger than one-tenth of the total wattage, gives a soft uniform radiance to the translucent bowl. The luminous bowl is only for decorative effect, and does not in any way compete with the indirect illumination which proceeds from the ceiling.

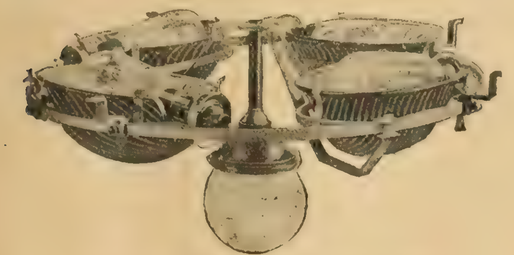


Fig. 8.—A New Semi-Indirect Fitting.

The company has also designed a new form of "Eye-rest" unit which, while possessing all the artistic and attractive features of the ordinary standard lamp, can, if required, be used for the general illumination of the room. It has a single upturned X-ray silvered glass reflector concealed in the silk shade. The light is thrown on to the ceiling and reflected down into the room again, in the same way as with the suspended "Eye-rest" fittings.

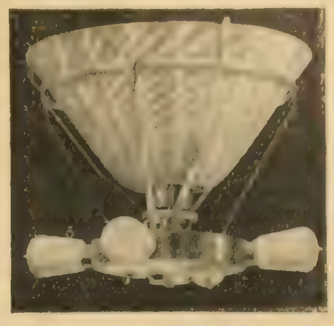


Fig. 9.—Semi-Indirect Fitting for Standard Lamp.

In addition there are two or three low wattage Mazda lamps uniformly spaced around the pedestal underneath the X-ray reflector. These lamps can be used for the direct illumination of a table or desk.

Since the lamps are separately switched, it is possible to use the "Eye-rest" standard either as an indirect or a direct lighting unit, or as a combination of both.

New Portable Accumulator.

The Naylor Battery Co., Ltd., of Lammermoor Road, Balham, have designed and obtained protection for a new electrode for storage batteries, to meet the increasing application of these to motor-car starters, and to the lighting of cars, omnibuses and railway trains. A distinctive feature of the new plate is the fact that it is hollow, the electrolyte being able to circulate through the interior of the plate. It might appear that this would not be effective in adding to the capacity of the plate, but in practice, we are informed, a very material gain is obtained; a plate $\frac{7}{8}$ in. thick × 4 in. wide × 7 in. high has a capacity of 35 ampere-hours, and is able to stand heavy charges and discharges. The plates are very strongly built, and have withstood for months without injury the jolting, vibration and overcharging experienced in omnibus lighting service.

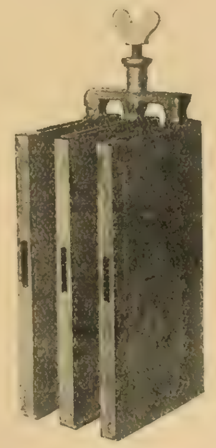


Fig. 10.—Naylor Battery Plate.

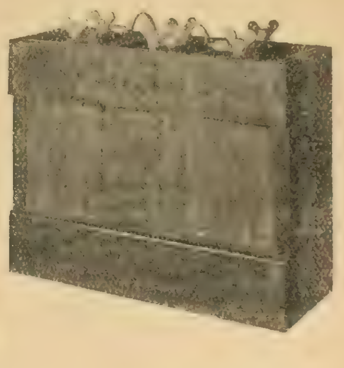


Fig. 11.—Naylor 6-Volt Battery.

Fig. 10 shows the three-plate positive, and fig. 11 a 6-volt set of 100 ampere-hours capacity. The train lighting cell weighs 33 lb. complete with electrolyte in an ebonite box, or 42 lb. in a wooden lead-lined box; when discharged at the rate of 20 amperes, it takes nearly six hours for the voltage to fall to 2 volts, or 10 hours to fall to 1·8 volts. Subject to only one condition, the company undertake to replace the plates of any cells they supply, when worn out, at a discount of 40 per cent. off the original price. They have had a ½-ton electric vehicle in constant use for 16 months and find that the cost per battery-mile works out at less than 1d. They have supplied a large number of batteries to electric carriage companies—77 to one company so far—under a new system of maintenance, and find that the type preferred for 38-cwt. landaulettes, carrying four passengers and driver, and capable of running 50 miles on one charge, with an average consumption of 40 amperes on the level, is a 200-A.H. cell, having an output of 12 watt-hours per lb. of cell complete when discharged at a rate of 50 amperes.

The Lavigne Electric Lock.

An ingenious unpickable electric lock has been developed by M. Eugène Lavigne, and is being placed on the English market by Messrs. Veritys, Ltd., and the Sun Electrical Co., Ltd. The arrangement is such that, while no signal is given when the door is opened by legitimate means, it is impossible to pick the lock, or, indeed, to begin to tamper with it in any way, without immediately sounding an alarm. The mechanical arrangement of the lock itself is such as to render it exceedingly difficult to open it except with the proper key, as the slightest pressure on the central pin closes an electric circuit; keys made of non-conducting material act like metal keys in this respect. The alarm can be set to ring when the door is opened from the outside, but not when it is opened from the inside; at night, however, it can be set to ring in both cases; the latch can similarly be made to give the alarm. The circuit is completed by way of the hinges, so that there are no visible wires to cut.

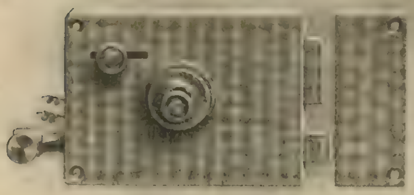


Fig. 12.—Lavigne Electric Lock.

The lock is adaptable for use with or without knobs, and with or without spring latches; various patterns are available, for private houses, banks, outhouses, shop doors, &c. We illustrate in fig. 12, a lock suitable for houses and offices; fig. 13 shows a shop door handle and lock, for use with a key. The locks are made of steel or copper, very handsomely finished, and are of very substantial construction. Further particulars can be obtained from the above-named firms, or from M. Lavigne at the Ivanhoe Hotel, W.C.

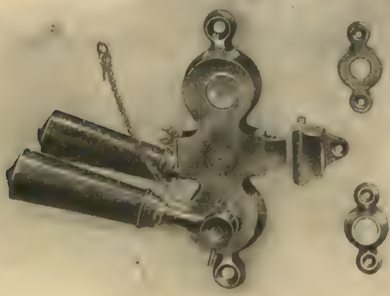


Fig. 13.—Electric Handle and Lock for Shop Door.

Electric Vacuum Cleaner.

The British Vacuum Cleaner Co., Ltd., of Parson's Green Lane, S.W., are now building a new model F.F. cabinet type electric vacuum cleaner. It measures only 11 in. × 9 in. × 7 in., and weighs only 11 lb., with a full range of cleaning implements.

The power unit consists of a ½-H.P. motor, with a fan at each end of the spindle. One fan creates a volume of air necessary for domestic cleaning, with a certain amount of vacuum, and the other fan practically doubles the amount of vacuum obtained with the first fan. Both fans are connected to one inlet, and it is claimed that the amount of vacuum obtained is nearly twice as much as is shown by the bulk of fan machines of about the same price. All dust passing into the machine is intercepted in a dust bag before reaching the fans.

Half-Watt Lamp Fitting.

The Wardle Engineering Co., Ltd., of 196, Deansgate, Manchester, have brought out a fitting for a half-watt lamp, fitted with an external reflector, which adequately protects it from the weather. We are informed that this fitting has developed 5,000 C.P. at 20° from the horizontal, when used with a half-watt lamp rated at 3,000 C.P.

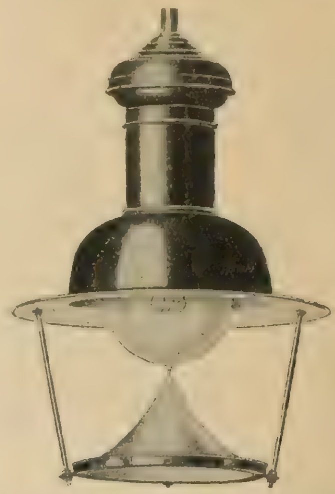


Fig. 14.—Half-watt Lamp Fitting with External Reflector.

LEGAL.

Western Electric Co., Ltd., v. The Great Eastern Railway Co.

Transit of Electrical Goods.

In the Court of Appeal, on the 19th inst., Lord Sumner, Lord Justice Kennedy and Mr. Justice Lawrence had before them this case, on the appeal of the defendants against a decision of a Divisional Court (Justices Channell and Coleridge) affirming a judgment of the City of London Court (see Electrical Review, February 21st, 1913). The action was brought to recover damages in respect of injury to certain electrical goods of the plaintiffs, which were carried by the defendants by steamer and railway from Antwerp to North Woolwich *via* Harwich. The injury to the goods was found by the judge to be due to the fact that they were wetted by rain on the railway journey from Harwich to Woolwich owing to the neglect of the defendants' servants. By the terms of the contract and the bill of lading, the goods were to be carried at a reduced rate at owners' risk. In respect of the sea transit there was a bill of lading which contained a clause exempting the defendants from liability for damage arising, *inter alia*, from the negligence of the crew. The document was in the railway company's ordinary form, which would also be applicable where goods were not sent at owners' risk. With regard to the carriage by land the plaintiffs had, under the contract, been given the option of paying a higher rate in consideration of the railway company accepting the position of common carriers. It was contended by the plaintiffs that, the contract being for one entire transit, and no option for an alternative rate having been given in respect of the sea portion of the transit, the condition exempting the defendants from liability for negligence was not just and reasonable within the meaning of Sec. 7 of the Railway and Canal Traffic Act, 1854. On the other hand, it was said on behalf of the defendants that the land transit was not governed by the terms of the bill of lading, and that an alternative rate having been offered in respect of that part of the journey, during which the damage was incurred, the condition exempting the defendants from liability was just and reasonable. The Divisional Court, affirming the decision of the County Court Judge, held that the plaintiffs were entitled to recover, inasmuch as in respect of the sea portion of the transit, the plaintiffs not having had the option of having the goods carried by the defendants with the ordinary liability of common carriers, the condition exempting the defendants from liability was unreasonable within Sec. 7.

Mr. Justice Channell remarked that he came to this conclusion with the greatest possible reluctance, because he felt the result was obviously unjust. The plaintiffs, he added, had accepted a lower rate of carriage from the defendants for many years, and had thereby saved a sum which was probably much larger than the damage they had now suffered, but when damage did occur, they raised this point under the Railway and Canal Traffic Act. Hence the present appeal of the defendants.

Mr. Leslie Scott, K.C., and Mr. Bruce Thomas appeared for the appellants; and Mr. R. V. Bankes, K.C., and Mr. R. H. Balloch for the respondents.

In support of the appeal, Mr. Leslie Scott argued that where, as in this case, there was a low rate and alternative conditions for the whole of the land carriage, the fact that there was no alternative for the sea portion of the route, was not enough to justify the Court in coming to the conclusion that the contract as a whole was unjust and unreasonable.

Mr. Bruce Thomas followed on the same side.

Counsel for the respondents were not called upon.

Giving judgment, Lord Sumner said that the only contract between the parties was one by which the defendants were bound to accept the goods tendered to them at owners' risk rates. There was, in his opinion, an offer of an alternative, and no more. It was a continuing offer, of which the plaintiffs could avail themselves at any time, but the evidence showed that at the time in question the bill of lading as tendered at Antwerp was the only form in existence. Although there was evidence from the railway rate-book, and from the documents signed in 1910, that there was a continuing offer, in point of fact the only terms upon which the plaintiffs' goods could have been carried, were those contained in the bill of lading. It had not been contended that the transit was indivisible, nor that, as the loss had happened on the part of the transit to which the unreasonable terms of the bill of lading did not apply, the sea transit might be disregarded, because it was now accepted that this was all one transit. It had been argued that, although the existence of some alternative rate was a well-recognised criterion of the fairness of the contract, it was not the only one, and that the Court was entitled to look at the facts, and to say whether in the circumstances the contract might be just and reasonable in the absence of an alternative. In his judgment, the effect of the authorities was such that on the materials in the present case he could not say that the contract was just and reasonable, and one that would be upheld in the absence of any alternative.

Lord Justice Kennedy and Mr. Justice Lawrence concurred, and the appeal was accordingly dismissed with costs.

Dean *v.* the Prudential Assurance Co., Ltd.

In the Chancery Division, on Monday, March 23rd, Mr. Justice Sargant concluded the hearing of this action, by which the plaintiff, a maker of X-ray and electro-medical apparatus, of Leigh Place, Baldwin Gardens, Holborn, sought to restrain the erection by the defendants of a high block of buildings in Dorrington Street at the rear, which plaintiff alleged so obscured the light coming to his premises as to render them unfit for the purposes of his business.

Mr. Mark Romer, K.C., in opening the plaintiff's case, said it was not one where any damages which the Court could award could compensate him for the loss of light he would sustain; in fact, the defendants had offered him £250, but he would rather pay £250 in order to retain his light. Commencing with the discovery of the X-rays, the business had grown to such an extent that he had been some years finding suitable premises. One of the great advantages of his present premises was that they had two separate sources of electrical supply, and the factory took 100-volt current from one source which, by means of a transformer, was converted into a 200-volt alternating current, and from another source he got a 500-volt current direct.

Mr. Martelli, K.C., for the defence, submitted that the effect of their building on the plaintiff's lights would be so slight as to be easily compensated for by damages.

His Lordship, however, came to the conclusion that the plaintiff's light would be materially affected if the defendants were permitted to build as they proposed. If carried out, their buildings would cause a serious nuisance, and they had been started with little regard to the plaintiff's rights. The plaintiff had had great difficulty in finding a suitable place as he required an electrical current of large voltage for testing his apparatus, and it was doubtful whether he could find other premises where he could get the same advantages. He saw no reason for displacing his *primâ facie* right to an injunction; no damages would compensate him, and he (the judge) had no option but to grant the injunction asked for with costs.

South London Electric Supply Corporation, Ltd., *v.* Slade.

At the Lambeth Police Court recently, plaintiffs sued defendant to recover from him £3 18s. 8d., being £3 15s. for repairing a motor taken on hire from the company, and 3s. 8d. for electricity charges. The motor was hired from plaintiffs, and defendant gave notice to terminate his agreement. For plaintiffs it was stated that when the motor was sent for it was found that the starting coils were burnt out. The cost of their repair was £3 7s. 6d. plus 7s. 6d. for carriage to and from the makers' works. Evidence for the company was to the effect that the damage was due to the switch being left too long on the starting position.

Kidderminster Electric Tramways.

By order of Mr. Justice Bailhache, sitting in the King's Bench Division, the two non-jury actions, Kidderminster and Stourport Electric Tramways, Ltd., *v.* Woodward Grosvenor & Co., and Woodward Grovenor & Co., *v.* Kidderminster and Stourport Electric Tramways, Ltd., which had now been consolidated, have been ordered to be heard not before March [illegible]th. Mr. Hugo Young, K.C., in mentioning the cases to the Judge, said that Mr. Duke, K.C., was against him, and it had been arranged, subject to the consent of the Court, that the cases that had now been consolidated should stand over till March [illegible]th. They were figuring at present in the warned list, and he asked the Judge to consent to this course, the cases keeping their places in the list.

Mr. Justice Bailhache: Yes, very well.

Collier Fined.

According to the *Western Mail*, Arthur Bridgeman (21), collier, Argoed, was summoned at Blackwood on Friday last for having an apparatus for producing a light (an electric flash lamp) in his possession at Oakdale Colliery. Defendant pleaded guilty. Mr W. S. Nash, J.P.: Would it be possible to light a pipe or cigarette from this? Witness: Of course, there's a spark with it. Defendant was fined £3.

THE MACKAY COMPANIES.

The annual report of the Mackay Companies, dated February 16th last, has just come to hand. The trustees congratulate the shareholders that progress has been made, but the reserves have not been increased to the same extent as in the previous year.

The Postal Co. has extended its system into parts not heretofore reached, and has strung many additional wires on its poles. The Commercial Cable Co. has also renewed parts of the oldest of its three cables. No doubt the management is an able one, and the several concerns forming the Mackay Trust stand in the front rank of telegraph undertakings. The nest egg of $12,000,000 resulting from a stock transaction is still in hand. The meagreness of the accounts, however, has, we believe, caused some dissatisfaction. It would be more satisfactory to know the exact nature of the assets described as "investments in other companies" $91,997,714.19, and their market values. The British Public Companies give a plain and detailed statement of accounts, and as there cannot be anything to conceal, it is suggested that the Mackay Companies should take shareholders a little more into their confidence. Would it not, perhaps, improve the price of Commercial Cable stock?

The report deals with wireless telegraphy, and describes it as "a communication between moving points or between a fixed and a moving point," and expresses the belief that there has been no development to modify the opinion which they (the Mackay Trust) and others have already expressed that wireless telegraphy in no way threatens the supremacy of the submarine cable. In confirmation of this, the cables recently laid are enumerated, and the length laid in the last five years is given as from 247,000—280,000 miles. The cable companies have always maintained that the introduction of cheap rates—which wireless competition has probably hastened—would necessitate additional lines, and if the growth of cables has been great, truly the progress of wireless has been phenomenal. Nor is it only between moving points, but also from shore to shore, and it is difficult to believe that nations are investing huge sums in long-distance stations, if they not satisfied that the advantages warrant the outlay. Much has been achieved since the signal "S" was received, and progress continue to be recorded, not only in efficiency, but also in the lowering of rates.

The question of Government ownership of landlines in the United States has been again brought forward, and it is claimed by the trustees that such a proposition will hardly commend itself to the intelligence and fairness of the American people (British officials please note), and statements follow concerning the British Government telegraphs. The whole idea is described as a "spectre, and a page and a-half of matter is employed to explain why it is so—intelligence notwithstanding. The subject has in recent years been so consistently brought forward that there is always the possibility of fruition. The purchase price is given at $2,000,000,000 including goodwill, and this sum suggests the remunerative nature of the service. The United States already exercises control over rates, and perhaps this is a step towards an end.

The Postal Co. view with disfavour the strong position of the Western Union Co. in Mexico, but as both companies have absorbed many smaller rivals, there is no occasion for stone-throwing. The Mexican trouble may, perhaps, yet convince the United States Government that for strategic reasons it would be well to own the telegraphic system.

LOAD, STRENGTH, STRESS AND STRAIN.

[COMMUNICATED.]

Many writers use the above four words in an incorrect manner. They are used wrongly and promiscuously also in manufacturers' catalogues; for example, we find in the latest edition of "Kempe's Year Book," tables which are credited to certain wire rope manufacturers, in which tabular figures are both correctly and incorrectly designated.

In the first place, the term "load" refers simply to any weight, pull, or push, stated in pounds, in tons, or in any other unit, to which any body may be subjected irrespective of its cross-sectional area. Thus a statement that a load of 1 ton is placed upon a 1-in. chain gives no information as to the stress, the strain, or the strength (the single word "strength" being the equivalent of "breaking load," or "breaking weight," although "breaking strength" is allowable) of that chain, unless accompanied by figures obtained from calculation or experiment.

The 1 ton is simply a load. But if the cross-sectional area in square inches be divided into the load in pounds, there will be obtained the load in pounds per square inch of area. This load is properly to be referred to as the unit stress or the stress per square inch. The term "unit stress" in British measures means tons per square inch, or pounds per square inch. For steel it usually implies tons in Britain and pounds in the United States, where, perhaps, it has become pounds to avoid the ambiguity of the ton of 2,240 lb. and the usual U.S. ton of 2,000 lb.

"Stress" is thus properly used on page 209 of the book referred to, on line 2, in the expression "breaking stress of 100 tons to the square inch." In the table below this heading, however, "stress" is wrongly used in the heading of the three columns "Guaranteed breaking stress." Here the expression should have been "Guaranteed breaking load," "Guaranteed breaking weight" or "Guaranteed strength," for every size of wire rope is made from steel of 100 tons breaking stress, but the different diameter ropes break with different loads or weights, according to their area of cross-section. Thus a 1-in. circumference rope breaks with a load of 1·75 tons at a unit stress of 100 tons, or under another set of conditions at 3·25 tons. Of course, the 100 tons stress is the test of the straight wire. The rope cannot, over a sheave, develop the strength of its individual wires. Turning to the table at the foot of page 207, wires are given certain "breaking stresses" in columns 7 and 8 of the table. In this case the heading should be "breaking loads" or "strength," for again the loads are meant which will break the different sizes of wire, and in column 7 these loads vary from 55 lb. to 10,470 lb. for wires of the same quality. In each case the stress is about 50,000 lb. per sq. in., but the breaking loads or strengths vary as the square of the diameter.

The same error appears in the first table on page 208. But in the second table on that page "stress" is properly employed to denote the unit stress in tons per sq. in. In Table III, on page 208, the heading is "Breaking stresses," which is wrong, for it should be "breaking load," "breaking weight," or "strength," as in the column headings. Thus this table is wrongly entitled and rightly carried out in detail. In the fourth table on the same page the expression "breaking stress" should be "strength" in every case. On page 210 also, the memo. employs "stress" wrongly. On page 235 there is less risk in the use of the word stress, but even in this case it is not, perhaps, quite correct, though it is permissible here, because it is only defining stresses in structures of no dimension, the dimensions of parts being intended to be calculated from these stresses, as shown on a mere diagram of centre lines. But "force" would be unambiguous, and would be preferable to stress, which should be confined to unit stresses.

A boiler ought not to be described as safe up to a bursting stress of 100 lb. This really means a tension per square inch of plate section of only 100 lb. In this case the words "bursting pressure" should be employed, meaning steam pressure in lb. per square inch of plate area.

On pages 260 and 261, "strength" and "load" will be found properly used. But on page 246 will be found "breaking strain." Here "strain" should have been "load" or "weight," for "strain" means the amount of deformation per unit dimension, produced by a given unit "stress," as when a "load" of 10 tons on a $\frac{1}{2}$-in. square bar produces a "unit stress" of 40 tons per square inch, and an "elongation" or "strain" of so much per foot of length.

Thus, in test practice, unit stresses produce unit strains, though the units may be square inches and linear inches or linear feet respectively. In the use of the word "strain" the statement of effect is really in the form of a percentage of the dimension on which the "strain" is measured, and so the amount of strain in the same specimen will vary according to the length measured, the elongation percentage decreasing as the length increases, for most strain occurs at or near the point of rupture in a tensile test on ductile material.

It is really important that the correct word should be used on every occasion, for a confusion of stress (load per unit area) and total load may arise from the improper use of "stress."

BUSINESS NOTES.

Deed of Assignment.—A. E. Hart, electrical engineer, 456, New Cross Road, S.E.—Claims must be sent by April 4th to the trustee, Mr. G. E. Corfield, of Corfield & Cripwell, 119-125, Finsbury Pavement, E.C.

Bennis's Contracts.—We have received from Messrs. E. Bennis & Co., Ltd., an imposing list of contracts that have been received by them during the last few weeks for their machine stokers. These include two for Yokohama, six for a flour mill at Karachi, two for ferryboat use for Alblasserdam, near Rotterdam, two for use with Woodeson water-tube boilers at H.M. Dockyard at Chatham, six and four respectively for two Birmingham breweries, four for a linen factory at Brechin, many more for other mills and works in different parts of the United Kingdom, and a repeat order from Keighley Corporation electricity works for two Sprinkler stokers for an 8-ft. diameter Lancashire boiler.

Westinghouse Cinema and Theatre Supplies.—During the last two weeks, the British Westinghouse supplies department, of 179, Wardour Street, W., has been holding a special exhibition of cinema and theatre electrical supplies, embracing practically everything required in the way of lighting, power and electrical specialities for this class of work. In addition to arc and half-watt lamps, the Cooper-Hewitt mercury vapour and ordinary tungsten lamp, and the many excellent types of ornamental fitting suitable for interior decorative lighting, there are shown specimens of fireproof stage fittings, stage projector arcs, bunch lights, &c., electric torches for attendants, and what would be a welcome addition in many picture theatres, small shaded lamps forming seat attachments for throwing some light on the usually dark gangways. We noted a section of specially prepared enamelled metal troughing for concealed lighting behind cornices; also a footlight innovation—an inverted float with a double casing so arranged as to safeguard the lamps from stage vibration. Amongst the sundries were various electrically-operated picture, number, and time indicators, and a manager's instruction indicator. Theatre dimmers, standby resistances, cinema motors, switchgear, fans, radiators, vacuum cleaners, and much other apparatus are included, the exhibits being well worth the attention of those interested in this growing branch of electrical work.

Van Horse Parade.—As several electrical firms are already interested in the forthcoming Easter Monday parade of the London Van Horse Parade Society, we are asked by the Society (2, Upper St. Martin's Lane, London, W.C.) to inform others who may be interested in the event that the last day for receiving entries is Tuesday, March 31st. This year a special effort is being made to secure 1,000 entries, and firms anxious to encourage drivers to take greater care of horses should obtain the Society's interested booklet.

Electric Cookers for South America.—The accompanying illustration shows one-seventh part of an order for "Calor" electric cooking apparatus that is being executed for South America by Messrs. Townshend's Art Metal Co., Ltd., of Birmingham.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. 52, No. 230. March 16th. London: E. and F. N. Spon, Ltd. Price 3s. 6d.—This issue contains the following papers:—"Electric Locomotives" (supplementary paper), and "Motor and Control Equipments for Electric Locomotives," by F. Lydall; "The Gulstad Vibrating Relay," by W. Judd; "The 'Cascade' Induction Motor," by L. J. Hunt.

"Laboratory Manual—Direct and Alternating Current." By C. E. Clewell. London: Chapman & Hall, Ltd. Price 4s. 6d. net.

"*Bulletin* de la Société Internationale des Electriciens." Vol. IV, No. 32. February. Paris: Gauthier-Villars. Price 2 fr. 50 c.

"The Elements of Electricity." By W. Robinson. London: Chapman & Hall, Ltd. Price 10s. 6d. net.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Vol. LVII, Part 5. March. Glasgow: The Institution.

"*Journal* of the American Society of Mechanical Engineers." Vol. 36, No. 3. March. New York: The Society.

"*Journal* of the Western Society of Engineers." Vol. XIX, No. 1. January. Chicago: The Society. Price 50 cents.

"*Journal* of the Franklin Institute." Vol. CLXXVII, No. 3. March. Philadelphia: The Institute. Price 50 cents.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Spèciales." Vol. 16, No. 4. February. Liége: Lahaye & Co. Price 1 fr.

"*Proceedings* of the South Wales Institute of Engineers." Vol. XXIX, No. 7, and Vol. XXX, No. 1. March 20th. Cardiff: The Institute. Price 2s. 6d. each.

"*Memoirs* of the College of Science and Engineering." Vol. V, No. 9, and Vol. VI, No. 1. Kyoto, Japan: The Imperial University.

Catalogues and Lists.—Messrs. Fredk. Ryman & Co., 116, Livery Street, Birmingham.—Twenty-two-page illustrated and priced stock list of wood blocks, switches, lampholders, fuseboards and fuses, &c.

The Selson Engineering Co., Ltd., 85, Queen Victoria Street, London, E.C.—Fifty-six-page catalogue showing excellent half-tone illustrations (art paper) of a selection of machine tools (shaping and milling machines, lathes, drilling, tool-grinding and other machines), such as are regularly stocked by them in London.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End.—Abridged catalogue of about 100 pages, giving brief particulars, with illustrations and prices, of "Royal Ediswan" lamps (half-watt, "Downlite," &c.) accessories, cables, wires, conduits, brackets, ship and majolica fittings, shades, instruments, fans, radiators, indicators, bells, pushes, telephones, signs and carbons. The items are more briefly given than in the firm's original catalogue.

Messrs. T. W. Ward, Ltd., Albion Works, Sheffield.—March catalogue of close upon 400 pages giving particulars and prices of new and second-hand machinery and boilers, tanks, tubing, rails, &c., in stock.

The Hoyt Metal Co. of Great Britain, Ltd., 26, Billiter Street, London, E.C.—Leaflet giving directions for using their I.C.E. metal, and hints on the lining of bearings; the latter are notes on tinning, heat, pouring, jigs, machining, &c., intended for the practical man.

The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—Sixteen-page sectional list giving fully illustrated and priced information respecting their "Striplite" electrical illumination material.

Messrs. W. B. Coupier & Co., 19-23, Oxford Street, London, W.—Four-page priced leaflet, illustrating a variety of designs of silk shades for electric candle and other fittings, also showing the "Kingolite" candle. Copies of the leaflet can be supplied to firms in the trade overprinted with their own names.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, S.E.—Leaflet No. 341 I, giving a brief description, with prices, of their Leclanché cell for use in connection with railway track circuits.

Messrs. Drake & Gorham, Ltd., 66, Victoria Street, London, S.W.—Three illustrated and priced descriptive pamphlets as follows:—No. 218, dealing with transformers (air-cooled 2,200-volt, oil filled up to 650 volts and air cooled house up to 250 volts); No. 219, devoted to "half-watt" lamps (Mazda Wotan, Extra Osram, and Ediswan), and lanterns and fittings for use with same; and No. 220, showing several types of electric grinding and drilling machines.

The Electric Suction Cleaner Co., 14, Queen Victoria Street, London, E.C.—Attractive 12-page pocket pamphlet, giving various illustrations of their new model "Frantz" electric suction cleaner, its parts and applications.

Messrs. Henrion Carbons, 31, Victoria Street, London, S.W.—Tabulated price list of carbons for cinematograph and projection work.

Messrs. E. Brook, Ltd., 178, Gray's Inn Road, London, W.C.—Forty-page book of half-tone pictures showing views of machinery of all kinds in all classes of factories, driven by Brook electric motors with ball bearings.

Messrs. W. and R. Jacobs, 39c, King William Street, London, E.C.—Eight-page pamphlet containing neat little illustrations and tabulated prices of artistic bead cascade shades for electric light.

Messrs. Wailes, Dove & Co., Ltd., Newcastle-on-Tyne.—28-page pamphlet, giving information relating to their patent "Bitumastic" solution for prevention of corrosion of iron and steel structures. The North Wales Power Co.'s pipe line and that of the British Aluminium Co., at Kinlochleven, are both shown among the illustrations.

Brimsdown Lamp Works, Ltd., Kingsway House, Kingsway, London, W.C.—12-page illustrated price list of Wirum battery lamps of various types and for various voltages and candle-powers. All the lamps are manufactured at Brimsdown, where further extensions to the works have been made.

Messrs. Ferranti, Ltd., Central House, Kingsway, London, W.C.—Small pamphlet, for enclosure with correspondence, accounts, &c., respecting electric fires and electric cooking. The loss of meat with different systems is graphically shown, and the current and coal bills are reproduced comparatively of a household of five persons before and during the use of electric cooking and heating. Contractors and supply authorities can have quantities of this publication on application.

Private Arrangements.—Albert George Mead and Cecil Herbert Jeffery (trading as Mead & Jeffery), electrical engineers, 23, The Avenue, West Ealing.—The creditors interested herein were called together on March 20th, when the statement of affairs presented showed liabilities of £388. The indebtedness to the trade was £338, and there were cash creditors for £50. The assets were estimated to realise £500, and the estate thus showed a surplus of assets over liabilities of £112. The assets were as follows:—Stock-in-trade at cost £197, expected to produce £158; fixtures and fittings £23, valued at £15; household furniture £40; good book debts £267, expected to produce £227; doubtful and bad debts £163, estimated to realise £20: and cash at bank £40. In addition to the assets shown on the statement, the debtors possessed a lease of the premises which had a number of years to run at a rental of £60 per annum. A portion of the premises were sublet at a rental of £70 per annum. It was stated that the debtors started business in May, 1910, at Gordon Road, with a capital of £50. They removed to their present premises in May, 1913, spending £50 in alterations. The turnover had gradually increased, and the profits also were larger year by year. Last year they made a bad debt of over £130 in connection with a company that went into liquidation. The drawings had been moderate. No definite offer of a composition was made, but it was stated that the debtors desired to discharge the whole of their liabilities in full. After some discussion, it was decided that the debtors should be allowed to continue the business for a period of three months, and at the expiration of that time a trading account should be prepared and submitted to the three largest creditors. The following are creditors:—

Sloan Electrical Co.	£140	Siemens Bros.	£22
General Electric Co.	43	Strauss & Co.	17
Falk, Stadelmann & Co.	48	Jeffreys	48

Bankruptcy Proceedings.—T. M. Woodcock, electrical engineer, 64, Holly Street, Sheffield.—Receiving order made March 18th on debtor's own petition.

M. Zains, "electrical engineer and tobacconist," 98 and 105, Wardour Street.—Application for debtor's discharge will be heard at Carey Street on April 7th.

Charles Blake, electrical engineer, of Church and Oxford Streets, Bilston.—At Wolverhampton Bankruptcy Court, on March 18th, this bankrupt again appeared before the Registrar of the Court (Mr. C. B. Cope), and was further examined by the Official Receiver (Mr. Sam. Wells Page). Debtor, in reply to questions, said he had kept no record of cash sales except special items. He had no record of petty expenses, which he estimated at £1 a week. The Official Receiver said he had added up the figures, and found that the total receipts were £622, and the total payments £849, so that debtor had paid away over £200 more than he had received. The Official Receiver suggested that the statement of receipts was inaccurate, and he added that the figures did not show the amount of the deficiency. The examination was adjourned to close.

E. J. Crosier, Newcastle-on-Tyne.—Date of release of trustee (Mr. J. A. Gardner) February 16th.

The Aero and Marine Exhibition.—Quite a number of firms were exhibiting petrol and paraffin lighting sets at the Aero and Marine Exhibition which closed on Wednesday last (25th inst.), at Olympia, the plants being suitable not only for the lighting of ships, steam and petrol motor-boats and yachts, but also for country house lighting, cinematograph theatre lighting and wireless telegraphy. Among the firms displaying such sets were the Aster Motor Co., Ltd., Wembley; the Austin Motor Co., Ltd., Northfield, Birmingham; Alvaston Motors, Derby; the Bristol Wagon and Carriage Co., Ltd.; Messrs. Boulton & Paul, Ltd., Norwich, whose exhibit included a 4½-H.P. set for the King of Siam; Messrs. Brazil, Straker & Co., Ltd., Bristol; Messrs. W. H. Dorman & Co., Ltd., Stafford; Messrs. Dixon Bros. and Hutchinson, Ltd., Southampton; Gleniffer Motors, Ltd., Anniesland, Glasgow; the Green Engine Co., Ltd., London; the Parsons Motor Co., Ltd., Southampton; and Messrs. Thornycroft & Co., Ltd., Basingstoke; Rushmore Lamps, Ltd., showed the Rushmore lighting dynamo and engine starter, as also a range of deck electric lamps and searchlights; Messrs. Arthur Lyon & Co., of Caxton House, Westminster, also displayed a special dynamo for boat lighting as well as searchlights, visual signalling apparatus, and a wireless signalling set. Finally, reference may be made to the exhibit of the Rouzet system of wireless telegraphy for use on aeroplanes, seaplanes, and airships, which has been introduced into this country by Mr. Alfred Tiano, of Warnford Court, Throgmorton Street, E.C.

A New "Underground" Poster.—The latest Underground poster takes the form of a large topographical map of the Metropolis, by Mr. Macdonald Gill, in the making of which the draughtsman has given unrestricted licence to his sense of humour. The idea is a novel one, and full justice has been rendered to its possibilities. The principal thoroughfares and buildings, the parks, the river, and the Underground stations are shown, and the life of London in various phases has been dealt with by the artist, after the fashion of the Middle Ages, every district being made to contribute its share of parodied characteristics. The poster is sure to arouse more than ordinary attention wherever it is exhibited.

Annual Dinner.—The directors of ELECTRICAL INSTALLATIONS, LTD., entertained some 100 members of the staff and guests at their seventh annual dinner, held last Saturday at the Hotel Europe, Leicester Square. A high class musical entertainment followed. Mr. H. F. Simon was in the chair, and he referred to the prevalent labour unrest in the electrical contracting industry. Several other gentlemen also spoke, and the entertainment was voted the most successful yet given by the company.

Trade Announcements.—MESSRS. ELECTRICAL INSTALLATIONS, LTD., 37, Martin's Lane, Cannon Street, E.C., notify that their telephone number is now 3897 City (3 lines).

MESSRS. LESTER B. BETTS & CO., LTD., of 9, London Street, E.C., have been appointed sole export agents for the Colonies and England for the Hurst Electric Manufacturing Co., of Belfast.

An Indian Invitation.—THE LAHORE ELECTRIC SUPPLY CO., LTD., is about to open an extensive showroom at its generating station, and it invites manufacturing firms who would like to be represented therein to communicate with it. See our advertisement pages to-day.

Exhibition in Germany.—Arrangements are in hand for the holding of an Electrical Exhibition in Frankfort-am-Main from August 15th to September 6th next.

LIGHTING and POWER NOTES.

Aberbargoed.—The Rhymney Valley and General E.S. Co. has applied to the B. of T. for consent to the supply of electricity in the town by means of overhead wires, at a pressure of 230 volts.

Aboyne.—E.L. SCHEME.—Lady Cowdray has decided to withdraw her opposition to the E.L. scheme which extends to a portion of her Birse estate.

Aldershot.—PROPOSED NEW PLANT.—The electrical engineer has advised the U.D.C. that it will shortly be necessary to augment the plant at the electricity works, and the engineer and members of the Council are to visit places where plants similar to that proposed are at work, and report.

Bedford.—The Electricity Committee has been recommended to extend its electricity mains to the works of the Bedford Engineering Co., at a cost of £180; a minimum revenue of £60 per annum has been guaranteed.

Bingley.—A canvass is to be made of probable users of electricity in Bailey Hills, with a view to extending the supply to that district.

Brazil.—A concession has been granted to Sr. Brandáo for the utilisation of hydro-electric power from the upper reaches of the S. Francisco River. The capital of the concessionaire or of the company working the concession is to be £1,000,000.—*Board of Trade Journal.*

Bury.—The Electricity Committee is applying to the B. of T. for sanction to erect overhead wires to cope with the demand for current in the Woolfold district.

Colwyn Bay.—PROPOSED NEW GENERATING STATION.—The U.D.C. has confirmed a scheme for the erection of a new electricity generating station in connection with the destructor at Bronynant. The estimated cost is £21,000, and the Lighting Committee pointed out that the present station, which would be used for distribution purposes, would require extensions costing about £10,000 by 1915. The scheme is to be submitted to a consulting engineer. The North Wales Power and Traction Co. has offered to supply electricity to the Council, and is to supply particulars of its proposal.

Continental Notes.—AUSTRIA-HUNGARY.—The East Bohemian Parschnitz overland electricity station has commenced operation, and supplies the Trantenau, Hohenelbe, Braunau and Koniginhof districts. It is proposed that the West Bohemian Pilsen overland station should first supply Pilsen, Blowitz and Rokitzan, and later Kralowitz, Prestitz and Zbirow. The cost of the initial network is estimated at 1,140 million kn. An association of municipalities in Central and North Bohemia has been formed to undertake the erection of an overland station on the Mittelelbe. —*Prager Tgblt.*

A union has been formed at Prague of 12 Czech administrative districts in Middle and Northern Bohemia for the construction of a joint electrical generating station on the Lower Elbe.

The Bau- und Betriebsgesellschaft für Centralanlagen, of Chemnitz, is about to build a large electrical generating station at Tepl, in Bohemia, to supply the towns in the neighbourhood of Tepl and some 14 adjacent districts.

BELGIUM.—The Société de la Charbonnage de Sacre Madame has decided to convert all the machinery at its collieries for electric operation, the current being taken from the Société de l'Electricité du Bassin de Charleroi.

GERMANY.—The Bremen municipal authorities are reported to have ordered two 5,000-H.P. six-cylinder vertical Diesel engines and 7,000-volt A.C. generators as additions to the electricity supply plant of that city.

NORWAY.—It is reported from Hardanger that an "all-electric" dairy—the first in the country—is to be erected by a company formed for that purpose.

According to the annual report, the extra load thrown on the Kristiania municipal electrical works during the last year, due to new installations, amounted to 2,480 KW. for lighting and 3,147 KW. for power. The maximum load reached 13,578 KW., instead of 15,000 KW., as anticipated, and the total KW. installed was 29,737.

Dundee.—YEAR'S WORKING.—The gross profit of the Corporation electricity department for the past year was £24,931, a decrease of £1,465, chiefly accounted for by reductions in the price of electricity. The total number of units sold was 10,050,880, an increase of 1,696,414, and the working costs were £27,459, an increase of £4,489, a third of which is represented by fuel, which increased in price by 40 per cent.

Edinburgh.—B. OF T. INQUIRY.—An inquiry was conducted last week by the Hon. T. H. W. Pelham into the applications of the Edinburgh Corporation to supply electricity to Cramond, Corstorphine, Colinton, Liberton and Newton, and of the Colinton Tramways Co. to supply electricity to Colinton and Corstorphine. The County Council favoured the Corporation's proposal.

The proposal of the E.L. Committee to insert a clause in the Draft Edinburgh E.L. (Extension) Order to allow it to apply the net surplus in any year to any of the purposes of the undertaking, including the formation of a fund for working capital, has been adopted by the T.C.

Epsom.—RURAL ELECTRICITY SUPPLY.—An inquiry was held at the B. of T. last week by Mr. Booth into the application of Mr. Gilbert Allom for a prov. order for the supply of electricity in the parishes of Banstead, Walton-on-the Hill, Kingswood and district. The proposal was to obtain electricity in bulk from Leatherhead, and possibly Sutton, and to supply it to the district mentioned for lighting purposes at 8d. per unit, with a primary charge of 13s. 4d. per quarter. The proposal was opposed by the Epsom and Reigate R.D.C.'s., but eventually an agreement was reached.

Guisborough.—PROPOSED E.L.—The Cleveland E.P. Co. has informed the U.D.C. that it is prepared to supply electricity to private consumers in the town if the latter will undertake the wiring at the same charges as are in force at Carlin How. Inquiries are to be made.

Hastings.—The T.C. has adopted the following scale of charges for outside lighting at cinematograph theatres:—4½d. per unit up to 5,000 units per annum, 2d. per unit between 5,000 and 10,000 units per annum and 1½d. per unit above that. The consequent reduction in revenue is estimated at £270 per annum.

Hornsey.—PROPOSED LOAN.—The B.C. is seeking sanction to borrow £13,744 for the erection of the first section of the sub-station at Fortis Green.

Heckmondwike.—Increased Charges.—The U.D.C. has increased the price of electricity for lighting purposes to 5d. per unit, and for power by 50 per cent., the sliding scale to remain in force, with discounts of 20 per cent. The new scale comes into operation on May 1st.

The Council has received sanction from the L.G.B. to the whole of the loans asked for in respect of the electricity undertaking. This grant is significant in view of the application of Dewsbury to incorporate Heckmondwike.

Hinckley.—B. of T. Inquiry.—An inquiry has been held this week into the application of the Midland Electric and Light and Power Co. for a prov. order to supply electricity for lighting in the parishes of Barwell and Earl Shilton in the Hinckley R.D.C. The opposition pointed out that the parishes were being supplied by the Leicestershire and Warwickshire Electrical Power Co., and that this was the same concern as was applying. The Inspector commented on the unprofitable character of such a district, and the unliklihood of competition there.

Ilford.—The U.D.C. has decided to oppose the Bill conferring further powers upon the North Metropolitan E.P. Supply Co., and the North Metropolitan E.P. Distribution Co.

Kettering.—Loan Sanction.—The U.D.C. has received the consent of the L.G.B. to a loan of £12,000 for electricity works extensions.

Llanfair Caereinion.—E.L. Scheme.—A town's meeting has decided to proceed with the proposed E.L. scheme.

London.—Battersea.—The Electricity Committee has recommended the B.C. to sanction the expenditure of a further £500 upon the outside lighting hire scheme.

The L.C.C. has been recommended by its Finance Committee to sanction the borrowing by the Woolwich B.C. Electricity Department of £1,841, as to £934 for mains and £907 for transformers and switchgear; and of £7,280, as to £1,200 for mains, £880 for services, £740 for meters and £4,460 for electrical apparatus to be supplied on the hire-purchase system. The St. Marylebone B.C. having decided not to take up the loan of £10,825 granted in November, 1913, for the purpose of its electricity undertaking, the L C C. has been recommended by its Finance Committee to cancel the same.

Hackney.—The Finance Committee of the B.C. proposes to transfer £2,500 from the estimated surplus of £7,848 on the electricity undertaking for the year ended March 31st next to the credit of the reserve fund, the balance to go in aid of the rates.

Manchester.—Street Lighting.—The Electricity Department has fixed four half-watt lamps at the junction of Market Street and Cross Street. It is intended to suspend similar lamps from the tramway poles in Oxford Road; centrally-suspended arc lamps are to be fixed from Whitworth Street to Deansgate.

Mansfield.—Loan Sanction.—The T.C. has received sanction to the borrowing of the following for the purposes of the electricity undertaking:—£2,000 for mains, £1,000 for services, £1,650 for boiler, superheater, &c., and £350 for mechanical stoker and driving.

Middlesbrough.—Negotiations are proceeding between the Lighting Committee and the Cleveland and Durham E.P. Co. in respect of a supply of electricity for lighting purposes at North Ormesby.

Middleton, near Teesdale.—Proposed E.L.—Mr. Best, who is promoting an E.L. scheme for the parish, has applied to the Durham C.C. for consent to the erection of posts for overhead wires.

Peterboro'.—Proposed Loans.—The T.C. has decided to increase its application to the L.G.B. for borrowing powers by £1,000 for mains, and £600 for services, in connection with electricity extensions.

Peterhead.—Proposed E.L.—As a result of the circulars which the manager of the gas works issued to gas consumers to find out whether they were inclined to adopt the electric light, and in which he took the precaution to inform them that electricity would cost twice as much as gas, only 50 favourable replies have been received.

Rochdale.—Loan Sanction.—The L.G.B. has sanctioned the loan of £65,000 for extensions of buildings and plant at the electricity works.

Southend-on-Sea.—A Surcharge.—The District Government auditor recently disallowed a payment of £9 5s. 4d. for the expenses of the electrical engineer in attending a conference at Harrogate. The T.C. appealed to the L.G.B., which has remitted the surcharge to the extent of £8 7s., with an intimation that it will not grant remission of any part of any future surcharge on similar expenditure. As to the balance of 18s. 4d., the L.G.B. considered that the engineer should refund it, and the Council has requested him to do so, as it constituted his personal expenses at the conference.

Southampton.—Hiring Charges.—Owing to the rental of electric radiators being increased by the T.C. to 10s. per annum, some 160 radiators have been returned, and it has been decided to revert to the original charge of 4s. per annum for old pattern radiators, the new ones to remain at 10s.

Stockton-on-Tees.—The T.C. has decided to supply electricity to the flour mill of the Co-operative Society on a load factor basis at 25s per KW. per quarter. The average price per unit will be 51d., subject to a five years' agreement and a minimum annual consumption of [illegible] units.

Swansea.—Rate Relief.—The B.C. has decided to act on the recommendation of the Finance Committee (see page 485) and allocate £2,200 out of the estimated profit of [illegible] on the electricity undertaking to the relief of the rates.

Torpoint.—E.L. Scheme Adopted.—The U.D.C. has adopted an agreement with the Electricity Co. for a supply of electricity for five years. Doubt was expressed as to whether the proposed company would be formed.

Tynemouth.—Year's Working.—The profit on the electricity undertaking for the year just ending is stated to be about £1,000, in spite of the revenue being reduced by £760, due to the reduction of the price of current.

Wallasey.—Loan Sanction.—The L.G.B. has sanctioned a loan of £65,000 for the erection by the Corporation, of a new electricity station in Poulton, which is to be completed by about the end of the year.

Warwick.—Sewage Pumping.—The T.C. has decided to take a supply of electricity for power purposes for the sewage farm from the Electrical Co. on a yearly payment of £300.

Wem.—The U.D.C. has retained Mr. A. J. Leigh as consulting engineer in connection with the proposed electric lighting scheme.

TRAMWAY and RAILWAY NOTES.

Continental Notes.—Hungary.—The Danube Steamship Co., which owns collieries at Funfkirchen, Hungary, has decided to convert its 12½ miles of tramway from the mines to the railway at Mszog to electric traction.

Russia.—According to the *Russ. Handelsnachr*, the electrification of the Baltic and Warsaw railways is to be commenced in the spring of 1915. The total expenditure involved amounts to 15 million roubles. The lines to Siverskaja, Gatschina and Oranienbaum will be converted first.

Darlington.—Year's Working.—The total revenue of the Corporation tramways department for the year just completed was £11,833, an increase of £334 upon the previous year. The passengers carried numbered 3,790,000, an increase of 16,000. The car-mileage was 380,400, and the receipts were 7·43d. per car-mile.

Dearne Valley (Yorks.).—Tramway Scheme Approved.—Subject to certain modifications, the Light Railway Commissioners have approved of the proposed Dearne Valley light railway scheme, which is being promoted by the Wombwell, Wath, Bolton and Thurnscoe Councils.

Dundee.—Year's Working.—The Corporation tramways undertaking shows a gross profit of £25,623 for 1913. The net profit was £10,764, an increase of £2,300 on the previous year, and the passengers carried numbered 17,734,162, an increase of 700.000.

The B. of T. inspection of the extension of the Blackness Road tramway line took place last week. The new section cost £5,000 to construct and equip. It is intended to double part of the tramway track at Morgan Academy.

Edinburgh.—Tramway Extension Dropped.—On the grounds that the route could not be made to pay, the T.C. has adopted a motion to delay the proposed tramway extension to Corstorphine.

Huddersfield.—Tramway Extensions, &c.—The B. of T. has sanctioned the doubling of the tramway track from Fartown Green Road to Smithy.

The Tramways Committee is to meet a deputation from the South Crosland U.D.C. with reference to the proposed extension of the tramways to Netherton.

The Corporation proposes to lay a double line of tramway along New Hey Road.

Japan.—The Tokio Municipal Assembly has passed a project for the construction of a suspended electric tramway—an aerial ropeway—from Ueno to Asakusa.

Liverpool.—Proposed Tramway Goods Traffic.—In a report on a proposal to inaugurate a service of tramway wagons and trailers for the conveyance of goods, the tramway manager, who has been instructed to enter into negotiations with other tramway authorities interested, says that the most that could be done with the existing lines would be to run three or four goods tramcars per day. If found successful, a more elaborate system could be established, providing that the Dock Board and the Bootle Corporation were prepared to grant the necessary facilities, and and that at least 1,314,000 tons of traffic per annum was guaranteed, which at, say, 2¾d. per ton per mile by the new system, would provide a revenue of £105,394 per annum. The scheme would involve the electrification of the dock railway or the construction of a line of tramways parallel with it, and the construction of tramways for dealing with the traffic between Alexandra Dock and Brunswick Dock and Knotty Ash, at a total cost of £246,750. The South Lancashire Tramways and Prescot Light Railway has promised to co-operate with the Tramways Committee in any scheme it may bring forward for the transport of merchandise over its system.

Manchester.—A Tramway Report.—As a result of his investigations into the tramway systems of the chief Continental and American cities, Mr. McElroy, general manager of the Corporation tramways department, has now prepared a report dealing with the passenger transport problem in Manchester. He recommends the construction of new arterial routes; the provision of new tramway termini on the old infirmary site, in Albert Square and St. Peter's Square, in High Street, and in Cannon Row; the opening up of negotiations with the Salford Corporation regarding the tramway traffic entering from that side; and the introduction of a limited system of transfer tickets. The report indicates that if the Tramways Department is to develop the transit facilities of the city, a limit must be placed for a time upon the amount applied from the revenue to rate relief, which should not exceed £100,000 per annum. The construction of underground railways and underground subways for tramcars cannot be justified on account of the great initial cost, unless a very large traffic is dealt with. Other points to be considered by the Tramways Committee are improvements in the loading and unloading of cars; the number of stopping places to be reduced in order to increase the speed of the cars; the simplification of fare collecting; and the provision of shelters and refuges. The report does not favour elevated rapid-transit lines, but declares that, in the near future, Manchester will have to be provided with rapid-transit facilities, preferably to work in conjunction with the surface lines.

Rochdale.—Tramway Accident Inquiry.—On Tuesday, Lieut.-Col. Druitt concluded an inquiry into the tramway accident in John Street on February 14th. The driver of the car stated that on the night of the accident he examined the brakes and sanders and found them in good condition. In John Street the rails were very greasy, and when he released the hand-brake he found that the wheels were not revolving. He reversed the motor, but the trolley came off and he was then practically helpless. He did not try the magnetic brake before reaching John Street. Col. Druitt subsequently inspected the sanding apparatus.

Stafford.—The Potteries Electric Traction Co. is installing a service of motor-'buses to run in conjunction with the tramways on routes which are at present overcrowded. The company is also opening a 'bus service between Tunstall and Biddulph and Tunstall and Talke.

Stoke-on-Trent.—Electric Vehicles.—The Cleansing sub-Committee has, we learn, decided to make a trial with a Fram electric street sweeping machine.

U.S.A.—The Commonwealth Edison Co., of Chicago, has reduced the maximum price for electricity for charging electric vehicle batteries in public garages from 2½d. to 2d. per KW.-hour except between the hours of 4 p.m. and 8.30 p.m. during November, December, January and February.

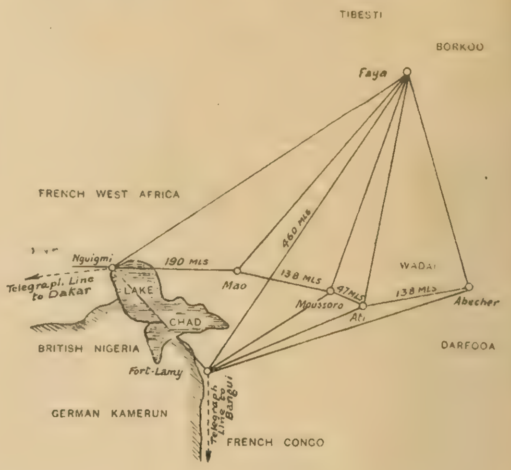
West Ham. — Standardisation of Cars. — The Tramways Committee has decided to obtain 15 covered bogie tramway cars, of the L.C.C. type, and to standardise as far as possible on two classes of cars, using standard trucks, equipments and bodies. These will include single truck cars to carry 60 passengers and bogie cars to carry 78 passengers, the former with not less than 35-B.H.P. motor equipment and the latter with not less than 45-B.H.P. equipment. Arrangements are to be made to replace 70 controllers with the new standard type.

TELEGRAPH and TELEPHONE NOTES.

Imperial Wireless System.—During the week the Select Committee of the House of Lords has continued the inquiry into the allegations against Lord Murray. On Tuesday last Lord Murray himself gave evidence.

Marconi Wireless Patents.—The action brought by the Marconi Wireless Telegraph Co. of America against the National Electric Signalling Co. (Fessenden's system) in the United States Circuit Court for infringement of Lodge's patent No. 609,154 (corresponding to English patent No. 11,575 of 1897, which has been prolonged for seven years) and Marconi's patent No. 763,772 (corresponding to English patent No. 7,777 of 1900, which was upheld in the English Courts a few years ago) ended, on the 18th inst., in a judgment for the plaintiffs. The judgment, which corresponds with those which have been delivered in other countries, declares both patents to be valid, and to be infringed by the defendants' system.

Wireless at Lake Chad.—An important network of seven wireless stations has recently been completed in the neighbourhood of Lake Chad, with a view to improving military communication in this district. It would be practically impossible yet to establish telegraphic communication by wire in this locality; certainly the volume of traffic would not justify the capital expenditure and risks incurred in erecting and maintaining a line. Six small radio-stations have therefore been installed. Each was designed for a range of 200-300 km., and since coolie transport had to be depended on for several hundreds of miles, the equipment was ordered for delivery in hermetically sealed cases each weighing not more than 154 lb. total. Each station was provided with two 98½-ft. steel masts, a 5-H.P. petrol motor and a 1,000 cycles per second Bethenod alternator. The condenser capacity = 0·05 mfd. in each case, and the note of the spark can be altered by varying the alternator excitation. The six southern stations (see map) were completed early last year, and connect to the French West and Central African telegraph networks at Nguigmi and Fort Lamy respectively. To the difficulties and discomforts of transport were added technical difficulties due to climatic conditions generally, and ionisation of the atmosphere in particular. With 1,300-m. waves, the maximum range by day was 150 km. (95 miles): with 3,500-m. wave length, good communication was established up to 650 km. (410 miles), despite the small power available. Wooden masts 33 ft. in height were mounted on top of the metal masts; the antennæ are of the horizontal sheet type, and earthing is improved by utilising the sheeting of the transport cases as ground plates. The seventh station (at Faya) was constructed of spare parts provided for the other six stations. Communication was at once established with Wadai, and then with Fort Lamy (455 miles). In recognition of the great difficulties which he overcame in completing this important service, it is proposed to admit Captain Chaulard to the Legion of Honour.



Wireless at Sea.—An Association of Wireless Telegraphists has been formed, consisting of operators on board ship, who allege that they are paid on a lower scale than anyone else at sea (20s. to 35s., some 55s., a week).

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Newcastle.—April 29th. P.M.G. Electrically-controlled clocks at Post Office, Newcastle, N.S.W. Schedule No. 361. See "Official Notices" March 20th.

May 12th. P.M.G.'s Department. Standard batteries for all States; Schedule No. 1,010. See "Official Notices" to-day.

Victorian Railways.—May 13th. One hundred enclosed arc lamps. Deposit £5. Mr. E. B. Jones, acting secretary.

Austria. — Nadworna.—Installation of public and private electric lighting and a water supply service. Tenderers must submit their own plans and specifications. Particulars of the Stadtgemeinde, Nadworna, Galicia.

Sniatyn.—Installation of an electric lighting service, erection of a generating station, &c. Particulars of the Magistrat in Sniatyn, Galicia.

Bedford.—April 1st. Corporation. 12 months' supply of high and low-tension cables; one-phase A.C. induction house service meters; metal-filament lamps. See "Official Notices" March 13th.

Belgium.—April 9th. The municipal authorities of Schaerbeek (Salle du College, 30 Rue de la Ruche) are inviting tenders for electricity meters and electric cables.

Bray.—April 7th. U.D.C. General stores and stores for electric light works. See "Official Notices" March 13th.

Carlisle.—April 1st. Ironmongery, packing and jointing materials, oils, &c., for a year, for the Corporation Electricity Department. Mr. F. W. Purse, Electrical Engineer, Victoria Viaduct (returnable deposit of 5s. for each schedule).

Devonport.—April 8th. 1,250-KW. turbo-alternator, with condensing plant, two 500-KW. rotary converters and switchgear, for the Borough Electricity Department. See "Official Notices" March 20th.

Dublin.—March 30th. G.N.R. of Ireland. Re-plating of electric battery in connection with Hill of Howth electric tramway. See "Official Notices" March 13th.

Edinburgh.—March 30th. Three or twelve months' supply of coal (washed singles, washed pearls, and washed or dry small dross or gurn) for the Electricity Department. Specifications, &c., from Mr. F. A. Newington, Dewar Place.

April 6th. Midlothian and Peebles Asylum. Six months' supply of electric fittings. Forms of tender from the Clerk and Treasurer, 19, Heriot Row.

Glasgow.—April 7th. Twelve months' supply of stores, fuel, &c., for the Tramways Department. Specification from Mr. J. Dalrymple, General Manager, 46, Bath Street.

Gloucester.—Low-tension, paper-insulated cable, for the Electricity and Tramways Committee. See "Official Notices" to-day.

Holywell.—Electric light installation, workhouse infirmary, for the B. of G. Mr. A. J. Leigh, Northwich.

Kirkcaldy.—Tenders are to be submitted to the Tramway Committee for four new cars with glass weather screens.

Keighley.—March 31st. Cabling for electric lighting, &c., at Technical Institute extensions. See "Official Notices" to-day.

London.—L.C.C. April 9th. Installation of 65 wiring points, 85 lights, and two power points, at Moxey Road centres, Woolwich. See "Official Notices" March 20th.

Manchester.—March 30th. Telegraph and electric fittings and electric light wires for a year, for the Lancs. and Yorks. Railway Co. Mr. Waring, Stores Department, Osborne Street, Manchester.

Portsmouth.—2,000-KW. turbo-alternator complete, for Borough Electricity Department. See "Official Notices" to-day.

Rathkeale (Co. Limerick).—April 18th. Gas engines and suction plant, dynamos, storage battery, switchboard, overhead lines and street lamps, for Rathkeale Electric Lighting and Power Co. See "Official Notices" to-day.

Rochdale.—April 15th. Corporation. Boiler feed pumps and crane. See "Official Notices" to-day.

Russia.—Mariupol.—May 14th. Concession for the building and working of an electric tramway. Particulars of the Municipality, Mariupol, Province of Ekaterinoslov, Russia.

Servia.—April 3rd. The Servian Ministry of Public Works, in Belgrade, is inviting tenders for 1,000 metres of insulated telephone cable.

Shanghai.—March 30th. The Municipal Council is inviting tenders for two motor-driven fire pumps. Particulars from Messrs. J. Pook & Co., 68, Fenchurch Street, E.C.

Spain.—April 5th. The municipal authorities of Bercero (Province of Valladolid) are inviting tenders for the concession for the electric lighting of the town.

Switzerland.—Lausanne.—The Kreisdirection of the Swiss Federal Railways in Lausanne is prepared to receive tenders for the supply of sundry electrical material (wire, insulators, brackets, &c.). Particulars from the Kreisdircetion der Sweiz., Bundes Bahnen, in Lausanne.

Tunbridge Wells.—April 30th. Corporation. Supply of 4,000 tons of small coal for use with underfeed stokers. Specifications from the Borough Electrical Engineer, Electricity Works, Stanley Road.

Wallasey.—April 7th. Economisers, extra-high-tension cables, extra-high-tension switchboard, engines, alternators and condensers, hand-power overhead travelling crane, rotary converters, transformers, water-tube boilers, for the Borough Electricity Department. See "Official Notices" March 13th.

Wigan.—April 18th. Corporation. Electrical accessories, service boxes, cables, &c. See "Official Notices" to-day.

April 20th. Corporation. E.H.T. feeder cable, transformer and switchgear. See "Official Notices" to-day.

Warrington.—March 31st. 750-KW. rotary converter; E.H.T. switchboard panel, for Electricity and Tramways Committee. See "Official Notices" March 6th.

April 14th. One year's supply of meters and transformers for the Borough Electricity Dept. See "Official Notices" to-day.

CLOSED.

Accrington.—The Corporation of Accrington has just placed a contract with Leyland Motors, Ltd., for a 30-H.P. motor tower wagon for the use of the electrical department.

Australia.—P.M.G.'s Department :—

New South Wales. 25,000 Pattern B insulators, £312.—Fischbeck and Insulator and Pottery Co.

75,000 galvanised-steel spindles for use with Pattern B insulators, £1 250.—Williams & Co.

18,000 galvanised steel spindles for use with Pattern A insulators, £31.—McPherson's Pty., Ltd.

Victoria. 1½ mile various sizes, switchboard cable, £232.—Siemens Bros. Dynamo Works, Ltd.

Queensland. 3,000 three-steel conductor cords, £200; 1,500 four conductor cords, £72.—B.I. and Helsby Cables, Ltd.

75 C.B. table pattern telephones, £180; 50 ditto, £139; and other telephone material. J. Paton & Co.

Western Australia.—6,000 porcelain insulators, £90.—Commonwealth Art Pottery and Insulator Co. Pty., Ltd.; 32 cast-iron cable jointing boxes, type "C," £193.—A. M. Bryan.

N.S. Wales Public Works Department.—226 miles of galvanised iron telegraph wire, £11 6s. 3d. per ton.—R. Johnson, Clapham & Morris, Ltd.—*Tenders.*

Cobram.—Electricity Supply :—

Suction gas engine and gas-producing plant, £747.—R. Hornsby & Sons.
Dynamos, switchboard, &c., £1,801.—Sutherland & Ashman.
Wire and cables, £435.—Stiffens & Noelle.—*Melbourne Age.*

Barnsley.—The Education Committee has accepted the tender of Mr. A. Brown, at £55, for installing electric light at Park Road Council School.

Bedford.—The T.C. has accepted the tender of Messrs. Gwynnes, Ltd., of Hammersmith, W., for electrically-driven pumps at the waterworks, at £3,190.

Belgium.—Five concerns submitted tenders last week to the Société Nationale des Chemins de Fer Vicinaux, of Brussels, for the overhead electrical equipment of the local electric railway between Ghent and Loochristy, the lowest being that of Messrs. Biske, Livron & Kalinowsky, of Liége.

Exeter.—The Tramways Committee has ordered four tramcars from Messrs. Dick, Kerr & Co., Ltd., for £2,832.

London.—L.C.C.—The Asylums Committee has accepted the following annual tenders :—

Electrical sundries.—Cox-Walkers, Ltd.; A. F. Goodwin & Co.; Edison and Swan U.E.L. Co., Ltd.; G.E. Co., Ltd.; Falk, Stadelmann & Co., Ltd.; G. Maclellan & Co.; Veritys, Ltd.; W. White & Co.; Siemens Bros. Dynamo Works, Ltd.

Electric lamps.—Edison & Swan U.E.L. Co., Ltd.; G.E. Co., Ltd.; British Thomson-Houston Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.

The Metropolitan Asylums Board has received the following tenders for the installation of a motor-generator at Queen Mary's Hospital :—

Napier Kimber, Ltd.	(accepted)	£169	10
Johnson & Phillips, Ltd		189	0
F. M. Preckter & Co., Ltd.		190	0
Malcolm & Allan, Ltd.		210	0
Spagnoletti, Ltd.		210	0
C. H. Cathcart & Co.		225	0
Crompton & Co., Ltd.		258	0

The Fire Brigade Committee reports having received the undermentioned tenders for the installation of the electric light at the Belsize fire station :—

A. Newman, Ltd.	(recommended)	£155
G. E. Taylor & Co.		179
Tredegar & Co.		195
G. Weston & Sons, Ltd.		195
R. H. & J. Pearson, Ltd.		203
Buchanan & Curwen		260

The Committee recommends that the offer of the Tudor Accumulator Co., Ltd., be accepted to repair the batteries of an electrically-driven escape van, at £66.

The Highways Committee recommends that the work of additional windings to be placed on 17 motor-generators at tramway sub-stations, to enable the load of each to be increased to 400-KW. capacity, be carried out by Messrs. Newton Bros. as an extension of their contract, at £635.

Battersea.—The Electricity Committee recommends the acceptance of the following annual tenders :—

Oils.—Prices, Ltd.
Turbine oil.—A. Duckham & Co.
Engine-room stores, packing, &c.—Pyke & Palmer.
Consumers' fuse-boxes.—B.I. and Helsby Cables.
Box compound.—Dussek & Co.
Electrolytic meters.—Reason Manufacturing Co., Ltd.
Troughing, bridges, bitumen, &c.—Callender's Cable and Con. Co., Ltd.
Carbon lamps.—B.T.H. Co., Ltd.
Coals (13,000 tons Bankness Lanarkshire washed peas).—J. Hudson and Co., Ltd.

HACKNEY.—The Electricity Committee recommends the acceptance of the tender of Messrs. W. Cory & Son, Ltd., for six or 12 months, at the decision of the Council, for 15,000 tons Scotch washed nuts, at 15s. 3d. per ton; 15,000 tons Scotch washed pea nuts, at 14s. 3d. per ton; 15 000 tons Methley nuts, at 15s. 9d. per ton; 15,000 tons washed Barnsley bed, at 14s.; and 6,000 tons washed rough small, at 14s. per ton.

The Committee also recommends that 12 time-limit devices for the main direct-current switchboard be obtained from Mr. G. Ellison, of Birmingham, at £20.

ISLINGTON.—The B.C. contract for Chamberlain & Hookham A.C. meters has been placed with Messrs. Venner & Co.

Leicester.—The Borough Education Committee has accepted the tender of Messrs. Gent & Hurley for electricity-generating machinery and plant for Desford Industrial School, at £1,157.

Luton.—The Electricity and Tramways Committee has accepted the tender of Messrs. Crompton & Co., Ltd., at £328, for a balancer.

Mansfield.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox at £1,910 for a boiler for the electricity works.

Mexborough.—The Electricity Committee has accepted the tender of Messrs. Galloways, Ltd., for eight new flue rings in connection with No. 3 boiler for £120, and that of the International Time Recording Co., Ltd., for the supply of an autograph recorder, at £20.

Rosyth.—An important contract has been placed with Messrs. Douglas & Grant, Ltd., Kirkcaldy, for the supply of machinery to H.M. Dockyard, Rosyth. The company has already carried out a large installation of somewhat similar machinery at H.M. Dockyard, Portsmouth, but the present contract is probably the largest single contract of the kind ever placed by the Admiralty with one firm. The special machinery ordered is all electrically-operated, and it is understood that Messrs. Douglas & Grant have secured the whole contract, including the electrical plant required in connection therewith. The Kirkcaldy company is also executing important orders for steam and electrically-driven pumping plant for H.M. Dockyards at Chatham and Pembroke respectively.

Southampton.—The Harbour Board has placed a contract for the annual supply of electrical stores with Messrs. Siemens Bros. Dynamo Works, Ltd.

South Africa.—The Johannesburg Municipality has been recommended to accept the tender of the British Westinghouse Co. for six 500-KW. rotary converters complete with switchgear, at £8,242. This was not the lowest tender, but the manager of the tramways and lighting department reported at length, showing that he recommended the firm named because (according to the *South African Mining Journal*) they were specialists in the manufacture of rotary converters, and had greater experience than any other firm in Great Britain.

Southend-on-Sea.—The T.C. has accepted the following tenders:—

Vandervell & Co.—Lighting six motor-'buses with the C.A.V. system, £292.

Brush Electrical Engineering Co., Ltd.—Three single open-deck tramcars (£2,811) and three electrically-driven coal wagons (£766 10s.) and equipment (£711).

Belliss & Morcom, Ltd.—Five Diesel oil engines for sub-stations, £14,150.

Swansea.—The B.C. has accepted the tender of Callender's Cable Co., at £12,998, for extra-high-pressure and low-pressure cables, conduits, &c., in connection with the proposed electrical extensions in the Uplands district.

Walthamstow.—The U.D.C. Lighting Committee recommends the acceptance of the tender of Messrs. E. Green and Son, Ltd., for replacing the economiser with pipes 2 ft. 6 in. longer, at £620, less 5 per cent.

Tenders by the following firms are recommended for acceptance for annual supplies of the electricity and tramways department:—

W. T. Henley's Co.—Cables, flex, compound for glands, rubber and other tape.

Liverpool Electric Cable Co.—India-rubber-covered wires.

Dussek Bitumen Co.—Box compound.

W. Geipel & Co.—Chatterton's compound.

B.I. & Helsby Cables, Ltd.—P. & B. paint.

General Electric Co., Ltd.—Soldering fluid, fuses, conduits, Sinclair insulators, &c.

J. H. Tucker & Co.—Switches.

Edison & Swan Co.—Ceiling roses, lampholders, opal shades, bell wire.

British Westinghouse Co.—Opal and iron shades and teak blocks, key switch-holders.

Wholesale Fittings Co., Ltd.—Fuse wire.

Pryke & Palmer.—Zinc rods, porous pots, dry cells, &c.

Chamberlain & Hookham.—Ordinary electric meters.

Electrical Co., Ltd.—Hour meters.

Sloan Electrical Co. Ltd.; Ship Carbons, Ltd.; and Siemens Bros. Dynamo Works, Ltd.—Carbons.

British Westinghouse; J. W. Rowlands & Co.; W. Wood & Co.; Anti-Attrition Metal Co., Ltd.; L. Andrew & Co.; Equipment and Engineering Co., Ltd.; Imeson & Finch.—Car accessories.

Electrical and Mfg. Supplies; Cryselco Co., Ltd.; and the General Electric Co.—Lamps.

C. C. Wakefield; Stern Sonneborn Oil Co.; A. B. Gross & Co.; and Vacuum Oil Co.—Lubricating oil and grease.

Whitehaven.—The T.C. has accepted the tender of Messrs. Doulton & Co., Ltd., for earthenware troughs for electric cables for a year.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, March 27th. At 7.30 p.m. At Philosophical Society, Westgate Road, Newcastle-upon-Tyne. Paper on "High-Speed Bearings," by Mr. G. Stoney.

Physical Society of London.—Friday, March 27th. At 5 p.m. At Imperial College of Science. Papers on "A New Type of Thermogalvanometer," by Mr. F. W. Jordan; and "An Experiment with an Incandescent Lamp," by Mr. C. W. S. Crawley.

Royal Institution of Great Britain.—Friday, March 27th. At 9 p.m. At Albemarle Street, W. Paper on "Improvements in Long-Distance Telephony," by Prof. J. A. Fleming, F.R.S.

Saturday, March 28th. At 3 p.m. Paper on "Recent Discoveries in Physical Science," by Prof. Sir J. J. Thomson, F.R.S.

Faraday Society.—Friday, March 27th. At 4.30 p.m. At Burlington House. Discussion on "Optical Rotatory Power."

Finsbury Technical College Old Students' Association.—Friday, March 27th. At 8 p.m. At Waldorf Hotel, Aldwych, W.C. Eighth annual smoking concert.

South-Western Polytechnic Institute.—Friday, March 27th. At 8 p.m. At Manresa Road, S.W. Prize-giving, by Lord Chelmsford, G.C.M.G.

Manchester Association of Engineers.—Saturday, March 28th. At Grand Hotel, Aytoun Street. Annual General Meeting. Address on "The Training of Engineers," by Mr. J. C. Maxwell Garnett.

Royal Society of Arts.—Monday, March 30th. At 8 p.m. At John Street, Adelphi. Howard Lecture on "Surface Combustion," by Prof. W. A. Bone, F.R.S.

(Colonial Section).—Tuesday, March 31st. At 4.30 p.m. Paper on "The Oil Resources of the Empire," by Mr. D. F. Mollwo Perkin.

Institution of Civil Engineers.—Tuesday, March 31st. At 8 p.m. At Great George Street, S.W. Ordinary meeting. Papers on "Some Recent Developments in Commercial Motor-Vehicles," by Mr. T. Clarkson, and "Comparative Economics of Tramways and Railless Electric Traction," by Mr. T. Graham Gribble, to be further discussed.

(Students).—Friday, April 3rd. At 8 p.m. Students' Meeting.

Wireless Society of London.—Tuesday, March 31st. At 8 p.m. At the Institution of Electrical Engineers. Discussion on "Telephone Receivers," opened by Mr. L. J. Lucas.

Batti-Wallahs' Society.—Wednesday, April 1st. Informal Evening.

Institution of Civil Engineers of Ireland.—Wednesday, April 1st. At 8 p.m. At 35, Dawson Street. Ordinary Meeting.

Dynamicables.—Wednesday, April 1st. Anniversary Dinner.

Chemical Society.—Thursday, April 2nd. At 8.30 p.m. At Burlington House, W. Ordinary Meeting.

Institution of Electrical Engineers.—Thursday, April 2nd. At 8 p.m. At Victoria Embankment. Paper on "Electric Signalling on Railways," by Mr. H. G. Brown.

(Newcastle Students' Section).—Monday, March 30th. At 7.30 p.m. At Armstrong College. Paper on "Points on the Lay-out of Static Substations," by Mr. W. Dixon.

(Manchester Students' Section).—Tuesday, March 31st. At 7.30 p.m. At Municipal School of Technology. Annual General Meeting.

(Students' Section).—Wednesday, April 1st. At 7.45 p.m. Paper on "Automatic Pressure Regulators," by Messrs. A. Arnold and E. L. M. Emtage.

(Newcastle Local Section).—Friday, April 3rd. At 7 p.m. At Hugh Bell School, Middlesbrough. Address on "Ozone," by Mr. E. L. Joseph.

Royal Institution of Great Britain.—Friday, April 3rd. At 9 p.m. At Albemarle Street, W. Paper on "Further Researches on Positive Rays," by Prof. Sir J. J. Thomson, F.R.S.

Saturday, April 4th. At 3 p.m. Paper on "Recent Discoveries in Physical Science," by Prof. Sir J. J. Thomson, F.R.S.

Association of Engineers-in-Charge.—Saturday, April 4th. Bohemian Concert.

North of England Institute of Mining and Mechanical Engineers.—Saturday, April 4th. At 2 p.m. At Newcastle-upon-Tyne. General Meeting.

Salford Technical and Engineering Society.—Saturday, April 4th. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "Mechanical Ventilation," by Mr. M. Sutcliffe.

THE ELECTRICAL ENGINEERS

(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, March 30th.—"A" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Tuesday, March 31st.—"B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Wednesday, April 1st.—Recruits only. Recruit instruction, 7 to 10 p.m. Rating examination for all Companies, 7 to 10 p.m.

Thursday, April 2nd.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Friday, April 3rd.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Saturday, April 4th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

The Easter Camp will be held at Cliffe Fort, near Gravesend, commencing on April 9th, for 15 days. Parade at headquarters at 11 a.m., April 9th, for the issue of arms and equipment. Members who wish to attend this camp should send in their camp cards without delay.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Good Friday Week.—Owing to April 10th being Good Friday, our issue for that day will appear on Wednesday, April 8th, and all editorial and advertisement matter will require to be in our hands two days earlier than usual.

A New Society.—The Igranic Engineering Society has recently been formed for members of the staff of the Igranic Electric Co., Ltd., of London and Bedford. The president of the Society is Mr. G. A. Mower, and the chairman Mr. A. H. Curtis. On Wednesday evening, 18th inst., a paper was read by Mr. F. Heaton on the subject of "Bridge Control," dealing fully with the electrical operating and signalling equipment of Scherzer rolling-lift bridges, transporter bridges, and swing bridges. The lecture was fully illustrated by lantern slides of a large number of typical bridges and controlling and signalling equipments, and was followed by a discussion. The full programme of the Society's meetings for the present session is as follows:—

February 4th.—"High-speed Elevator Control," by Mr. A. H. Curtis.
February 18th.—"Printing Machinery and its Control," by Mr. A. H. Mackley.
March 4th.—"Board of Trade and Home Office Regulations," by Mr. S. E. Hall.
March 18th.—"Bridge Control," by Mr. F. Heaton.
April 1st.—"Electric Control of Laundry Machinery," by Mr. F. N. Pickett.
April 15th.—"Alternating-current Control Apparatus," by Mr. F. Oglesby; "Automatic Temperature Control," by Mr. H. H. Rapley.
April 29th.—"Lifting Magnets," by Mr. S. R. Wright.

The Utilisation of Solar Energy.—Mr. A. S. E. Ackermann will shortly read a paper before the Society of Engineers (Incorporated) on "The Utilisation of Solar Energy," embodying the results of his 48 trials of the Shuman plant for raising steam and generating power from the sun's heat. The plant tested has cost some £30,000, the investigations cover nearly four years, and though many experiments with sun power have been made during the last 50 years, this is the first paper of its kind. The meeting is to be held at the Institution of Electrical Engineers on Monday, April 6th, at 7.30 p.m.

In view of the satisfactory results obtained from the plant at Meadi, near Cairo, the Egyptian Government has placed an order with the makers for a similar but larger plant for irrigation work in the Sudan. The Cairo plant has an output of 50 B.H.P., and the heating surface covers an area of about 1 acre.

Electrical Trades Benevolent Institution.—On Wednesday the annual festival of the Institution was held at the Trocadero, and there was a record attendance. Mr. Hugo Hirst presided, and was supported by Sir David Salomons (President), Mr. C. H. Wordingham (Vice-President), Mr. Justus Eck (Chairman of Committee), and Mr. Godfrey Isaacs. A report will appear in our next issue, but in the meantime we wish to congratulate Mr Hirst on the splendid success which he has achieved, the record sum of £2,762 having been subscribed in connection with the dinner. This is more than three times last year's record, which itself was double the previous one.

Smoke Abatement.—The Smoke Abatement Bill, promoted by Lord Newton, which has reached the second reading in the House of Lords, makes it an offence for anyone to use a furnace not constructed to burn its own smoke, or to use such a furnace in a negligent manner, and omits the reference to "black smoke." The L.G.B. will, however, have power to exempt any particular works in which it is not reasonably practicable to comply with the requirements of the Bill.

Electrical Accidents in Germany.—According to a recent return, 251 electrical accidents occurred in Germany last year, causing the death of 147 persons and slight injuries to 10 others, while 71 were badly injured. Fourteen of the accidents occurred during repairs to electric mains, 38 were due to short-circuits, 6 to falling of wires, 126 to cable failures, 23 to carelessness, and 30 cases are attributed to unknown causes.

Appointments Vacant.—Storekeeper for Hampstead Borough Electricity Department (£2 10s. and bonus); junior assistant engineers (young men just leaving college, or apprentices out of their time), for Yorkshire Electric Power Co.; assistant constructional engineer, for Birmingham Electric Supply Department (£250); mains assistant, D.C. three-wire system, for Brighouse (25s.). Particulars are given in our advertisement pages.

The Patents Act.—A Bill to amend the Act of 1907 has been introduced by the Board of Trade. It amends Sec. 91, so as to extend the rights of priority to the legal representatives or assignees of an applicant for protection. As this proposal follows upon an international convention held in 1911, it appears to be somewhat belated.

Electric Treatment at a Lancashire Infirmary.—The relatives of the late Alderman T. R. Greenough, J.P., have decided to give to the Leigh Infirmary a new building equipped with the latest and best apparatus for radiographic treatment. No institution in the country will have a better equipment. In addition, the new building will contain everything requisite for the electric treatment of disease.

Staff Dinner.—The annual dinner of the staff of the Osram and Robertson Electric Lamp Works was held at the Clarendon Restaurant, Hammersmith, on Monday, March 23rd. Mr C. Wilson occupied the chair, and among the visitors present were Mr. Hugo Hirst, Mr. Forman (Mayor of Hammersmith), numerous familiar G.E.C. friends, and a very liberal sprinkling of Borough Councillors. The staff and visitors present totalled about 1[illegible], visitors being in the majority. Following an excellent repast the chairman gave the usual loyal toasts and then proposed the "Allied Firms." Mr. Wilson laid special emphasis on the directors' keen interest in the welfare of their staff and workpeople. The advantages of the staff club to the foundation of which the directors had contributed so handsomely were appreciated daily by every member, and as regarded the workpeople, the collapse of their sick fund, due to unfortunate indirect effects of the Insurance Act, had been repaired by the generosity of the directors in placing a special fund at his disposal to be applied to the benefit of invalid workers. He particularly welcomed Mr. Hirst, to whom so much of the firms' prosperity was due. From the commercial standpoint, the policy of the allied firms had been successful in conception by the directors, and in application by the staff. So long as the combination continued to work with its present energy and harmony, the success of the allied firms was ensured. In responding to this toast, Mr. Hirst expressed his keen pleasure at being present, and dwelt on the national importance which the work of the allied firms had assumed, and on the very considerable material benefits which had thereby accrued to the borough of Hammersmith during the last 20 years. The health of the "Visitors and the Press" was proposed by Mr. F. P. Driver. In replying, the mayor expressed the pleasure which it gave him and his colleagues to be present that evening, and endorsed Mr. Hirst's remarks concerning the value of the Osram and Robertson Works to the borough. In every respect the interests of the borough and of the works were linked together, the activities of the latter were much appreciated, and everything had been, and would be, done to facilitate the development of these activities. He had great pleasure in wishing the allied firms every success. Mr. J. Fletcher expressed forcibly his reluctance to speak at length, but thanked the staff very heartily for the hospitality extended to him and his colleagues. Mr. Sydney Rentell replied suitably on behalf of the Press. Later in the evening Mr. P. Pring proposed the health of the chairman. This toast, together with Mr. Wilson's reply, was received vociferously, and demonstrated beyond doubt the esteem in which the genial works manager is held. An excellent musical programme was arranged, reliance being placed, as in previous years, almost entirely upon staff talent.

The London Electrical Trade Dispute.—Several meetings have lately been held in London during the last 10 days, relating to the London electric wiremen's dispute. A Committee of the Masters met a Committee of the Men on 19th inst., to discuss the demands respecting pay and conditions. Afterwards Mr. Kinniburgh, organising secretary of the E.T.U., said that on their main demand for 11d. an hour, the employers would not give way. On the 20th the workers held a meeting at the Caxton Hall at which they resolved that unless the masters gave a favourable answer by yesterday (Thursday), they would cease work. A mass meeting for to-night is mentioned in one Press report; the men are then expected to give a final decision on the employers' terms before declaring a strike. The men have passed a resolution declaring that they will have no form of disability clause in their rules. The Conference between the London Master Builders' Association and the building trade workers' organisation was only able to take place last week by the exclusion of the E.T.U. and other Unions not involved in the building trades dispute.

[What is the matter with the *Daily Telegraph* and the *Daily News*, that in a threatened strike of wiremen they see a prospect of London being without its supply of electricity?]

Income-Tax Assessment.—A note appeared in several technical journals recently to the effect that a new method of dealing with income-tax assessment on electricity undertakings had been "discovered" in St. Pancras, by which a considerable saving on this item of expenditure had been effected. We believe, however, that this "discovery" is based upon some long negotiations between Mr. Jennings (secretary and accountant of the Marylebone electric supply) and the Inland Revenue authorities three years ago. Mr. Jennings's memorandum on this matter has been circulated widely, and a large number of municipal electrical undertakings have taken advantage of the decision. The St. Pancras treasurer's report is merely one based on Mr. Jennings's report of 1911.

Boy's Damage on N.-E.R.—At the Tynemouth Police Court on March 24th, an 11-year old boy was charged with having damaged rails on the North-Eastern Railway. The evidence was that on February 12th a portion of the line was discovered to be on fire near Cullercoats Station. The flames were extinguished by sand, and then it was found that a piece of metal had been placed across the live rail and the running rail, creating a short circuit. The running rail was burned completely through, and the piece of metal had been welded to the conductor rail. The cost of repairing the damage was £1 8s. 6d. The boy's father was ordered to pay a fine of 5s. and costs, as well as the damage.

Inquiries.—Makers of Wilk's patent transparent bell-pushes, "Securitas" rubber solution, "Shawtype" lightning arresters, and small metal stampings are asked for.

Institution and Lecture Notes.—ASSOCIATION OF ENGINEERS-IN-CHARGE.—On Saturday last the annual dinner of the Association took place at the Holborn Restaurant; the president, Dr. R. T. Glazebrook, occupied the chair, and there was a large attendance of members and guests, the company numbering over 300.

After the loyal toasts, Mr. B. A. Raworth proposed that of "Science, Practice and Technology"; he referred to the trials of the engineer-in-charge, who often had to run machinery designed by another engineer who never had had to run it himself, and pointed out that a machine was not scientifically designed unless it worked properly in practice. The engineer-in-charge had to keep the machines going for the sake of those whose comfort and well-being depended upon its operation, and therefore to aim at extremely high efficiency at the expense of reliability was neither scientific nor practical. Efficiency must be given a very broad definition, in which cost was an essential factor. They could not make much progress without the aid of science; but many invaluable discoveries had lain dormant for years for want of a practical man to apply them. Responding, Sir Alfred Keogh said that this country was very slow to take advantage of advances in science. The great college of which he was the head was established with the object of bringing science and industry together, and of giving young men a better training for practical work; a guiding principle which they had adopted was that of seeking the advice of great leaders of industry in preparing their schemes.

Mr. A. E. Penn (hon. secretary) proposed "Kindred Institutions and our Guests," to which Mr. Leslie T. Robertson responded, pointing out that all the kindred institutions were combined in their representation on the Engineering Standards Committee (of which he is the secretary). He said it was important that the junior members of the profession should have the opportunity of joining in technical discussions and exchanging views, and the Association had done good work in educating its members to fill positions of trust. Sir Thomas Pile also replied, ascribing the success of the Association largely to the ability of its secretaries.

Sir Boverton Redwood, proposing "The Association," gave some amusing reminiscences of his early experiences in connection with engineering. He said that the Association was making satisfactory progress, though its numerical strength was limited by the strict examination of the credentials of candidates for admission. Unfortunately, unqualified men were often appointed as engineers-in-charge, and in a recent advertisement, the same salary was offered by a certain board of guardians for an engineer of wide knowledge and experience, as for a cook. How could the right sort of man be obtained under such conditions? A system of certification was needed, and there was work for the Association to do in arousing the authorities to a sense of their duty. Dr. Glazebrook, in responding, said that the Association had done good work in its various functions, and deserved to have its value better known. Remarking that all such institutions started in a small way, he traced the development of the Royal Society from its birth, and concluded by offering cordial thanks to the officers of the Association, by whom its affairs were so admirably conducted—especially Mr. Neale (chairman), Mr. Ball and Mr. Penn (hon. secretary).

During the evening a programme of music was performed, under the direction of Mr. George Hardy.

ASSOCIATION OF ELECTRICAL STATION ENGINEERS.—An open general meeting of the Bradford Section was held at Dewsbury on March 17th. This meeting being the first one held at Dewsbury, a statement was made outlining the aims and objects of the Association, and an appeal was made for new members. As is usual at all open meetings of the Association, the non-members present were somewhat critical, the criticisms on this occasion being based on unfounded statements which appeared in the provincial daily Press after the London Electrical Masters' meeting in London, in January. The meeting was of the opinion that the executive of the A.E.S.E. should make a definite statement of the policy of the Association at the earliest possible moment, as being the only way to allay the fears of those prospective members who were still in the "wait-and-see" camp.

A meeting of the Midland Branch was held at Birmingham on March 17th. The usual branch business was transacted, and a small committee was formed to arrange "visits" for the summer months, with a view to getting more into touch with private plant engineers.

A meeting was held recently at Manchester, and a paper was read on "Electric Driving in Cotton Mills." The advantages and disadvantages of electric and steam driving were considered, also the relative merits of individual driving and group driving of spinning machinery. The writer of the paper, Mr. W. G. Stokes, expressed himself as being in favour of group driving. An interesting discussion followed.

INSTITUTION OF ELECTRICAL ENGINEERS.—At the meeting of the Birmingham Local Section on Wednesday last a paper was read by Mr. W. Fennell, M.I.E.E., on "Electric Lighting of Cottages." The discussion was closed.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—At a meeting of the West of Scotland Branch on Friday last, Mr. Charles E. Hart, Glasgow, read an interesting paper on "Rock Drills." Referring to electric drills, the author said that there were some purely electric drills in use, but they were used entirely in soft rock, coal and shale, and the motion was rotary. The Marvin Sandycroft drill had found a limited field for employment in some quarries, and open-air work, but he did not think it could compete with the compressed-air drill. To the Ingersoll Rand Co. must be given the credit of getting the nearest approach to an electric drill in their electric air drill. The astonishing feature about it was the great reduction it afforded in power, as a 5-H.P. motor drove an electric air drill equivalent in capacity to a 3½-in. diameter compressed-air percussive rock drill, which took 20 H.P. and sometimes even more. The fact that the air was used over and over again, and not exhausted, accounted for the low power required, which was the chief advantage of the machine.

On the invitation of the Pumpherston Oil Co., the members of the East of Scotland Branch are to visit the Breich Colliery, Breich, to-morrow, to inspect the electrical winder which is in operation there, and for which highly successful results are claimed.

NOTTINGHAM SOCIETY OF ENGINEERS.—On March 11th, Mr. W. C. Mountain read a paper on "The Utilisation of Exhaust Steam for Collieries, Iron Works, &c., and the Cost of the Electric Current Generated."

PHYSICAL SOCIETY OF LONDON.—On March 13th, a paper entitled "Time Measurements of Magnetic Disturbances and their Interpretation" was read by Dr. C. Chree. A paper, entitled "The Asymmetric Distribution of the Secondary Electronic Radiation Produced by X-Radiation," by Mr. A. J. Philpot, was taken as read.

Parliamentary.—GLASGOW CORPORATION BILL.—Amongst the petitions which have been deposited in the Private Bill Office against the Glasgow Corporation Bill (water, tramways, &c.) are those of the Airdrie and Coatbridge Tramway Co., the Greenock and Port Glasgow Tramways Co., the Coatbridge and Airdrie Electric Supply Co., and the Lanarkshire Tramways Co.

READING CORPORATION BILL.—The Select Committee of the House of Lords before which the Reading Corporation Bill was down for consideration, has reported that all opposition has been withdrawn, and therefore it had been referred to the Unopposed Bill Committee. The Bill provides for additional tramways in the borough and also for the running of trolley vehicles.

PRESTON CORPORATION BILL.—The Preston Corporation Bill came before Mr. Middlebrook's Select Committee of the House of Commons for several days last week. The main portion of the Bill dealt with the improvement of the Ribble navigation. Power was also sought to borrow £26,000 for tramway extensions, but there was no opposition to this portion. Evidence was given by Mr. Simpson, the tramways engineer. The Committee sanctioned all the clauses with the exception of one empowering the Corporation to enter into agreements to supply electrical energy to trolley vehicle systems in adjacent districts.

Protection or Tyranny?—The following letter came to hand after our "Correspondence" columns were closed:—"The reference to this correspondence in your last issue by the chairman of the Council is typically B.E.A.M.A. To pass off the whole matter by such a supercilious reference is no answer to the case. The recent correspondence from the Electric Construction Co. more than justifies what I have said.

"However, I have made my protest and, as far as I am conconcerned, the matter is at an end, but it will be found on record when the day, which is fast approaching, comes that the buyer is in subjection to the seller, and the former finds himself in the same position as the Government to-day are, in their purchasing of 'Armour plates.'

"F. W. PURSE, *City Electrical Engineer.*

"Carlisle, March 24th, 1914."

Labour Dispute at Glass Works.—Early on Saturday morning a settlement of the dispute at the Lemington Glass Works, near Newcastle-on-Tyne, was reached, whereby the bulb-blowers, numbering about 80 men, who came out on March 12th, thereby laying between 300 and 400 employés of the works idle, were to resume work on Monday, the 23rd inst. The dispute arose owing to the introduction of machinery in the making of electrical lamp bulbs, and we understand a settlement has been effected on the basis of the men giving the machines a fair trial, and the employers making up any deficiency should the men prove to be unable to make a certain average wage.

The Electro-Harmonic Society.—The last smoking concert of the season, held on Friday last, was one of the best of the year, in spite of the regrettable fact that two of the principal artistes were unfortunately prevented by sudden illness from taking part in the entertainment. Excellent substitutes were found at short notice in Messrs. Alec Chentreus, the Anglo-French comedian, and Jan Linden ('cello), an artiste of the first rank, and the company as a whole was above the average. Mr. Robert Howe, as a newcomer to the Electro-Harmonic, deserves special mention, as well as Mr. Anderson Nicol and Mr. Robert Radford; and Prof. Anders performed some remarkable and inexplicable feats with cards and handkerchiefs. The audience was enthusiastic, almost all the items being encored.

Labour Disputes.—A Manchester paper states that after being out on strike for 15 weeks 3,000 engineers at Bolton resumed work on Monday.

Press reports also show that the Sheffield electrical trade dispute is at an end, the men accepting the masters' offers of 2s. advance on April 3rd, and 1s. six months later, with 6 per cent. advance on piecework rates and a three-year agreement.

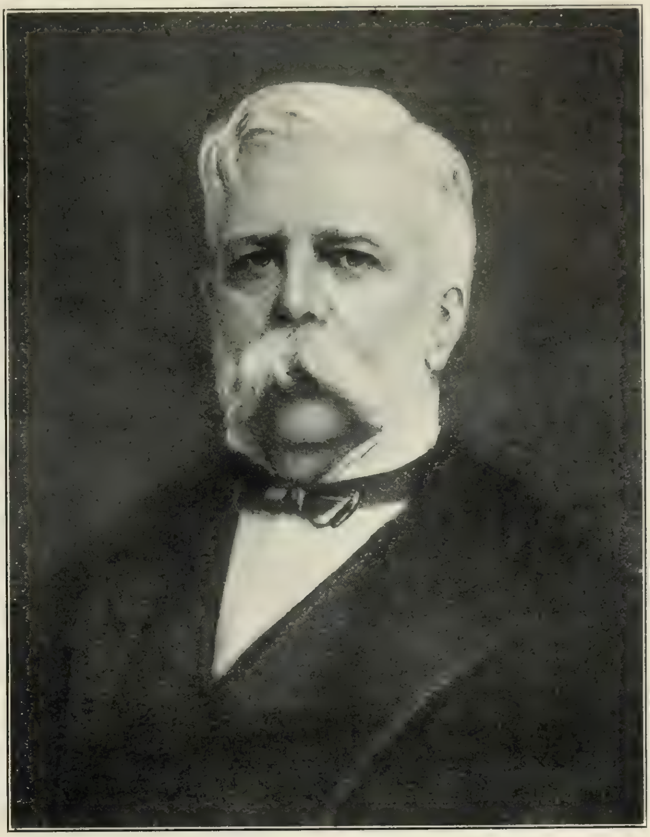
British Science Guild.—The *Times* announces that Sir William Mather will preside at the annual dinner of the British Science Guild at the Trocadero Restaurant on May 22nd.

Annual Social.—The Bermondsey Electricity Department held its fourth annual social recently at the Spa Road Town Hall. Some 200 ladies and gentlemen were present, being received by the Mayor and Mayoress.

(*Continued on page* 542.)

THE LATE MR. GEORGE WESTINGHOUSE.

The late George Westinghouse was a man of striking presence and strong personality. Perhaps there was no other man in American or British electrical engineering affairs to whom fell so much influence and distinction coupled with wealth and honours. Some of the articles that have appeared since his death seem to us to needlessly strive after contrasting the "comparatively humble circumstances" in which he began life, with the position of wealth and fame with which his career has closed. It must not be imagined from such a comparison that he was either a newspaper boy or a crossing-sweeper. As a matter of fact, he was the son of a manufacturer of agricultural machinery, was educated at public high-schools and college, came of an engineering stock and was reared in an engineering atmosphere, and he had four brothers—a circumstance preventing pampering and luxury, and aiding the development of character. He was at the age of ten when his father opened the agricultural machinery works; as a boy, machinery provided him with his chief amusement, and his early years were spent among his father's business affairs. We suppose, regarding these conditions purely from the dollar standpoint, and remembering that George Westinghouse has died worth many millions, they were comparatively humble, but they were ideal surroundings for a lad possessed of inventive ingenuity. He was not a mere visionary or impossible contriver as an inventor; his surroundings and subsequent experience and training gave him a remarkable grasp of and ability in financial and commercial affairs—qualities so often lacking in inventors to whom success never comes. The importance of such qualities in controlling the vast industrial and other organisations that were established in consequence of his discoveries is readily recognised.



The Late Mr. George Westinghouse.

Mr. Westinghouse was born at Central Bridge, New York, in October, 1846; his family was of German extraction. Ten years later came the removal to Schenectady to start the agricultural works already mentioned. At the age of fifteen George had invented and built a rotary engine; in the next year he served in the New York National Guard, and later in the New York Cavalry, and in 1864 and 1865 he served as third assistant-engineer in the United States Navy. When nineteen he produced a device for replacing railway cars on the track. It was, however, at the age of twenty-two that he made the invention which formed the basis of his other enterprises—viz., the Westinghouse air-brake, the first patent for which was granted in April, 1869. Mr. Westinghouse came to England in 1871 for the purpose of introducing the air-brake, which revolutionised the methods of railway working, and in the process of meeting new conditions the automatic feature was introduced. The patent for the quick-action brake was granted in 1888.

In 1863, he turned his attention to the application of pneumatic control to the operation of railway signals and switches, and developed and patented the system now manufactured by the Union Switch and Signal Co.

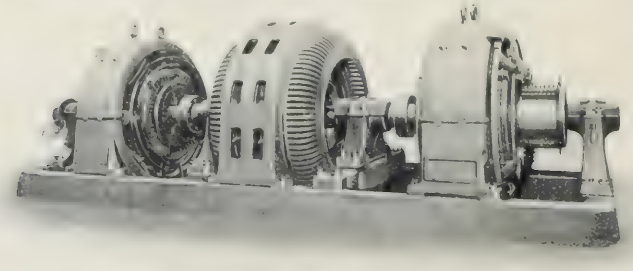
He became interested in the manufacture of lamps and electric lighting apparatus in 1886, the Westinghouse Electric Co. being formed for this purpose. The United States Electric Lighting Co. and the Consolidated Electric Light Co. were absorbed by this company, the whole being reorganised and consolidated in 1891 into the Westinghouse Electric and Manufacturing Co. at East Pittsburg. He was one of the first to perceive the limits of the direct-current system, and in 1885 acquired the American rights to the inventions of Messrs. Gaulard and Gibbs in connection with alternating currents, which he introduced as a system of distribution, in spite of the strongest opposition and the opinion of eminent men such as Lord Kelvin as to its commercial value. He gathered about him William Stanley, Nikola Tesla, O. B. Shallenberger and others, who contributed not a little to this development. He backed Mr. Tesla with both manufacturing and financial assistance in the development of the induction motor, while his foresight in perceiving the advantages of the alternating transformer for varying pressure has made possible the transmission of energy over long distances and its utilisation at remote points.

Allied to this, and his previous connection with railway work, was his great interest in the problem of railway electrification—in particular of the development of the possibilities of the single-phase motor for traction work, and his keen appreciation of the essential conditions of railway working.

His interest in electric lighting is instanced by the formation of companies to manufacture the Nernst lamp, the Cooper-Hewitt mercury vapour lamp, the Bremer arc lamp, and the carbon and metal-filament incandescent lamps.

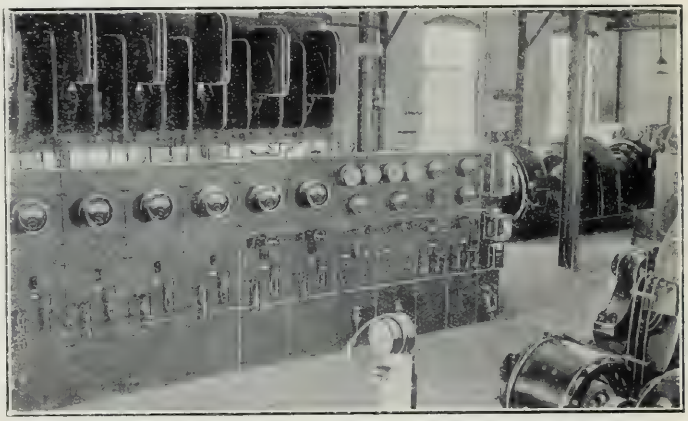
Most important, also, has been the work done by Mr. Westinghouse in the development of the steam turbine, and still more recently in the solution of the problem of its application to marine propulsion.

Mr. Westinghouse was given the honorary degree of Doctor of Philosophy by the Union College in 1890. In 1896 the Koniglische Technische Hochschule, of Berlin, bestowed upon him the degree of Doctor of Engineering; he was also decorated with the Legion of Honour of France, the Royal Crown of Italy, and Leopold of Belgium. He was the second recipient of the John Fitz Medal, and was honorary member of several American Associations. In December last he received the decoration of which he was, perhaps, prouder than any other, viz., the Drashof Medal, awarded for having obtained the most important results in engineering during the year. Mr. Westinghouse was the first American to receive this tribute, which is conferred annually in memory of Frantz Drashof by the engineering profession in Germany.



1,000-kw., 2,400-volt d.c. Motor-Generator Set, as Installed in Sub-stations, Butte, Anaconda and Pacific Railway.

At the time of his death, Mr. George Westinghouse was director of 18 Westinghouse undertakings (of 15 of which he was president) having an aggregate capital of over one hundred million dollars, the largest of which are the Westinghouse Air Brake Co., the Westinghouse Machine Co., and the Union Switch and Signal Co., employing in and around Pittsburg alone some 50,000 persons. Only one of the five brothers is now living, namely, Mr. Herman H. Westinghouse, who was associated with the deceased gentleman in most of his enterprises.



2,400-volt d.c. Switchboard, &c., Anaconda Sub station.

THE 2,400-VOLT DIRECT-CURRENT ELECTRIFICATION OF THE BUTTE, ANACONDA AND PACIFIC RAILWAY, U.S.A.

The Butte, Anaconda and Pacific Railway is one of the most remarkable examples of steam road electrification in the States. Besides being the first 2,400-volt direct-current road, it is also credited with being the first steam road operating both freight and passenger schedules, to electrify its lines purely for reasons of economy.

The equipment was supplied by the General Electric Co., U.S.A., and the first electric locomotives were put into service on May 28th, 1913, hauling ore cars between the East Anaconda yards and the smelter. During the first seven months of service, they ran approximately 201,000 miles, and hauled about 2,365,000 tons of ore.

The change from steam to electric haulage was made without any change in the personnel of the train crews and without any delays or alterations in the schedule. The engineers, without exception, have expressed themselves as being greatly pleased with the easy operation of the locomotives.

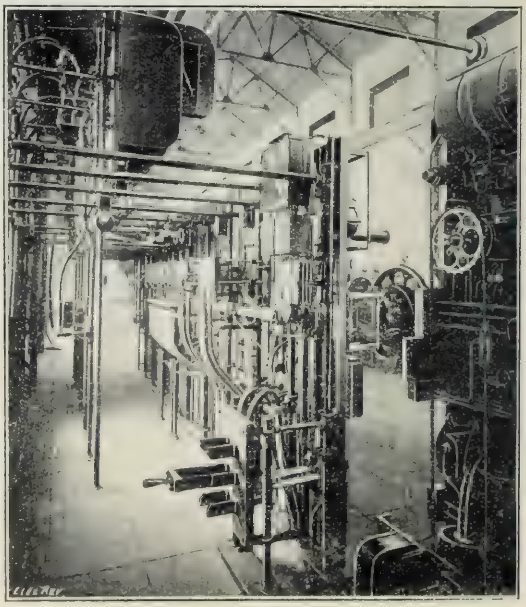
The electrified lines of this system extend from the Butte Hill yard to the smelter, a distance of 32 miles. There are numerous sidings, yards, and smelter tracks that have been equipped with overhead trolley, making a total of about 95 miles on a single track basis.

The Butte, Anaconda and Pacific Railway is essentially an ore hauling road, the freight traffic from this source originating at the copper mines located near the top of Butte Hill. From the mines the ore trains are lowered down the mountain, a distance of 4½ miles to the Rocker yards located a few miles west of the city of Butte. At this point new main line trains are made up for transportation to the smelters at Anaconda. The main line division extends through a rough mountainous country, a distance of about 20 miles, with grades as high as 0·3 per cent.

At East Anaconda the main line trains are broken up and hauled up Smelter Hill to the stock bins, where each car is run over the scales and weighed. The shifting of cars in connection with weighing and subsequent delivery to the contractors is done by single locomotives.

The east-bound traffic consists in returning empty cars to the mines and the transportation of copper ingot to the Butte yards, where it is shipped over other roads to refineries.

Between the cities of Butte and Anaconda, which are located at the ends of the electrified portion of the system, there is considerable local traffic both passenger and freight. The city of Butte and vicinity has a population of about 65,000, and Anaconda, about 10,000. At Butte, the Butte, Anaconda and Pacific connects with the Great Northern Railway, the Northern Pacific and the Chicago, Milwaukee



Rear View of d.c. Switchgear, Butte Sub-station.

and St. Paul Railroad; and at Silver Bow, about six miles from the city, connection is made with the Oregon Short Line.

Eight-track Tangent in the Butte Yards.

For a distance of 16 miles the Butte, Anaconda and Pacific Railway is paralleled by the trans-continental lines of the Northern Pacific and the Chicago, Milwaukee and St. Paul. The last-named company has already contracted for power for the operation of electric trains from Harlowton, Montana, to Avery, Idaho, a distance of 440 miles.

Electric Locomotive and Train at Butte Station.

The maximum curvature on the system (20°, 285 ft. radius) occurs on the Butte Hill line. On this part of the road there is an average curvature of 6° to 10°. The locomotives are designed with sufficient flexibility to take a curve of 31° (180 ft. radius) at slow speed.

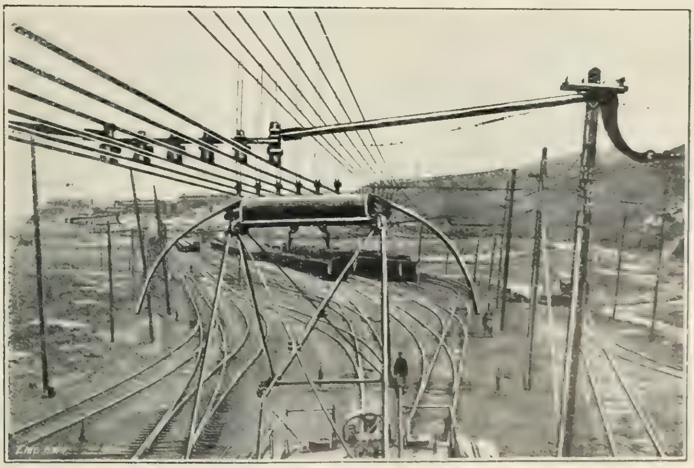
The freight traffic consists largely of copper ore, and amounts to more than 5,000,000 tons a year. This material is handled in steel cars, weighing about 18 tons, and having a capacity of 50 tons each. Trains of 30 loaded cars, weighing 2,000 tons, are made up at the Butte Hill yards, and hauled by two-unit locomotives to the Rocker yards, where 4,000-ton trains are made up for the main line. At the East Anaconda yards the trains are again broken up, and 1,400-ton trains are sent up Smelter Hill to the ore bins. All of the shifting and "spotting cars," at the smelters and in the sorting yards, is done by single locomotive units. The customary train make-up for both east and westbound traffic is given in the table on the next page.

Eight passenger trains per day are operated between Butte and Anaconda, four in each direction. The main line trains were first hauled by electric locomotives on October 1st, 1913, and promptly demonstrated their ability to make better time than was possible with steam engines. Single locomotives are used, hauling trains of from three to five passenger and baggage cars.

Energy for the operation of electric trains is purchased from the Great Falls Power Co. The generating plant is located at Great Falls, Mont., on the Missouri River, and has a nominal rated capacity of 21,000 k.w., generating 6,600 volts, three-phase, at a frequency of 60 cycles. The power is stepped up to 102,000 volts for transmission to the transformer sub-station at Butte, a distance of 130 miles, over two separate parallel lines constructed on the same right-of-way. An extension of the system transmits power at 60,000 volts to a second transformer station at Anaconda, 26 miles farther on.

The Butte station forms the centre of the extensive power system operated by the Montana Power Co. Besides the Great Falls 102,000-volt transmission lines, there are several 60,000-volt transmissions terminating at this point, which form a part of the Montana Power Co.'s system. These lines bring in power from the Hauser Lake, Canyon Ferry, Madison and Big Hole plants. At the Butte sub-station the pressure is stepped down to 2,400 volts and all the lines are tied in on the 2,400-volt a.c. bus-bars. Ample protection is, therefore, afforded from interruption of service.

It is an interesting fact that the railway load was taken on without any increase in the high-tension transmission facilities. It is estimated that the additional load from this source is approximately 20 per cent. of the railway, industrial and lighting load furnished by the street railways, mines, and smelters at Butte and Anaconda.



Pantograph Engaging Six Trolley Wires.

The two existing sub-stations at Butte and Anaconda were used to house the 2,400-volt motor-generator sets required for operating the electric trains, so that no additional buildings were constructed for this purpose. Power is furnished by two 1,000-kw. 3-unit motor-generator sets in each sub-station, taking power from the 2,400-volt A.C. bus-bars. These units operate continuously 24 hours per day, seven days of the week, to supply the necessary current for train operation; each consists of a three-phase, 60-cycle, 1,450-k.v.a., 720-r.p.m. synchronous motor direct connected to two 500-kw., 1,200-volt generators, insulated to operate in series for 2,400 volts. The generators are compound wound, and have both commutating poles and compensating pole face windings. These fields are connected on the grounded side of the armature, and the main fields are separately excited from 125-volt exciters.

Condensed Information of Freight Movement.

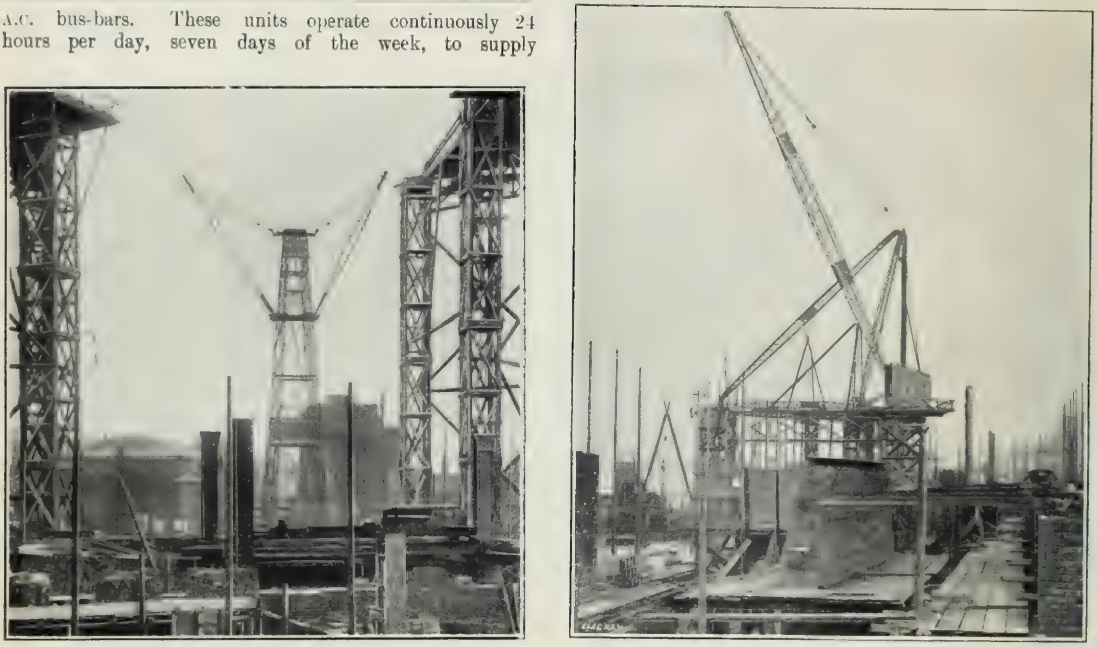
	West Bound.			East Bound		
	Butte Hill line.	Main line.	Smelter Hill.	Smelter Hill.	Main line.	Butte Hill line.
Trailing load in tons	2,000	4,000	1,400	1,000	1 260	650
Number of cars ...	30	60	20	55	70	35
No. of 80-ton locomotives per train	2	2	2	2	2	2
Approximate grade against load ...	2·5 %	0·3 %	1·1 %	1·1 %	1 %	2·5 %
Approximate speed on level tangent track, M.P.H. ...	—	21	—	—	25	—
Approximate speed on max. grade...	12	16	16	20	16	16
Average trolley voltage	2,200	2,200	2,200	2,200	2,200	2,200
Length of run in miles	4 6	20·1	7	7	20·1	4 6

(To be continued.)

ELECTRICAL POWER APPLICATIONS IN THE CONSTRUCTION OF THE COUNTY HALL, WESTMINSTER.

Electric current, as applied for power purposes, has had but little difficulty in showing its superiority over the old-fashioned steam plant in most industries. Undoubtedly, however, one of its most marked successes has been gained by its compactness, cleanliness and saving of expense for the use of the building and engineering contractor, where the former methods of using numerous isolated steam power plants entailed a prodigious amount of labour, fuel expense and general inefficiency.

By the courtesy of Messrs. Holland, Hannen & Cubitt, of Hyde Street, W.C., we have recently been able to inspect the construction works for the new County Hall at the southern end of Westminster Bridge, which they are carrying out as contractors for the future headquarters of the London County Council.



Duplex Electric Tower Crane. Scotch Electric Derrick Crane.

Electric Cranes at the new County Hall Buildings.

On these works, which cover a ground space of about 6½ acres, and have a river frontage of 750 ft., the most modern machinery and plant is being used, and some very interesting examples of electrical power application are to be seen.

The total number of motors at present installed amounts to 26, aggregating about 360 h.p., while additional plant now in course of erection will require a further supply of about 80 h.p.

For general lifting work at different points of the building, seven Scotch derrick electric cranes have been

General View of Crane Structures at the County Hall Site.

installed, while another of the same type is now in course of erection. These cranes, supplied by Messrs. Butter Bros., of Glasgow, have a lifting capacity of 5 tons at 78 ft. radius, and 2 tons at 60 ft. radius. They are of the single-motor type, equipped with a 20-H.P. motor, and having two lifting speeds of 60 and 80 ft. per minute. These cranes are raised on timber gantries 100 ft. above the ground level, each leg being ballasted with 20 tons of brickwork.

For handling the material brought by road, a large duplex electric tower crane has been installed on the portion of the works fronting the Belvedere Road. This crane, which was supplied by Messrs. Anderson & Co., is unique in its construction, being the only one of its kind at present in use, and was formerly used in the carrying out of the recent extension to the British Museum. It is of the travelling type, and runs on an 18-ft. track. Ascending to the operating platform, which is situated within the lattice girderwork tower at a level of 40 ft., we were able to obtain from the driver many interesting particulars of its construction and working. The total height of the tower is 100 ft. and it is equipped with two 45-ft. gibs, on opposite faces. Their slewing is effected by means of vertical shafts extending from the operating shed to a spur-and-pinion gear placed 35 ft. above the shed. The gibs have a maximum radius of 40 ft., and each can be slewed through an angle of 180°. The lifting capacity of each is 3 tons at 40 ft. radius, and 8 tons at 17 ft. radius. The motor equipment of the crane, which is by the Lancashire Dynamo Co., consists of one 22-H.P. motor for each gib, giving two lifting speeds of 20 and 60 ft. per min., and one 10-H.P. motor, situated at the base of the tower, for travelling. This is geared to the running wheels by double reduction worm gear. All the motors are of the series type.

Power is transmitted to the vertical slewing shafts from the lifting motors through a double friction clutch, and the gibbing is arranged so as to maintain the load at a constant level while varying the radius. The controllers of the shed motors are of the tramway pattern, and an Igranic worm-operated controller is provided for the travelling motor. The total weight of the crane, with 25 tons of ballast, is 75 tons. Its work consists of unloading the bricks, stonework and girders brought up by motor and horse lorries on the Belvedere Road, the bricks being taken up in skips of about three-quarters of a load at a time.

On the wharf a large 10-ton electric crane of the Scotch derrick type has been erected for dealing with the circular stone front on what is to be called the Members' Terrace, and this will unload the stone blocks from barges and place them direct in position. This crane is one of the largest of its type that has ever been made. The length of the jib is 137 ft., and the crane has a lifting capacity of 10 tons at a radius of 110 ft., and 4 tons at a radius of 125 ft.

In addition, two travelling wharf cranes are in the course of erection on the river front, for unloading other material from the barges, and depositing it on the site of the building. The length of the jibs of these cranes is 45 ft., and their lifting capacity is three tons at a radius of 40 ft.

An interesting example of labour saving by electrically-driven contractors' plant is provided by the concrete crushing and mixing machinery which has just been installed. This plant is situated on the river front of the works about 60 ft. from the wharf side. Either of the two wharf cranes mentioned will unload rubble and cement from barges on to a raised platform on which is placed the crushing plant consisting of a combined toggle-jointed jaw crusher and toothed crushing rolls in which the material is reduced to $\frac{3}{4}$-in. size. From here it descends through a rotary screen, to gauge skips on a lower platform, cement being passed down a separate shute to a suitable gauge also on this level. These gauges tip into a duplicate mixing plant placed in the sub-basement level of the building.

The crusher and screens are driven by countershafting from a 15-H.P. motor, while another motor of 15 H.P. is provided for the mixers. This entire unit is about to be duplicated by another of similar construction placed adjacent to it. The two will turn out about 200 cb. yd. of concrete per day under working conditions. Each unit will require only six men for its operation, showing a proportionate saving in working cost compared with the usual plant, which requires from 10 to 13 men, and produces only about 30 yd. per day. The concrete produced will be conveyed to any desired point of the works by a system of rails in the sub-basement on which it will be carried in skips of 20 cb. ft. capacity to any one of five electric hoists installed in the lift wells of the building. These hoists, each operated by a 10-H.P. motor, will have a useful lifting capacity of 1 ton at 150 ft. per min.

A 10-H.P. electrically-driven mortar-mixing plant, provided with its material by the wharf cranes on the front of the building, will also be served by the skip railway.

For dealing with surface water collecting in the basement, two 20-H.P. electrically-driven centrifugal pumps are used and one of 5 H.P., while another of 5 H.P. is about to be installed.

Included among miscellaneous electrical tools for small operations are three grinding tables, each consisting of a 24-in. emery wheel running on a vertical shaft at 6,000 ft. per min. and driven by a 15-H.P. motor. These are used for shaping bricks and tiles for the formation of arches and other curves, and show a great superiority in finish to the older method of chiselling them by hand.

In the two carpenters' shops on the works, electrically-driven circulars saws are being used, one of 10 H.P. and two of 15 H.P.

The lighting of the works which is arranged for general rather than local illumination, is by 12 10-hour 9-ampere "Angold" flame arc lamps used four to the 230-volt circuit, and fixed at the height desired upon the various crane structures.

Electric power is obtained from the three-wire D.C. mains of the London Electric Supply Corporation, at 460 volts, through three separate services of armoured concentric cable, these being of ·8, ·5 and ·12 sq. in. area respectively. These service cables which, together with the distribution scheme, was carried out by Messrs. Donnison, Sillem & Co., Great Portland Street, terminate at distributing centres located at various points in the basement of the building, where they are split up into 75 and 50-ampere circuits, and led by concentric distributors to Siemens terminal boards, each circuit being separately metered. Ironclad fittings are used throughout, each power plant being efficiently earthed to separate earth plates, in conformity with the rules and regulations of the Board of Trade. The design of the various electric schemes has been in the charge of Mr. Ingram Pettit, consulting engineer, of Charing Cross Road.

The motors used throughout the works for the machinery and mixing plants were supplied by Messrs. Siemens.

We have to thank Mr. B. Tarring, works manager, for kindly taking such pains in verifying the accuracy of the above particulars; also his electrician, for spending a great amount of time in showing us around and explaining the various features of the plant.

Electrical Contracts in Turkey.—In the course of its annual report for 1913, the British Chamber of Commerce of Turkey and the Balkan States contains the following statement:—

"Electrical work of British Embassies and British Consulates without tender.—Your Council has been informed that certain electrical installation work had been given out to foreign firms without British firms having been invited to tender. Correspondence has ensued both with his Majesty's Embassy and with the Office of Works, with the result that the latter department has undertaken to invite tenders for all future work, and some five local firms representing British manufacturers have been put on the list."

In the issue of the *Journal* of the Chamber just received it is stated that "cases may be cited of British travellers in widely different articles accidentally taking in Constantinople on their way home from Egypt, and such purely accidental visits have been known to surpass all expectations. It should be remembered that it is the numerous small articles, from tooth-paste to office stationery, which can be developed. Turkey purchases nearly all her requirements abroad, and given a time of quiet, trade is bound to increase, as the imports have been cut down to the strictest necessary for a year or two past. The openings for the remunerative employment of capital in public works and enterprise are numerous. Railways and ports have to be constructed. Cities will be lit by electricity, and tractive power supplied. The mineral wealth of the country awaits capital and transport facilities for development. Local industries are almost nil, but with the prospective increase of the import duty from 11 to 15 per cent., and the exemptions from taxation and the facilities granted to industries, the time is at hand when new factories for every kind of manufactured articles, not requiring expert technical training, will spring up."

NOTES.

(*Continued from page* 536.)

Late Legal.—War Office Sue Electrical Engineers.—An action against Messrs. Kirkland & Capper, electrical engineers, of 17, Victoria Street, Westminster and Mr. John H. T. Woodd, an architect, of Broad Sanctuary Chambers, Tothill Street, Westminster, brought by the Secretary of State for War in connection with the defendants' supervision of certain electrical works erected by the War Office and entitled the new Medical Staff College and Laboratory at Millbank, came before Mr. Justice A. T. Lawrence, in the King's Bench Division on Wednesday. The Secretary of State for War claimed to recover damages against both the defendants in connection with their supervising direction of works. Both defendants denied being guilty of the negligence alleged against them.

For the War Office the Solicitor-General, Sir Stanley Buckmaster, K.C., M.P., Mr. Gordon Hewart, K.C., M.P., and Mr. Brandon appeared; for the defendant, Mr. Woodd, Mr. M. Shearman, K.C., and Mr. Eustace Hills (instructed by Dowson, Ainslie & Co.), and for the defendants Kirkland & Capper, Mr. J. A. Walter, K.C., and Mr. G. R. Blanco White (also instructed by Dowson, Ainslie & Co.).

The history of the case, said the Solicitor-General in opening, was quite simple, but something would depend upon the construction of the documents. In 1903 the War Office were engaged in constructing at Millbank this Medical College, a large and fine building, having residential quarters for the officers and a large laboratory. The defendant, Mr. Woodd, was engaged as architect on a commission of 5 per cent. on November 3rd, 1903, and it was his duty to superintend the whole of the works of the building, including the installation of electric lighting, but the contract expressly provided that the lighting work should be placed in the hands of experts. In February, 1904, the defendants, Messrs. Kirkland & Capper, were employed by the plaintiffs, through Mr. Woodd, to supervise the electrical lighting of the building. The acceptance was recommended to the War Office of two tenders submitted by Messrs. John Bolding & Sons for the installation, the amount being £838, in respect of the residential portion of the building, and £801 for the laboratories. These were accepted by the War Office early in 1906. Messrs. Bolding undertook to execute the work in accordance with the current Board of Trade regulations and the wiring rules of the Institution of Electrical Engineers.

In connection with the wiring of the building for electric light, it was stipulated that lead-covered wire should only be used in cases where the wires were passed through cornices, mouldings or walls, and the plaintiffs' complaint was that the defendants, Mr. Woodd and Messrs. Kirkland & Capper, had approved of the wiring of this place throughout with these lead-covered cables. A further ground of complaint was that the wires were hidden in plaster.

The defendants (it was alleged) took no steps to ascertain where the wires were laid that fed the lights, and the whole wiring work was extremely unsatisfactory, and it would be contended for the War Office that the certificate for payment for the work was negligently given. The system was found to be a failure, and then it was asserted that some of the circuits had gone wrong because attempts had been made to repair them by Royal Engineers, and this work had been clumsily and improperly done, but the plaintiffs' case was that this could not be possibly held to account for the utter failure which was found. The only remedy was to re-wire throughout, and this was done by Messrs. Foote & Milne in April, 1910. These were the facts of the dispute, and counsel would contend that there was a clear case of negligence against the defendants as supervisors.

At this stage Mr. Walter, K.C., remarked that he denied the negligence, and proposed to show that the trouble was caused by interference with the work after it was done.

Mr. Justice Lawrence said that, without expressing any opinion on the question of damages, it might appear when they got further that the matter would be so detailed that some expert or referee would have to investigate the items and calculate the possible damage.

The various documents and contracts were dealt with at great length by the Solicitor-General, who pointed out that the contract with Mr. Woodd provided that he should, as an architect, superintend the building, and have as remuneration a commission of 5 per cent. on the net cost of the building and works completed under his direction: and it threw on him the responsibility for the proper supervision of the execution of the work. Generally speaking, Mr. Woodd was to be responsible for the lighting, as also for the rest of the building under Clause 4.

The technicalities of electric wiring were explained in great detail by the Solicitor-General, and also the various acts which it was alleged were contrary to the contract, and to which the charge of negligence related.

Mr. Woodd, in his defence, totally denied negligence, and he referred to the fact that the contract provided for the electric lighting to be placed in the hands of experts, and that they were to be responsible to the War Office.

On behalf of Mr. Woodd, Mr. Shearman said he could state at once that his position was that he was architect for the building, and the engineers had to do with the electric lighting. Mr. Woodd would contend that he was not responsible for the electric lighting, except so far as seeing that the electric light works did not interfere with the proper building of the house. He was entitled to give instructions to the engineers in so far as it assured no interference with the building. The contract provided for the employment of electrical experts, and they were so employed, and Mr. Woodd's position, briefly put, was: "They are the engineers, I am the architect."

Sir Stanley Buckmaster said that what had caused this system to fail was the putting of lead-covered conductors into plaster without proper protection, and he could not see how any of the defendants could evade responsibility, as this was directly contrary to the terms of the contract.

[Our report will be continued next week.]

Colliery Explosions.—A new process for treating coal dust is being tried at Washington Colliery, County Durham, a liquid spray being used which does not evaporate.

Liverpool Electrical Trade Association. — It has been decided to form an association of the employers of electrical labour in Liverpool and district, to cover a 20-mile radius. Mr. Egerton G. Pulford is acting as secretary *pro tem.* An employer of labour stated that whereas over 80 per cent. of the men now belonged to a strong trade union the master electricians in the city were in no sense organised. Already within the last 12 months the rate of pay had been increased 1d. per hour, the standard rate now being 9½d. The employés were now asking for a further 2½d. per hour advance, and a reduction of working hours from 50 per week to 46½; night shift one hour less work or one hour at overtime rate; dinner hour not to be movable except at overtime rates; charge hands demanded 1d. extra instead of ½d., and under the heading of dirty work the men were asking for an extra 1s. per day each man. Starting time had usually been left to employers individually, but now it was proposed to have a fixed starting time of 8 o'clock. Increases were also asked in regard to overtime and Bank Holidays. What was most resented by many employers was the question of boundary, the E.T.U. now demanding that fares should be paid both ways to jobs, out in men's time, and back in employers' time. In the case of country jobs an increase of 1s. per day was asked for, all fares and travelling time to be paid. Most of the employers were determined to resist these proposals.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Having regard to the fact that its electrical engineer was one of the selected candidates for a similar position under the Salford Corporation, and that it is desirable in the interests both of the undertaking and the continuity of policy in connection with the position of the undertaking, to retain his services, the West Ham Corporation is being recommended to increase Mr. Beauchamp's salary to his present maximum of £700 per annum as from April 1st next, and to fix the future maximum at £900, to be reached by annual increments of £100, provided the Council may rely on retaining his services for a further period of two years at least.

Mr. W. Fennell, engineer and manager of the Wednesbury Corporation electrical station, has resigned, and the assistant manager, Mr. J. P. Smith, has been appointed to take charge.

The Fulham Borough Council, at its last meeting, increased the salary of the electrical engineer from £600 to £625. The approximate increase in salaries in the electricity department amounts to £160.

Mr. H. H. Jowers, of Stockport, has been appointed to the position of mains and permanent way superintendent in the Darlington Corporation electricity and light railways department.

The following advances in salaries have been made this week by the Manchester Corporation:—Mr. J. Wood, assistant tramways manager, £500 to £600, by four annual increments of £25 each; Mr. J. T. Oakes, tramways traffic superintendent, £475 to £500; Mr. J. A. Cookson, electric mains surveyor, £400 to £425; Mr. W. E. Foden, electricity department accountant, £425 to £450; Mr. F. E. Hughes, electricity department secretary, £475 to £500; Mr E. Bolton, electricity sub-station engineer, £375 to £400.

Mr. C. Handley, senior switchboard attendant at Birkenhead electricity works, has resigned his position in order to take up the duties of switchboard attendant and test room assistant at H.M. Dockyard, Devonport.

While feeling greatly flattered at the decision of the Salford Committee recommending that Mr. H. Richardson, Corporation electrical engineer, Dundee, be appointed to a similar post under the Salford Corporation at a commencing salary of £1,000 per annum, the Dundee Town Council does not like the prospect of losing the services of its electrical chief. Mr. Richardson, who is only 38 years of age, has been in Dundee since 1903, and his emoluments amount to £650. At a meeting of the Electricity Committee, Mr. Nairn, the Convener, said it would be a great loss to the department, indeed a calamity, if they lost such an able official, and if he was worth £1,000 to Salford he was surely worth the same to Dundee. The Convener submitted statistics to demonstrate the high efficiency to which Mr. Richardson had raised the department, and pointed out that the entire cost of the alterations of recent years, amounting fully to £26,000, was paid out of revenue. He moved that the engineer's salary be raised to £800, rising by annual increments of £50 to £1,000. In the discussion that followed, a member pointed out that from the business point of view, no one would increase any manager's salary by 50 per cent. simply because he had got an offer from another firm which was doing twice the business and enjoying twice the profits. Bailie Macdonald said they should realise the value of a man and not wait until he got the offer of such a situation. While supporting an increase, Treasurer Soutar thought that if the Town Council in 1903 had the capacity to select a star like Mr. Richardson, they could do so again. The Convener's proposal was carried.

At a special meeting of the Dundee Corporation, on Monday, it was decided to raise the salary of Mr Richardson, the electrical engineer, to £800, with increments of £50 a year until the maximum of £1,000 is reached, and a clause is added to the terms of service binding Mr. Richardson to remain at Dundee for five years. Mr. Richardson, it is understood, is prepared to accept the terms.

Tramway Officials.—The Southport Tramways Committee is to recommend the Council to increase the salary of Mr. T. J. Kendrew, tramways manager, from £200 to £250 per annum.

Mr. R. F. Dixon, who is leaving the Hull Corporation tramways to take up a position under the Southampton Corporation tramways, was the recipient on Wednesday last week, of a case of fish knives and forks, and a silver cigarette case, presented by the staff and employés. Mr. Elliott made the presentation on behalf of Mr. Wilkinson, who was unavoidably absent.

General.—On March 16th, Mr. W. S. Murray was appointed by the New York, New Haven and Hartford Railroad Co. to be consulting engineer in general charge of all electrical engineering and construction, reporting to President Hustis, with offices at New Haven. Mr. Murray, following the substantial completion of the construction of the system for complete electrical operation west of New Haven, will enter into closer relations with the railroad company. His jurisdiction will hereafter be extended to also include the electrical features of operation in addition to electrical construction. He will continue with the firm of McHenry & Murray in general consulting practice as before.

Mr. P. J. White, general manager of the London Electric Warehouse Co., was married, on the 5th inst., at St. Mary Abbot's, Kensington, to Miss Pauline Scott.

Sir Francis Hopwood, G.C.M.G., K.C.B., has been appointed to a seat on the general board and Executive Committee of the National Physical Laboratory, in the place of Sir Arthur Rücker, F.R.S., resigned.

Sir Henry Babington Smith has been appointed as a member and chairman of the Pacific Cable Board, in succession to Sir Henry Primrose, resigned.

Mr. E. G. Thomas, charge engineer at the Burslem electricity works, who is taking up a similar position at Sheffield with Messrs. John Brown & Son, has been presented by his colleagues with a set of silver-mounted military brushes.

The electrical staff of the Great Western Railway at Swindon have presented a barometer to Mr. H. G. Sutcliffe on his marriage.

Obituary.—Mr. William Holt, formerly in charge of the electricity plant at the Blackburn Technical School, died at Alberni, British Columbia, last week, at the age of 68 years.

The death is reported of Mr. Frederick Evan Evans at the age of 80 years. The deceased gentleman, who passed away at Hastings on 20th inst., was superintending engineer in the Postal Telegraph Department at Birmingham. He, of course, retired from the service many years ago.

NEW COMPANIES REGISTERED.

Adaptable Code Condensers, Ltd. (134,711).—This company was registered on March 20th, with a capital of £1,000 in 850 5 per cent. cumulative preference shares of £1 each and 3,000 ordinary shares of 1s. each, to carry on business as experts in, advisers upon and teachers of the art of condensing matter intended for transmission by cable or by telegraphy or any description, whether by wire or wireless, proprietors, inventors, compilers, adaptors of or advisers upon telegraphic codes, &c., and to adopt an agreement with H. G. Telling. The subscribers (with one preference share each) are:—H. G. Telling, 7, Pearfield Road, Forest Hill, S.E., gentleman; W. T. Duke, The Chestnuts, Cranleigh, Surrey, gentleman. Private company. The number of directors is not to be less than two or more than seven; the first are H. G. Telling and W. T. Duke; qualification of H. G. Telling, 2,000 ordinary shares; of W. T. Duke, 300 preference shares; of other directors 100 ordinary shares; remuneration (except managing director) £20 per annum, divisible. Registered by Freeman & Son, 30a, George Street, Hanover Square, W.

Vincent Pump and Transmitter Co., Ltd. (134,675).—This company was registered on March 18th, with a capital of £15,000 in 5s. shares, to carry on the business of mechanical, electrical and general engineers and contractors, manufacturers of pumps, hydraulic apparatus and machinery, tool and boiler makers, &c., and to adopt an agreement with the Rotoplunge Pump Co., Ltd. The subscribers (with one share each) are:—H. T. Box, Preswylfa, Cardiff, solicitor; L. Morgan, Duffryn, Llandaff, solicitor; E. Neal, Beaumont, Whitchurch, Glamorgan, tea and coffee merchant; W. H. Taylor, Bradstow, Cefn Coed Road, Cardiff, merchant; J. H. Morgan, 26, High Street, Cardiff, solicitor; D. E. S. Browne, 23, Parade, Barry, solicitor, F. H. Gentle, 66. Llanfair Road, Cardiff, clerk. Minimum cash subscripton 25 per cent. of the shares offered to the public; the number of directors is not to be less than three or more than seven; the first are J. Hibbert, H. T. Box, L. Morgan, W. H. Taylor, H. A. Moore and J. Browne-Martin; qualification, 20 shares; remuneration (except managing director), £50 each per annum (chairman, £65); solicitor, J. H. Morgan, 26, High Street, Cardiff.

Electrolysers, Ltd. ([illegible]).—This company was registered on March 13th, with a capital of [illegible] in 2,000 pref. shares of £1, and [illegible] ordinary shares of 1s. each, to acquire from J. T. [illegible] certain inventions for improvements in electrolytic apparatus, a process of and means for producing a bleaching, disinfecting, deodorising and preservative agent, and in apparatus for bleaching fabrics, together with the patents to be granted in respect thereof, to carry on the business of electricians, electrical engineers, bleachers, dyers, &c. The subscribers (with one pref. share each) are:—A. Moy, 19, Old Broad Street, E.C., financial agent; J. G. Watson, [illegible]gate, E.C., financial agent. Private company. The number of directors is not to be less than two or more than five; the first are J. T. [illegible] and J. G. Watson; remuneration, £25 each per annum, and a percentage of the [illegible]

General Acoustic and Dictograph Co., Ltd. (134,[illegible]).—This company was registered on March 19th, with a capital of £[illegible] in £1 shares, to take over from the General Acoustic Co., of New York, the benefit of certain acoustic and telephonic inventions, to carry on the business of makers of instruments for the deaf, manufacturers of and dealers in anatomical, orthopædic and surgical appliances, chemists, druggists, providers of requisites for hospitals, patients and invalids, telephone instrument makers, &c. The subscribers (with one share each) are:—J. McL. [illegible], Beechfield House, Birkby, Huddersfield, pianoforte dealer; W. A. [illegible], Clarence Villa, Clarence Road, Wimbledon, S.W., gentleman. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Walter Martin & Co., [illegible], Queen Victoria Street, E.C.

E.M.F. (1914), Ltd. (134,649).—This company was registered on March 18th, with a capital of £3,000 in £1 shares, to take over the business of electricians, electrical engineers and fittings makers carried on by E.M.F., Ltd., at London and Walsall, and to adopt an agreement with G. Little (liquidator of E.M.F., Ltd.), and W. H. Rowe. The subscribers (with one share each) are:—W. H. Rowe, "Beverley," Stoneleigh Drive, Worcester Park, Surrey, electrical engineer; J. M. Bein, 91, Belvedere Road, Walsall, Staffs., electrical engineer. Private company. The number of directors is not to be less than two or more than three; the first are not named. Solicitor, F. Cooper, Walsall.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Tramways Light and Power Co., Ltd.—Trust deed dated February 26th, 1914, to secure £200,000 debenture stock redeemable at a premium of 5 per cent., with power to create and issue further stock, ranking *parri passu* with above, but so that the total amount shall not at any time exceed 75 per cent. of the aggregate amount for the time being issued of the preferred and ordinary share capital, charged on 136,468 shares of £1 each, and £36,785 5 per cent. debenture stock of the Derbyshire and Nottingham Electric Power Co., 20,500 shares of £10 each of the Nottingham and Derbyshire Tramways Co., 7 510 shares of £10 each in the Leicestershire and Warwickshire Electric Power Co., 194 preferred and 6,528 ordinary shares of £10 each, and 32,950 debenture stock of the Leamington and Warwick Electrical Co., 3,139 shares of £10 each in the Midland Electric Light and Power Co., Ltd., present and future, rights and interests of the company, in or to such shares, debenture stock and debenture scrip and the company's undertaking and other property, present and future, including uncalled capital. Trustees: Trustees, Executors and Securities Insurance Corporation, Ltd., Winchester House, Old Broad Street, E.C.

Burnham and District Electric Supply Co., Ltd.—Debenture, dated March 12th, 1914, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Wilts. and Dorset Banking Co., Ltd., Salisbury.

Broom & Wade, Ltd.—Debenture, dated March 4th, 1914, to secure not more than £4,000, charged on the company's undertaking, real and personal estate, property, patents, and issued or uncalled capital. Holders: Barclay & Co., Ltd., 54, Lombard Street, E.C.

Yorkshire (West Riding) Electric Tramways Co., Ltd. (84,167).—Capital, £600,000, in £5 shares (70,000 pref. and 50.000 ord.). Return dated February 6th, 1914. 46,261 pref. and 40,977 ord. shares taken up, £436,190 paid. Mortgages and charges: £275,000.

Central Electric Supply Co., Ltd. (53,080).—Capital, £100,000, in £5 shares. Return dated February 17th, 1914. All shares taken up, £100,000 paid. Mortgages and charges: £458,600.

Nottinghamshire and Derbyshire Tramways Development Co., Ltd.—A memorandum of satisfaction in full on March 13th, 1913, of debentures, dated June 22nd, 1910, and October 2nd, 1911, securing £1,875, has been filed. (Notified March 19th, 1914.)

Madras Electric Supply Corporation, Ltd.—Issue on March 12th, 1914, of £4,000 debentures, part of a series of which particulars have already been filed.

City of Oxford Electric Tramways, Ltd.—A memorandum of satisfaction in full on February 24th, 1914, of debentures, dated December 14th, 1908, securing £15,000, has been filed.

Cecil Hodges & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated November 4th, 1913 (filed February 11th, 1914). All shares taken up. £1 per share called up on two. £2 remains in arrears. £998 considered as paid on 998 shares. Mortgages and charges: £500.

Electric Train Lighting Syndicate, Ltd. (112 932).—Capital, £5,200 in £1 shares. Return dated March 2nd, 1914. All shares taken up. 5s. per share called up on 900. £225 paid. £1 per share considered as paid on 4,300. Mortgages and charges: Nil.

CITY NOTES.

British Insulated and Helsby Cables, Ltd.

Dr. E. K. Muspratt presided over the annual meeting held in Liverpool on Monday, and in moving the adoption of the report (see Electrical Review, page 501), he stated that the profit for the year amounted to £247,351, as compared with £218,395 for the previous year, an increase of £28,956, results which he was sure would be regarded as satisfactory. He was pleased to be able to say that the good results had been obtained not through extraordinary profits or volume of business, but by a general increase of business in the various departments. It was only fair to state, however, that competition in their line of business was somewhat on the increase, but they felt confident that the company would be fully able to deal with this. While prospects of trade generally throughout the country were not so good as they were, their works still continued to be fully employed, and some contracts of exceptional magnitude were at present on hand, notably the making and laying complete of large quantities of telephone cable for the General Post Office. With regard to the profit and loss account, the chairman said that adding the balance brought forward from 1912, there was an available sum of £321,581. Out of this the directors' and trustees' fees had been paid, with interest on debenture stock, a preference dividend, and interim dividend on ordinary shares. Sums had also been written off to depreciation, and £35,000 had been written off patents and goodwill, reducing the last item to nil. The item had originally stood at £251,672, and its annihilation should very materially strengthen the financial position of the company. The directors were following the policy of judiciously extending the company's manufacturing plant to meet the demand in the departments returning the best profits. Their interests in subsidiary companies were improving, and it might be anticipated that they would year by year form an increasing source of strength. Owing to the insufficient supply of workmen's dwellings at Prescot, and the long distance the men had consequently to travel daily, the directors were contemplating the development of a site near the works on town-planning lines. In conclusion, the chairman paid a tribute to the hard and intelligent work of Mr. Sinclair, the general manager, and other principal officials of the company.

Mr James Taylor seconded the motion, which was carried unanimously.

A dividend of 9s. per share on the ordinary shares, making with the interim dividend previously paid a return of 13 per cent. for the year, was approved of. Messrs. James Tavlor and G. Crosland Taylor, the retiring directors, were reappointed.

Guildford Electricity Supply Co., Ltd.

The directors' report for December, 1913, shows that the company has again made very satisfactory progress, the gross receipts being £11,786, as compared with £10,069, an increased revenue of £1,717. The accounts show a balance on the revenue account of £4,044 (after crediting depreciation fund account with £1,250) as compared with a balance of £3,705 (after crediting depreciation fund account with a like amount), on the revenue account for 1912. After making due provision for debenture interest, dividend on preference shares, &c., and the placing of £500 to the credit of reserve fund account, the net revenue account shows a balance of £1,166 for distribution. Out of this sum the directors recommend the payment of a dividend at the rate of 5 per cent., less tax, for the past year on the ordinary share capital, which will absorb £758, thereby leaving £408 to be carried forward to the credit of the net revenue account for the present year. The following table shows the progress of the business :—

Year.	Number of connections.	Total revenue.	Total costs.	Gross profit.
1911	874	£8,679	£4,376	£4,303
1912	969	£10,069	£5,114	£4,955
1913	1,090	£11,786	£6,492	£5,294

This undertaking, in common with other undertakings of a like nature throughout the country, has suffered in consequence of the heavy rise in the cost of fuel during the past year.

Units sold, lighting, 370,125, as compared with 331,930 for 1912: power and heating, 672,475, as compared with 437,896; total, 1 042 600, as compared with 769,826; H.P. motors connected, 810, as compared with 753; total number of connections, 1,090, as compared with 969.

Newmarket Electric Light Co., Ltd.—The directors' report for 1913 shows that the equivalent of 1,918 33-watt lamps have been connected to the mains, making the total connected 29,729 lamps. Applications for a further 300 lamps have been received this year. The profit on working, added to £61 brought forward, amounts to £2,692, which, after providing for debenture and other interest, £733, leaves a balance of £1,958. A dividend of £4 per cent. is recommended, that £750 be carried to reserve for renewal of plant, and that £146 be carried forward. Mr. Albert Lane has been elected a director in place of Mr. F. W. Cobb, who retired on account of ill-health.

Folkestone Electric Supply Co., Ltd.—At the annual meeting the chairman (Alderman Spurgen) congratulated shareholders on the extremely satisfactory increase in the business during the past year. There was now, he said, being supplied the equivalent of 7,847 8-c.p. more lamps. He summarised the results stated in the report (see Electrical Review, page 500). The subsidiary branch at Sandgate had purchased current to the amount of £817, which was sold at 6d. per unit, and realised £1,283; and Hythe had taken current of the value of £2,354, and sold it at £3,806. The report was adopted.

O. C. Hawkes, Ltd.—After paying 5 per cent. on the preference shares, £3,006 is to be carried forward. An 11 weeks' strike disturbed the business and, ending in a considerable advance in wages, affected the profits, but good relations now exist.

Globe Telegraph and Trust Co., Ltd.—An interim dividend at the rate of 2s. per share on the ordinary shares is payable on 31st inst.

Robey & Co., Ltd.—The profits for 1913 were £25,412. A dividend of 5s. per share is to be paid, carrying forward [illegible]

Continental Electrical Companies.

The report for 1913 of the *Swiss Electrical Industry Co.* (*Schweiz-Gesellschaft fur Elektrische Industrie*) of Basle, which is closely associated with the group of the Siemens & Halske Co., states that the company took over portions of new issues in the Societa Elettrica Riviera di Ponente and the Siemens Elektrische Betriebe, and the underwriting business also experienced changes. The gross profits amounted to £180,000, as compared with £136,000 in 1912, and the net profits were £69,200, as against £69,300; the dividend proposed is at the rate of 7 per cent. on ordinary share capital of £800,000, being the same as in 1912. During the year the company made a fresh issue of £600,000 in bonds, thus increasing the loan capital to £2,400,000.

The report of *Felten & Guilleaume, A.G., of Vienna*, states that the stock of orders brought over from 1912 afforded adequate work and equivalent profits in the first half of 1913, but business became slacker with every succeeding month, and restrictions in working had to be made. After placing £16,900 to the depreciation account, as compared with £18,300 in 1912, the accounts show net profits and balance forward amounting to £92,100, as against £117,160 in the previous year. It is proposed to pay a dividend of 15 per cent., as contrasted with 17½ per cent. in 1912. The report remarks that no improvement in activity has taken place in the new (the current) financial year, and it is not expected that a decided change in the situation will occur in the near future. If, however, the monetary requirements of the Government are met, the company estimates that large orders will be received from the State. It is added that the stock of orders standing over from 1913 is considerably less than a year ago.

The balance-sheet of the *Société Suisse pour l'Industrie Electrique*, of Basle, Switzerland, for the last financial year, shows a net profit of £69,655, as compared with £69,350 in 1912. A dividend of 7 per cent. is again being declared.

The *Société Industrielle des Telephones*, of Paris, reports a net profit of £68,370 for the last financial year. It has been decided to apply a sum of £25,200 to depreciation, £2,045 to legal reserve, £430 to bonuses, while the shareholders are to receive £38,400 in dividends, leaving £2,295 to be carried forward.

The report of the *Kabelfabrik und Drahtindustrie Gesellschaft*, of Prague, for the last financial year shows a net profit of £50,723, as compared with £41,850 in the preceding year. The net profit in the case of the Kabelfabrik Gesellschaft, of Pressburg, amounts to £27,242, as against £27,303 in 1912. In both cases a dividend of 12 per cent. is being repeated.

The report for last year of a number of electrical undertakings in Italy have lately made their appearance. *La Societa Electricita Alta Italia* made a net profit of £61,969, as compared with £62,088 in 1912. A dividend of 5½ per cent. is again being declared on a capital of £1,000,000. The net profit reported by the *Union Italiana dei Tramvie Elettriche*, of Genoa, amounts to £78,448, as contrasted with £78,214. The same dividend as in 1912, 9½ per cent., is being paid. The balance-sheet of the *Societa Siciliana d'Entreprises Electricas*, of Milan, shows a profit sufficient to pay a dividend of 8 per cent., and to apply a sum of £16,000 to reserve and depreciation. The net profit of the *Societa Officine Electrica*, of Genoa, has advanced from £69,539 to £89,268. The shareholders are receiving a dividend of 10 per cent. The *Societa Adriatica d'Electricita*, of Venice, reports a net profit of £46,640, as against only £32,112 in 1912. The dividend is being increased from 6 to 7 per cent. The report of *Societa Idro-Electrica Ligure*, of Milan, shows that the net profit increased from £20,492 to £28,375. The shareholders are receiving an 8 per cent. dividend, as compared with only 7½ per cent. in 1912. The *Societa Ligure-Toscana d'Electricita*, of Leghorn, is increasing its dividend from 6½ to 7 per cent.

London United Tramways, Ltd.

The directors' report for 1913 shows gross receipts amounting to £337,194. Including the balance brought forward, and deducting all expenses chargeable to revenue, including an appropriation of £20,000 to the reserve for reconstruction and renewals, there remains a balance of £14,601. It is proposed to pay a dividend on the preference shares at the rate of 1 per cent. per annum, £12,500, carrying forward £2,101. Expenditure during the year to the amount of £12,825 has been charged to the reserve for reconstruction and renewals, and £2,637 to general reserve. The gross traffic receipts, in spite of a smaller car mileage, show the satisfactory increase of £5,662 over those of 1912. Owing, however, to the increased cost of coal and material, and to special expenditure on permanent way and overhaul of rolling stock, the net profits show a decrease of £5,635. The work of welding the joints on the older lines has been completed. Pending a final settlement in the matter of the purchase of the company's tramways in Hammersmith the L.C.C. has agreed to make further advances to the company for the reconstruction of the remainder of the older lines within the Borough, and the work is almost completed. The directors have given their careful consideration during the year to the rates of pay and conditions of labour in various grades. As a result, amongst other concessions to employees, the directors have made a substantial increase in the rate of pay of conductors. A Bill is being promoted by the company in the present Session of Parliament to empower them to enter into working agreements with the owners of tramways and railways and for various other purposes.

TRAFFIC SUMMARY

	1912	1913
Mileage open at 31st December	43.5	43.5
Passengers carried	61,149,285	62,645,125
Car miles run	9,454,504	9,407,226
Average receipts per car mile	8.06d.	8.05d.
Average receipts per passenger	1.304d.	1.26d.
Cars in stock at 31st December	338	338

The meeting was held on Wednesday

British Aluminium Co., Ltd.

The directors' report for the year to 31st December, 1913, states that the trading profit for the year, together with interest and dividend on investments and deposits, and the revenue derived from Kinlochleven and Foyers Estates, and transfer fees, was £268,720, plus £10,207 brought forward.

This has been dealt with as follows:—Provision for income tax, legal expenses, bad and doubtful debts, depreciation of investments and furniture and proportion of profits payable to directors, £23,007; prior lien debenture service fund, £48,000; debenture stock service fund, £43,224; reserve for depreciation, £50,000; carried to reserve account, £50,000; leaving £64,696. The directors recommend the dividends of 6 per cent. per annum on the preference share capital, requiring £17,974, and of 5 per cent. per annum on the ordinary share capital, requiring £30,031, leaving to be carried forward, £16,690. The dividends will be paid on 1st April. It is now proposed that the dividend on the preference shares be paid half-yearly on 1st April and 1st October in each year. The interim dividend in respect of the current year will be paid on 1st October, 1914. The reserve account, including £50,000 added out of the profits of the year, amounts to £130,000. The depreciation reserve account, including £50,000 set aside out of the year's profits, now stands at £150,000. The various works of the company have been operated satisfactorily during the year. Additional plant has been installed at the aluminium works at Vigelands, Norway, thereby increasing the productive capacity of these works. The new rolling mills at Warrington, Lancashire, are now in operation, and the power plant for these works is in course of erection. Arrangements have been made for a temporary supply of power meantime. Land has been acquired at Burntisland, Scotland, and arrangements are in course of preparation for the erection of a works for the manufacture of alumina for supply to the company's factories in Norway and elsewhere. Further extension is also required to the works at Kinlochleven for the manufacture of carbon electrodes, and arrangements are in progress in this connection. The company has purchased from its subsidiary company a large tonnage of good quality bauxite, in order to secure a reserve of raw material. This will only be used if and when required to supplement the supply under existing contracts. The output and sales for the year have been satisfactory. The prices obtained show a considerable improvement over the previous year. The demand for the metal continues to increase, although at the present time there is a temporary slackness, due to the general falling off in trade in the chief markets at home and abroad. There is no change to report with regard to the Orsières power and railway schemes. The company's rights and interests are properly safeguarded.

The meeting is to be held to-day.

Metropolitan Electric Tramways, Ltd.

The directors' report for 1913, shows that the revenue was £539,246. Including the amount brought forward and deducting all expenses chargeable to revenue, there remains an available balance of £52,282, out of which £12,000 is to be placed to reserve account; £25,000 is required for dividend on the preference shares; dividend on the ordinary shares at the rate of 3 per cent. absorbing £14,230; £1,052 being carried forward. In March last the directors issued £50,000 5 per cent. debenture stock, the balance of the total amount authorised. £4,740 4½ per cent. debenture stock and £2,500 5 per cent. debenture stock was bought and cancelled during the year under the provisions of the trust deeds. The Metropolitan Electric Tramways (Railless Traction) Act, 1913, received the Royal assent in August. Negotiations are proceeding for the transfer to the Middlesex County Council of the powers conferred upon the company by the Act. The through running arrangements with the L.C.C. referred to in the two preceding reports have been extended to other service routes converging at Finsbury Park, and the company's cars now run to the Euston, Holborn and Smithfield termini of the County Council's system. The facilities thereby given of travelling between the centre of London and the various northern suburbs without the necessity of changing cars are greatly appreciated by the travelling public. The agreement with the L.C.C., under the terms of which the company had for five years the exclusive user of the short length of tramway in the Archway Road, Highgate, expired in December last, and has been temporarily renewed pending the completion of negotiations for the institution of a through service between Barnet and London *via* that tramway. An agreement has been entered into with the Hertfordshire County Council for the abandonment of the authorised light railways in Watford and Bushey, the directors being of opinion that the revenue obtainable from these districts would not yield a sufficient return upon the capital expenditure which the construction of the railways would require.

TRAFFIC SUMMARY

	1912	1913
Mileage open	[illegible]	[illegible]
Passengers carried	[illegible]	[illegible]
Car miles run	[illegible]	[illegible]
Average receipts per car mile	[illegible]	[illegible]
Average receipts per passenger	[illegible]	[illegible]
Cars in stock	[illegible]	[illegible]

The meeting was held on Wednesday.

North Metropolitan Electric Power Supply Co., Ltd.

The directors' report for 1913 states that the revenue was £164,407, an increase of £21,115 over 1912, and the expenditure £85,773, an increase of £11,115. The balance of £78,634 at the credit of the account compares with £71,[illegible] in 1912. Adding interest and dividends receivable and the amount brought forward from last account, there is a total of £[illegible]. After providing for mortgage, loan and debenture interest, transferring £2,000 to reserve to secure the debentures, and placing £21,150 to the credit of the depreciation account (increasing it to £100,000), the dividend on the 6 per cent. cumulative preference stock and the payment of a dividend at the rate of 6 per cent. per annum, together with a bonus at the rate of 12s. per fully-paid share on ordinary shares, there is £1,054 to be carried forward. The capital expenditure during the year amounted to £66,181, making the total £752,252. A further issue of £40,000 5 per cent. mortgage debentures, to which reference was made in the last report, was sold in April, 1913. During the year the third and the final instalments, amounting to £50,000, on the £100,000 6 per cent. cumulative preference stock issued in 1912, were paid up. The directors have accepted an offer for the purchase, at a premium, of a further issue of £100,000 6 per cent. cumulative preference stock. The total number of units sold was 34,430,384, which, compared with the previous year's figure of 29,231,099, is an increase of 5,199,285 units, or approximately 18 per cent. The building and plant extensions in connection with the Brimsdown and Hertford power stations referred to in the last report are now completed. The extensions of the Willesden and St. Albans power stations are still in progress. The shareholders have approved a Bill which has been deposited in the 1914 Session of Parliament to increase the authorised capital of the company to £1,000,000, and to confer further powers on the company and the North Metropolitan Electrical Power Distribution Co., Ltd. The business of the North Metropolitan Electrical Power Distribution Co., Ltd., continues to develop satisfactorily, and a dividend at the rate of 6 per cent. has been paid by that company in respect of the past year.

The annal meeting was held at the Electrical Federation Offices, W.C., on March 20th, Mr. E. Garcke presiding.

The Chairman, in moving the adoption of the above report, said that as the whole of the ordinary shares were held by the Metropolitan Electric Tramways Co., any remarks he made were addressed to the preference stockholders. The position of the company, both from the point of view of the ordinary shareholders and of the preference stockholders was a very satisfactory one. The ordinary shareholders were receiving a larger dividend, while the preference shareholders were receiving 6 per cent. per annum through good and bad times, which could not be described as a small return seeing that they had priority both as to dividends and capital, and that the profits of the company were sufficient to cover the preference dividend nearly five times. The growth of the company's business continued satisfactory. The units sold last year amounted to 34½ millions, or an increase of 18 per cent. over the preceding year. The revenue for the past year amounted to £164,400, which was an increase of £21,000, equal to about 15 per cent., over the revenue of the preceding year. One, perhaps, unsatisfactory feature was the fact that the expenses of generation did not go down in the same ratio as the volume of business increased. There had been no actual increase of the generating expenses so far as the administrative expenses were concerned, and, indeed, they were rather less, but they had had to pay something like £3,500 more for rates and taxes, which represented about one per cent. on the ordinary capital. The reason the generating expenses did not go down relative to the increased output as might be expected was that they had had to pay more for coal and other items necessary for production. However, there was in the opinion of the directors every reason to be hopeful for the future. They expected a still further extension of business and they hoped to be able to secure a reduction of costs if that were possible. The load upon their stations having increased very considerably, they had had to enlarge the plant at all their power houses, and the extension of the main to which they made reference in the last report was now, of course, being carried out. It would involve a somewhat large expenditure of capital, but they were satisfied that it would fructify and fully justify itself in the course of a few years. This extension necessitated an increase of capital. They issued some more preference stock last year, and also a small amount of debenture stock. They proposed to issue a further £100,000 of preference stock in the course of this year. They obtained a very satisfactory price for the stock they issued last year, and they had been able to place the £100,000 preference stock which they proposed to issue this year at practically the same figure, which he thought spoke very well for the credit of the company. They had received a 6 per cent dividend from the North Metropolitan Electrical Power Distribution Co., of which they held the whole of the shares. That company was progressing very nicely and the business was developing satisfactorily. Their contribution to the depreciation fund had now raised that fund to £100,000, which, they would agree, was a very substantial sum in relation to the paid-up capital. Shareholders might have expected him to say something with regard to the scheme for dealing with the London electric supply situation, but fortunately they were outside that controversy and he need make no reference to it. They had a Bill in Parliament in which they sought power to increase their capital and to make various modifications in the existing acts which experience had shown to be desirable. In conclusion, the Chairman congratulated the shareholders on the efficient management of the company under Mr. Devonshire and his very able staff.

Sir Ernest Spencer seconded the motion and it was agreed to.

British L. M. Ericsson Manufacturing Co., Ltd.

The ordinary general meeting was held on March 18th at the Memorial Hall, Farringdon Street, E.C., under the chairmanship of Mr. W. M. Crowe.

In proposing the adoption of the report (see Elec. Rev., page 415), the Chairman said that the company continued to make good progress; and that the prospects for the current year were exceedingly good. The net profit for the past year had amounted to £23,809 and that was after writing off £10,503 for depreciation and paying debenture interest of £2,500. That result might be considered as a very fine one in view of the fact that wages had gone up considerably during the year and other expenses had increased. The net profit for the previous year was £18,563, so that last year there was a net increase of £5,219. The depreciation might be considered a generous allowance, and he would like to point out that the company had been very particular in writing down its capital assets each year from the commencement. He noticed that some newspapers stated that although they deducted £10,500 for depreciation in 1913 nothing was debited in 1912. As a matter of fact they put £10,000 aside that year and during the past six years they had written off no less than £69,000 for depreciation. That, he thought, proved that they had been very liberal in their writings off. In addition they had always kept up the standard efficiency of the plant, buildings, and machinery at their factory at Beeston, and each year they had written off liberally any doubtful stocks. Those facts, and the fact that no amount stood in the books for goodwill, patents, or any such thing, proved that the company was in a sound and healthy condition. The directors recommended that the balance of the preliminary expenses, which in the ordinary way would have been spread over four years, be entirely written off, which left the company absolutely without a single doubtful asset of any kind. The past year was fairly satisfactory as far as orders were concerned, but he regretted to say it was necessary to cut prices often to a very fine point so as to secure orders from the Post Office. Had it not been that they had had a large amount of work other than telephone work the result would not have been as good as it was. That outside work was becoming an important factor in the company's business and the directors were doing all in their power to encourage and extend it. It seemed that the telephone had not made such progress in this country as it was expected it would when the Post Office took over the business of the National Telephone Co., and the consequence was there was not sufficient work in the country for all the telephone manufacturers. Therefore they had to look elsewhere in order to keep their factory going. They had a scheme in hand at the present time by which they hoped to tap a source of telephone work that was new to them as a company. In the past they had confined themselves to making and supplying only high-class telephone material such as was required by the Post Office and other Government offices and the Colonies, and they had left the making of the cheaper class material to other manufacturers. They intended now to go into that business and to appeal to the contractor whose business it was to supply telephones to private houses, factories, hotels, &c., and they hoped to secure a part of that business. It was a growing business and would increase as the telephone became more indispensable. Their policy had always been to keep up the standard of workmanship and finish for which their Beeston factory had been noted, and they intended to keep up that standard for all Government work and for such work as they put into the switchboard which they supplied last month to Windsor Castle; but they must produce the cheaper class instrument in order to meet the demand he had referred to. At their factory they had machinery of the very latest type; they had an enormous capacity for turning out work cheaply.

Mr Harold Sands seconded the resolution and the report was adopted without discussion.

London and Suburban Traction Co., Ltd.

The directors, in their report for the period ended 31st December, 1913, state that the company was incorporated in November, 1912, for the purpose of consolidating the interests of the shareholders in the Metropolitan Electric Tramways, Ltd., the London United Tramways, Ltd., and the Tramways (M.E.T.) Omnibus Co., Ltd., and for acquiring interests in other similar concerns. The following is a list of the shares acquired:—

	Total Number of Shares issued.	Shares Acquired at 31st Dec., 1913.
Metropolitan Electric Tramways, Ltd.—		
£1 Preference (fully paid)	500,000	448,463
£1 Ordinary (fully paid)	474,336	461,915
London United Tramways, Ltd.—		
£10 Preference (fully paid)	125,000	121,069
£10 Ordinary (fully paid)	100,000	97,935
Tramways (M.E.T.) Omnibus Co., Ltd.—		
£1 Ordinary (1/- paid)	200,000	200,000
South Met. Elec. Tramys. & Ltg. Co., Ltd.—		
£1 Preference (fully paid)	169,569	168,246
£1 Ordinary (fully paid)	181,190	181,190
Gearless Motor Omnibus Co., Ltd.—		
£1 Ordinary (fully paid)	28,040	2,490
Do. do. (16/- paid)	10,000	10,000
1/- Deferred (fully paid)	100,000	Nil.

By means of these investments the company has secured important interests in tramway, omnibus and electric supply undertakings operating within Greater London, and these are detailed in the report.

The undertakings and operations of the North Metropolitan Electric Power Supply Co. (the only shares of which are held by the M.E.T., Ltd.), and the N.M.E.P.D. Co. (the whole of whose capital is held by the N.M.E.P.S. Co.), and the South Metropolitan Electric Tramways and Lighting Co., Ltd., are also summarised in the report.

The capital of the company at 31st December, 1913, was as follows:—

	Authorised.	Issued & fully paid.
4½ per cent. First Mort. Deb Stock	£550,000	£179,385
5 per cent. Cum. Pref. Shares of £1 each	£1,700,000	£1,591,999
Ordinary Shares of £1 each	£1,900,000	£1,840,270

With the exception of the 507 preference shares taken up by the signatories to the memorandum and articles of association, which were paid for in cash, the whole of the above debenture and share capital was issued as fully paid in connection with the acquisition of shares in other companies. For the purpose mainly of providing the funds required for the completion of the purchase of the omnibuses of the Tramways (M.E.T.) Omnibus Co., Ltd., the company has obtained advances from its bankers amounting at 31st December last to £160,000. The directors have made arrangements for an issue of capital for the purpose of repaying these advances and providing additional working capital for the subsidiary undertakings. The company's revenue for the period under review, consisting almost entirely of the dividends and interest receivable upon its investments in and loans to the subsidiary companies, amounted to £105,371. After deducting all expenses chargeable to revenue, including debenture and loan interest, there remains a balance of £88,252. Out of this the 5 per cent. dividend on the preference shares has been paid, leaving a balance of £8,597, which the directors propose to carry forward. The directors anticipate that the income of the company from investments will be considerably larger in future years, especially as the omnibus fleet was not in full service until August last.

Direct Spanish Telegraph Co., Ltd.

The 62nd ordinary general meeting was held on March 18th at Electra House, E.C., Sir J. Denison Pender, K.C.M.G., presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev., page 448), said the traffic receipts showed an increase of £65. That was hardly worth mentioning by itself, but when it was taken in connection with the increase in 1912, which amounted to over £3,000, he thought they were fortunate in having even so slight an increase in the revenue. The traffic from the 1st of January of the present year showed satisfactory results, in fact, it was pretty well up to the average of the previous two years, and therefore if there was no great falling off in the next nine months he thought that they might have pretty much the same satisfactory accounts to present at the next meeting. The working expenses for 1913 showed an increase of £1,158. It was in the salaries at the stations where the advance had taken place, owing to a revision of salaries which the directors considered it just to make and which came into force on July, 1st, 1912. That revision, including the normal increases which would have taken place had meant an addition of £1,170 to the salaries of the operating staff. The balance of the £33,000 which they expended in 1911 on the partial renewal of the Bilbao cable, disappeared from the accounts as they had taken £8,168, which was the balance left over, out of the reserve. The Bilbao cable was interrupted on the 3rd October last and was repaired on the 14th of the same month, so that the interruption only lasted for 12 days. The cost of the repairs, £2,506, had been charged against revenue account. The £30,000 4½ per cent. debenture stock, issued 20 years ago, was repayable on 30th June next, and £29,024 had been put aside for that purpose—£800 of the debentures having already been purchased and cancelled some time ago.

Sir A. J. Leppoc Cappel, K.C.I.E., seconded the motion and the report was adopted.

Mackay Companies.

THE accounts published by the Mackay Companies give the following particulars:—

Income from investments in other companies...		$4,202,413.30
Disbursements:—		
Dividends on preferred shares ...	$2,000,000	
„ common shares ...	2,069,020	
Operating expenses, including transfer agents, registrars, auditors' and trustees' compensation, office rent, salaries, stationery, engraving of certificates, &c.	30,587.70	
Balance carried forward	102,805.60	$4,202,413.30

BALANCE-SHEET.

Assets:—		
Investments in other companies		$91,997,714.19
Cash		471,995.31
		$92,469,709.50
Liabilities:—		
Preferred shares issued	$50,000,000	
Common „ „	41,380,400	
Surplus	1,089,309.50	$92,469,709.50

Automatic Telephone Manufacturing Co., Ltd.

MR. JAMES TAYLOR presided over the second ordinary general meeting held in Liverpool on Monday.

In moving the adoption of the report and balance-sheet, the CHAIRMAN said the profit for the year amounted to £24,166, an increase over the previous year of £10,668, which under all the circumstances, the directors considered satisfactory. The directors' faith in the future of the automatic telephone had, if anything, been strengthened during the year's operations. The amount of actual automatic work completed had, however, been disappointing. The number of orders received had been quite satisfactory, but the company had not been able to complete any substantial amount of the work for the reason that the purchasers had not been ready to take delivery. In addition to the above, the company had orders from the British Post Office for automatic exchanges for Newport (Mon.), Portsmouth, Paisley, Chepstow and Accrington. Once that initial delay, which was beyond their control, had been overcome, the orders in hand and others, that it was confidently expected would be obtained in the near future, would follow in regular sequence through the factory. Several small automatic exchanges for commercial undertakings in this country had been supplied, and were giving satisfaction. A good commencement had been made with business abroad. The sum of £18,183 had been spent on capital account during the year, this being for additions to the factory and offices to cope with the increased business they expected in automatic telephone equipment in the near future. Altogether the directors felt that the prospects of the company for the future were brighter than the results shown by last year's working would appear to indicate.—MR. D. SINCLAIR, who seconded, said that they had on their books very good orders indeed, and the automatic system had not disappointed them in the slightest degree. From a commercial point of view they knew that Government departments, built, managed, and exercised as they were, were of necessity slower than some other commercial departments, and they had to submit and wait as shareholders, because the Government were the only important buyer in the country, and, as they were the Government, the company had to comply with the conditions which existed. There was nothing wrong with the conditions except perhaps that the Government were a little slower than some of them would like to see. The motion was unanimously carried.

South Metropolitan Electric Trams and Lighting Co., Ltd.—The directors report that the total revenue for 1913 was £63,135, compared with £61,944 for the preceding year. After deducting expenses, payments to local authorities under agreements, interest on debenture stock, and setting aside £3,000 to the renewals fund, there remains a surplus of £15,026. It is proposed to place to reserve £5,000, to pay a dividend of 6 per cent. on the preference shares, £10,174, carrying forward £775. The *Financier* states that the gross receipts from the tramways and light railways amounted to £45,443, an increase of £301. The company's motor-omnibuses commenced running in August, and the net receipts therefrom amounted to £1,035. The gross receipts from the electricity supply section (including the sale of energy to the tramways) amounted to £15,694, as compared with £14,124 for 1912. The total units sold during the year, including 198,697 supplied to the tramways, were 1,034,061, as compared with 920,316 in 1912. The units sold for lighting and power purposes were 835,364, an increase of 107,784 units. The number of consumers at December 31st last was 1,759, as compared with 1,535.

Crompton & Co., Ltd.—The *Times* reports that a meeting of the debenture-holders of Crompton & Co. was held on Monday by order of the Court, at which the proposed scheme of arrangement was passed by a large majority. The debenture interest will be raised from 5 per cent. to 5½ per cent.

Urban Electric Supply Co., Ltd.

THE directors report that for the year ended December 31st, 1913, the gross profits amount to £[illegible] as compared with £[illegible] a year ago, and after deducting the expenses shown in the profit and loss account, a balance of £[illegible] is carried down to net profit and loss account. In the latter account the amounts required for interest and debenture stock redemption absorb £[illegible], leaving an available balance, including the sum of £[illegible] brought forward, of £23,021, which the directors recommend should be applied as follows:—To reserve for depreciation, £12,000; to dividend of 1 per cent. for the year on the preference shares, £10,000; to balance to be carried forward, £1,021. The balance of the 5 per cent. dividend on the preference shares will be satisfied by funded dividend certificates in accordance with the terms of the resolution passed and confirmed at the extraordinary general meetings held on February 2nd and 17th, 1912. The following table shows the equivalent in 33-watt lamps connected, and the gross profits, at December 31st of each year:—

	Lamps.			Gross profits.		
	1911.	1912.	1913.	1911.	1912.	1913.
Hawick	65,599	70,251	[illegible]	£1,840	£1,7[illegible]	£1,962
Stamford	32,411	34,515	40,[illegible]	1,407	1,[illegible]	2,0[illegible]
Weybridge and Walton ..	6[illegible]	71,[illegible]	7[illegible]	[illegible]	[illegible]	6,[illegible]
Godalming	32,271	[illegible]	[illegible]	3,[illegible]	3,41[illegible]	3,443
Twickenham and district	113,068	129,166	146,162	10,[illegible]	11,612	12,129
Dartmouth	24,543	25,271	26,[illegible]	2,657	2,410	2,171
Camborne and Redruth and Cornwall	105,178	146,954	179,[illegible]	[illegible] 727	13,869	19,657
Newton Abbot	20,719	22,761	24,[illegible]	1,695	2,[illegible]	2,252
Grantham	39,269	40,586	42,962	2,[illegible]	3,1[illegible]	3,182
Glossop	28,782	33,125	35,422	2,983	[illegible]	2,651
Berwick	21,683	25,[illegible]	24,958	1,565	1,616	1,728
Caterham	16,563	18,426	19,916	1,636	1,927	2,074
Newbury	23,675	24,926	26,423	2,259	2,873	2,746
Total	589,737	677,495	760,819	£[illegible]0,850	£57,136	£64,871

The meeting is called for April 1st.

Shawinigan Water and Power Co.—For 1913 the directors show that the increase in gross income is $121,211. With the completion of the addition to the two plants at Shawinigan Falls, now under construction (says the *Financial Times*), there will have been made the largest single increase in capacity ever undertaken by the company. This installation consists of three additional units of a total capacity of 45,000 H.P. A second transmission line of the steel tower type has also been built to Three Rivers, which city continues to develop as a market for power. The net earnings amounted to $1,473,400, out of which dividends amounting to 6 per cent. have been paid; there has been transferred to reserve and sinking funds, $206,483; to contingent fund, $10,000; to depreciation reserve, $100,000; leaving a balance at credit of profit and loss of $19,878.

Companies Struck Off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

Auto Conveyors.
British Electrics (Moseley's Patents).
British Patent Tube Cleaning Syndicate.
Davies Patent Boiler.
Ecco Battery and Electrical Co.
Electromuse.
Hunslet Electrical Pottery Co.
Madeira Electric Lighting Co.
Mutual Electricity Supply Co.
Premier Electric Lamp Co.
Simplex Arc Lamp Syndicate.
Westminster Automatic Telephone Syndicate.

Minehead Electric Supply Co., Ltd.—Mr. H. D. Leather presided at the annual meeting. He said that they had had a very satisfactory year with an advance from 181,417 to 212,969 units, and an increase from £2,893 to £3,257 in income. The works costs per unit were ·93d., a decrease of 15 per cent. The increase in revenue was mainly due to heating and cooking. They proposed to adopt a new system of charging based on the rateable value of the premises supplied. The speaker referred to the excellent services of Mr. Swarbrick, the engineer and manager, and of the employés. The report was adopted.

Richardsons, Westgarth & Co., Ltd.—The directors' report for 1913 shows a definite improvement but unfavourably affected by the delay in completing the contracts taken before the trade boom set in. The steam turbine department is well supplied with work, including two land units of 18,000 and 15,000 H.P. respectively, which are among the largest in the country, also a marine geared-turbine twin-screw set of 6,000 H.P. The position generally is more favourable than for several years past, and, given normal labour conditions, a continuation of the improvement shown in the year under review is reasonably assured.

Continental.—FRANCE.—A new company has lately been formed at Chatelard (Savoy), with a capital of £6,000, and the title La Société d'Eclairage Electrique et de Forces Motrices des Bauges, to put down a plant to utilise the water power of the River Cheran in the generation of electrical energy for lighting and power purposes to a number of small towns in the district.

SWITZERLAND.—The Oerlikon Akkumulatorenfabrik Gesellschaft is declaring a dividend of 20 per cent. for the last financial year, the same as for the preceding twelve months.

American Telephone and Telegraph Co.—For 1913 the net earnings were $10,576,746, an increase of $2,669,102 over 1912. Interest charges were $7,656,656 and the dividends at the regular rate of 8 per cent. were $27,454,037. Of the balance, $5,466,053, there was carried to reserves $2,500,000 and to surplus $2,966,053. The directors say: "The proprietors of the company should rest quietly, and not be scared or frightened into sacrifices of their securities. Whether Government purchase be ultimately decided upon or not, the property is well worth more than the market price of its securities. This is not mere assertion, it is an established fact. Friendly and unfriendly appraisals of the various properties have been made; in no instance has the appraised value been placed below the book value, while in most instances it has been placed in excess."—*Financial News.*

Cleveland and Durham Electric Power Co.—In the report for six months to December last capital expenditure on works is stated (according to an abstract in the *Financial News*) to have been £14,500 and gross profits, including dividend receivable from Cleveland and Durham County Electric Power Co. for 1913 of £18,900, amount to £25,700. After providing for debenture and other interest there remains £16,175, plus the amount brought forward, making £18,641. It is proposed to pay 5 per cent. dividend on preference shares, to transfer to depreciation and renewals account £1,000, to reduce expenses of issue of debentures by £500, and carry forward £8,798. Connections to the company's system at December 31st increased by 3,700 H.P. during the six months, and a further 12,500 H.P. has been arranged for.

Wedmore Electric Light and Power Co.—At the annual meeting held last week, the managing director, Mr. W. G. Burrough, in the chair, shareholders expressed complete satisfaction with the manner in which the affairs of the company had been carried on, various extensions having been made in lighting the villages of Theale and Blackford. A dividend of 5 per cent. was paid.

Weaverham (Northwich) Electric Supply Co.—According to a financial daily a dividend of 5 per cent. on the ordinary shares is announced. After writing 20 per cent. off preliminary expenses and providing for depreciation, £45 is carried forward. Revenue from sale of electricity has increased by 80 per cent., and the area is being extended to include Sandiway and Buddington villages. Overhead distribution is employed.

South Staffordshire Tramways Co., Ltd.—The annual meeting was held on Monday. Mr. S. R. Blundstone, who presided, said that the income for the year was £3,546. After meeting expenses and writing off depreciation on investments, a dividend of 3½ per cent. was to be paid on the preference shares.

Stock Exchange Notices.—The Committee has ordered the following to be quoted in the Official List:—

Buenos Ayres Lacroze Tramways Co.—£500,000 5 per cent. con. mort. debs. of £100, Nos. 5,001 to 10,000, in lieu of scrip.

Vancouver Power Co., Ltd.—Further issue of £650,000 4½ per cent. perp. guar. deb. stock.

Browett, Lindley & Co., Ltd.—A financial daily states that after providing for interest charges and writing off £5,062 for depreciation, the accounts for 1913 show a net profit of £3,661, reducing the debit balance of £17,562 brought forward to £13,901.

Lancashire Dynamo and Motor Co., Ltd.—The directors have declared a dividend at the rate of 10 per cent. per annum on the ordinary shares, making 8 per cent. for the year 1913.

Alldays & Onions Pneumatic Engineering Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum on the ordinary shares is recommended for the past half-year.

STOCKS AND SHARES.

Tuesday Evening.

With prices in the Stock Exchange so dependent upon the political situation, and with the sentiment swaying from day to day, what is written on Tuesday night may have the appearance of something akin to nonsense on Friday morning. The financial paragraphist, always alive to this responsibility, feels more than ever that he must tread circumspectly in such conditions as now obtain. For depression and buoyancy follow so quickly upon one another's heels, even in the course of an hour or two, that the strength of markets this evening may be shattered before this appears printedly.

The Stock Exchange settlement just concluded found plenty of money available for employment, and this being so at the end of the quarter, it may be taken as conclusive testimony to the amount of capital awaiting investment so soon as political conditions permit of a rise in the Stock Exchange markets. Inquiries made in person throughout some of the provincial centres afford equally conclusive evidence of the willingness to invest, and the ability to do so, on the part of a large section of the public which is shaping its course according to the events in Westminster and Ulster. That trade is less buoyant than it was a little while ago, few people deny, but that there are plenty of orders still going, is admitted in the same breath.

Last week's new issues left underwriters in some cases with substantial proportions of their obligations. The London and Suburban Traction Debenture issue was taken up to the extent of only about 6 per cent. by the public. The Toronto Power Company's offer of Debenture stock also left the public cold, underwriters being saddled with something like 80 per cent., and the price of the latter scrip is quoted at 2½ discount, while the London and Suburban Debenture dropped to 6 discount upon the issue price of 92. Probably enough, however, the underwriters will find homes for both securities in course of time; and although the stream of new issues has been checked to some extent, there are appeals being prepared for the public, the advent of which may be expected before long. For instance, we understand that the General Electric Company is about to take powers to issue substantial amounts of new Ordinary and new Preference shares.

The County of London new shares have been quoted about 2s. premium, this being considerably below what they would probably have been started at in the market, had it not been that proprietors were offered the opportunity of subscribing for more shares than they were entitled to in virtue of their existing holdings. This being the case, of course neither shareholders nor jobbers were anxious to buy shares in the market when there was a chance of their being able to get them at the issue prices from the company. After the allotments, no doubt fairer premiums will develop.

Bournemouth and Poole shares have again risen, because of the scarcity of the supply and the fact that there are one or two buyers about. But the market for Electricity Supply shares as a whole is somewhat dull. Cities, Counties and St. James have all gone back. Westminster Preference regained their $\frac{1}{16}$ decline. The heated controversy which has arisen as to the scheme in connection with the holding company has had the effect of keeping people away from the market, rather than encouraging them to acquire fresh interests; so that until something definite is settled, we scarcely look for any particular movement in prices. The passage of the County of London's Bill would illuminate the situation not a little; whether it will go through or not seems to be regarded as a matter of great speculation.

The Urban Company has done well, and, on the good results now announced, the price of the Preference shares hardened to 3.

Affairs in Mexico are at this moment considered to be tending towards some unravelment of the tangled skein of domestic politics over there, and it is stated that the United States Government has at length sent a representative to treat with General Huerta, with the idea of evolving some sort of order out of the chaotic conditions too long prevalent. On the hope that the mission might be successful, most stocks and shares connected with Mexico experienced substantial recoveries, the railway stocks being prominent in the rise, followed at a more respectful distance by the securities connected with the utility concerns. These last had some fresh cause for anxiety in the threat made at the end of last week to dispossess the Mexican Light and Power Company of its concessions—a threat that was promptly denied.

Mexican Light and Power Common have gained a point, but the 5 per cent. First Mortgage Gold bonds are easier, being now quoted at almost the same price as the company's 7 per cent. Cumulative Preference shares. Mexico Trams Common are 4 points higher, but, oddly enough, both issues of the bonds have fallen. Declines in Rio Tramway First and Second bonds did not amount to much. Brazil Tractions slumped at one time to 79¼, from which there has been a smart recovery to 82, leaving the shares 1½ down on the week. Para Electric Railways Ordinary lost ⅛, and most of the markets connected in any way with Brazil have been dull, with a better tendency on Tuesday.

Anglo-Argentine Tramways First Preference shed ⅛, which brings the return on the money to over 5¾ per cent., the shares now obtainable at a small discount. British Columbia Deferred rose 2, this market, as a whole, being steady. Toronto Power 4½ per cent. Debenture fell 2½ upon the result of the company's offer of stock, mentioned above. La Plata Tramways are slightly easier.

Home Railway stocks, after a bout of flatness, hardened substantially at the beginning of the week. Comparatively little stock changed hands, and sentiment was largely responsible for putting up prices hand-over-fist. Metropolitans are 2 up, but the Surplus Lands stock is again a point lower. Underground Electric Income bonds gained 1½. Districts are steady at 29, having been 27½. London and Suburban Traction issues are unchanged, but London United Tramways 4 per cent. Debenture stock dropped 3 to 62, the offer of a small amount finding the market by no means anxious to take it.

Changes in the Telegraph and Telephone list are not exciting. Amazons dropped ½ to 6. Small declines tock place in Anglo-American Deferred, Eastern Ordinary and West India and Panama shares. Westerns retained their rise at 13⅝, at which they stand just £1 higher than Eastern Extensions, the dividends on both being 7 per cent. The Eastern Extension position is a thoroughly sound one, and an exchange from one into the other would give an increase of about 7s. 6d. per cent. in the return. Oriental Telephones have hardened. Marconis went back in the general depression, but rallied from their loss. Reuters are weak at 8½. Telegraph Constructions at 38 are 10s. down. Of the manufacturing list, British Insulateds are strong, with a 5s. advance, and British Westinghouse 4 per cent. Debenture went up 2. British Aluminiums are the turn easier.

Rubber again rose to half-a-crown per lb., and the Mincing Lane auctions this week have been satisfactory to the sellers. Rubber share prices show moderate improvements, but in this section, as in so many others, public interest has been smothered by Ulster.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 24th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	15½ — 17½	..	..
Do. Do. Deferred ..	100	..	..	6½ — 8½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	3	..	56 — 59	.	5 1 8
Do. 5 % Perp. Deb. ..	100	5	5	96 — 99	+1	5 1 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Central London Railway, Ord. ..	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 5
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Def.	100	2	2	57 — 62	..	3 4 6
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	.	5 3 1
Do. Do. 1896	100	5	5	93 — 96	—1½	5 4 2
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1903	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	67 — 72	..	6 5 0
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 3
Lancashire United, 5 % Deb. ..	100	5	5	87 — 89	+1	5 12 4
London and Suburban, Ord. ..	1	..	..	7/32 — 9/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅝ — ¾	..	6 18 4
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	79 — 84	..	5 7 2

NAME.	Stock or Share.	Dividends for		Closing Quotations March 24th.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	60 — 64	—3	6 5 0
Metropolitan Railway Consol. ..	100	1⅝	1⅝	42¾ — 43¼	+2	3 15 2
Do. Surplus Lands	100	2¾	2¾	61 — 63	—1	4 7 3
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	..	4 5 4
Metropolitan District Ord. ..	100	Nil	..	28¾ — 29¼	+ ¼	Nil
Do. 6 % Deb.	100	6	6	138 — 141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	85 — 88	..	5 2 2
Do. 3½ % Gtd.	100	3½	3½	71 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 9
Do. 5 % Deb.	100	5	5	88 — 91	..	5 10 0
Potteries, Ord.	1	3½	..	⅜ — ½	..	..
Do. 5 % Pref.	1	5	5	17/32 — 21/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	3 — 3½	..	Nil
Do. "A"	1/-	..	..	⅜ — 7/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 — 114	..	5 5 3
Do. 4½ % Bonds	100	4½	4½	99 — 101	..	4 9 0
Do. 6 % Income	100	6	6	89½ — 90½	+1½	6 12 7
Yorkshire (West Riding), Ord. ..	5	Nil	..	5/16 — 9/16	..	Nil
Do. 6 % Pref.	5	3	4	4 — 4½	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	83 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 11/16 — 5 1/16	— ⅛	5 17 4
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 9/16	..	6 0 7
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 — 106	..	4 14 3
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 — 100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	81 — 83	—1½	7 4 7
Brisbane Trams Invt., Ord. ..	5	8	8	7⅝ — 8⅛	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 — 101	..	4 9 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	115 — 119	+2	6 14 6
Do. Pref. Ord.	100	6	6	104 — 108	—1	5 11 1
Do. 5 % Pref.	100	5	5	100 — 103	—1	4 17 2
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	94 — 96	+ ½	4 8 7
Calcutta Trams, Ord.	5	7½	5†	6¼ — 6¾	..	5 11 1
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 18 4
City Buenos Aires Trams (1904)	5	5	5	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	95½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord. ..	1	..	..	¼ — ½	— 1/16	..
Do. Pref.	1	4⅜d.	6	⅞ — 1	..	6 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1¼ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1⅛ — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	5 — 5⅜	..	5 11 7
" Elec. Tr. (1904), Deb. ..	100	5	5	101 — 103	..	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ — 100½	..	4 19 6
Mexico Trams Com	$100	7	7	73 — 76	+4	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	78 — 82	—2	6 2 0
Do. 6 % Bonds	100	6	6	75 — 79	- 6	7 12 0
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	4¾ — 4⅞	— ⅛	10 5 2
Do. 6 % Pref.	5	6	6	4⅛ — 4⅜	..	6 8 9
Do. 5 % 1st Deb.	100	5	5	92 — 94	..	5 6 5
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	94 — 96	—1	5 4 0
Do. 5 % Mort. Bonds	100	5	5	87 — 89	..	5 12 5
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 — 100	+1	5 0 0
Singapore Trams, 5 % Deb. ..	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	95 — 98	..	5 2 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	+ ½	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord. ..	10	6	7	10¾ — 11¼	+ ¼	6 4 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	+ ½	4 10 0
Do. Second 6 % Pref.	10	6	6	10¼ — 10¾	+ ¼	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 97	..	4 12 9
Brompton & Kensington, Ord. ..	5	10	10†	9 — 9⅝	..	5 4 0
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 9⅛	..	3 16 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91½ — 94½	..	4 4 8
Charing Cross, West End & City	5	5	6	4½ — 5	— 1/16	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅞	..	4 12 4
Do. " City Undertaking " 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅜	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	Stock	4½	4½	97 - 100	..	4 10 0
City of London, Ord.	10	9	10	17 — 18	— ¼	5 11 1
Do. 6 % Cum. Pref.	10	6	6	12¾ 13¾	..	4 7 3
Do. 5 % Deb.	Stock	5	5	116 - 120	..	4 7 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 - 103	..	4 8 1
County of London, Ord.	10	6	7	12 — 12½	— ½	5 12 8
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	— ⅛	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	102½ — 105½	— ½	4 5 9
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 — 103	..	4 7 5
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	93 —	..	4 14 9

Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 8	..	5 12 6
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1 7/16 — 1 13/16	..	4 12 8
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4¼	4½	3½ — 4	..	5 6 3
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ - 10½	..	5 14 3
Oxford	5	7	7	5 13/16 6 5/16	..	5 11 0
St. James' and Pall Mall, Ord. ..	5	10	12	9⅜ 9⅞	— ⅛	6 1 6
Do. 7 % Pref	5	7	7	6½ — 7 xd	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5½	5½	3 — 3⅜	..	6 10 4
Do. 5 % First Mort. Deb. ..	100	5	5	98 - 101	..	4 19 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/32 — 1 9/32	..	5 9 2
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 - 100	..	4 10 0
Urban, Ord.	£3	Nil	..	⅜ - ⅝	..	
Do. 5 % Cum Pref.	5	3¾	4	2¾ — 3¼	+ ⅛	6 3 1
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86 — 89	..	5 1 3
Westminster, Ord.	5	10	10	8½ — 9	..	5 11
Do. 4½ % Cum Pref.	5	4½	4½	5 1/16 — 5 5/16	+ 1/16	4 4 9

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* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 8s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 24th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Adelaide, 6 % Pref.	5	6	6	5 — 5¼	..	5 14 3
Calcutta, Ord.	5	8⅛	5†	7⅝— 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5⅜— 5⅝	..	4 18 0
Calgary Power, 1st Mort. Bds.	100	5	5	90 — 92	..	5 8 8
Canadian Gen. El. Com.	$100	7	8	113 —117	..	6 16 9
Do. 7 % Pref.	$100	7	7	123 —128	..	5 9 5
Cordoba Lt., Power and T., Ord.	1	5	..	7/16— ⅝	..	7 12 0
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88 — 90	..	6 13 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	..	5 5 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32— 3/32	..	Nil
Do. 6 % Pref.	1	6	6†	13/32— 17/32	..	10 11 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1½— 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	105½—106½	..	4 14 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	65 — 70	—2	7 2 10
Mexican Lt. & Power, Common	$100	4	4†	41 — 44	+1	..
Do. 7 % Cum. Pref.	$100	7	7	78 — 82	..	8 10 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	78 — 80	—3	6 5 0
Do. 5 % 2nd Mort. Bonds	100	5	5	65 — 69	..	7 4 11
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	54 — 59	..	..
Montreal, Lt., H. and Power	$100	9	10†	230 —235	..	4 5 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	235 —245	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	103 —108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	102 —104	..	4 6 7
Shawinigan Water, Capital	$100	5½	6†	138 —142	..	4 4 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	..	4 8 8
Toronto Power, 4½ % Deb.	Do.	4½	4½	94 — 96	—2½	4 18 9
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Victoria Falls Power, Pref.	1	6	6	23/32— 25/32	..	7 18 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	100 —102	..	5 17 8

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 24th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	23/32— 27/32	..	8 5 0
Do. 6 % Pref.	1	6	6	¾— ⅞	..	6 17 2
Babcock & Wilcox	1	16	14†	3 5/32— 3 9/32	+ 1/32	4 17 6
Do. Pref.	1	6	6	1 5/16— 1 7/16	..	4 8 6
British Aluminium, Ord.	1	..	..	1 1/16— 1 3/16	— 1/16	..
Do. 6 % Cum. Pref.	1	6	6	⅞— 1	+ 1/32	6 0 0
Do. 5 % Prior Liens Debs.	100	5	5	96 — 99	..	5 1 0
Do. Deb. Stk.	100	5	5	88 — 93	..	5 7 6
B.I. & Helsby Cables	5	10	13	9¾— 10¼	+ ½	6 6 10
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	102 —105	..	4 5 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	2	Nil	..	1 7/16— 1 9/16	..	Nil
Do. Deb.	100	4	4	70½— 72½	+2	5 10 6
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	39 — 43	..	10 9 6
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	11¾— 12¼	..	6 2 4
Do. Pref.	5	5	5	4 15/16— 5 3/16	..	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	22½	2½— 2¾	.	..
Do. Deb.	100	4½	4½	104 —107	+1	4 4 1
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	⅜— ⅝	..	..
Do. Pref.	1	6	6	23/32— 27/32	..	7 2 9
Edison & Swan, A, £2 paid	5	Nil	..	1/16— 3/16	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	17/32— 21/32	..	7 12 6
Do. Pref.	1	7	7	15/16— 1 1/16	..	6 11 7
Greenwood & Batley, Pref.	10	7	7	6¾— 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10¼— 10½	..	5 14 3
Do. Deb.	100	4	4	86 — 90	..	4 9 0
Henley's, Ord.	5	15	20	13½— 14½	..	6 17 11
Do. Pref.	5	4½	4½	4¾— 5	..	4 10 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	7½	10½— 11½	..	6 10 5
Do. Pref.	10	5	5	8¾— 9½	..	5 5 3
Telegraph Construction	12	20	20	37 — 39 xd	— ½	6 8 1
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref.	100	..	..	50 — 55	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 24th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾— 6¼	— ½	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	124 —127	+1	6 6 0
Do. Collat. Trust	$1000	4	4	91 — 94	..	4 5 3
Anglo-American Telegraph	Stock	3	3	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	108½—109½	..	5 9 4
Do. Def.	Do.	30/-	30/-	23½— 24	— ½	6 5 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7⅜— 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	81½— 83½	..	4 16 0
Cuba Telegraph	10	6	6†	8¾— 9¾	..	6 8 1
Do. 10 % Pref.	10	10	10	15¾— 16¾	..	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3½— 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	..	7½— 8	..	6 5 0
Direct United States Cable	10	4	4†	6¾— 7¼	..	5 10 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	132 —135	—1	5 3 8
Do. 3½ % Pref. Stock	Do.	3½	3½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	+1	4 1 8
Eastern Extension	10	7	7	12⅜— 12⅞	..	5 8 9
Do. 4 % Deb.	Stock	4	4	94½— 96½	+ ½	4 3 0
Globe Telegraph and Trust	10	6	6†	11⅜— 11⅝	..	5 1 1
Do. 6 % Pref.	10	6	6	12½— 13	..	4 12 4
Great Northern Telegraph	10	20	5†	32 — 34	..	5 17 8
Indo-European Telegraph	25	13	5†	58 — 60	..	5 8 4
Mackay Companies Common	$100	5	5	85 — 89 xd	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	70 — 73 xd	..	5 9 7
Marconi's Wireless Telegraph	1	20	20	3½— 3⅝	..	5 10 4
Do. 7 % Cum. Partic. Pref.	1	17	..	2 13/16— 3 1/16	..	5 10 3
Monte Video Telephone, Ord.	1	6	6	13/16— 15/16	..	6 8 0
Do. 5 % Pref.	1	5	5	¾— ⅞	..	5 14 8
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99¾ - 100¾	..	4 9 0
Oriental Telep. and Elec.	1	10	8†	2⅛— 2⅜	+ ⅛	4 4 3
Do. 6 % Cum. Pref.	1	6	6	1 3/16— 1 5/16	+ 1/16	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	87½ - 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 - 100	..	4 0 0
Reuter's	10	10	10†	8 — 9	— ½	11 2 2
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½ - 98½	..	4 11 5
United River Plate Telephone	5	8	6†	6⅜— 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5⅛— 5⅝	..	4 9 0
West Coast of America	2½	2½	..	1 5/16— 1 7/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	1½	2⅜ — 2⅝	— 1/16	4 15 3
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞ — 10⅛	— ⅛	5 18 5
Do. 6 % Cum. 2nd Pref.	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	10	7†	7	13⅝— 13⅞	..	5 0 11
Do. 4 % Debs.	Stock	4	4	95 — 97	..	4 2 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 — 98	..	4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

An Ornamental Power Station.—The outside of the Barmbeck power station (Hamburg rapid transit system) was compulsorily made decorative owing to the proximity of the Hamburg municipal park, and the operating company voluntarily decided to make the inside of the station equally ornate, so that the whole building now forms one of the finest stations (architecturally) in Europe. The outer walls are broken by square-figured panels and arched pilasters round the doorways and windows. The smoke-stack (261 ft. in height) is surrounded by columns for a considerable height, the remainder being fluted. The turbine room and basement are tiled to a height exceeding 6 ft., and the switchboard gallery and stairs are similarly finished. Decorative lines and patterns are used in the window recesses and elsewhere to break the monotony of the tiles, and the lighting and other fixtures are very artistic. The high-tension switchboard compartments are of Duro asbestos, the bottoms being finished with tiles, and a dyke being formed at the front to prevent burning oil overflowing into the aisle. The board itself is of Duro asbestos finished in Dutch tile for the sake of appearance.

TRADE STATISTICS OF INDIA.

The following figures of the imports of electrical and similar goods into British India in the year ended 31st March, 1913, are taken from the recently issued official trade statistics; details for the year ended 31st March, 1912, are added for purposes of comparison and notes of any increases or decreases are given.

	1911-12. £	1912-13. £	Inc. or Dec. £
Brass, wrought.—			
From Great Britain ...	37,000	34,000	— 3,000
,, Germany ...	7,000	10,000	+ 3,000
,, Austria	3,000	3,000	—
,, Other countries	18,000	25,000	+ 7,000
Total	65,000	72,000	+ 7,000
Copper and copper ware.—			
From Great Britain ...	1,023,000	813,000	— 210,000
,, Germany ...	525,000	653,000	+ 128,000
,, Belgium ...	15,000	7,000	— 8,000
,, France	88,000	28,000	— 60,000
,, Austria	7,000	5,000	— 2,000
,, Japan	125,000	61,000	— 64,000
,, Other countries	10,000	14,000	+ 4,000
Total	1,793,000	1,581,000	— 212,000
Iron wire.—			
From Great Britain ...	8,000	55,000	+ 47,000
,, Germany ...	22,000	47,000	+ 25,000
,, Belgium ...	23,000	23,000	—
,, Other countries	16,000	26,000	+ 10,000
Total	69,000	151,000	+ 82,000
Iron and steel plates and sheets.—			
From Great Britain ...	2,809,000	3,194,000	+ 385,000
,, Germany ...	240,000	284,000	+ 44,000
,, Belgium ...	98,000	147,000	+ 49,000
,, United States ...	234,000	200,000	— 34,000
,, Other countries	5,000	1,000	— 4,000
Total	3,386,000	3,826,000	+ 440,000
Steam engines (except locomotives).—			
From Great Britain ...	402,000	312,000	— 90,000
,, Germany ...	22,000	8,000	— 14,000
,, United States ...	9,000	5,000	— 4,000
,, Other countries	5,000	2,000	— 3,000
Total	438,000	327,000	— 111,000
*Electrical machinery.**—			
From Great Britain ...	193,000	198,000	+ 5,000
,, Germany ...	30,000	18,000	— 12,000
,, Belgium ...	2,000	1,000	— 1,000
,, Italy	13,000	6,000	— 7,000
,, United States ...	26,000	7,000	— 19,000
,, Other countries	3,000	11,000	+ 8,000
Total	267,000	241,000	— 26,000

* In 1912-13 imports of generators were £38,071, of motors £99,296, of other kinds £103,000. Similar details were not available previously.

Mining machinery.—			
From Great Britain ...	43,000	50,000	+ 7,000
,, Germany ...	—	1,000	+ 1,000
,, United States ...	40,000	11,000	— 29,000
,, Other countries	1,000	1,000	—
Total	84,000	63,000	— 21,000
*Machinery, other (except textile and agricultural).**—			
From Great Britain ...	902,000	574,000	—
,, Germany ...	114,000	45,000	—
,, Belgium ...	6,000	5,000	—
,, United States ...	62,000	31,000	—
,, Other countries	19,000	10,000	—
Total	1,103,000	665,000	—

* The details for the two years are not strictly comparable, those for 1911-12 including some items which were not included in 1912-13.

Railway carriages, &c.			
From Great Britain ...	883,000	1,495,000	+ 612,000
,, Belgium ...	7,000	22,000	+ 15,000
,, Other countries	26,000	67,000	+ 41,000
Total	916,000	1,584,000	+ 668,000
Locomotives and tenders, and parts thereof.—			
From Great Britain ...	526,000	596,000	+ 70,000
,, Germany ...	5,000	7,000	+ 2,000
Total	531,000	603,000	+ 72,000

	1911-12 £	1912-13 £	Inc. or Dec. £
Rails and fishplates			
From Great Britain	557,000	769,000	+ 212,000
,, Germany .	33,000	7,000	— 26,000
,, Belgium ...	2,000	—	— 2,000
Total	592,000	776,000	+ 184,000
Electrical instruments, apparatus, &c.			
From Great Britain ...	391,000	432,000	+ 41,000
,, Germany ...	35,000	54,000	+ 19,000
,, Belgium ..	1,000	4,000	+ 3,000
,, Austria	4,000	7,000	+ 3,000
,, United States ...	5,000	34,000	+ 29,000
,, Other countries	4,000	21,000*	+ 17,000
Total	440,000	552,000	+ 112,000

* Italy £15,000.

Electric fans.—			
From Great Britain ...	—	20,000	—
,, Italy	Details	14,000	—
,, United States ...	not	19,000	—
,, Germany ...	available.	3,000	—
,, Other countries	—	1,000	—
Total	—	57,000	—
Electric lamps and parts.—			
From Great Britain ...	—	33,000	—
,, Germany ...	Details	8,000	—
,, Austria	not	2,000	—
,, Japan	available.	2,000	—
,, United States ...	—	2,000	—
,, Other countries	—	2,000	—
Total	—	49,000	—
Electric wires and cables.—			
From Great Britain ...	—	132,000	—
,, Germany ...	Details	15,000	—
,, Belgium ...	not	2,000	—
,, Other countries	available.	2,000	—
Total	—	151,000	
Scientific, &c., instruments.—			
From Great Britain ...	102,000	80,000	— 22,000
,, Germany ...	5,000	4,000	— 1,000
,, United States ...	2,000	2,000	—
,, Other countries	5,000	6,000	+ 1,000
Total	114,000	92,000	— 22,000
Telegraph construction materials.—			
From Great Britain ...	1,000	8,000	+ 7,000
Telephone construction materials.—			
From Great Britain ...	Not	19,000	—
,, Germany ...	available.	1,000	—
Total	—	20,000	—

In addition to the foregoing, the following were imported as Government stores:—

Instruments, apparatus, &c. (except musical).—			
From Great Britain ...	119,000	136,000	+ 17,000
,, Germany ...	3,000	3,000	—
,, United States ...	1,000	—	— 1,000
Total	123,000	139,000	+ 16,000
Machinery.—			
From Great Britain ...	187,000	169,000	— 18,000
,, Germany ...	23,000	1,000	— 22,000
,, United States ...	1,000	3,000	+ 2,000
Total	211,000	173,000	— 38,000
Iron wire.—			
From Great Britain ...	14,000	10,000	— 4,000
Iron and steel plates and sheets.—			
From Great Britain ...	39,000	50,000	- 11,000
Railway carriages.—			
From Great Britain ...	753,000	734,000	— 19,000
,, Other countries	5,000	—	— 5,000
Total	758,000	734,000	— 24,000
Locomotives.—			
From Great Britain ...	299,000	482,000	+ 183,000
Rails and fishplates.—			
From Great Britain ...	423,000	198,000	— 225,000
Telegraph construction materials.—			
From Great Britain ...	86,000	72,000	— 14,000
Copper and copperware.—			
From Great Britain ...	134,000	97,000	— 37,000
,, Other countries	10,000	58,000	+ 48,000
Total	144,000	155,000	+ 11,000

REVIEWS.

Electric Lighting. By A. H. Avery. London: Cassell and Co., Ltd. 1913. Price 2s. net.

This book is a guide-book for the amateur wireman, and from its very nature can scarcely be expected to receive favourable notice from the practical electrical engineer. It would be difficult to find any branch of handiwork less suited to the efforts of the amateur than "Electric Wiring," and it is certainly a very dangerous proceeding to recommend to the readers of "Work," to whom the preface of the book is specially addressed, that they should undertake the electric lighting of their own houses.

Having said so much, it must be admitted that Mr. Avery has made good use of his opportunities, subject to certain definite self-imposed limitations. The book treats the subject in the most elementary fashion, and deals only with such technical points as would be necessary to make explanation of the instructions easy.

Mr. Avery practically confines his instructions to such as would be required for small houses requiring 20 lights or so, and it is possible that by very carefully following those instructions a satisfactory installation would be obtained. Obviously, however, it is impossible, in a small volume of 150 pages, to foresee all the possibilities that arise in wiring work, and it is just in the small variations from standard arrangements that occur in every installation that the risk of defective work will occur.

For example, Mr. Avery advocates the use of slip tube, and though he rightly points out the importance of the electrical conductivity of the tubing system, there is but little doubt that the great majority of amateurs would fail to ensure this.

Mr. Avery's argument turns mainly on the necessity of satisfying the supply company's inspector, and he seems to imply that if that result is achieved, all is well. As the supply authority has no control over the system of wiring, so long as the insulation is in order, the inducement to do the work properly is small.

Mr. Avery's objection to screwed tubing, by the way, is rather naive. He advocates screwed continuity nipples, rather than screwed tubing, as "any wires already in position do not have to be twisted when tightening up a joint, because neither the tubing nor the fitting turns round, only the screwed nipple."

If anyone should take Mr. Avery's estimate of cost on pages 146 and 147 as representing average figures, it is probable that he will be disappointed, when they are compared with actual results. The quantity of tube provided for 17 lamps, including one 2-light and one 3-light fitting, or, say, 14 points, is 210 ft. only, or an average of only 15 ft. per point—an average run far below what is usually found necessary, even with several points in one room instead of one only, as in the case presented.

Mr. Avery has a chapter on "Self-contained Installations," in which he discusses in 15 pages, including illustrations and diagrams, the possibilities of lighting from an engine plant, from secondary and primary batteries, from water-power, wind-power and from miscellaneous sources. General agreement will be accorded to almost the last sentence in the chapter, which reads—"Manual labour as a motive power is never a very successful idea."

Beyond the Atom. By John Cox, M.A. London: Cambridge University Press. Price 1s. net.

This volume tells, within short compass, the romantic story of the discoveries which, within the last decade, have led us beyond the atom. For its compilation, all the standard text-books have been freely drawn upon, but principally those of Rutherford, Madame Curie, Strutt and Soddy. The author was a colleague of Rutherford, and he says in his preface—"I have also drawn upon my happy memories of those exciting times when, for nine years, I was privileged to witness at close quarters and to discuss from day to day the work achieved by my friend and colleague, Prof. Rutherford, in the Macdonald Physics Building of McGill University, Montreal, of which I was director."

The book is the best we have come across for the man engaged in scientific pursuits, who desires to possess a succinct knowledge of what is now known regarding the atom and radioactivity. It is small, cheap, and to the point: does not involve one in a mass of experimental detail; states the premises easily and gives the conclusions exactly. Nor is it elementary in character, for nothing is omitted that is of any value.

Chapter I commences with a short historical account of discoveries relating to the atom. The position reached in the seventies of last century is summed up in a famous passage from Maxwell's article in the "Encyclopædia Britannica," ninth edition, 1875, which concludes as follows:—"In the present state of science, therefore, we have strong reason for believing that in a molecule, or in one of its component atoms, we have something which has existed either from eternity, or at least from times anterior to the existing order of nature. But besides this atom, there are immense numbers of other atoms of the same kind, and the constants of each of these atoms are incapable of adjustment by any process now in action. Each is physically independent of all the others."

This was written at a time when the march of science had seemingly paused. During the century the whole field of natural knowledge had been systematically ransacked. It was felt that there was very little left for the future. But, as the author says, in science it is very unsafe to venture a negative, and the world was on the verge of discoveries which have given a Sophoclean irony to Maxwell's words.

Chapter II deals with the vacuum tube, and states the results of Crookes's experiments therewith, given in his famous lecture to the British Association in 1878. Crookes concluded that the kathode rays were streams of minute particles travelling at very high speeds, and each conveying a negative charge. Controversy raged round this theory both here and on the Continent, and it was reserved for J. J. Thomson, by a beautiful series of experiments, to clear up the matter and prove that these minute particles were electrons, each a thousand times as small as the mass of the hydrogen atom. The canal rays are next discussed. These consist of streams of particles of atomic size, and there are many types. For instance, in an oxygen tube were found ordinary molecules of oxygen, each consisting of two atoms united; neutral atoms; atoms with single or double positive charges; atoms with one negative charge; molecules with one positive charge; molecules of ozone (O_3) with one positive charge, and O_6 with one positive charge.

The X-rays are then considered. Their main properties are as follows:—They issue equally in all directions; they travel in straight lines, for they cast shadows; their power of penetration is not selective; they can be reflected, refracted and polarised, and made to show interference; they are unaffected by magnetic or electric fields; they excite fluorescence, affect a photographic plate, and render the air conductive. What are these rays? At present they are generally regarded as series of irregular pulses in the ether, but the theory is by no means firmly established.

Chapter III is entitled "The New Rays," and deals with the discovery of and experiments with the radioactive substances. In this connection it may be said that descriptions and diagrams of essential experiments are given throughout the book, but minus all superfluous matter.

Chapter IV deals with the new substances uranium X, thorium X, &c., the emanations from the radioactive substances, and the active deposits found on solids which have been in contact with the emanations.

Chapter V has to do with disintegration, and Chapter VI gives a family tree of radium and its derivatives. In connection with the disintegration theory, the confirmation by Dr. Gray and Sir William Ramsay is mentioned. These experimenters have succeeded in directly determining the molecular weight of the radium emanation, by weighing it and measuring its volume, temperature and pressure. The results of five experiments range between 227 and 218, with a mean of 223. Since the equivalent of radium is now established at 226·4, that of the emanation, resulting from the loss of one α particle, should theoretically be $226{\cdot}4 - 4 = 222{\cdot}4$, an extraordinarily close agreement.

Chapter VII is on "Verification and Results." For this purpose a few of the leading verifications are collected together.

Chapter VIII deals with the objective reality of molecules. A student may well be staggered by the inconceivable minuteness of the quantities in which he is called upon to believe. He may well ask himself whether the whole thing is not a myth or a delusion. But it is clearly shown here that the molecule is an absolute fact of Nature.

The last chapter considers the "New Atom" in the light of the foregoing. The general conclusion is as stated in the author's last paragraph :—"The new knowledge gained in the last decade is a true development, not a destructive resolution. Conservation of energy stands where it did, though unsuspected and enormous stores of atomic energy have been brought into view. And the atomic theory is still the guide of the chemist, though for the purpose of modern physics he has been compelled to look beyond the atom, and in the words of Blake :—

To see a world in a grain of sand,
And a heaven in a flower,
To grasp infinity in the palm of the hand,
And eternity in an hour.

—W. J. Crawford.

Electric Circuit Theory and Calculations. By W. P. Maycock. London : Whittaker & Co. Price 3s. 6d. net.

This work is intended to supplement the author's "Electric Wiring, Fittings, &c.," and his "Electric Lighting and Power Distribution." The ground covered by the present volume is primarily that embraced by the Grade I and Final City and Guilds Examinations in wiremen's work. The theoretical principles underlying numerical problems in electric installation work are expounded, and the working of such problems is illustrated. Magnetic circuit problems relate rather to design than to installation work, and accordingly receive no treatment in this volume. The numerous worked examples presented are divided into groups, each of which is preceded by a more or less complete exposition of the theoretical principles involved. Since the work is intended for the use of elementary students, no theoretical considerations of A.C. problems are included. It is an extremely difficult matter—particularly when one is familiar with theory—to determine exactly how much theory can safely and profitably be left out of such a work as this. On the whole, we believe the author has throughout drawn the line very suitably between explanation and mere statement.

The electric circuit and Ohm's law first receive treatment, and the information presented concerning battery E.M.F. and resistance, and the best combinations for various services, should do much to improve the practice of electric bell installation. In connection with Ohm's law and A.C. circuits (page 20), we think the author would be wise to take the reader more into his confidence concerning the "mechanism" of inductance in a choking coil. Following notes on the electrical production of heat and light, and instructive experiments with volt and ampere-meters, the author discusses the characteristics of conductors and non-conductors, and goes on to deal with the uses and qualities of various insulators, and with dielectric strength. The ensuing 40 pages take up the various principles and methods involved in calculations of resistance, conductance, conductor area, series and parallel circuits, &c. Here, as elsewhere, the paragraph headings are set out boldly so as to facilitate the finding of the exact section required, and the numerous examples are arranged very clearly.

The author explains clearly why the maximum permissible current density depends on the size of insulated conductors, and then proceeds to a consideration of pressure drop in closed and pressure distribution in open circuits. We do not care for "a.p.s.i." as an abbreviation for amperes per square inch, and, while on the subject of abbreviations, we see no advantage in terming the KW.-hour a *kelvin*. The name of Kelvin needs nothing to immortalise it ; KW.-hours is as quickly written ; and the term kilowatt-hour is descriptive, whereas *kelvin* is merely abitrary. The case of a fundamental unit (such as the ohm, the volt or the inch) is, of course, quite different.

The meaning of direct-current power and calculations connected therewith are explained clearly ; the interpretation and calculation of lamp and machine efficiencies are dealt with, and three-wire systems and their economy are considered. In a later edition, we think it would be wise to explain phase displacement in A.C. circuits, power factor and A.C. circuits and power calculations in greater detail. In the present edition, the author endeavours to spare readers the admitted difficulties connected with A.C. circuits but, in these days, we fear these difficulties must be encountered and overcome by every electrical engineer, and the present work is certainly one in which a thorough and exact grounding in A.C. calculations might very well be given. A.C. power and the numerical evaluation of measurements and problems connected therewith form at present a dreadful stumbling block to most students.

The author discriminates clearly between amount of heat and temperature, and between power and work or energy, and then deals at some length with practical electric heating and illuminating calculations. Leakance and insulation resistance are dealt with clearly as regards general principles ; the I.E.E. and Phœnix rules are presented ; and insulation resistance in ordinary circuits and in those exalted installations employing "modern switching systems" is considered. The comparison between gas and electric lighting and costs follows well-known lines, and the notes on charging systems should prove very useful.

At first we were surprised to find 40 pages devoted to arithmetic (decimals, proportion, reciprocals, equations and square roots), but on consideration, we believe this feature to be thoroughly good. Many men in practice become rusty in their arithmetic and a separate treatise, devoted exclusively and minutely to this subject, does not meet their needs, which are, however, well covered by the appendix to this volume. This work is to be recommended as excellent value. It is well arranged, well produced, well indexed, and contains 356 problems with answers, in addition to the large number of fully worked examples in the text.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

An interesting light on the accuracy of modern electricity meters when turned out from the factory is thrown by statistics published by the Dominion Government in a recent report showing that, during 1913, 118,639 meters were tested, out of which number only 189 were rejected. It should, perhaps, be explained here that each individual electricity meter, before it can be put into service, must be tested by the Government inspectors and stamped by them.

It is proposed to utilise lignite coal (of which there are extensive deposits in the Province) in the Edmonton district of Alberta for the generation of power on a large scale and to transmit the power at high voltage to the surrounding places.

The city of Edmonton contemplates spending about £100,000 this year on extensions to the electric power plant.

In Fort William, Ontario, a by-law is being submitted to raise money for improving and extending the telephone system, and the spending of about £18,000 is contemplated. Money has been already voted for the extension of the electric street railway system.

By-laws have also been carried recently in Hamilton, Ontario, and Humboldt, Saskatchewan, to spend $385,000 and $20,500 respectively on extensions to the electrical system.

Municipal ownership is becoming very popular in Canada, and frequently one hears of a street railway or electric lighting system being bought up by the town. Nelson, B.C., has just recently decided to buy the local street railway system.

Anyone who has been in Toronto during the last three years or so is almost sure to have heard of the battle that has been raging, largely in the newspapers, over the question of the city buying out the Toronto Street Railway Co. and the Toronto Electric Light Co. Several times it has seemed that the matter must shortly be decided one way or another, but, for some reason, nothing is done, and the long-suffering citizens pack themselves into the cars so closely, and the air therein rapidly becomes so foul, that one has visions of a mild form of Black Hole of Calcutta. For years this state of affairs has been declared to be absolutely intolerable, but it goes on still. Municipal tramcars, tubes and motor-'buses have been, and are now, acclaimed as suitable means of freeing the city, but nothing tangible has yet been accomplished.

It was announced a little while ago that a charter for a railway 111 miles long, to be operated electrically, and to run across the State of Maine and connect with existing lines in Quebec and New Brunswick, had been secured by the president of the St. John Valley Railway Co.

A goodly number of British firms are now represented in this country, and some few are erecting works here, among these being Armstrong, Whitworth & Co., who are building a large plant at Longveuil, Quebec. The Montreal Light, Heat & Power Co. will supply current for lighting and power.

Reference was made recently in these notes to the fact that two firms had come forward with proposals to build tubes for the city of Montreal. It is now understood that engineers there are preparing a report recommending that subways be constructed at once, connection being made with existing surface car routes.

Diesel engines and oil-fired boilers are recommended as reserve plant for hydro-electric power at Point Grey, B.C. The former seem to be growing in favour in Western Canada, as there are several plants in operation, and in some instances repeat orders have been given for additional plant.

The State of New York has sanctioned the formation of a new company which will import 46,000 electrical horsepower from the Electrical Development Co., on the Canadian side of Niagara Falls. The former company is limited to an average charge of $19 per horse-power year—*i.e.*, it must not pay more than this for its supply of energy.

This is a very different figure from the $9 per horse-power which the Hydro-Electric Power Commission of Ontario pays for its power, and no doubt the Electrical Development Co. will make a good profit out of the $19 charge.

According to the daily papers, the idea of utilising the very considerable fall which exists in the Niagara River between the foot of the falls and Queenston, where the river joins Lake Ontario, is being again brought up. The difference in level between these two points is about 60 ft., and it is stated that about 400,000 H.P. could be developed.

It is quite likely that this year will see the appointment of a commission to inquire into the power possibilities of the St. Lawrence River, which are very great; and it is probable that very soon an inquiry will be made by a commission on behalf of the Dominion Government into the commercial feasibility of the Georgian Bay Canal. The engineering problems have already been considered and reported on, but many people appear to think that it would be a financial failure. As it would be possible to generate a considerable amount of power by utilising the falls at the various locks, this point will receive the attention of the proposed commission, if one be formed.

Albania.—A German-Austrian company has been formed, under the style of the Deutsch-Oesterreichische Handels und Industrie Gesellschaft, with offices in Berlin, Trieste and Durazzo, for the financing and promotion of industrial undertakings in Albania. Large industrial firms, several banks, and a number of Albanian notabilities are joined in the scheme. The building of roads and the erection of factories are among the first objects of the promoters, for which electricity generated by water power will be employed. As Albania is plentifully provided with water, it is believed that the factories will soon be supplied with an abundance of cheap motive power.—*Zeitschrift für das Gesamte Turbinenwesen.*

RELIABILITY OF SUPPLY AND THE MAINTENANCE OF PLANT.

By L. MARSHALL JOCKEL, G.I.Mech.E., A.Am.I.E.E.

THE increased outputs of so many of our generating stations of late are no doubt largely due to the fact that the public are coming to regard a supply of electricity as not only a cheap and most serviceable commodity, but one which can be relied upon as well. The managements and directorates of manufacturing and industrial concerns have, with true commercial instinct, generally kept pace with the times, and availed themselves of a cheap and reliable supply of electricity when such has been offered, with due regard, of course, to the condition of their own power plant, and the capital expenditure incidental to changing over.

These factors have no doubt been instrumental in increasing station outputs generally, and those of municipal stations particularly, with, of course, the happy result that load factors have improved, and up-to-date and highly efficient generating plant has been installed to meet the new conditions.

Reliability of supply of service is therefore of paramount importance, and the modern generating station can only be a financial success when the conditions necessary for this essential obtain. In the case of power companies, the consumers may possibly be protected by indemnity agreements against financial losses due to an interruption in the supply, but up to the present municipal undertakings appear to fight shy of power supply under such conditions, although in the majority of cases they are probably in a better position with regard to standby plant and the loading of the distribution system.

The actual results of a shut-down can, however, hardly be gauged from a financial point of view, as the shattering of public confidence which is entailed has far-reaching effects, particularly in regard to prospective consumers, the lay mind naturally taking a considerable time to forget such incidents.

In view therefore of the great importance of reliability and continuity of supply, it is imperative that the generating machinery and the distribution system receive every possible attention and be maintained in first-class order and a high state of efficiency.

Whilst a defect in the distribution system is certainly unfortunate and detrimental in many respects, yet it must be allowed that a defect in the generating station equipment is usually of far greater importance, imperilling as it may the continuity of supply of the whole area served by the station. This is particularly the case in modern stations where a large area is often supplied from a central source in order to obtain the inherent advantages attached to generation on the most suitable site by means of large and therefore efficient units of plant.

Although the employment of large generating units certainly savours somewhat of the adage of "putting all one's eggs in one basket," yet the actual results would seem fully to justify this practice, and the tendency in up-to-date stations run on commercial lines, is to reduce the capacity of standby plant to as small an amount as possible consistent with safety, for obvious reasons. Further, the improvement of the load factor, which in most instances is due to the acquisition of a power load, generally results in the more precise loading, and possibly temporary overloading, of suitably graded plant, and this, of course, entails the necessity of maintaining the generating machinery in first-class condition, whilst low works costs can only be obtained by keeping the plant in a high state of efficiency.

Obviously then it is necessary that all routine work, such as cleaning, inspection, and minor adjustments to plant be efficiently carried out, and all defects which may develop in working be promptly discovered and rectified, if possible, before a breakdown somewhat forcibly concentrates attention on the matter and imperils the continuity of the supply. In a modern station of any importance it is generally conceded that the establishment of a system is necessary to ensure that such work is properly carried out, although there is perhaps a certain amount of so-called "red tape" almost inseparable from any system. Despite the disadvantages of "red tape" (which are perhaps sometimes unduly enlarged upon) there is much to be said in favour of a definite system, whilst it has the advantage of defining the responsibility of both the men and the officials responsible for supervision.

The actual system adopted in any specific case will, of course, be largely dependent upon the particular conditions obtaining, such as the size of the station, the class of plant installed, and the provision or otherwise of an adequate staff, while the individualities of the resident engineer and the executive officials will generally be influential factors. The personal factor is naturally of importance in any station, not only on the part of the resident engineer, but of his assistants as well, for unless there is a healthy spirit of camaraderie existing among the supervising staff, the best of systems will in all probability possess an inherent weakness.

Intimately bound up with the personal factor is the question of the training and capabilities of the supervising staff, for the writer is convinced that in a station of any importance the best results can only be obtained when the plant is in charge of properly qualified engineers, who have had both workshop and subsequent central station experience. Unfortunately the salaries offered in many undertakings do not attract the proper class of men, and the results are sometimes obvious on the cost sheets, for despite the introduction of up-to-date and highly efficient plant, the most sanguine expectations of the chief are never quite realised, or, if realised, are possibly not maintained for any great length of time. This is particularly true in regard to the steam-raising plant, for in a modern station some 50 to 70 per cent. of the works cost is generally accounted for in the boiler house, and obviously here is scope for economy and efficiency on the part of a properly trained engineer with sound mechanical experience.

Turning now to the actual question of routine and maintenance work, it will be evident that no very hard and fast rules can be laid down without a detailed knowledge of the specific conditions obtaining in any case, but experience in different types of power stations under public and private administration is certainly very helpful when considering the adoption of a system. Taking what is perhaps the most general case, a station of moderate plant capacity giving D.C. supplies for traction, lighting and power, and also a three-phase H.T.A.C. supply, the running staff will be under the direct supervision of the charge engineers, who in turn are responsible to the station engineer or superintendent, while the maintenance, or repair staff, will be responsible to the station superintendent.

The usual routine work such as cleaning, periodical inspection and testing of engine room plant, and possibly light repairs, will be undertaken by the running staff principally on the day and night shifts and at week-ends, while the maintenance of the boilers and engines and other heavy plant will be carried out by the repair staff, who are usually fitters with little or no technical knowledge. This system is fairly satisfactory in practice and possesses certain good features, but unfortunately it takes little account of the abilities and personality of each of the men concerned, and usually throws a somewhat excessive amount of responsibility on the station superintendent. Numerous instances of trouble which need never have arisen could be cited to illustrate this weak link of the system, the root of the whole matter generally being traceable to an insidious slackness or want of conscientiousness on somebody's part, the somebody concerned usually succeeding in escaping the consequences. Where this system is considered thoroughly satisfactory, it will generally be found on careful investigation that its successful working is not so much due to the system itself as to the fact that certain individuals (probably only one or two) either possess a splendid spirit of conscientiousness or else take an unusual interest in their work, it being almost a physical impossibility for the station superintendent to keep in touch with every detail relating to both the plant and the men engaged on the running and maintenance staffs.

In some stations a system of routine and maintenance work is adopted in which the plant is divided up into sections, and each section allotted to a responsible member of the running staff. The actual allocation of the plant will, of course, vary in different types of stations, but speaking generally, the charge engineers and switchboard attendants will each have a certain portion of the engine room plant, for the efficiency and cleanliness of which they will be held personally responsible. The sections of plant may be arranged so that each charge engineer has, say, one or more of the generating sets, with its auxiliaries and pipework, and possibly a section of the converting or transforming plant, while each switchboard attendant may have a portion of the switchgear, battery and booster plant, and electrical auxiliaries and lighting circuits, etc.

If there is a grading of the technical staff as regards pay, and seniority, or to lessen the effect of any question of overlap with regard to the sections, the allocation of the plant may be arranged so that each charge engineer or switchboard attendant has a complete portion for which he is responsible. For example, the senior charge engineer may have the prime movers and generators, the second charge engineer the condensers, auxiliaries and pipework, while the third charge engineer could be responsible for the converting and transforming plant or auxiliary machinery in the engine room and boiler house.

The boiler plant should preferably be under the direct supervision of the station superintendent, for unless it is kept in a high state of efficiency and repairs are promptly executed, the works costs will unmistakably bear witness to the fact.

The actual cleaning of the plant will, of course, be allocated to the cleaners or greasers whether the responsibility is divided up or not, but it is futile to expect that a cleaner, who has a portion of the plant under his care, can also take the responsibility for routine and maintenance work, which generally requires some engineering training and technical knowledge for its efficient carrying out.

The adoption of a system on the lines indicated renders it necessary for each item of the plant to be thoroughly inspected from time to time by the person responsible, any extensive repairs required being promptly reported to the station superintendent, so that if necessary the plant affected may be taken out of commission and thus not jeopardise the reliability of the supply. If thought desirable a report sheet can be made out, say, every week by the charge engineers responsible for each portion of the plant, the sheet giving particulars regarding the routine work and also details of any adjustments or repairs executed, which can be entered up later in the plant record books or filing system.

It may be argued that the adoption of such a system entails extra work on the part of the charge engineers and the switchboard attendants, who in some stations are sufficiently occupied with running duties, but generally the time involved is a comparatively small fraction of the shift, and in practice the argument proves to be more apparent than real.

It is undoubtedly true that unless the responsibility of each member of the staff is clearly defined and a definite system of working inaugurated, then it is indeed a difficult matter to unearth the responsible person if a breakdown of plant or interruption of the supply occurs, either due to neglect or the adoption of a don't worry policy, for "what is everyone's job is no one's job," and satisfaction is neither given nor obtained.

THE GULSTAD VIBRATING RELAY.[1]

By W. JUDD, M.I.E.E.

In this description of the Gulstad Vibrating Relay the object is to bring to general notice this remarkably ingenious and efficient piece of telegraph apparatus.

Devised by Mr. K. Gulstad, some time Engineer-in-Chief to the Great Northern Telegraph Company of Copenhagen, and given freely to the world by means of descriptions in the Electrical Review of June, 1898,* and August, 1902,† it has been in use by that company for over 20 years, and in more recent years by other telegraph administrations to a small extent.

This relay, while being several times as sensitive as the ordinary polarized relay, is at the same time much more stable in the presence of disturbances from neighbouring lines, or from a defective duplex balance. These most important and valuable features consequently give a higher speed and more stable signals than any other polarized relay known to the writer.

It is only applicable to double-current Morse signalling, and is efficient on all land lines and submarine cable having a K R of from 0.5 to 0.75 second. On a cable having a K R of 1 second it will give very fair results, but that is rather beyond the safe limit.

The somewhat remarkable combination of increased sensibility to signals and increased stability against disturbances, appears to be explained by a consideration of the vibratory circuits. Premising that no line current is present, it will be seen that when the tongue of the relay comes in contact with one or other stop, a condenser is charged through one relay auxiliary winding, pressing the tongue momentarily on this stop. Then, the condenser being charged, the current rises in the opposite auxiliary winding, through an external resistance, and pulls the tongue off, when the discharge current from the condenser flowing through both auxiliary windings throws it vigorously over on to the other stop. The same cycle of operations is then repeated with opposite polarity of the battery. In this manner a continuous and regular vibration of the armature and tongue is set up, with contacts firmly made and cleanly broken.

The speed of these vibrations must be made equal (or nearly equal) to the pre-arranged speed of dot signals from the line to which the relay is applied, by suitable adjustment of the values of capacity and resistance in the local circuit, and the rate of rise of the local current also must be made to correspond with that of the cable current.

When these conditions are fulfilled, the only duty left for the cable current is to control the vibrations. This control is obtained by furnishing the electromagnets of the relay with a separate winding through which the signals received from the cable pass.

The heavier currents in this "main" winding, *i.e.*, the cable "dash" or "space" signals, overpower the local vibrations, and hold the tongue on one or other stop according to their polarity, until such time that the dash or space being completed at the distant end of the line the strength of the cable current at the receiving end falls below that of the local current by an amount giving a preponderance to the latter. The armature is then surrendered to the local forces, is pulled off, and is driven vigorously over to the opposite contact by the discharge from the condenser.

When "dots" are received from the cable their current amplitude is so small that only a very slight control, and in some cases practically none at all, is exerted over the tongue.

If the cable to which the relay is applied is a short one, the dots may control the tongue's vibration to the extent of accelerating or retarding its natural rate, thereby tending to correct any difference of phase between the impulses of the cable dots and the relay vibrations. In working through a moderately long cable, however, the current amplitude of dots at the receiving end would not have any appreciable influence upon the vibrations, and only the heavier dash and space currents would control the relay, which, however, would still reproduce the dots perfectly, by reason of the continuation of the local vibrations during periods when no controlling force is present in the main winding to check them.

Briefly stated, the resultant effect of the controlling cable currents and the local currents in the relay is this: that where dots received from the cable are to be reproduced, the vibrations are allowed to continue, and where dashes or spaces occur, the vibrations are damped out; and the short and long contacts of the tongue thus obtained are registered on the local recording instrument with all the increased firmness and definition supplied by the local forces.

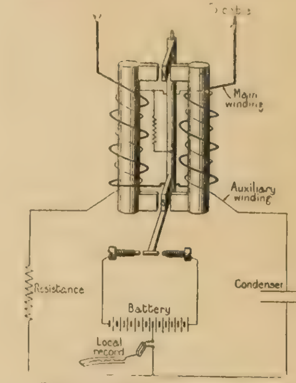
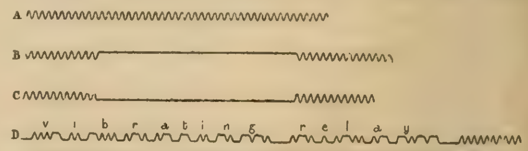


Fig. 1.—The Gulstad Relay.

With the Gulstad relay the cable current is relieved of the work of moving the armature and of overcoming the magnetic inertia which falls upon it with an ordinary polarized relay; great sensitiveness is thus attained. The instrument is also very adaptable to signals of varying character or of distorted formation, by reason of the elasticity of the electric combinations in the local circuit.



A, Vibrations free; B, Vibrations checked by marking current (dashes, &c.); C, Vibrations checked by space current; D, Signals.

Fig. 2.—Signals Registered on Local Record.

The accompanying diagrams, Figs. 1 and 2, illustrate the relation of the relay to its auxiliaries and show an example of the signals produced by it on the recording instrument.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

The annual general meeting of the above society was held on March 19th, at the Institution of Electrical Engineers, Victoria Embankment, Mr. A. Bruce Anderson presiding.

Before the business was proceeded with, the Chairman remarked that since the last meeting they had lost Sir William Preece, their President. He was a man ripe in years, full of the honours which the profession could award him, and much esteemed by all who knew him, and his death was greatly regretted.

In moving the adoption of the report and accounts, the Chairman said it was satisfactory to see that the grants were more than double those of the previous year. That, of course, was what the Institution existed for, and it was evidence of satisfactory progress. If they could continue doubling their grants for a few more years they would soon reach respectable figures. He must say that he felt that the work of the Institution was not sufficiently appreciated. There was no doubt as to its need, and he did feel that something ought to be done to make it a bigger thing than it was to-day. Many of the leading members in the industry had given a great deal of time to looking after the affairs of the Institution, and many had subscribed handsomely to the funds, but the smaller manufacturers and the rank and file of the industry had not yet been educated up to the necessity of supporting the Institution.

Mr. Justus Eck, Chairman of the Committee, in seconding the motion, said that it was very satisfactory to find that last year there had been an increase in the support accorded to the Institution, and that there had also been an increase in the money distributed in relief. As the Chairman had told them, they had spent double the amount in relief in 1913 as compared with 1912, and 1912 was double that of 1911, so it would be seen that they were making progress, and from what he had seen he thought he could tell them that the current year would be well ahead of its predecessors. They had had to cut their coat according to their cloth, and while they would have liked to have gone in for more propaganda work, their funds had not permitted of their doing so to any great extent. He found that when he made it a personal matter he could induce persons to join or subscribe to the fund; but it was very difficult to bring the claims of the Institution before those whom they particularly wished to see as members. He would particularly like to see the smaller firms, the electrical contractors, and the small manufacturers or middle men come in, for such firms could not look after their men in the same way as the big electrical companies and firms did. In the year 1913 the total capital invested in the railways of the United Kingdom was 1,310 million pounds, and the Railway Benevolent Institution, which looked after the railway servants, had an income of £76,000. He believed there were some 500 million pounds invested in the electrical industry, and therefore, in comparison with the railway industry, the income of their Institution was nowhere near in proportion to that of the Railway Benevolent Institution. He was hopeful that this year they would extend their activity to the provinces.

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[1] Excerpt from the *Journal of the Institution of Electrical Engineers.*

* Electrical Review, Vol. 42, pp. 751 and 792, 1898.

† *Ibid.*, Vol. 51, pp. 294 and 832, 1902.

The report was adopted.

The following retiring members of the Committee were re-elected:—Messrs. W. B. Esson, E. Garcke, T. E. Gatehouse, C. E. Hunter, C. Koettgen, W. Schmahl, A. A. Campbell Swinton, L. Thurnauer, and R. J. Wallis-Jones; and Lieut.-Col. Leaf and Mr. W. C. Mountain, of Newcastle, were added to the Committee.

The resignations of Mr. W. Davenport and Mr. T. J. Grainger as members of the committee were accepted with regret, and votes of thanks were accorded them for their past services.

A short discussion ensued as to the desirability of more of the rank and file of the industry becoming members of the Institution, Mr. W. R. Rawlings, Mr. R. W. Hughman, Mr. H. Bevis and other speakers pointing out that there was an impression abroad that the Institution was mainly an employers' affair. The speakers emphasised the fact that the Institution was really in the nature of a provident society, and that it should look for its main support from the rank and file who, in the event of need, could claim its benefits.

Mr. F. B. O. **Hawes** (the Secretary), while agreeing with the previous speakers, gave it as his opinion that they could not expect the rank and file to come in all at once. The class of "members" had, he said, only been in existence for about two and a-half years, and the numbers had steadily grown, and this year it would be found that the membership had increased 50 per cent.

A cordial vote of thanks to the Chairman, proposed by Mr. **Guy Burney**, and seconded by Mr. T. E. **Gatehouse**, concluded the proceedings.

ELECTRIC BATTERY VEHICLES.

Opening a discussion on this subject at the **Institution of Electrical Engineers**, on March 19th, **Mr. F. Ayton** said that the importance to the central station of the load to be obtained by a general use of electric vehicles could hardly be over-rated. It was in practically all cases an "off-peak" load; and as it would in nearly all cases come on during the night, when the majority of the other consumers had ceased to make any demand on the supply, it would have a tendency to flatten out the generating-station load curve in a most favourable manner.

At the moment, the most promising opening for the electric vehicle appeared to lie in its use for commercial purposes; but it was by no means improbable that the passenger-carrying vehicle would eventually be considered from the central station point of view almost as important as the commercial type.

It could not be too strongly emphasised that the electric vehicle of to-day was not to be judged by the experiences of even a few years ago in this country. Great advances had been made in storage battery construction, the design of the motors for electric vehicles had been improved, ball and roller bearings had been brought to a high pitch of perfection, chassis construction had been lightened, and better and more efficient rubber tires could be obtained.

The proper sphere of utility for the electric vehicle at the present time was undoubtedly in interurban and suburban districts where its mileage limit per charge was not a drawback. The lighter vehicles were generally capable of doing from 50 to 60 miles per charge, and in most cases this covered the daily requirements for work in such districts.

In the United States alone there were over 37,000 electric vehicles in use, of which more than half were passenger-carrying machines. About 40 firms were engaged in constructing these vehicles in America. In certain cities on the European Continent, also, this type of automobile was rapidly coming into general use, and hundreds were already running and giving satisfactory and economical service.

Within its own sphere the electric vehicle could show a degree of economy, and a record for reliability, with which no other existing type of vehicle could hope to compete.

For haulage purposes in large towns the days of the horse were numbered, and upon the basis of operating costs the electric vehicle was the only type of power-driven machine that could take its place. The relief of the traffic congestion in the main streets of our large cities and towns was an acute and pressing question. A general widening of main thoroughfares was economically out of the question; more efficient use must be made of the present street area. One obvious method of obtaining relief was to bar horse haulage entirely. A pair of horses and a large van took up nearly double the street area required for an average motor vehicle of the same capacity and for equal carrying capacity the electric vehicle took up the least space of any. Considerable further relief of the congestion would follow from the fact that a good commercial motor-vehicle could do in the same time more than twice the amount of work of two double-horse teams in city service. An immense saving would accrue to the business community by the wholesale adoption of motor transport for city service.

The already extensive adoption of the petrol type of commercial vehicle for this purpose had brought in its train noise and smell which were frequently the cause of bitter complaint. Both these disagreeable features were absent from the electric vehicle, and for this reason alone it should assuredly commend itself for universal adoption in large cities and towns.

The position of the electric vehicle could hardly be considered apart from methods of charging its battery. With the batteries at present fitted, the impressed voltage required towards the end of the charge was in the neighbourhood of 110 to 120 volts. Since the supply pressures in use were generally above 200 volts, in most cases the charging must be done through the medium of some pressure-reducing apparatus. It was essential that the charging operation should be made as simple as possible—practically automatic. It therefore remained for the central station authorities and the manufacturers to see that reliable automatic apparatus was provided, so constructed that when the correct terminal voltage for the whole battery (which was a good approximate indication of the battery's condition) had been reached, the motor-generator was automatically shut down. It was of great importance that vehicles should be able to run into any place where charging facilities were provided, and get connected up with ease. This pointed to the necessity of standard charging receptacles and plugs. The Electric Vehicle Committee, realising the importance of this, had decided after careful consideration to recommend to the British Engineering Standards Committee the desirability of adopting the 150-ampere plug and receptable of the Electric Vehicle Association of America as the standard fitting for this country. They could not look for much assistance at the present time from existing motor traders and garage proprietors. The pioneer work had to be done, and it behoved the electricity supply authorities, as those who were going to benefit most by the extension of the use of the electric vehicle, to work hand in hand with the manufacturers and to carry on an active propaganda for advertising the electric vehicle. They must show the public that it was by far the simplest and most sturdily constructed power-propelled vehicle at present on the road, and advertise all its other good qualities, its ease of driving, its all-round economy, and its reliability.

At the conclusion of his introductory remarks, **Mr. Ayton** stated that he had received a letter from Mr. P. P. Wheelwright (Blackburn), who pointed out the difficulty of getting any guarantee of mileage from petrol vehicle makers. The first cost of the electric car was high, but subsequent running costs were much lower than for a petrol car; the roadster vehicle which he used for inspection purposes ran three miles on one unit.

Mr. J. W. Beauchamp (West Ham) mentioned that he had six of the heavy type electric vehicles in use in his district, and the average revenue to the station was about £20 each per annum. The car-mileage obtained in practice was uncertain, depending on the conditions of use. There were several good electric vehicles available, but their introduction and the future of the business was really a financial question. If money could be introduced to finance contract haulage schemes using electric vehicles, he felt sure that they would be successful, being cheaper than other forms of power wagon, and many electric trucks would, no doubt, be sold when they were seen in use. He pointed out that 1,200 heavy electric trucks in West Ham would take as much energy as the Corporation tramways; also, that the cost of energy was only about 20 per cent. of the operating cost, and that it would be unwise to cut down the selling price until more experience had been obtained.

Mr. R. J. Mitchell (Edison Co) said he thought ¾d. per unit would be a suitable all-round price for charging energy, and 1½d. would be too high. The electric vehicle was most likely to cut out the numerous horse vehicles which congested the street and stopped all other traffic. A petrol truck rated at 35 ton-miles per gallon only did about 15, owing to the condition of the streets. He suggested that the University of London might institute a research, similar to that carried out in America, with a view to obtaining reliable information and data as to transport methods and costs; it would add to the confidence of the user if a scientific body's opinions were available on the matter. He did not think that the central station engineers should be expected to spend much money on providing charging facilities at the commencement, and hoped that the Vehicle Committee would reconsider its verdict as to the non-earthing of plugs, as it might be possible under certain conditions to get 230 volts between the frame and earth.

Lieut. Sladen (London Fire Brigade) gave some particulars of the vehicles in use by the London Fire Brigade (which have been described by us). He said they were using lead batteries, and the vehicles weighed about 5¼ tons, or from 5 to 6 cwt. more than similar petrol-driven vehicles. The results obtained were so satisfactory that the "electric" had been adopted almost as a standard for life-saving appliances where the gradients were moderate. The cost of such vehicles averaged about 1s. per mile, not including depreciation and capital charges, but petrol-driven vehicles cost about 1s. 3d. per mile. If all charges were considered, both types of vehicle were about equal—£150 per annum. Maintenance and renewals on escape vans worked out at about £40 per annum. They required a maximum pressure for charging purposes of 240 volts, but very few London undertakings would supply at less than 400 volts, and charging apparatus was installed in each station. The charging bill at most stations only came to some £2 per quarter. He emphasised one valuable feature of the electric type of vehicle, viz., rapidity of turn-out; this took 7 or 8 secs. only, and was absolutely unequalled by any other type of car, for which the best time was 15 secs. The electric vehicle started off at top speed, being instantly ready, while the others required time to get fully going, and this was a matter of importance, as the runs only averaged about ½ mile. Electric braking was also a valuable feature in the operation.

Mr. P. A. Mossay pointed out that the electric vehicle had a higher efficiency than any other. He urged the importance of studying the operation of such vehicles in detail, mentioning that as the result of comparative tests with different sizes of tires, it had been found that a greater car-mileage was obtained, with the same battery and vehicle, when larger tires were used. Five years' experience in Germany showed that the tires of electric cabs had an 80 per cent. longer life than those of petrol cabs. He concluded by showing numerous slides illustrating the progress made by German makers in municipal and commercial battery vehicles.

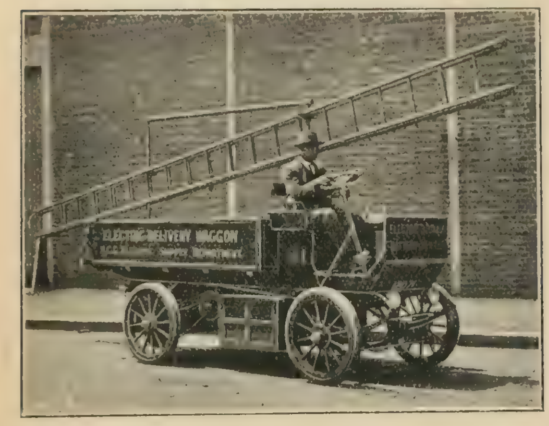

Fig. 1.—Baker Half-Ton Electric Truck used by the Melbourne Electricity Department.

Dr. C. Porter (Marylebone) laid stress on the hygienic advantages of the electric vehicle, which was the only one which was really silent and did not contaminate the air, giving discomfort which was inimical to health.

Mr. C. Barber said it was not sufficiently realised that the present-day vehicle battery was very different from the older ones; he thought it would be found that for 30 to 40 miles per day the electric chassis of 10 years; he was satisfied that it cost 25 per cent. less to operate the battery vehicle. The battery maker must satisfy the user in regard to battery upkeep. His own experience on battery maintenance was that materials cost from 1d. per mile for light vehicles up to 2½d. per mile for a 5-ton vehicle. If, further, the removal of the battery to and from the garage were included (complete maintenance) these costs would be increased to from 1½d. to 3½d. respectively. The figures given were derived from a number of vehicles. There were 15 battery 'buses at Brighton, which compared with the 5-ton vehicle, and had been in use for six years, and battery maintenance (with the exception of removal of batteries) remained below 3d. a mile. The efficiency of the lead battery in practice was about 75 per cent. The cost per mile held good for a car running a good mileage. The batteries mentioned at Brighton saw two years' service before going there with a London electric 'bus company.

Mr. E. Fox pointed out that the operating mileage of vehicles depended on conditions of use, and often 50 miles a day was not required; one London house found its daily average mileage was only 32. There would, however, be no difficulty in designing a chassis for 100 miles operating radius. It was easy to detect faults in the "electric" when in use, but a petrol car required an expert mechanic to inspect it. The electric vehicle also facilitated accurate cost keeping.

Mr. H. Brazil gave some particulars of the running of a lorry weighing 9½ tons loaded, which consumed 1·3 units per mile and had a range of 35·45 miles. The control system fitted tended to reduce heavy discharges and maintain the battery in good condition.

Mr. A. J. Makower gave some figures relating to the use of electric battery cabs in a German city. A hundred cabs were in use, each averaging 90 miles a day and 350 days a year service. The cabs each weighed 2·4 tons. The operating costs were battery ·99d.; current, ·90d.; tires, 1·87d.; driver (day and night service), 1·56d.; repairs, ·71d.; general expenses, ·63d.; depreciation, ·33d.; making a total of 6·99d. per mile run. About 31,000 miles were run per annum, and 2½ million units would be required, costing, say, £11,000. The figures showed the advisability of encouraging the vehicle business in its initial stages.

Mr. W. A. A. Burgess suggested the advisability of standardising electric trucks with a view to cheapening construction. The vehicle battery voltage should be chosen at approximately half supply voltage, and twin cells could be used, charged in series and discharged in parallel. He thought there might be a saving by using tappings from the battery for starting. The suspension of the motor was important, as the unsprung weight affected tire wear.

Mr. W. E. Burnand referred to his own experience of a petrol and an electrical vehicle, and mentioned that the latter usually got the work to do, not because of its less costly operation, but because anyone could drive it. With the battery vehicle, the battery discharge rate was generally too high in non-electrical hands, and its maintenance was likely to be high; but there were undoubtedly possibilities for it. Regeneration was quite feasible, and his own experiments had shown that it was possible to return 30 per cent. of the energy on a trial run.

Mr. E. S. Shrapnell-Smith said it was probable that the electric car would pass through the financial troubles which had beset the petrol and steam-driven vehicles in their initial stages, but it would mark out its own sphere of work. It was a point that the electric car was silent on all speeds, while the petrol car at its best was noisy on low speeds. It was scarcely likely that the electric vehicle business would make money at the start; the working cost was the great factor in the sale of a vehicle, and such matters as noise or design were secondary. He had never been able to find out what the operating cost of the electric vehicle really amounted to.

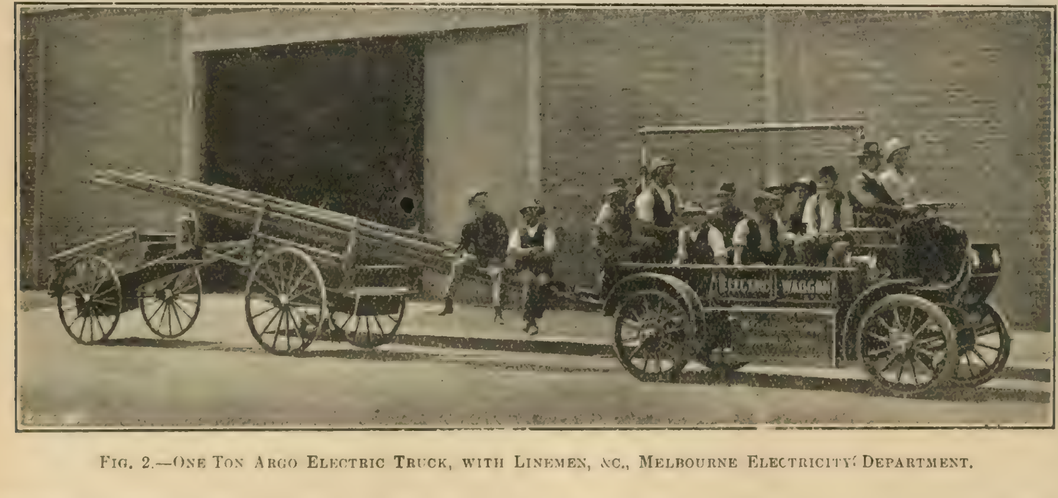

Fig. 2.—One Ton Argo Electric Truck, with Linemen, &c., Melbourne Electricity Department.

battery car compared very well with petrol and steam-driven cars. The whole question of electric vehicle use was bound up with first cost, but he thought there was scope for municipal authorities to introduce it for their own use.

Mr. A. B. Pescatore said it was necessary to satisfy the public that the electric battery vehicle was cheaper to run than a petrol vehicle. The petrol chassis had a useful life of five years, and the

This concluded the discussion; we have, however, received a letter from Mr. H. H. Harper, city electrical engineer, Melbourne, Australia, bearing on the use of battery vehicles by the Melbourne electricity supply department, which is of some interest in this connection, and is given herewith:—

"As a result of a trip through the United States between two and three years ago, I was very impressed with the possibilities in regard to the use of electric vehicles for transportation uses in the streets of a city. The vehicles shown in the photographs were purchased as a result of my inquiries in the States. All four vehicles are fitted with the Edison storage battery, of which, for transportation purposes, I have formed a very high opinion. They are of American make, the first one on the left (fig. 3) being the 'Argo' roadster capable of carrying four persons. With this vehicle we find it quite easy to maintain a speed of 25 miles an hour on the level, and the battery has sufficient capacity to run the car for about 60 to 70 miles on one charge.

"The next car shown is a 1-ton 'Argo' lorry or truck, as they are termed in America. This is fitted with an A6 size battery, as against the A4 size for the roadster. This vehicle is shown in a separate photograph (fig. 2) loaded with employés and linesmen, and drawing two linesmen's trucks. This vehicle is particularly useful in shifting men from place to place in the city, and for conveying materials and tools. It is capable of a speed of about 15 miles an hour on the level.

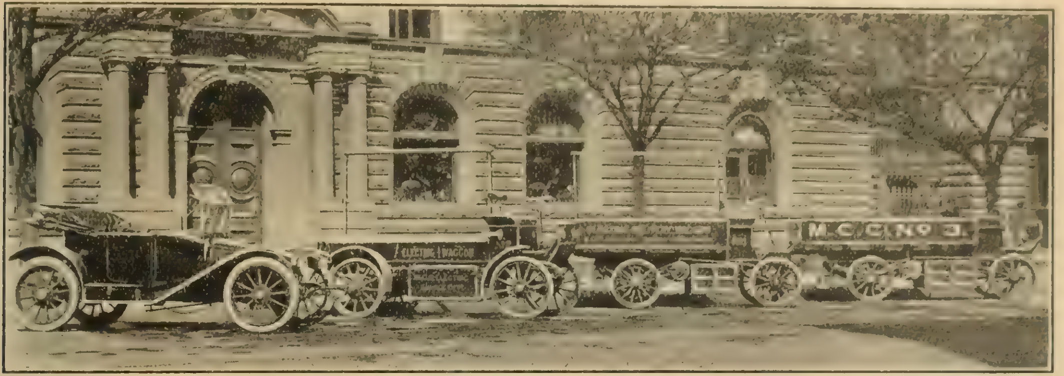

Fig. 3.—Group of Electric Vehicles used by the Melbourne City Council, Australia.

"The next two cars shown are of the well-known 'Baker' make, one being of ½ ton capacity (see also fig. 1), and the other, which is used by the city surveyor, of 1 ton capacity.

"The most striking feature in regard to the electric vehicle is the low cost of operation. Our records show that the roadster consumes about ·25 of a unit per car-mile, while the wagons consume about from ·54 to ·67 of a unit per car-mile. On a daily run of, say, 30 miles, and allowing a charge of ½d. per unit for current, which is a good covering price, as the accumulators are charged after midnight, the cost of current for the roadster is under 4d. per day, and for the wagons from 8d. to 10d. per day.

"I expect that the near future will see a considerable increase in the number of electric vehicles operated by the City Council as a result of our experience with the four cars shown."

THE SHANGHAI ELECTRIC SUPPLY PROPOSAL.

The report of the Committee, which has been under consideration by the Municipal Council at Shanghai, and is referred to in our leader pages to-day, states that the Committee accepts in principle the following postulates:—

"1. The Council should hold not less than half the total number of shares in order to control all meetings of the company.

"2. The present security against the electricity loans should not be weakened.

"3. The liability for the repayment of the electricity loans should be duly provided for.

"In addition to these safeguards, it would be necessary to make stipulations with regard to the tariff of charges, including that for public lighting, and to ensure that any advance in rates shall receive the Council's sanction. It should also be agreed that the present policy of inviting tenders for machinery, supplies, wiring and accessories, shall be perpetuated.

"The franchise to be held by the company would, in these circumstances, not require a time limit.

"The Committee records the view that the departmental balance-sheet is as accurate a statement of the assets and liabilities of the department as can be compiled, and that therefore it would form a reliable basis upon which to work.

"The conversion, so far as it is a cash transaction, may be facilitated by providing for investment in instalments during a period of two years or more, as funds may be required.

"The present Electricity Committee may be requested to act as provisional directors during the conversion.

"As regards the capital of the company, the Committee inclines to the figure Taels 6 millions, on the grounds that it would be unwise to hamper the directors of the company as to the manner in which they may desire to raise additional capital in the future. Thus, even with a reserve of unissued capital of Taels 2 millions, the board may elect to issue debentures.

"It would be advisable that a moderate capital sum should be inserted as the value of the franchise to be computed with due regard to the fact that it will bear dividend without possessing any earning power.

"The Committee considers that the capital should be divided into 120,000 shares of Taels 50 each, fully paid up, and that the articles of association should contain provision for increasing the total if necessary.

"It is admitted that the scheme will for the first few years weaken the Council's security against the electricity loans. The Committee, however, regards such weakening as not material, and in recommending the adoption of the scheme the Committee records the view that by investing in the shares of the proposed company the Council would be doing no more than protect the ratepayers' interests, while, if the project is carried to a conclusion, the general status of municipal debentures will be strengthened by the fact that the sinking fund appropriation will be calculable upon the whole issue of debentures.

"The Committee does not consider that it is within the scope of its present inquiry to lay down an exact basis of conversion, which will be a matter for the Council's consideration, upon the scheme meeting with the approval of the ratepayers; but the Committee is prepared to furnish an outline of its proposal as soon as the statement of accounts of the department to December 31st is published."

In the course of a separate report Mr. T. H. U. Aldridge, the municipal electrical engineer, shows that the Council in converting the department would be relieved of a heavy responsibility, and would benefit financially. In regard to the cardinal question: "What advantage would accrue to the community by making the suggested change?" he gives the following answer:—

"1. That the Council would be relieved of the recurring necessity of raising large sums of money for extensions.

"2. That instead of receiving the small sum of Taels 26,000 per annum, it would receive an assured 8 per cent. on the capital invested in the co-operative company, bringing in some Taels 60,000 net profit on Taels 3,000,000 invested, that is 2 per cent. over and above the 6 per cent. at which the money was originally borrowed. In the likely event of more than 8 per cent. dividend being paid, so the return to the Council on its invested capital would be larger. Assuming a 10 per cent. dividend, the net annual profit to the Council would amount to Taels 120,000.

"What would be the position of the consumer of electricity?

"1. He would, by the greater outlets and possibilities of an expanded supply undertaking stand to obtain reduced rates of electricity.

"2. Electrical supplies would be obtainable at cheaper prices because the company's policy would be to sell fittings and accessories at lowest possible cost—not to make large profits thereon—in order to encourage the use of electricity to the utmost.

"3. The predominating share and influence of the Council's representation on the board would safeguard the consumer against the possibilities of the company becoming monopolistic and raising prices.

"There is also the investing public. This section of the community would be provided with an outlet for practically a secure safe investment, and would, as the undertaking expanded, have frequent opportunity for further investment.

"The need of some such system of co-operative dual control of electricity supply is being felt in both Europe and the United States. What cannot be too emphatically expressed is that the suggested scheme is not to hand over the electricity department to a purely private company which would have entire control and do as it pleased. Such a transfer would be disastrous and have nothing to commend it, but I submit that handing over the responsibility for the management and general control to a company, formed on the lines proposed, would achieve results which cannot be obtained whilst the undertaking is purely municipal, or, which could not be obtained if it were sold outright to a private company without the assistance of municipal finance. The advantage of the dual control is manifestly to give greater flexibility and opportunity to the concern whilst the municipal connection would, by enabling the company to obtain money more cheaply, provide greater facilities for lowering the cost of electricity. At the same time the Council would reap large contributions to the common good as represented by its holding of shares."

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

5,890. "Devices for intermittently making and breaking electric circuits." R. G. Fyson. March 9th.

5,893. "Bar photometer." W. B. Ferguson and F. F. Renwick. March 9th.

5,894. "Electric switches." B. Thomas and E. Thomas. March 9th.

5,931. "Manufacture of armour-plate." S. O. Cowper-Coles. March 9th.

5,932. "Manufacture of metallic reflectors." S. O. Cowper-Coles. March 9th.

5,944. "Telegraph relay systems." A. Orling and Orling's Telegraph Instrument Syndicate, Ltd. March 9th.

5,966. "Device for the electrical control from a distance or other mechanisms, by means of a source of continuous currents." E. Schneider. March 9th. (Complete).

5,978. "Electric time-limit apparatus." British Thomson-Houston Co., Ltd., and E. B. Wedmore. March 9th.

5,991. "Means for telephonic and telegraphic communication with mine cages." J. H. Reinski. March 9th. (Addition to 19,102/12). (Complete).

6,008. "Railway locomotive controller." H. Hewitt, T. Gorst, and J. Smellie. March 10th.

6,013. "Shock-proof and fool-proof lampholder for electric lamps." L. S. Heaven. March 10th.

6,024. "Electric-light ball-joint bracket, with compression-plates." A. E. Green. March 10th.

6,037. "Electric filament lamps." E. Vass, L. Mateh, and F. Burger. March 10th. (Complete).

6,050. "Incandescent electric lamps." R. W. Birkett and J. H. Weiss. March 10th. (Complete).

6,054. "Electric smelting-furnaces." Fried. Krupp Akt.-Ges. March 10th. (Convention date, December 13th, 1913. Germany). (Complete).

6,055. "Electrodes." Fried. Krupp Akt.-Ges. March 10th. (Convention date, April 15th, 1913, Germany). (Complete).

6,066. "Apparatus for the electrical starting of petrol engines and the like." H. E. Donnithorne. March 10th.

6,070. "Electric switches or circuit-breakers." F. B. Holt. March 10th.

6,074. "System of selective electrical distribution." C. F. Kettering and W. A. Chryst. March 10th. (Divided Application on 7,545/13, March 31st. Convention date, November 20th, 1912, United States). (Complete).

6,088. "Power-generating plant." British Thomson-Houston Co., Ltd. (General Electric Co., United States).

6,093. "Electric baths." H. Aub. March 10th. (Complete).

6,097. "Telephone systems." E. A. Graham and W. J. Richet. March 10th. (Complete).

6,102. "Thermopiles." J. Marschall. March 10th. (Complete).

6,104. "Arc-light carbons." H. Ayrton. March 10th. (Addition to 1,775/13). (Complete).

6,118. "Mercury-joint packing for vacuum vessels." Quarzlampen G.m.b.H. March 10th. (Convention date, April 2nd, 1913, Germany). (Complete).

6,122. "Fuses or cut-outs for electric circuits." V. Hope. March 11th.

6,162. "Sequence switches." Western Electric Co., Ltd. (Franklin Tuthill Woodward, Belgium). March 11th.

6,173. "Electric-light reflectors." G. F. Allom. March 11th.

6,180. "Switch apparatus for use in connection with the electric lighting and heating equipments of railway and other vehicles." Electric & Ordnance Accessories Co., Ltd. & J. Etchells. March 11th. (Complete).

6,182. "Electric current collectors." T. B. G. Janssen. March 11th. (Complete).

6,199. "Generation of electrical power and methods of application of squirrel cage and asynchronous-synchronous electric motors and rotary converter systems, for power transmission and speed regulation, in electrical propulsion of ships, railway, tramway, road, aeronautical, agricultural, military, submarines, locomotive, trains, or similar self-contained or other vehicles, industrial machinery and the like." W. P. Durtnall. March 11th.

6,209. "Electrical impulse-transmitters and the like." Betulander Automatic Telephone Co., Ltd. & W. Aitken. March 11th.

6,210. "Automatic or semi-automatic telephone exchange systems." Gotthilf Ansgarius Betulander. March 11th. (Addition to 29,615/13. Convention date, May 24th, 1913, Sweden). (Complete).

6,214. "Means for electrical transmission and distant control of movements specially applicable to systems for signalling orders and the like." E. A. Graham & W. J. Ricketts. March 11th. (Complete).

6,229. "Electroscopes and other electrostatic apparatus." G. B. Burnside and Glasgow Scientific Instrument Co. March 12th. (Complete).

6,285. "Dynamo-electric machines for use in lighting road vehicles and for starting the motors thereof." Carleon Electrical Co., Ltd. and G. Inrig. March 12th.

6,293. "Means for fixing electrical switches in wall boxes and the like." E. Brooks (trading as Walsall Hardware Mfg. Co.) & A. E. Read. March 12th.

6,319. "Photometers." J. M. G. Trezise. March 12th.

6,341. "Electricity meters." Siemens-Schuckertwerke G.m.b.H. March 12th. (Convention date, March 12th, 1913, Germany). (Complete).

6,350. "Arc lamps." W. E. Gray and W. Best. March 12th.

6,351. "Control of electric winding-gear." British Thomson-Houston Co., Ltd. & E. I. David. March 12th.

6,352. "Vapour electric devices." E. Weintraub. March 12th. (Convention date, March 13th, 1913, United States). (Complete).

6,353. "Vapour electric devices." E. Weintraub. March 12th. (Convention date, March 13th, 1913, United States). (Complete).

6,356. "Telephone systems." E. A. Graham, W. J. Ricketts and E. A. [illegible]. March 12th. (Complete).

6,379. "Device for heating air electrically to assist in starting automatic lighting-plant driven by internal-combustion engine." R. A. Lister & Co., Ltd., and D. J. [illegible]. March 13th.

6,389. "Automatic telegraphic or radio-telegraphic transmitters." J. [illegible]. March 13th. (Complete).

6,390. "Electrical solenoids or electromagnets." S. Whipp, C. W. F. [illegible] and F. Whipp. March 13th. (Complete).

6,398. "[illegible]." E. C. R. Marks. March 13th. (Geb. Siemens and Co., Germany). (Complete).

6,403. "[illegible] fittings for electric [illegible] system." F. J. B. [illegible]. March 13th.

6,418. "Electric [illegible]." Allgemeine Elektricitäts-Ges. March 13th. (Convention date, March 13th, 1913, Germany). (Complete).

6,421. "[illegible] for [illegible] when the flow of current in [illegible]." A. F. [illegible]. March 13th.

6,42[illegible]. "[illegible] apparatus." [illegible] March 13th.

[illegible] G. Evans. March 13th. (Convention date, [illegible] 1913, [illegible]). (Complete).

6,428. "Telephone systems." Automatic Telephone Mfg. Co., Ltd. March 13th. (Automatic Electric Co., United States). (Complete).

6,430. "Combined electric starting and lighting arrangement, more particularly for use on motor-cars and the like." A. H. Midgley and C. A. Vandervell. March 13th.

6,439. "Filaments for incandescent electric lamps and methods of making the same." British Thomson-Houston Co., Ltd. (General Electric Co., United States). March 13th.

6,440. "Device serving as electric current indicator, current-strength indicator, and installation protector." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts-Ges, Germany). March 13th.

6,458. "Electrical apparatus for the detection of icebergs and the like for ships at sea." E. Lawton. March 14th.

6,492. "Electric current distribution means and collecting-apparatus therefor." G. Cope. March 14th.

6,520. "Means for electrically operating railway or other signals." Siemens Bros. & Co., Ltd., and L. de M. G. Ferreira. March 14th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

21,485. Illuminating Devices. British Thomson-Houston Co. and H. S. Wheat. March 19th. (March 19th, 1913).

26,781. Sound Reproducing and Transmitting Apparatus. W. H. Derriman. (Automatic Enunciator Co.). November 21st.

26,782. Telephone Systems. W. H. Derriman (Automatic Enunciator Co.). November 21st.

1913.

1,599. Electric Switches. British Thomson-Houston Co. and H. C. Heath. January 20th.

1,775. Arc-light Carbons. H. Ayrton. January 22nd.

1,927. Automatic Electric Switch. H. F. Bigge and F. R. Butt. January 23rd. (July 10th, 1913).

4,499. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). February 21st.

4,507. Starting Switches and the like for Alternating Current Induction Motors. Siemens Brothers Dynamo Works, Ltd. and C. Rogers. February 21st.

4,508. Electric Ignition Systems for Internal Combustion Engines. C. F. Kettering. February 21st. (March 4th, 1912).

4,584. Selective Electric Signalling. H. H. Harrison and C. M. Jacobs. February 22nd.

4,931. Section Insulators for Overhead Conductors. J. Ramsey and A. W. Maley. February 26th.

5,086. Advertising Appliances. J. Farley. February 28th. (Addition to 9,561/10).

5,763. Method of Electrically Governing the Speed of Engines at Sea. A. W. Fithian. March 8th.

7,382. Electric Insulators. F. Browalski. March 28th. (March 30th, 1912).

7,885. Apparatus for the Display of Announcements, Advertisements and the like. A. E. Turnham. April 3rd. (Cognate Applications, 9,980/13 and 19,110/13).

7,918. Enclosed Electric Switches. V. Hope. April 4th.

8,445. Means for Connecting Lamp Holders to Bracket or Pendant Tubes or like Wire Conduits. G. St. J. Day. April 10th.

9,592. Electric Contacts and Switching or Contacting Apparatus. Soc. Anon. les Etablissements L. Bleriot. April 23rd. (April 24th, 1912.)

9,624. Transmission Systems for Electric Telegraphs and the like. W. P. Thomson. (Soc. Anon. des Telegraphes Edouard Belin). April 24th.

12,238. Extensible Electric-light Fixtures. F. Garrecht. May 26th.

12,437. Means for Electrically Indicating or Counting Revolutions of Shafts, Axles, or the like. Siemens Bros. & Co., and F. Hird. May 28th.

12,956. Multipole Ignition Magneto with Rotary Field Magnet. Neufeult and Kuhnke (Firm of). June 4th. (January 13th, 1913).

13,610. Cooling of Apparatus Built in Connection with an Electric Motor. Akt. Ges. Brown, Boveri et Cie. June 12th. (February 20th, 1913).

14,188. Electrical Switches. A. P. Lundberg, G. C. Lundberg, P. A. Lundberg, and G. Pegg. June 19th.

14,380. Windings for Dynamo Electric Machinery. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.). June 21st.

14,426. Magnetic Separators. Fried Krupp Akt. Ges. Grusonwerk. June 21st. (July 19th 1912).

14,459. Operating Mechanism of Sand Discharge Valves for Electrically-propelled Vehicles. J. F. Simpson. June 23rd.

15,060. Regulating Relay Devices for Use in Connection with Electric Circuits. Maschinenfabrik Oerlikon. June 30th. (March 7th, 1913).

15,259. Electric Alarm for Preventing the Unauthorised Opening of Locks. O. Schumann. July 2nd. (August 5th, 1912).

15,284. Charging and Discharging of Electrical Condensers or the like. W. J. Mellersh-Jackson (Signal Ges.). July 2nd.

15,686. Variable Speed Dynamo-electric Machines. B. Brooks and W. Holt. July 8th.

16,428. Electro-motors for Portable Electric Drilling Machines and the like. G. F. D. Campbell. July 17th.

16,609. Means for Operating Electrical Switches. M. Drysdale and Displayer Co. July 19th.

16,705. Trolley Heads for Overhead Conductor Electric Traction Systems. E. H. Underwood. July 21st.

17,416. Electric Glow-lamps. Siemens & Halske Akt. Ges. July 29th. (August 2nd, 1912).

17,665. Electrically-heated Flat Irons. Siemens-Schuckertwerke Ges. August 1st. (August 6th, 1912).

17,918. Electric Imitation Candle Lamps. Candolite Co. and F. Taussig. August 6th.

19,517. Polyphase Alternating Current Commutator Motors. E. F. W. Alexanderson. August 28th. (August 28th, 1912).

19,592. Selector Switches for Telephone Systems. Sterling Telephone and Electric Co. (Telephonfabrik Akt. Ges. vorm J. Berliner). August 29th.

20,796. Recording Galvanometers. Paul Braun & Co. September 15th. (September 14th, 1912).

21,891. Marine Cableways. T. S. Miller. September 29th.

22,744. Process for the Electrolytic Deposition of Metals from Solutions [illegible]. N. A. Helmeth. October 8th.

22,74[illegible]. Electrolytic Process for Extracting Copper from Ores. October 8th. N. A. [illegible].

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(J. A. Berly's).

1914 EDITION

NOW READY.

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE DISPUTE IN THE ELECTRICAL TRADE.

THERE has been a great deal of comment in the public Press during the past few days on the dispute between the Electrical Trades Union and the London Electrical Masters' Association and its possibilities. It is impossible for technical journals to get on the track of all the absurd statements that are made at such a time as this. Were it likely to be of any avail in relieving the present position, we would stop now to correct some of them. So far as our readers are concerned, we have kept them informed regarding the limited character of the dispute.

The strike has now actually begun, the E.T.U. having selected Wednesday, April 1st, as the day upon which their men would lay down their tools. Our readers will judge for themselves whether, considering all the circumstances, the date be appropriate. At the time of writing, we learn that a number of men were discharged on Tuesday night, and about 400 struck work on Wednesday morning.

For some time our columns have borne evidence to the growing friction, and we much regret that negotiations for peace have failed. We hope, however, that wise counsels will soon prevail, and that a small Committee, on which both masters and men are represented, presided over, if necessary, by an impartial chairman, will thoroughly discuss the points at issue.

As regards wages and hours, the differences should soon be surmounted. The men ask for 11d. per hour as a minimum for electrical fitters and wiremen, the masters offer for wiremen 10d. per hour from the first pay-day in April to the first pay-day in July, and 10½d. thereafter, so that practically there is only ½d. per hour between the parties. As regards hours, the men ask for a working week of 50 hours, and the masters stipulate that the recognised working hour shall not exceed 53 hours per week.

There are, however, two further points on which, up to the present, no working compromise has been suggested. It is well known that in modern conduit wiring work a considerable proportion of the total labour consists in the preparing and fitting in position of the conduits and accessories. The masters claim that men employed solely on this work shall be termed "pipe-fitters" and paid at the rate of 9d. per hour. This differentiation between the workers has been in force for some time, as it is clearly stated in the rules prepared by the Electrical Contractors' Association in January, 1912.

The men strongly object to this clause. They state that it would be possible by a rigid interpretation of this stipulation to displace 70 per cent. of the higher-paid workmen, as wiremen need only be sent to a job to run the wires through previously prepared conduit runs. It is to be hoped that a working compromise on this point may soon be arranged by such a committee as we have suggested. Safeguards should be introduced to prevent the masters lowering the standard of the work done, while at the same time the men should be prepared to allow the preliminary unskilled part of the work to be done by the lower-paid hands. The Union's organiser is credited with the admission that the pipe-fitter's rule will affect only a few large firms—four or five. Are we to understand, then, that this limited number employ 70 per cent. of the higher-paid workmen?

The remaining point is an old one as regards Trade Union disputes, and in this case it is more important than all the others. The masters claim liberty to employ whom they will, whether they belong to a Trade Union or not; the men stipulate that Trade Unionists shall not be asked to work with non-unionists. This is a point on which the masters cannot be expected to give way. At the present time there are a large number of thoroughly competent men who deliberately stay outside the Trade Union, and to become parties to an attempt to force them into the Union by applying the pressure of dismissal from long-held situations would be a breach of faith which we do not believe the masters will contemplate for a moment.

The situation at the present time needs very careful handling, but, given the right body and the right atmosphere, it should not be impossible to find a *via media* acceptable to all but the extremists on either side. Unfortunately, however, the extremists are as usual very much in evidence. Originally the men declared that the masters were out to "smash" the Union. Now the Union says that it is out to "hit" the masters. We are not likely to get any "forrader" while this sort of talk is indulged in. It is the Union's way of saying that it is not anxious to cause the public any inconvenience. It disclaims any desire to do so "unless necessity arises." This present regard for the public welfare is interesting when we recall that the Union would have been delighted a few weeks ago at the prospect of holding up London's electricity, if the central-station men had fallen at its bidding.

Lead.

There has been a decided development of uneasiness in the lead market, caused in the first instance from the news filtering out that fair quantities of American domestic lead had been sold for export to Europe. The initial sales of the kind were not important, comprising merely 100 short tons of Missouri lead from the Saint Joseph Co. to London, but this lead was followed by other and more important quantities, and at the time of writing lead from America has come into Liverpool, Manchester and Bristol, which is taken to mean that there is a moderate quantity of metal in the United States available for shipment to the European centres. No doubt further shipments depend to a very large extent upon the prices relatively ruling in New York and London. If the London price moves up to about £20, while that in New York remains round 4 cents a lb., there is no question that it would suit America very well to sell to the English outports such as Liverpool, Bristol, &c., but the drop in London has put further business on the shelf for the present again, though there is always a chance of some fresh move to allow of further sales. Enthusiasm in the market has been very much checked, however, by the development of events, and there is no more talk of squeezes such as those which have been a recurring factor for months past in the market. What is more, not only has American lead come here in moderate quantities, but the arrivals of Australian and Spanish lead have been on a more liberal scale, and there are good quantities afloat now for the consuming centres, all of which tends to show that there has come a pause in the tightness of the metal. There can be no doubt that the selling of American lead for export took many people by surprise, and there was some scepticism expressed as to the accuracy of the earliest statements made regarding the quantities of the metal which had been sold. There is abundant evidence now, however, plain for all men to see, that the original estimates erred, if at all, on the side of moderation, while there are fair quantities yet to be shipped. So far, however, there is not any excess of material about here, but the tendency of the market at large has been affected unfavourably. If the United States, which ordinarily is dependent to a considerable extent upon imports from Mexico of silver lead, can not only do without supplies from this quarter, but can actually spare lead refined from Missouri ores for shipment abroad, there can be not the least doubt as to the extent to which general trade across the Atlantic has been suffering recently. There is always the hope that things in this respect will improve, and, indeed, a general strengthening of the industrial position in respect of all metals is long overdue, but it is unlikely that there can be any material and defined alteration for the better until the railway rates decision is safely out of the way. The point of main importance in considering the United States situation is the position of the railway companies. These have stood sullenly aloof from buying for many months now, and if there is to be a persistence of this attitude for the rest of the year, it is quite hopeless to look for an improvement of any substantial character in trade, especially metals. If, however, there is to be a permitted raising of rates, the immediate result should be an enormous buying movement, for railway orders have been withheld till the stores are depleted, and not only have replacements become urgent, but there has been an absolute standstill in new construction. Hence the near future rests very largely on the attitude of the railways. Meantime lead is not likely to improve much until confidence is restored, and this cannot occur till the United States position is regarded as having materially improved with the disappearance of the possibilities of further sales from across the Atlantic.

Vibration of Machinery.

Are engineers fully alive to all the new conditions by which they are surrounded? The environment of an engineer's profession and experience is a very fluent quantity. It is constantly changing. A case of nuisance recently passed through the Courts in which the plaintiff sought protection from the noise of machinery in an adjoining premises, there being a party wall. It appears that this heavy party wall was in close and firm connection with the hard concrete floor on which stood the machine which was productive of the worst of the noise. There was a steel and concrete ceiling above, also in firm connection with the wall. Inside the workshop there was by no means a particularly serious amount of noise, and what there was came mostly from details such as iron trolley wheels running on the concrete floor, and therefore easily preventable by the use of rubber tires. The least noticeable noise came from a machine in which were certain gear wheels. The work of the machine was variable in cycles of two seconds, and resulted in a force which for a few degrees of arc caused the driven wheels to become the drivers, thus producing the familiar sound of backlash in the backward contact of the teeth and again when running forward. Inside the plaintiff's premises, however, this backlash was extremely noticeable, and especially so since it occurred off and on from 8 p.m. to 4 a.m., with periodical intervals. And as usual with running machinery, whether it be a clock or a marine engine, it is the stoppage which is more noticeable than the running. A sleeper does not become accustomed to alternations of sound and stillness, though he may become used to a noise, more particularly if it be steady and continuous in volume.

It appeared from the evidence of the engineers called by the plaintiff that the trouble of noise arose from the conveyance of the sound in the workshop by the very solid continuous structure of the concrete and steel ceiling and floor. Of course, no place intended to be used as a workshop, more particularly for night work, should be solidly connected to a dwelling house and be a party to the dividing wall. There should be two dividing walls, with a sound-deadening filling in between, and no connection whatever to transmit the molecular vibration of sound.

It appears to be the case that homogeneously solid ferro-concrete buildings transmit sound very freely and loudly throughout their structure. In an ordinary building, with beams and joists merely resting on walls which are not too solidly compounded of small bricks with mortar joints, there is a reduction of vibration at every joint and at every change of material and structural continuity. Engineers should be alive to the new state of affairs, which has come into play since the introduction of ferro-concrete work. This material is so hard and firm and continuous, that the transmission of sound takes place through it with great facility, and solid walls and floors become transmitters of sound to the air, for their continuous surfaces become sounding boards or tympana. There is nothing to retard transmission and to muffle its sharpness in the way that a wooden joist will do when resting on a brick wall.

The question of sound should be studied with care in new buildings, for it is likely to become serious in the future.

ELECTRIC LIGHT AND POWER ON THE PETROLEUM FIELDS.

By FRANK B. LEA, B.A.

In the enormous developments that are taking place throughout the world in all the numerous petroleum or crude oil producing territories—themselves receiving additions almost every month—it is not surprising that there should be also a greatly increased use of electric light and power to enable the work of drilling, bailing, and pumping to be carried on continuously, and with greater safety and economy than could otherwise be done.

The advantages of electric working are obvious in regard to both these directions—light and power. Bearing in mind the dangerous nature of an oilfield, where there are, as a rule, large quantities of highly inflammable hydrocarbon gases nearly always rising from the bore holes and permeating the whole region (being heavier than air), there can be no two opinions as to the absolute necessity for installing incandescent electric light in the derricks and on the field generally if continuous working is to be adopted in the way that every oil engineer desires.

Otherwise, drilling, bailing, and pumping could only be carried on properly so long as daylight lasts, and the absurdity of closing down the work of drilling at nightfall, when ill-chance may find the field engineer in the middle of a ticklish bit of repair work, or anxious to keep the casing in movement lest it should stick, must be obvious even to the non-technical man who has never seen an oil well.

No other mode of artificial illumination could be entertained for this purpose, and the sole aim of the electrical engineer controlling a supply to the oilfields—whether individual or general—is to make sure that no conceivable defective switching or other contact shall at any time give rise to spark or flash communicating with the highly explosive mixture of gas and air which may at the moment very likely permeate the whole neighbourhood.

Efforts have been made by the mining authorities in more than one field to ensure greater safety in this direction by insisting that every individual switch—no matter what its size—shall make and break under oil; but, needless to say such a regulation has been found almost impossible to enforce, and at present no more can be done than reduce as much as possible the number of switches or movable contacts, and box them up away from access by the outer air.

One great difficulty and disadvantage to encounter in the installation of electric lighting on an oilfield, lies in the comparatively short existence of the latter as a local area of active work; and this applies still more to individual derricks or wells. Until the field engineer knows whether a new well is going to be productive, and on what scale, he can hardly be blamed for regarding its installation and equipment as very largely provisional and temporary. He may have to abandon the well at any time before or after reaching the oil stratum; why then instal an expensive and permanent electric lighting system? Herein lies a very important difference between oil boring and coal sinking. In the latter case the engineer knows exactly what he is going to get, and plans his installation accordingly, on complete up-to-date lines, to serve for years to come.

There is, however, far too much of the "temporary" element about oilfields electrical work, even after allowing for the likelihood of early changes; and whatever trouble has at any time occurred in this connection (and there has been such trouble) was practically due altogether to the use of work and material that sadly required Home Office and fire office rules and regulations for protecting life and property.

It is not right, for instance, that 500 volt 3 phase alternating current bare wires should be carried about and across an oilfield on the ordinary type of short wooden telegraph or telephone poles, even though the position and direction of these overhead mains may require constantly changing as the field develops; it should be quite easy to so design the system of supply that perfect safety may be secured with due economy in capital outlay or working expenses.

Probably much more care has been spent on the development of electric power in the oilfields, since there are in this direction serious competitors in the shape of steam and gas engines.

In the ordinary way, as has been pointed out on many occasions in these columns (see the Elec. Rev. 23rd December, 1910, p. 1042, and 6th January, 1911, p. 28), very great economy can be obtained by the use of electric power both in drilling and bailing, or pumping, as compared with steam engines drawing steam from boilers fired with oil fuel; and this saving will to-day be even greater owing to the much-increased value of crude oil, which renders its use as boiler fuel almost impossible.

Naturally, the figures of working cost are affected somewhat unfavourably towards electric power when the steam boilers can be fired as they now very often are by the oil gases emanating from the wells, and otherwise wasted on the field, where, as mentioned, they constitute a distinct source of danger. It is, however, necessary to have a large number of wells from which to draw gas in this way, otherwise the source of supply is too uncertain; besides which even the oil gases—being highly benzinous—are nowaday getting too valuable to burn as a fuel, since they should be capable of conversion into gasoline, or other forms of light spirit of great value in the market.

The chief advantage claimed by the advocates of steam power in oil derricks is, of course, the great elasticity of a steam engine, which fits it so well for the wide range of power required in drilling or bailing. The ordinary driller is quite satisfied and contented to use nothing but a roughly made high pressure single cylinder common or garden engine, leaking steam everywhere, and as full of rattle and bang as a donkey pump on a tramp steamer. What it costs to run in wasted steam—perhaps half a mile from the boiler—and repairs (necessary, but not always carried out) is no concern of his, so long as it does what he wants for the time being, and it is perfectly astounding what work these contraptions are capable of doing for so long under such exacting conditions.

The increasing use of rotary drilling, however, has called for a little more scientific exactitude, and the economy of working with electric motors is beginning to be more widely appreciated. At first, engineers made the natural and usual mistake of installing motors of too small a capacity for the work—contenting themselves with one of 30 H.P. where a 50 or 60 H.P. motor would have done the work far better and quicker, and with little more consumption of energy.

A speed reduction countershaft is necessary, but this is no great practical disadvantage, as it enables the motor to be fixed in a separate small fireproof brick building, covered with corrugated iron, and secured by lock and key from interference, away behind the derrick. Two slots in the wall allow the passage of a driving belt from the motor on to the countershaft, whence another belt is led to the drilling rig in the derrick.

Even in steady percussion drilling, where the ground is comparatively soft rock—shales, marls, or sands—the variation in power required is very great from time to time, as the drilling bit, or the bailer, occasionally binds, or the casing sticks. An inrush of sand may take place, and the motor is suddenly called on for nearly double its normal load. The belt may slip enough to give it time to recover, but the work is hardly what one would choose for a 3-phase motor of this type.

There is probably a very large sphere of usefulness in all kinds of drilling work—whether percussion or rotary, and more especially with the latter, because of the more easy control of feeding the drill bit—for a more flexible and reliable intermediary gearing between the motor and the bit; a system, for instance, like that devised by Profesor Hele Shaw, and now offered by the Compayne Company, should have very great advantages in both systems of drilling. The electric motor can in this case be installed at a considerable distance from the derrick, out of range of any gas eruptions. It drives direct an oil pump, forcing oil through two small bore copper pipes carried to an oil motor in the derrick, and this motor it is possible to regulate through a considerable range of speeds, at full power if necessary, by hand or even semi-automatic means.

So far as ordinary pumping is concerned, there is no difficulty in using an electric motor and countershaft, coupled up to a pumping rig with arms and chains, or wires, leading to the various derricks and wells to be pumped; and, as practically no attention or supervision is required, the plant may be left to run itself for as many hours each day as the oil can be pumped. Gas engines are also used for the same purpose, for which they are much better fitted than for drilling or bailing—as the load on a pumprig is very even where a number of wells are being pumped. In some cases, too, enough oil gas may be secured from one or more of the pumping wells to operate the engine, and in such instances the economy of working cost is hard to beat, as the engine fuel cost is practically nothing at all.

For the work of drilling and bailing, the gas-engine—although it has been used with fair success—is nothing like so handy or convenient, nor yet so elastic, as the electric motor, owing to the great variations in power required. Its first cost is also greater, being in proportion roughly about £400 as compared with £280 for steam engine and boiler, and £180 for a 30 h.p. electric motor with transmission gear, or £204 for a 50 h.p. motor and equipment.

Quoting the figures as to the working cost of electric motors from experience in the Roumanian oilfields, it may be estimated that in percussion drilling, from 90 to 120 kw.-hours per day are required, and for bailing a somewhat greater allowance—say, from 140 to 160 kw.-hours per day. Percussion drilling with water flush takes more power—from 180 to 250 kw.-hours per day; the figures for rotary drilling can hardly be given as yet, until more experience with these newer systems has been gained.

Current is provided for power purposes at 1.2 centime per kw.-hour. The price is calculated for a fuel cost at the power station equal to 35 frs. per ton, and for every franc rise or fall in the price of fuel at the power house, the price of energy rises or falls by one-tenth of a centime.

Assuming that a well is drilled for four months, and then bailed for eight months, and allowing for holidays and wasted time, the energy used for the well during the year would be 35,000 kw.-hrs., and the daily cost between 14 and 15 francs, or, allowing for repairs and maintenance of the electric equipment, the total cost should not exceed 15 frs. 50 c., equivalent to about 12s. 6d., which can hardly be called an excessive sum for cost of energy per day per well.

NOTES FROM CANADA.

[From our Special Correspondent.]

As a result, probably, of the terrible disasters which occurred on the Great Lakes in the storm of last November, the Dominion Government has decided to install a large electrically operated fog-horn at Goderich, Ontario.

The Electric Power Company, which supplies current over a large area in Eastern Ontario, the power being chiefly generated on the Trent Canal and Trent River, is evidently following the example of the Hydro Electric Power Commission of Ontario, as it is stated that the services of its engineering staff are at the disposal of any municipality, presumably actual or prospective customers, considering lighting and power problems.

Montreal proposes to build a municipal electric plant of 10,000 h.p. capacity, and a loan of $2,000,000 has been authorized for this purpose.

On the French River, which runs from Lake Nipissing to Georgian Bay, a dam is to be built by the Department of Public Works in order to facilitate navigation, but advantage will be taken of the water power thus made available to generate electric current for lighting the navigable channels and supplying what power is required at the dam.

In the town of Sudbury, which lies just north of the mouth of the French River, it is proposed to add to the power plant.

The Montreal Tramways Co. has just built a car designed specially for carrying prisoners from the city out to the new prison seven miles away. Fifty-four passengers can be carried, and there are two separate compartments arranged so that the convicted persons can be kept apart from those not convicted.

The Public Utilities Commissioner of Winnipeg has submitted a report to the Government of Manitoba dealing with the question of generating and distributing hydro-electric power throughout the Province. A year or two ago there was talk of the possible formation of a Hydro-Electric Commission, on the lines of that already making such rapid progress in Ontario; apparently the report mentioned above is a sort of preliminary in order to ascertain whether it would be worth while taking up hydro-electric works in this manner.

The Commissioner bases his remarks largely on information which has recently been made available by the publication of a report on the water powers of Manitoba by the Water Power Board of the Department of the Interior at Ottawa. Although the report does not favour the immediate establishment of a provincially owned system and the building of many miles of high-tension transmission lines, it is by no means hostile to the idea. The chief difficulty, due largely to the scanty populations to be served, seems to be that of making such a scheme a financial success. In this view the Commissioner is no doubt correct as, although the provision of cheap electric power would certainly attract many industries and give rise to great increases in population, yet, even so, it would be many years before there could be any considerable number of inhabitants in Manitoba, and until such a time came it would be difficult to make a large hydro-electric scheme pay its way. Western towns, it is true, have a reputation and a capacity for growing apace, but where distances are so great and populations so small it is well to be cautious in considering great outlays of capital for ambitious enterprises.

To anyone at home, unfamiliar with Canada, Ontario, the most thickly populated Province of the Dominion, even in the south-western portion, which is the most densely inhabited section (if such terms as "thickly populated" and "densely inhabited" may be allowed), seems to contain an insignificant number of people. The whole area of Ontario is about three and a half times that of the British Isles, and its total population is a little over two and a-half million people, or rather more than one-third that of the whole of Canada. By far the greater number of these people live in the already mentioned southwestern portion. Toronto, with nearly 500,000 citizens, is by far the largest city, others containing populations of 20,000, 30,000, or so, and the remainder consisting of little towns and villages.

Wireless telegraphic communication has just been established with Port Nelson, on Hudson Bay; by this means the men working out there will get the news of the outside world and life will undoubtedly be made much more pleasant. Looking at a map of Canada and comparing the centre of population, considered latitudinally, with the location of Port Nelson and Fort Churchill makes one think that the latter are in the regions of the Far North, and so far as temperatures are concerned they really are, yet Port Nelson is not much further north than Edinburgh. Probably the immense stretch of uninhabited and practically uninhabitable land covered with forests, with peat bogs of enormous extent, wild and uninviting and subject to temperatures of 40, 50 and more degrees below zero in winter, is responsible for the impression referred to. Port Nelson will be the terminus of the Hudson Bay Railway which is to give the western grain markets another outlet to Europe, and an engineer has recently gone to this place and Fort Churchill to plan out town sites for these two places which, if the anticipations as to the utility of the Hudson Bay route are realised, will no doubt become thriving towns soon after the railway is completed.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Lighting of the I.E.E. Theatre.

While I am in complete agreement with your remarks on the subject of the lighting of the I.E.E. theatre, I think you might also have added a few criticisms on the ventilation of the theatre.

There is a deadly stagnation about the air of the theatre which is most depressing. When the attendance is at all large, the heat and closeness towards the end of the proceedings is very trying. I may be told that the air is carefully filtered and warmed before it is passed into the theatre, but, speaking for myself, I should infinitely prefer a few open windows letting in the possibly impure, but, at least, fresh air, from the river, even if it involve some risk of draughts.

The atmosphere closely resembles that of the House of Commons, and it was admitted recently that the conditions there are adjusted to meet the requirements of somewhat elderly men.

Surely the average age of the Institution membership is sufficiently low to permit of the admission of a little fresh air without undue risk to health.

M. Farrer.

Twickenham, *March 26th*, 1914.

I have noted with interest, not unmixed with amusement, the correspondence evoked by the leaderette in your issue of the 20th inst. The implied condemnation of indirect lighting, as such, by Mr. Trotter, and the attack, by Mr. Broadbent, upon the use of "shadowless" lighting and the employment of the open-type arc lamp, are equally irrelevant and uncalled for.

The fact that the lighting of the theatre in question, largely by the indirect method, has to some extent failed to give continuous satisfaction in service, does not in any sense indicate that the system of indirect lighting, *per se*, is at fault, but merely that insufficient regard was paid to the fact that not only both the light sources used have a very high "ageing" coefficient, but that the initially high absorption of the mahogany panelling would increase materially with the passage of time, a lapse of quite an excusable character having regard to the knowledge of such factors available three or four years ago.

In citing the lighting of the Lecture Theatre at the Institution of Civil Engineers in support of his views, Mr. Trotter stands self-condemned. Reference was made to this installation at the last meeting of the Illuminating Engineering Society, when a photograph showing the artificial lighting was exhibited. It was then stated on behalf of Mr. Trotter that the system adopted was generally similar to that used in the theatre of the Electrical Engineers, that the average illumination in foot-candles was practically the same, but that in this case the proportion of the total illumination contributed by the direct lighting was so small as to be, for all practical purposes, nonexistent, whereas in the case of the Electrical Institution Theatre, the proportion so contributed is just over 25 per cent. of the whole.

If, therefore, as Mr. Trotter states, the "general effect" of the lighting of the Civils' Theatre "is much better," and I and others who have seen it quite agree that it is, then it must be conceded that the improvement is undoubtedly attributable to the fact that the lighting is in this case *more indirect*.

Those harrowed by the contemplation of Mr. Trotter's pen picture of the "invalid wearying of slops, however nourishing, and longing for something to bite," may also turn with relief to the spectacle of the "Handy Man" who, after a spell afloat on hard biscuit, "plumps" on reaching port for a diet graphically described by him as "soft tack" or "mush."

Mr. Broadbent's views on the subject of "shadowless" lighting would be interesting, although not very enlightening, if such lighting, or anything approaching it, could be obtained in practice. As it cannot, and especially as it cannot by the use of arc lamps, and as, moreover, the bubble of "shadowless" lighting was pricked and effectively burst some three years ago, they are at this date irrelevant in the extreme, although not devoid of unconscious humour.

The "fallacy" of 20 years ago that the light from open type pure carbon arc lamps, or at all events from certain forms of such, is the nearest approach to daylight which is yet available for the purposes of general illumination has also, like many another supposed fallacy, since been conclusively proved to be true, and it is significant in the extreme that amongst those whom Mr. Broadbent so impolitely describes as "dupes," are numbered many of the most progressive and important firms and individuals in the business world of to-day.

That indirect lighting, and again in particular indirect lighting by arc lamps, is in many cases and for many purposes *more* rather than less efficient than other forms of lighting, is also now well known to, and freely admitted by, both illuminating and consulting engineers who have studied the subject, as well as by many rank and file users who, knowing nothing of the underlying scientific reasons, have by actual experience conclusively satisfied not only themselves, but their employés, that this is so.

May I also point out to Mr. Broadbent, and to those whom his statements may have misled, that where suitable arc lamps are used—and such are readily obtainable—the regular attention which must, perforce, be given to them, does away with the bulk of the losses in the resultant illumination due to the "ageing" of the light sources and the deposition of dust and dirt upon them, and/or the shades or reflectors when these are used, and leaves only to be reckoned with the fading or darkening of the surrounding walls and ceiling.

Carefully conducted experiments by impartial authorities have resulted in the determination of losses due to these causes of upwards of 40 per cent. in comparatively short periods in the case of certain light sources.

There are, on the other hand, many installations of arc lighting—and even of the type of arc lighting so despised by Mr. Broadbent—in which the falling-off in the illumination has not amounted to anything material, even after the lapse of several years. One such, using inverted arc lamps of a make which shall be nameless, was spoken of at the meeting of the Illuminating Engineering Society above referred to, by a leading Westminster consulting engineer, who stated that illumination measurements made by him after some two years' use of the premises—a large modern store—agreed within a very small margin indeed with those made when the lamps were first installed and the premises were new.

With such facts as these upon which to build up their constitution, indirect lighting and the pure carbon arc lamp can withstand with impunity both the kick which you, Sirs, are incorrectly alleged to have administered, and the more general if less scientific pummelling of your correspondents, and will continue in spite of all mis-statements to make more and more progress as their merits become more widely known.

Justus Eck.

London, *March 30th*, 1914.

I was interested in the discussion upon the lighting of the Institution theatre, interested because, as I see it, neither your good selves nor your correspondents fully grasped the intricacies of the problem. As it appears to me, there are many situations where the indirect light fitting, with its flat shadowless light, is not suitable, and where, apart from the decorative value of the fitting, the light itself must be considered, not so much from the efficiency as from the æsthetic standpoint.

For instance, I have seen it claimed that indirect lighting has been successfully applied to installations in churches. I should beg leave to doubt that unqualified statement. I would suggest that whereas such lighting might by some people be considered successful in the kind of meeting place which is, by courtesy, called a church, yet one feels that the beauty of our cathedrals, and of most of our churches, depends to no small extent upon the subtle and beautiful use of light, and the no less beautiful use of shadows with their mystery.

There is something here more than "foot-candles" and "lumens;" there is something metaphysical in the effect such shadows create upon the human mind, and not always the ignorant human mind.

In quite another connection the same considerations arise. I have heard lighting engineers discuss the unscientific lighting of certain restaurants, and other places of public resort. They evidently thought that, say, Frascati's would be improved by being illuminated with the flat shadowless light of the indirect system; I doubt whether they would enjoy the change. When one is sitting at a well-laid table in a public room, and the bubbles are rising in one's glass, and there are pretty faces and the glint of jewels to look upon, it is one's senses, and not one's sense, that make demands; and the designer and decorator of such places, if he knows his work, will continue to sin in point of efficiency in the same old way.

A more homely illustration is, perhaps, the ordinary dining-room fitting with a silk shade, brightly illuminating the table and diners, but leaving the rest of the room in shadow. The mere idea suggest comfort and pleasure.

I would suggest to the advocates of the new forms of lighting that it is possible to do their cause harm by undue insistence upon its merits. There are many positions where it is absolutely right, but there are more where it is absolutely wrong.

The world does not consist solely of insurance offices and lecture theatres, and although such delectable places are often perfectly illuminated by our lighting experts, one feels that even an illuminating engineer might object to living in them always.

T. Birkett,
Manager, Simplex Conduits, Ltd.,
Art Fittings Department.

Birmingham, *March 30th*, 1914.

Maintaining High Power Factor.

In reply to "R. E. M.'s" letter appearing in your issue of the 20th inst., I beg to submit the following:—

1. There is no hard and fast rule. As a rough rule, it may be said that when running off the mains of a supply company, the horse-power of a squirrel-cage motor which has to start on heavy load should not exceed 5 per cent. of the K.V.A. of the total minimum generating plant, or 10 per cent. if it starts on light load. On a large power system lower figures than the above would have to be taken. On a self-contained system such as a group of collieries with their own generating plant, these figures may be easily doubled. On the Continent in certain districts rigid laws exist forbidding the use of squirrel-cage motors above a certain size.

2. In most cases the station engineer will look after his own power factor by having an over-excited synchronous motor running in his own station.

3. "R. E. M." will find numerous examples in any good book on alternating currents.

4. *Proceedings* Institution Electrical Engineers, "Starting and Speed Control of Induction Motors," by F. C. Aldous.

John Barratt.

Middleton, *March 20th*, 1914.

Crane Motors at the County Hall.

We note in the current issue of your journal that there is an article on the "Electrical Power Applications in the Construction of the County Hall, Westminster," and whilst reference is made to Messrs. Siemens and the Lancashire Dynamo Co. as being makers of certain motors, no mention is made of the fact that we supplied the motors on all the Scotch cranes supplied by Messrs. Butters Bros. on this contract, these being the 20-H.P. motors referred to (see first column on page 541). We have supplied at least seven of these 20-H.P. motors for this contract, and in pointing this out we might remark that we have in many instances noticed in various technical journals, when describing electrical installations of this kind where our motors have been in use, that no mention has been made of our name, and we think it only due that we should have similar recognition as our competitors in such circumstances as these.

For **J. P. Hall & Co., Ltd.,**
A. G. Hall, *Director.*

Oldham, *March 30th*, 1914.

[We regret very much that due credit was not given to our correspondents for their share in this undertaking, regarding which we had no information. While we are not concerned with the failings of other journals, we always endeavour to ensure that justice shall be accorded in our pages to all who bear a share in any noteworthy undertaking.—Eds. Elec. Rev.]

Load, Strength, Stress and Strain.

The writer of the article under the above heading in your issue of March 27th has called attention to a source of confusion which undoubtedly exists. I am not sure, however, that he succeeds in making matters much clearer, nor do I find that his view as to the correct use of the term "stress" is the one which is generally supported by writers on mechanics.

Unless I misread his argument, his contention is that the only correct use of the term "stress" is its employment as synonymous with "unit stress," when it is measured in terms of lb. or tons per unit of section.

On referring to some half-dozen text-books on mechanics, taken at random from my shelves, I find that in every case, except one, stresses are taken as measurable in lb. or tons, and that a distinction is drawn between such stresses and "intensity of stress" or "unit stress" which can be measured in lb. or tons per square inch. The exception is, curiously enough, Prof. Perry's "Practical Mechanics," which states that "stress is the load per square inch," and proceeds, two or three pages later, to speak of the *stress per square inch*, a manifest "contradiction in terms" of his previous definition—a contradiction which may be noted also in the article in your columns (see third paragraph).

Surely we are so accustomed to speaking of "stress diagrams" and the calculation of the "stresses" in the members of structures, that we cannot limit ourselves to using "stress" in the sense suggested by your contributor. The term "strength" can just as easily be defined in terms of "tons per square inch" as in tons, whereas your contributor appears to limit the use of this term so as to make it synonymous with "total breaking load," and to exclude its meaning as defined by "breaking load per square inch of section."

In conclusion, I think that clearness is to be reached by indicating the units adopted when speaking of "stress," "strength," "load," &c., rather than by fixing an arbitrary meaning to these general terms, which is not universally accepted.

Charles F. Smith.

Leeds, *March 29th*, 1914.

Appointment of an Assistant Electrical Engineer.

I applied for, and received, a form of application for the above position, and I found one of the conditions of appointment (Item No. 10) read as follows:—No application will be considered unless the certificate at the end of this form is signed by the head of the department where the applicant is at present employed.

I wish to protest against the insertion of such a condition as this. How many of us would care to go to our chief engineer and ask him to sign a form of application for a berth elsewhere? In my own case, if I did such a thing I should be asked to resign, although I have many years of service to my credit. I think this is not only a hard condition but unreasonable, as I for one am barred because it would not be policy for me to let my employer know I thought of leaving, more especially as I consider my chances were good on account of having had Diesel experience, this station having Diesel engines.

Chief Assistant.

The Borough of Worthing recently advertised for a chief assistant electrical engineer, maximum salary £175 per annum; applications had to be made on a special form supplied by the borough. One of the conditions of the application was that "No application will be considered unless the certificate at the end of this form is signed by the head of the department where the applicant is at present employed." The certificate read as follows:—"I have perused the replies to the questions on this form and the information contained therein is correct." The questions on the form are rather more detailed than is customary; they relate to age, health, married or single, present and past employment, with dates, salary, &c., practical and theoretical training, with. dates, examinations passed, degrees held, central station and mains experience with dates, all this to be certified as correct by the head of the department where the applicant is at present employed. In my opinion, no chief engineer could sign one of these forms conscientiously, and, again, it is grossly unfair to force all applicants for the position to inform their present chiefs that they are applying for another position; it is generally quite time enough to let them know when you have obtained the position. I cannot help thinking that the certificate is on the application form by an oversight. I know that a number of very efficient men have not been able to apply for the position owing to the fact that they did not think it advisable to get their chiefs to sign the certificate, and I believe in one or two cases chiefs have refused to sign on the plea that they could not guarantee the correctness of the replies to questions with regard to previous positions. I enclose a copy of the form in question.

W. J. Ebben,
Hon. Sec., A.E.S.E.

London, N.E., *March 31st*, 1914.

The Policy of the A.E.S.E.

The daily Press has recently informed the public at large that owing to the present wiremen's dispute London will probably be without its tramway, tube and electric light and power services. As some of the members of the A.E.S.E. are responsible for these services, the Executive Committee of the A.E.S.E. has requested me to contradict again emphatically the statement that the A.E.S.E. is involved in any way in the present dispute, or is connected with or co-operating with any Trade Union, and also to state that, as far as the A.E.S.E. is concerned, these services will not be affected.

The inference that has been drawn from these daily Press reports by a number of provincial members, prospective members and others, seems to be that the London members of the A.E.S.E. are about to strike, which is absurd. Anyone who knows the minds of the members of the present Executive Committee and the London District Committee (who are responsible for the conduct of the general business of the Association and the London district respectively), will realise the absurdity of the mere suggestion of a strike of A.E.S.E. members; in fact, the general body of the members as well as the members of the various committees of the A.E.S.E. I am convinced would not strike, as they are quite certain that they can better their general working conditions, salaries, &c., and, incidentally, raise their status by methods of a more peaceful character.

Recently the chief engineer of a large London supply authority expressed a wish to the writer that the A.E.S.E. would become of such standing that chief engineers requiring to fill vacancies in their stations could insist on having a member of the A.E.S.E., membership of the A.E.S.E. being the "hall-mark" of efficiency.

It is the aim of the present Executive Committee to endeavour to attain this high standing, at the same time using every effort to improve the general working conditions and salaries of all engineers in charge of electrical plant.

W. J. Ebben,
Hon. Secretary, A.E.S.E.

London, *March 31st*, 1914.

Railway Rates and Charges.

I shall be glad if you will kindly allow me to trespass a little on the space of the "Correspondence" columns of your valued paper, to call the attention of traders generally to the increases in the rates and charges at present being enforced by the various railway companies.

There is the 4 per cent. on all rates excepting class rates, straw, coal and coke, timber, and live stock. It cannot be admitted by any that the recent increase in wages paid by the companies amounts to anything like 4 per cent., and it is very singular that with one or two exceptions, every company shows such an increase in its returns just completed, as to warrant the payment of increased dividends; it is, therefore, apparent that a 2 per cent., or at the most a 2½ per cent., increase would be ample to meet the extra expenditure incurred; further, the companies are charging the 4 per cent. on the maximum fixed terminal and service charges, in addition to the actual conveyance rates, which is not legal.

Erroneous charges occur in many instances in charging goods in their wrong classes, and not in accordance with the railway classification and regulations, and errors in weight—charging 4-ton consignments at 2-ton rates, where no 4-ton rate is in operation, instead of getting a 4-ton rate fixed. As regards the classification at present in operation, the following are a few of the modifications which should be made:—

Castings, brass or light iron, should be Class 2.

Electroliers and electric fittings should be Class 3.

Calculating and cash registering machines in parts, packed, should be Class 3; fitted, packed, Class 4.

Tools, engineers', in cases, should be Class 2.

Tubes, brass or copper, packed, should be Class 2; not packed, Class 3.

Chemicals (not dangerous), in bags or bales, should be Class 1; in casks or iron drums, Class 2.

Paints in casks, drums or tins, packed in cases, should be Class 1.

Varnish in casks, drums or tins, packed in cases, should be Class 2.

The above are only a few instances which show how the friendly relations between buyer and seller may be upset through railway carriage overcharges, as when a customer is charged an excessive rate repeat orders are rarely placed.

Traffic is conveyed by the particular company's own routes to whom it is first handed, whereby delays frequently arise, together with late arrivals for markets, &c., claims resulting being inevitably refused by the companies, when, if submitted in accordance with law of carriage, they would have to be admitted. Shorter routes exist in the majority of cases, and if goods were fully and properly consigned, they would receive much quicker transit.

Then there is the very important question of rebates, to which traders are entitled in many cases, *i.e.*, private sidings, loading and unloading of goods, cartage and delivery, returned empties, &c., these allowances being lost by traders through their ignorance of railway matters and not availing themselves of the services of fully qualified railway specialists in the handling of their railway and shipping business. Many rates are excessive, not being based on the shortest mileages or rates from other stations taken in comparison.

The charges for demurrage should not be raised—this would not, in many cases, be necessary if traders were allowed four days instead of the two days, as at present, for unloading traffic, and if then incurred should be at the rate of 6d. per truck per day, and not 1s. 6d. and 3d. per sheet per day, as is now enforced.

What is necessary, undoubtedly, is a strong Railway and Shipping Traders' Protection Association, and those interested are cordially invited to communicate with me, when I shall be pleased to render any assistance in my power.

J. E. Thompson, F.C.I.

86, May Lane, King's Heath, Birmingham,
March 28th, 1914.

LEGAL.

War Office *v.* Kirkland & Capper, and J. H. T. Woodd.

(*Continued from page* 542.)

The Solicitor-General, continuing his opening statement in great detail, said that by Clause 13 of the War Office specification, it was provided that the conductors were in all cases to be accessible to authorised persons, they were to be enclosed in casing or conduit, carried on cleats, or to be lead-covered. It was provided that a particular sort of conduit, namely, "barrel," was to be employed for the protection of conductors when buried below plaster or in concrete work, and that lead-covered conductors might be used in any situation, provided the conductors were accessible, and might be run through walls or partitions, or under plaster for short lengths, *e.g.*, behind cornices or mouldings. It was also provided that in order to comply with the condition as to accessibility the lead-covered conductors might require to be drawn into conduit or otherwise protected. Lead-covered conductors where liable to mechanical injury were to be drawn into conduit. It was complained that Kirkland & Capper negligently allowed the contractors to employ lead-covered conductors buried in the plaster without conduits and without any strong covering or protection of sufficient strength to resist a nail, or any sufficient protection at all, and to carry the conductors over rough walling and rough corners, so that the lead covering became broken. It was also said that the defendants, Kirkland & Capper, negligently allowed the contractors to lay the lead-covered conductors in an irregular way so that the defendants did not have any record of the places where they were laid. So complete was the failure of the installation, that the War Office had to renew the wiring over the whole building, Messrs. Foote & Milne, electricians, being paid about £1,400 for the work.

Sir Stanley Buckmaster, dealing with the defences, said that in answer to certain interrogatories as to the terms upon which they were engaged, the defendants had stated:—Answer of Mr. Woodd: The plaintiff, through me, appointed Messrs. Kirkland and Capper as experts to prepare plans for and to supervise the electrical engineering and lighting work for a payment based on the cost of work carried out under their supervision. Their payment was to be at the usual rate of 5 per cent., and in accordance with a then standing agreement between myself and Messrs. Kirkland and Capper, 1 per cent. out of this 5 per cent. was to be paid by them to me for services to be rendered by me to Messrs. Kirkland and Capper in connection with the work, for which I should not have been entitled to charge, and did not charge, the plaintiffs. I do not myself recollect what was said as to which of us was, or were, to be responsible to the plaintiffs, but it was common ground between us that Messrs. Kirkland & Capper would be. The answer of Kirkland & Capper was as follows: The plaintiff, through the defendant Woodd, appointed Messrs. Kirkland & Capper to prepare plans for and to supervise the electrical engineering and lighting work for a payment based on the cost of work carried out under their supervision. This payment was to be at the usual rate of 5 per cent., and in accordance with a then standing agreement between Mr. Woodd and Messrs. Kirkland & Capper, 1 per cent. out of that 5 per cent. was to be paid by them to the defendant Woodd for services to be rendered by the defendant Woodd to Messrs. Kirkland & Capper in connection with the works for which the defendant Woodd would not be entitled to charge, and did not charge, the plaintiff. The defendants, Kirkland and Capper, were to act as responsible experts. So far as the defendants, Kirkland & Capper, recollect, no further terms were agreed, and in particular nothing was said as to the responsibility of the defendant Woodd.

The Solicitor-General said that the installation was such a failure that he would show that at an important function soon after the opening of the establishment the whole place was plunged into darkness. There was an inspection in March, 1909, by the Westminster Electricity Supply Corporation, who found that there were serious defects. The Solicitor-General said that a War Office electrical engineer, named Mr. Allan Kirk, had inspected the electric installation at the place and had reported as follows regarding the section comprising C.O.'s quarters and officers' mess at the Royal Army Medical College, Millbank, S.W.:—

"The electrical supply is obtained from the Westminster Electric Supply Corporation on the three-wire system (continuous-current) having a pressure of 400 volts between the outers. The three-wire supply is divided at the main switches to give two supplies at 200 volts with a meter on each side controlling two equal installations, each wired on to the two-wired looped distribution board system.

"The whole of the circuit wiring has been carried out with twin lead-covered v.i.r. wires buried in the plaster. This system, unless very carefully installed, invariably breaks down due to the lead covering being damaged by 'kinking' or abrasions, and in any building where there is a possibility of nails being driven into the plaster the system becomes dangerous. In the present instance the workmanship appears to have been defective, the reasons for this statement being that on one piece of wire being taken out the lead covering had evidently been torn against a sharp edge of the brickwork whilst being installed, the rubber insulation had broken down and the wires were fused; further, the lead covering and tape on all the wires where attached to boards, fittings, &c., have been carelessly trimmed back, and no attempt seems to have been made to connect the wires up in their proper order, even the sub-mains in one instance having been wrongly connected. The defects are not merely isolated cases, but are general over the whole installation, due to the fracture in the first instance of the lead covering and contingently to the failure of the rubber insulation.

"In a twin lead-covered system, assuming that the lead covering is intact throughout and that the rubber insulation is perfect, no electrolytic or chemical action will occur, and there is no proved instance of lead being attacked by plaster or its components, so far as I am aware.

"The distribution boards appear to be of inferior make and poor insulating qualities; the latter defect is probably due to metallic veins in the insulating bases and lack of efficient bushing pieces.

"The flexible wires throughout are in poor condition, the vulcanised rubber having perished and cracked in many places; the practice of knotting the flexible wires inside the ceiling roses to act as cord grips, which has been resorted to, is very unsatisfactory.

"There is an entire absence of labels, lists, or other means of identifying the lights controlled by the various fuses, or any of the main or sub-distribution boards."

The Solicitor-General went on to refer to correspondence that took place when the matter got into the solicitor's hands. The Solicitor-General said there was a letter on behalf of Kirkland and Capper, in which (he alleged) there was no denial of the use of the lead-covered wiring that the War Office said caused the breakdown of the system, but which suggested that the lead wiring system was introduced at the instance of Woodd. In effect, the letter said "it was Woodd who made us do what we did, and it is on Woodd that the responsibility must rest." Their use of the lead wiring they did not appear to challenge, but they only said it was a question as between themselves and Woodd which of the two was liable.

In reply to a comment by Mr. Walter, K.C., the Solicitor-General said with emphasis: "What we say is perfectly clear. We say that there was negligence in permitting lead wiring to be used, and that the use of that wiring caused the breakdown of the whole system." The Solicitor-General went on to say that Mr. Woodd was asked to explain why—contrary to the contract—he allowed the lead-covered wiring to be buried in plaster, and a reply was received, but he declined to accept full responsibility. There was no serious attempt to contest the allegation that the use of this particular form of conductor caused great mischief, but what was disputed was liability. Mr. Woodd had the superintendence in general terms of the lighting, although the actual work was given out to experts, but if Woodd directed the use of a system contrary to the builders' contract it was a breach of his duty as an architect. Messrs. Kirkland & Capper were employed by the War Office to see that the work was carried out according to the specifications, and that they clearly did not do, because they permitted the wires to be placed in a manner that the specifications prohibited. The question, therefore, was, did this system of wiring cause the mischief complained of?—and counsel thought there could be only one answer to that question.

The other side said the test the War Office had made was unsatisfactory as it tested the fittings, but he would point out to the Court that when the final test was effected they tested nothing but the wires. They got rid of all the fittings and took the naked wires from the lead covers, and tested them in each case, so that when the test was made in July, 1910, the failures, however they might be explained, were due to failures in the lead-covered circuits. Mr. Woodd disclaimed all responsibility, and said the work was executed by contractors appointed by the War Office under a contract that he had never seen. He added: "It was tested and approved not only by the experts employed to superintend its execution (under Clause 14 of my conditions of employment as architect for these buildings), but also by a representative of the War Department who declared the installation to be satisfactory in June, 1908, more than a year after the buildings and installation had been taken over for occupation." It was pleaded in defence also that there was negligent user of the installation, and the particulars of negligent user said fuses were removed and copper wire substituted. This would involve that you placed in a fuse box a piece of wire that could stand a much stronger electric current than the fuse wire that had been taken away. That meant you might transmit into your circuit a stronger current than would otherwise be there, but that would not in any way affect the stability of the circuit if the circuit were properly laid and properly protected. The next thing is this: "The fittings were altered in position and refixed in a clumsy unworkmanlike manner and unsafe manner." That does not affect the circuits tested in the way in which these circuits were tested in January, 1910. "The distribution boards were not kept clean," is one observation applied to them.

The Solicitor-General then proceeded to call expert evidence in support of the case for the War Office.

Mr. Allan Kirk, A.M.I.E.E., said he had had 25 years' experience in electrical work, and was now in the service of the War Department. Before entering that he had 16 years in private practice. He had tested many installations. With regard to the use of insulated wiring covered by lead, he had examined installations where that system had been adopted. It was not usual to adopt that system where it was necessary to lay the conductors behind plaster, as it was impossible to lay it in plaster without faults occurring. He had examined some 5,000 installations, and in about the five cases only where this system was employed he found it had broken down. In February, 1909, he inspected this particular installation, and made the report that had been referred to. He found nothing wrong till he came to the sub-fuse boxes; at the latter he made tests to see if the circuits were in order, and the failures were discovered. They were due to the use of lead-covered wires buried in plaster without any protection. He thought alterations made by the Royal Engineers might have affected five circuits only. The failure to keep the distribution boards clean could not account for the defects that he found. The cost of wiring with lead-covered conductors put into the plaster as here was less than that of wiring through properly screwed or protected conduits. He reckoned the difference in the cost of the two systems for the work here was £268 17s. 8d.

Witness expressed the opinion that except for [the danger of external injury, lead in plaster would be safe if it could be laid without injury, but his view was that this could not be done. He had heard that at Guy's Hospital they had a twin lead-covered system, and he would like to be able to inspect it.

He added, that the plaster in the majority of places put on top of the Frazzi blocks was deep enough to bury a $\frac{5}{8}$th barrel pipe. He believed that substantially the floors and ceilings of all the storeys were made of Frazzi blocks. The fact that on the ground floor alone of the laboratory there were 202 pendant lights that all came through Frazzi blocks was quite immaterial.

Replying to **Mr. Walter**, K.C., **Mr. Kirk** said that he had been with various electrical firms. He was supervising foreman for Smeaton & Page, and had done practical work. There certainly were faults between the sub-boards and the connector-boxes that were apart from cases where the Royal Engineers had put in new meters. He was not prepared to agree with counsel's suggestion that every defect in the installation arose where the Royal Engineers had tampered with the work. He was not cognisant of his own personal knowledge of the alterations that were made by the Royal Engineers.

Mr. Walter, during the cross-examination, remarked that he had never heard of a more disgraceful usage than this electrical installation had been subjected to.

Re-examined by the **Solicitor-General**, Witness said the main defects were not discovered between the sub-fuse boxes and the connecting boxes, but between the connecting boxes and the lights. He could not explain that; it was a matter of luck. He denied that any of the defects were resultant upon any alterations effected by him.

Mr. William Henry Patchell, M.I.E.E., was the next witness. He said he was called in with regard to the present matter about a year ago, and on various occasions he made inspections of this electrical installation. He understood that it was in April, 1911, that Messrs. Foote & Milne had completed their work under the new contract. He only heard of the old installation in March, 1913. He had examined a number of specimens of the lead-covered wire and other things taken from the buildings, and he had read the specifications and the material documents in the case. To run lead-covered wires buried in plaster was a dangerous thing; the risks were too great. The Institution rules prohibited it. There might be mechanical damage by the plasterers; there was also the danger of anybody driving a nail into the wall. The danger of damage through leakage, in his opinion, was perhaps the most important risk. It arose primarily through bad work. The whole system must be made watertight and continuous, and it was very difficult, even when one was standing over the workmen all the time, to ensure that.

Mr. Gordon Hewart: It is said that where Frazzi blocks are used in the building, it is impracticable or very difficult to use wires in conduit. What do you say to that?—Frazzi blocks can be, and have been, cut, and in places that I saw in this particular building there was depth enough to put the conduit in the plaster without cutting them.

Taking the diameter of the barrel conduit itself, what is that?—Five-eighths.

For that you would need how much plaster?—If it was a job that had to be highly decorated, and you did not wish any appearance of the wires to show in the plaster, I do not think it would be safe to leave anything less than a quarter.

If you have the total of seven-eighths of an inch of plaster, or something more than that, that would suffice?—Yes.

Is that an unusual quantity of plaster to have upon a Frazzi block?—No; they had $1\frac{5}{8}$ in this particular one.

Witness agreed with Mr. Kirk that these blocks could be chased even after they had been built in. He saw no reason why barrel conduit could not be employed.

Witness, in further evidence, produced calculations to show that the method adopted was cheaper than that that the War Office said should be adopted. He estimated the difference in the cost at about £213 10s. He examined specimens of lead-covered wires that had been cut out, and pointed out to Mr. Justice Lawrence the various defects in them.

(To be continued.)

Cross Claim for Damages.

In the King's Bench Division on Tuesday, March 31st, Mr. Justice Rowlatt heard cross actions between the Kidderminster and Stourport Electric Tramways, Ltd., and Messrs. Woodward Grosvenor and Co., Ltd., a firm of Kidderminster carpet manufacturers, in which damages were claimed on both sides: in the one case for injury to the tramway, and in the other for damage to a private electric cable.

Mr. Duke, K.C., with whom was Mr. Eustace Mills, in opening the case for the Tramway Co., said that as the actions both arose out of the same matter it might be convenient that the evidence taken in one case might be regarded as applying to both.

Mr. Hugo Young, K.C., for the defendants in the first action (Messrs. Woodward, Grosvenor & Co.), suggested that both actions should be tried together.

Mr. Duke, however, did not agree, and continuing his opening, said that the plaintiffs were the proprietors, under statutory powers, of an electric tramway at Kidderminster and the defendants were a well-known firm of carpet manufacturers in the same district, where they had several establishments, and the action was brought in respect of interference by them with the plaintiffs' tramway by tunnelling under it for the purpose of laying private cables to connect the lighting of their different premises. Those premises were separated by one or two streets, and the tramway ran along one of those streets. The question was whether the defendants had any right to tunnel under the tramway for the purpose of laying their cable. If they had any right, then the question arose as to whether they had exercised that right with reasonable care, having regard to the interests of the Tramway Co., and, if not, what damages they ought to be made to pay.

His Lordship: Do you bring your action for damage to the tramway? What is the action against you for?

Mr. Duke: We claim against them for damage to the tramway and they claim against us for cutting one of their cables.

Continuing, Counsel said that the defendants' cable being laid in the soil, the only means of getting at it would be by breaking up the tramway. He did not think any question arose as to the plaintiffs' rights to maintain the tramway, without interference by other persons, in a manner which might increase the cost or give rise to risks to themselves or to their passengers. The *locus in quo* was a street called Oxford Street, alongside an ancient highway known as Wolster Street. Oxford Street was constructed upon artificially-made ground, and the line of the two cables ran across the junction of Oxford Street and Wolster Street. What the defendants had been doing was to carry a cable from a point in Green Street under the paving of Oxford Street, and the tramway was interfered with in two places where the cable crossed. In July of last year the defendants gave the plaintiffs notice of their intention to open the street for the purpose of laying an electric power main. That notice appeared to have been given in the belief that they had statutory powers, but that did not seem to be the fact, and the plaintiffs obtained an injunction restraining defendants from interfering with the tramway. Subsequently, upon an application to continue the injunction till the trial, an undertaking was given by the defendants that they would not interfere with the work. On September 2nd the defendants proceeded to sink pits on either side of the road with a view to tunneling under the roadway. The tunnel was completed, and it came within 18 in. of the actual structure upon which the tramway rested. There had been a good deal of conflict about the making of that tunnel, and between the 2nd and 16th, it was found that the surface of the tramway below the rails had subsided appreciably. The plaintiffs' surveyors found it necessary to take up the roadway, when they found that the concrete foundation had been fractured from the point where the tunnel had been made. The cost of repairs was not a serious one, but the principle involved was a more important matter. The expense of making good the tramway subsidence would be about £29 or £30, and the making good the tramway itself for a distance of 20 yards would be about £60. The main question was whether anyone was at liberty to dig a pit and drive a tunnel under the road.

Mr. **Arthur Charlton**, the first witness called, said that until recently he was managing engineer to the Tramway Co., a position which he had occupied for eight years. He was, and is, engaged in reorganising a tramway system at Sheerness. During the whole time he was with the plaintiff company it was part of his duty to superintend the permanent way, the construction of which he described in detail.

(*To be continued.*)

Crompton & Co., Ltd.

In the Court of Appeal, before the Master of the Rolls, Lord Justice Buckley and Mr. Justice Channell, on March 26th, Mr. **Wright** applied that an appeal which had been entered in *re* Crompton & Co., Ltd., from a decision of Mr. Justice Warrington, appointing a Receiver on behalf of debenture-holders of the company, might stand over until next sittings. Counsel stated that the learned judge had suspended the operation of his order until April 6th. The trust deed provided that the security should become enforceable if there was a winding-up otherwise than for the purposes of reconstruction. There had been a winding-up for the purposes of reconstruction, but Mr. Justice Warrington had held that the security had become enforceable, and an appeal had been entered from that decision. A scheme of reconstruction had been formulated under Sec. 120 of the Act, which scheme had been sanctioned by large majorities at the first meeting, and the confirmatory meeting had been fixed to be held next Tuesday week. In the circumstances, the learned counsel asked that the appeal should be ordered to stand over until after that meeting was held.

The **Master of the Rolls** stated that the application would be granted, as, having regard to the work which the Court had pledged itself to hear before the sittings ended, no interlocutory appeals from the Chancery Division would be heard before Easter.

Edwards *v.* Brixham Gas Co.

Nuisance from Electric Light Plant.

Application was made to Mr. Justice Astbury (for Mr. Justice Neville) in this action for the extension of the suspension of the operation of an injunction granted on December 17th to restrain an alleged nuisance of noise and vibration arising from the working of the defendants' electric light plant.

At the trial of the action, which took place in December last, the plaintiff, who was the owner of a shop and some cottage property at Brixham in the neighbourhood of the defendants' works, claimed relief in respect of damage to his property caused by defendants' recently-installed electric light plant. The defendants denied the nuisance and pleaded statutory obligations, and in granting the plaintiff an injunction his Lordship suspended its operation for three months to enable the company to alter their plant so as to abate the nuisance. That suspension had been continued by agreement from March 17th, and Mr. Gover, on behalf of the company, now applied for a further three months' suspension. This, he understood, the plaintiff would not object to on certain terms.

Mr. **Peterson**, K.C., who represented the plaintiff, said that was so. Two of the plaintiff's cottages, owing to what had taken place, there had been a great deal of difficulty in letting, and he asked that the defendants should pay as rent for them 3s. a week for each cottage as from March 17th. A further term he desired to impose was that the defendants should not use as evidence the result of any experiment they might make in those cottages, unless they gave the plaintiff or his advisers three days' notice of their intention to make the experiment and an opportunity to the plaintiff to attend.

Mr. **Gover** accepted those conditions, and his **Lordship** stayed the operation of the injunction until June 17th, accordingly.

Workmen's Compensation Claim.

Judge **Mellor**, K.C., sitting in the Manchester County Court on Monday, delivered his reserved decision in a case under the Workmen's Compensation Act, in which Samuel Robert Hart, of James Street, Openshaw, claimed compensation from Messrs. Vaughan and Son, Ltd., electrical crane makers, of West Gorton. The claimant's case was that on January 22nd he ascended a gallery to remove some rope blocks. In doing this he placed one hand on a rail along which a travelling crane ran. The crane started to move and he lost two fingers. The defence was that the accident did not arise out of, and in the course of, the man's occupation, and that Hart, by doing as he did, incurred a risk not incidental to his employment for which the employers were not liable. Judge Mellor held that although it was the claimant's duty to remove the rope blocks, he had incurred unnecessary risk in ascending the gallery and placing his hand on the rail, instead of climbing a ladder which had been used by a fellow workman for a similar purpose. Such a risk was not in the contemplation of either party at the time the workman was engaged. In his opinion, the accident did not arise either out of or in the course of the employment, and therefore there must be an award for the respondent.

OUR LEGAL QUERY COLUMN.

Questions addressed to this column should be written on one side of the paper only.

Company" asks:—"Has an urban authority power to compel a supply undertaking working under Parliamentary powers to lay all future cables in the roadways, when most of the original cables were laid under the pavement?"

⁂ The question is one of first impression, as it does not appear to be expressly provided for in the Electric Lighting Acts. By Clause 14 (1) of the Schedule to the Electric Lighting (Clauses) Act, 1899, it is provided that where the exercise of any of the powers of the undertakers in relation to the execution of any works will involve the placing of any works in, under, along or across any street or public bridge, notice must be given to the local authority, together with a plan of the proposed works showing the mode and position in which the works are intended to be executed, and the manner in which it is intended that the street is to be interfered with. The local authority may, at discretion, approve any such works or plan, subject to such amendments or conditions as may seem fit, or may disapprove them. There is an appeal from the approval or disapproval of the local authority to the Board of Trade. It would seem to be very unreasonable of the local authority in question suddenly to change their policy, but there is no case which shows that their discretion in the matter can be in any way controlled.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

On Wednesday last week the Festival Dinner of the Institution was held at the Trocadero. Mr. Hugo Hirst was the president of the evening, and there was a record attendance, one hundred and sixty-two guests sitting down to dinner, whilst a considerable number, who had taken tickets but were prevented from attending, sent messages of regret. The president was supported by Sir David Salomons (president of the Institution), Mr. Justus Eck (chairman of committee), Mr. C. H. Wordingham (vice-president), Mr. George Sutton, Mr. E. Garcke, Capt. H. Riall Sankey, Mr. Ll. Preece, Mr. M. Railing, Mr. L. G. Byng, and many other prominent engineers and supporters of the Institution.

After the toast of "The King," Mr. **Hirst** communicated the regret of many sympathisers at their absence from the table, including Mr. Cutler (president of the Garrick Dramatic Society), Baron Erlanger, Messrs. Ferranti, Hadfield, Koettgen, Touche, and Walters, and others, all of whom had intended to be present. He said that he had been collecting for a deserving cause, which had been too much neglected in the past. Electrical people were so much engrossed in their work that they were impervious to what was going on around them. Others, equally deserving, but less fortunate, had just failed to achieve success, and had gone down to a depth from which it was difficult to rise again. They were apt to blame a man for failure, but most of them had realised that, apart from ill-health, the electrical industry offered more chances for failure than any other industry—they had had to run great risks. Others had run the same risks and had failed, and they must sympathise with these. They all knew of such cases amongst their own friends. Poor men had the right to solicit favours and to ask for support, and society had organised relief for such cases; but those who were formerly their equals could not do so, and therefore they were organising a fund for their benefit. On their behalf his sympathies had been enlisted; it was not too pleasurable work, but it was worth doing. He expressed his appreciation of those who had come forward whole-heartedly in response to his application. There were others who would do so if the committee would take note of their criticisms. Amongst the former class he thanked the electrical and the daily Press. Next Mr. Garcke, one of those who came forward last year to support a proposal of Mr. Byng, who offered to give £100 if nine others would do the same. Unfortunately sufficient support was not given to that proposal, but Mr. Garcke gave his £100 all the same. Thanks were due to Mr. Hirst's own staff for their energetic support; they had applied to many people connected only indirectly with the electrical industry, who had contributed handsomely. As regarded electrical firms, he had received a number of interesting letters. Some were very flattering, and sent cheques through him, or through the usual channels, but some asked for whose benefit this fund was formed; it could not be too widely known that it was for anybody who was working, or had ever worked, for the electrical industry in any capacity. Others said that there was an undue relation between the expenditure and the benefits given; but this must always be the case when starting a new organisation. Others again said that the electrical industry had enjoyed a period of great prosperity—why should they beg at this time? The obvious reply was that that was the right time to provide against bad times. A great many large concerns and municipalities said that they had no funds for such a purpose, or had their own sick funds; but they must remember that men changed their employment and moved from one situation to another, why should such men, if they fell ill or into trouble, not have a call upon those who could afford to help them? He suggested that, if possible, the committee in future elections should put on their list representatives of institutions, prominent firms and undertakings as members of the council, and make it clear to them that the fund was at the service of their employés; by this means it would be possible to extract regular subscriptions from them and build up an annual income. Until this came about, they would have to go on as they started.

Sir David Salomons, in supporting the toast, thanked the members for electing him president, and recalled that thirty years ago he brought forward the proposal to found a Benevolent Fund for the Institution of Electrical Engineers, which had thriven to that day. As president, he followed his great friend, the late Sir William Preece, who supported his proposal to change the name of the Society of Telegraph Engineers to its present form. Thirty years further back still, when Faraday announced the discovery of electromagnetic induction, a lady asked him of what use it was. The great inventor replied: "Of what use are babies?" Faraday was a true prophet, for the infant discovery had extended its influence to almost all industries. He wished prosperity to the fund, and hoped that its members would never have occasion to call upon it.

Mr. Wordingham, also supporting the toast, said he had stopped subscribing on principle, but now came forward as an enthusiastic convert to the scheme. He was averse to the multiplication of organisations, which caused inefficiency and waste; but there was an unanswerable reason for the existence of this fund, namely, that the I.E.E. fund was for the benefit of members of that Institution only, while this was for the vastly larger class who could not be assisted by the former. Some might urge that the Insurance Act did away with the necessity for this fund, but there were many who could not benefit by that Act. Their fund was not giving much at present in comparison with the cost of giving it; but the electrical industry and the fund were both very young, and organisations of this kind could not do much good until they had large sums invested, so that they could give out of income, not out of capital.

In the absence of Mr. Faithful Begg, Mr. Godfrey Isaacs supported the appeal, saying that it was the duty of every industry to create an institution of this kind. They should associate with their fund a lesson in thrift, by asking those who were provided for to subscribe towards the fund. He was a member of a company employing a large number of men, which had made provision at the rate of £5,000 a year to assist those who would benefit by their fund, but made the latter contribute one-half of the income. They would substantially support any institution of this nature.

Mr. Eck proposed the health of the president of the evening, to whom he expressed their thanks not only for presiding at the dinner, but also for his ceaseless industry on behalf of the Institution; from the beginning they had had the benefit of Mr. Hirst's advice and practical aid, and he had aroused the sympathy of his partners. His late partner, Mr. Gustav Byng, left the first legacy to the Institution, and Mr. Byng's sons had also supported them in a whole-hearted manner. As the result of Mr. E. Byng's suggestion at the last festival, not only Mr. Garcke, but also Mr. Dane Sinclair had presented £100, and other contributions had followed. There was a record attendance that night, and he expected another record when the President announced the result of the collection, leading him to hope that their ideal of £20,000 a year as well as a well-endowed orphanage was not beyond the reach of probability. He had watched the steady progress of Mr. Hirst, under whose hand new industries were always developing, and he cordially submitted the toast, which was accorded musical honours.

In reply, Mr. Hirst expressed his gratitude to his supporters, and said he was particularly glad to see Mr. Godfrey Isaacs amongst them. The result of the collection in connection with the dinner was £2,762, but this was not quite the total, as there were some important subscriptions to be added.

An excellent musical programme was provided, the artistes being Mr. E. Beaumont, Miss V. Oppenshaw, Mr. G. Blackmore, Mr. T. E. Gatehouse, Miss Renée Haslam and Mr. Fred Rome. Mr. Bernard Flanders was at the piano.

Electrical Steam Generation.—A recent issue of the *Journal of Electricity, Power and Gas* refers to the use of hydro-electric energy for steam generation, which is to be tried in Eastern Canada, where two 750-KW. 2,400-volt three-phase boilers, to produce steam at 125 lb. pressure for heating, &c., are being installed in a cotton mill. Our contemporary refers to numerous plants of a similar kind which have been in operation in Europe. The 750-KW. unit is 6½ ft. in diameter and 11 ft. high; the builders estimate that 1 KW.-hour produces about 3 lb. of dry saturated steam at commercial pressures up to 125 lb. The internal arrangement of the boiler apparently consists of groups of electrodes in non-conducting tubular structures, which take in water at one end and discharge steam at the other, the water forming the resistance. The electrodes are movable, and are switched on in groups, giving the necessary control over the steam raising.

BUSINESS NOTES.

Fittings for His Majesty.—Messrs. [illegible] and Denelle, Ltd., of 129, Wardour Street W., have recently been honoured with the Royal Warrant of Appointment as Manufacturers of Electrical Fittings and Bronzes to His Majesty King George V.

Wholesale Traders' Association.—The Wholesale Traders' Association held its annual meeting on March 19th at the registered offices, 26, Corporation Street Birmingham. We have received from the secretary, Mr. G. G. Poppleton, a copy of the annual report for the year ended at September last, in which it is stated that the Association had a very satisfactory year in all departments; 233 new subscribers were enrolled, making the number on the register 2,630. The status inquiries received numbered 117,097, this department being very largely made use of. It is suggested that "long firm" frauds could in most instances be checked in their earlier stages if victims would at once lay the circumstances before the Association and co-operate with its officers in bringing the offenders to justice; 32,957 debts were placed in the Association's hands to collect, and out of £286,298, £175,837 was recovered without legal proceedings. A speciality is made of the collection of debts in Scotland, Ireland and abroad. Other matters touched upon in the report are the New Bankruptcy Bill and Deeds of Arrangement, the law's delays, railway rates, and the insolvency department. The Association, which has an Electrical Trades Section, has offices at Birmingham, London, and Sheffield.

Catalogues and Lists.—Messrs. Crompton & Co., Ltd., Chelmsford.—Advance copy of a pamphlet (8 pp.) No. 536, giving a general description, fully illustrated, of their searchlight projectors, commercial and military patterns.

Messrs. L. Gardner & Sons, Ltd., 87, Queen Victoria Street, London, E.C.—Small pamphlet, intended merely as an illustrated index to the various types of vertical gas and oil engines, &c., manufactured by them.

Trafford Park Estates, Ltd., Manchester.—A 56-page booklet concerning Trafford Park, its situation, advantages, works and industries. Many photographic pictures and a coloured map showing the location of different factories, are included. The publication should be studied by anybody interested in the building of new works or thinking of removing from one centre to another.

Messrs. Balcke & Co., Ltd., Broadway Court, Broadway, London, S.W.—New 16-page catalogue No. 311, containing a full and well-illustrated description of their patent dry-air filters. We understand that they have now supplied and on order in this country, dry air filters dealing with a total of nearly 80 million cb. ft. of air per hour. Two of the plants are each dealing with not less than 7½ million cb. ft. per hour.

The Hagen Accumulator Works, 15, Holborn Viaduct, London, E.C.—Sixteen-page illustrated price list of their Hagen accumulators for various purposes.

Messrs. Ozonair, Ltd., 96, Victoria Street, London, S.W.—New Catalogue, No. 1, of 16 pages describing and giving illustrations and prices of Ozonair machines of various types and sizes suitable for dealing with air in private rooms and offices, cold stores, hospitals, cinemas, factories, &c. In several of the older patterns improvements have been made and new patterns of portable and semi-portable apparatus are included. For the convenience of retailers the first page of the list is detachable.

Messrs. Scholey & Co., Ltd., 151, Queen Victoria Street, London, E.C.—The March number of *Scholey's Magazine* contains a photograph and notice of Mr. J. F. C. Snell, descriptive notes on the Graham automatic electric lift, an illustrated description of the Frantz electric suction cleaner, a quarterly price list of various electrical materials, and some comments on the "British Electrical Manufacturer in the World's Markets."

Messrs. Reavell & Co., Ltd., Ranelagh Works, Ipswich.—New catalogue (TS 1) of 20 pages containing fully illustrated particulars of their three-stage compressors for use with Diesel engines, semi-Diesel engines, and the auxiliary work in connection with land and sea Diesel installations.

Messrs. S. H. Heywood & Co., Ltd., Reddish, near Stockport.—56-page catalogue containing a large collection of illustrations of their electric transporters, pulley blocks, and runways of various capacities in service in different classes of works. A specification and some tabulated particulars of sizes, weights, &c., are included.

Messrs. Elliott Bros., Ltd., Central Buildings, Westminster.—New illustrated price list (Section 54, 32 pages) of Elliott recording instruments of a variety of patterns for switchboard and portable use.

The British Thomson-Houston Co., Ltd., Rugby.—Descriptive list No. 5,951, of 24 pages, fully describing their B.T.H. feeder voltage regulators—their principles, mechanical design, method of operation, efficiencies, &c.

Messrs. Ruston, Proctor & Co., Ltd., Lincoln.—Publication No. 3,483, illustrating and describing the Ruston exhaust gas-fired boiler for utilising the exhaust heat from internal-combustion engines.

The Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, London, W.—Ninth edition of their catalogue of telephones for all purposes; also electric bells, indicators, fire alarms, batteries and wires. In the course of its 160 pages, which are very fully illustrated and contain descriptive notes and particulars of prices, the following items are noticed:—A double-pole "Bell" receiver, British Post Office standard in enamelled drawn brass case; a domestic hand-combination set finished in cream and gold; "equipoise" arm for carrying G.P.O. table sets, keeping the telephone always handy yet never in the way; a sanitary glass mouthpiece, for use with G.P.O. wall sets and table sets, which shows all dust and dirt, and is easily removed and cleaned; a special clock for timing trunk calls; a conversation counter for checking message rate accounts; "Ferro case" phones, fitted in enamelled drawn steel cases, suitable for all climates; "Primax" interphones in a variety of patterns, including a new "factory" interphone, specially designed to stand rough handling; secret interphones with lamp signals; a comprehensive range of 'phones for use in mines, all complying with the Home Office requirements; electric blasting machines to comply with Home Office requirements; a complete range of iron-case bells; a new mechanical replacement bell indicator; and a new range of cables for interphone systems, with enamelled wire conductors. The same company has sent us a 28-page illustrated and priced pamphlet describing the "Sterling" car lighting system for motor-cars and boats, also electric horns, sparking plugs and other accessories for motor-cars.

The Electrical Co., Ltd., Charing Cross Road, London, W.C.—No. 3 of the *E.C. Journal* contains February metal price curves, an illustrated account of the firm's small machine factory, with notes on the Nitra lamp, house water pumps, electrical advertising, C.C. ampere-hour meters, and stock lists of dynamos and motors.

Messrs. Hans Renold, Ltd., Brook Street, Manchester.—24-page pamphlet dealing with the use of Renold chains in a Keighley electrically-driven woollen mill. The latter half of the publication is devoted to a reprint of the illustrated description of the electrical equipment of the mill (Messrs. Clough, of Keighley), which appeared in the Electrical Review in June, 1912.

Messrs. S.A. Industries Chimiques Chiasso (Suisse).—Brochure relating to the merits of "Isolit," which, it is claimed, is the best means of fixing porcelain insulators to iron supports, being unaffected by heat and cold, prepared with water, slow in setting, and firmly binding, while it is also an excellent insulator.

Messrs. Abercrombie & Son, 36, Whitfield Street, Tottenham Court Road, London, W.—16-page pamphlet illustrating and pricing some examples of choice electric candle fittings, such as they keep in stock, these including Adam, Georgian and Jacobean and all classic styles.

Liquidations. — The Stolz Electrophone Co. (1913), Ltd.—Under a compulsory winding-up order made against this company, the statutory first meetings of the creditors and shareholders were held last week at the London Bankruptcy Court. There was a large attendance of shareholders. and considerable resentment was displayed at the inanition of the directors by the investors who had lost money in the company.

Mr. H. E. Burgess, Official Receiver, made a lengthy report.

In the course of a discussion which ensued, a shareholder asked if any steps had been taken by the directors to ascertain the whereabouts of Mr. Holt, who recently disappeared.

Sir John Thrift, the chairman of the board, said he had not the slightest notion where Mr. Holt was at the present time. When the catastrophe occurred, the board were of opinion that the facts ought to be laid before the Public Prosecutor, with a view to the issue of a warrant for that gentleman's arrest. It was believed that in the first instance Mr. Holt went to New York, but it was subsequently rumoured that he had gone to South America.

A shareholder thought it was impossible for the present crisis to have come about without the directors knowing something about it.

Asked regarding the issue of the share certificates, Sir J. Thrift said he did not sign the certificates for the bogus applications for the 30,000 shares, and in fact he knew nothing about them until Mr. Holt had absconded.

Dr. Clarke said he had signed certificates without the transfers at the request of Mr. Holt. He knew nothing about the business side of company business, but joined the board as a medical man to deal with the investment part of the business, and did so with the consent of the Medical Council.

A decided opinion was expressed by shareholders that the directors had been guilty of gross negligence, and that steps should be taken to enforce their responsibility and recover some of the money subscribed.

The liquidation was left in the hands of the Official Receiver. who observed that it was perfectly obvious that the directors did not know their duties. It was further intimated by a shareholder that an action had already been commenced against the directors, and the whole circumstances would, in due course, be ventilated in the Courts.

Electromotor Equipment Co., Ltd.—A meeting of creditors is called for April 14th at 21, Old Broad Street, E.C., by the Liquidator, Mr. O. Steiner, to whom claims should be sent forthwith.

Osram Half-Watt Lamp in Street Lighting.—The Metropolitan Electric Supply Co., Ltd., before January 16th, installed a 105-volt 1,500-watt half-watt Osram at the corner of Vernon Place and Southampton Row, W.C., this being, we believe, the first of the new lamps used for street lighting in London. The half-watt Osram is contained in a lantern originally used for a cluster of three standard tungsten lamps, a new reflector having been fitted to accommodate the single unit. The result is said to be extremely good, and the illumination remarkable when compared with the high-pressure gas lighting in the vicinity.

Bankruptcy Proceedings. — Frederick Isaac Behrens (trading as Fred Burns), electrical engineer, 16, Market Street, Barnsley, Yorkshire.—The public examination of the above debtor was held at the County Court Hall, Regent Street, Barnsley. The debtor's statement of affairs showed a deficiency of £276, but this had since been amended to £133. Debtor attributed his failure to sickness of himself, bad debts, loss by fire, loss by stock being stolen when being taken to jobs, and loss on contracts. In his deficiency account the debtor placed his expenses incidental to illness, including specialists' fees, at £91, and loss by fire at £25. The Official Receiver (Mr. Basil S. Briggs) stated that debtor commenced business for himself in October, 1909, and had no capital. The beginning of his difficulties was in November, 1911, when he lost nearly £90 through the lessee of an entertainment hall in Barnsley becoming bankrupt. About that time his health broke down and he had been under doctor's treatment intermittently for various ailments ever since, and had incurred considerable expense for expert advice and treatment. By a fire at his shop last midsummer he lost £25. Debtor's wife was the tenant of the house and shop and she claimed the household furniture. Answering the Official Receiver, debtor said that owing to ill-health he had since December last been quite unable to attend to his business. He had employed four men, their wages being about £5 per week. He had lost very little on contracts, but he had lost money in giving discount in order to obtain payment of accounts owing to him. He did not know he was on the wrong side until December last. The examination was closed, the Registrar remarking that it was an unfortunate case.

J. W. Garsden (J. W. Garsden & Co.), electrical engineer, Blackburn.—Last day for receiving proofs for dividend, April 10th. Trustee, J. Smith, 27, Ainsworth Street, Blackburn.

L. Joseph Holt, lately the managing director of the Stolz Electrophone Co., Ltd., 85, Fleet Street, E.C.—A sitting of the London Bankruptcy Court was appointed to be held last week before Mr. Registrar Hood, for this public examination. The receiving order was made on January 30th, at the instance of Messrs. Dyer Bros. & Thomas, stockbrokers, 3, Finch Lane, E.C., creditors for £130. The act of bankruptcy cited was failure of the debtor to comply with the requirements of a bankruptcy notice duly served upon him. An order of adjudication was made on February 20th, and at the first meeting of creditors, Mr. F. S. Salaman, C.A., 1 and 2, Bucklersbury, E.C., was appointed as trustee, to act with the assistance of a Committee of inspection. Proofs of debts to the amount of £3,631 have been sent in by creditors. A registered letter containing notice of the proceedings was sent to the debtor at 85, Fleet Street, but was returned by the secretary to the Stolz Electrophone Co., with the intimation that the debtor was no longer connected with the concern. Mr. F. T. Garton, Official Receiver, reported that the debtor had not surrendered to the proceedings, and nothing was known regarding his movements or present whereabouts. Under those circumstances he asked for the sitting to be adjourned *sine die*. His Honour made an order in those terms. Messrs. Daniell & Glover represented the petitioning creditors.

T. M. Woodcock, electrical engineer, Sheffield.—First meeting April 8th; public examination April 23rd.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. 52, No. 231. April. London: E. & F. N. Spon, Ltd. Price 3s. 6d.—This issue contains papers on "The Design of Rolling Stock for Electric Railways," by H. E. O'Brien, and "Steam Boiler Working in Electrical Power Stations," by J. W. Jackson.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXX, Part 3. March. Newcastle-on-Tyne: The Institution. Price 5s.

"The Principles of Automatic Telephony." By Walter Atkins. London: *Electrician* Printing and Publishing Co., Ltd. Price 2s. net.

"*Transactions* of the University of Toronto Engineering Society." Vol. VIII, No. 10. February. Toronto: The University.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 3. March. New York: The Institute Price $1.

"*Giornale* ed Atti della Associazione Elettrotecnica Italiana. Vol. I, Nos. 5 and 6. March 15th and 25th. Milan: The Association. Price L. 1 each.

"The Passenger Transport Problem." Report of the Special Sub-Committee of the Manchester Corporation. Manchester: Corporation Tramways Department.

Russia.—In the statement of foreign trade for 1913, just issued by the Russian Custom House Department, it is observed that there has been an exceptionally rapid advance in the importation of dynamo-electric machines and electric motors of all kinds. The weight in 1913 amounted to 383,000 poods; the corresponding movement in 1911 was represented by only 211,000 poods, in 1909 by 143,000 poods, and in 1907 by 91,000 poods.—*Financier*.

Lantern Slides.—Messrs. Browett, Lindley & Co., Ltd., of Sandon Works, Patricroft, Manchester, have a number of lantern slides of their high-speed engines, consisting of photographs of various types and drawings for same, which they will be pleased to lend to lecturers for any suitable paper they may be giving on high-speed steam engines.

For Sale.—The Felixstowe and Walton U.D.C. has for disposal a 150-KW. C.C. dynamo; Rotherham Corporation has for disposal a Harris-Anderson patent oil extraction and filtering plant. Particulars are given in our advertisement pages to-day.

Trade Announcements.—Messrs. J. E. & S. Spencer have removed their offices to 16, Dowgate Hill, London, E.C., and their warehouse address is now 33, Dowgate Hill, E.C.

The Stirling Boiler Co., Ltd., are to-day removing to 54, Victoria Street, Westminster, S.W. Telephone number unaltered.

The London offices of Messrs. Saville & Walton are now at 39, Victoria Street, Westminster, S.W.

Messrs. Norton & Gregory, Ltd., have opened a branch office at 6, Budge Row, E.C., where they have installed electric plant for plan copying by all processes.

Messrs. Ward & Goldstone, of Manchester, announce that, owing to increased business in Scotland, they have opened larger premises at 50, Wellington Street, Glasgow, where they occupy the first floor, and have large offices and showrooms. Scottish inquiries should be sent to that address.

Catalogues for Alberta.—Mr. G. M. Hall, Industrial Commissioner of the City of Edmonton, in the Province of Alberta, suggests that British manufacturers who wish to extend their overseas trade should furnish him with copies of their catalogues. He will be pleased to place them upon record in his office, and advertise the fact in the hope that it may serve to help merchants in his neighbourhood to obtain some kinds of goods that they do not get now, and also to help British manufacturers to sell their goods in Edmonton.

Deed of Assignment.—M. Sims, electrical engineer, late of 46, Leigh Road, and Milton Road, Southend-on-Sea. Claims must be sent by April 21st to the trustee, Mr. J. Mortimer, of 3, Pancras Lane, Queen Street, E C.

The Argentine Republic.—From the preliminary returns which have lately been issued with regard to the imports into the Argentine Republic during last year, we learn that the imports of electrical goods attained a value of 7,027,000 gold pesos, as compared with 6,862,000 pesos in 1912.

Thames Ironworks.—According to the *Times* the engineering departments of the Thames Ironworks Co. at Greenwich are to be re-opened at an early date, giving employment to 1,500 to 2,000 men.

Exhibition.—The fifth International Printing, Stationery, Box-making and Allied Trades' Exhibition is to held at the Royal Agricultural Hall, Islington, N., from May 13th to 30th.

LIGHTING and POWER NOTES.

Argentina.—The Municipality of Paso de los Libres (Corrientes) has signed a contract with Messrs. Moran & Saldana, for the erection of an electricity works, which is to be completed within a year.—*Review of the River Plate.*

Australia.—The Leederville (W.A.) Council is raising a loan of £5,000 to extend its electrical plant.—*Tenders.*

Basingstoke.—Street Lighting.—The T.C. has given notice that in six months' time it will convert 59 street lamps, at present lighted by gas, to electric lighting.

Bexley.—New Plant.—The U.D.C. has decided to apply to the L.G.B. for a loan of £5,500 for additional plant at the generating station. The Council has decided to offer a supply of current in bulk to the Foots Cray Electricity Supply Co., at the rate of £3 5s. per kw. and ·33d. per unit.

Blackrock.—E.L. Scheme Adopted.—After considering several E.L. schemes, Mr. Tierney, the consulting engineer, has recommended the U.D C. to generate its own electricity. The Council has adopted this scheme, and instructed Mr. Tierney to prepare plans, &c.

Bolton.—Proposed Loan.—The Electricity Committee has decided to borrow £23,023 in connection with the alteration of the distribution systems, and £5,000 for the equipment of a proposed sub-station at Shifnal Street tramcar shed.

Loan Sanction.—The L.G.B. has sanctioned the borrowing by the T.C. of the following sums in connection with the Back-o'-th'-Bank electricity works:—£7,277 for steelwork, viaduct and foundations; £4,367, as to £2,610 for suction ash-handling plant, £783 for coal tippler, and £974 for electric capstan and ballards; £3,314, as to £1,556 for coal-conveying plant, £625 for coal-weighing plant, £163 for weighbridge and £162 for water meters.

Bradford.—Last week representatives of the West Riding Electrical Contractors' Association joined a deputation representing the plumbers' and gasfitters' interests, which waited upon the Gas Committee of the Corporation to protest against the proposal for opening a shop by the Gas Committee. The deputation were assured that the Corporation, in the new premises referred to, would not sell any articles of its own, but would merely offer facilities for local traders in gas apparatus to display their goods effectively, marked with the name of the trader and price of the article, and in cases in which a sale was effected the money would be handed over to the tradesman concerned. This is said to be a much more favourable position for the plumber, ironmonger and gasfitter than is enjoyed by the electricians.

Bradford-on-Avon.—E.L. Scheme.—The R.D.C. ha waived its option to purchase the proposed E.L. undertaking. The whole of the works will not be in the Council's area and the Council has taken this step rather than lose the scheme. The U.D.C. has approved of the agreement with Mr. J. H. Edwards, the promoter of the scheme.

Bramber and Beeding (Sussex).—Proposed E.L.—Efforts are being made to secure a supply of electricity for public and private lighting in these villages from Steyning.

Brazil.—According to the *Board of Trade Journal*, the concession granted to Sr. Brando for the utilisation of the hydro-electric power of the Sao Francisco River, reported in our last issue, has been annulled. The Paulo Affonso falls are stated to be the largest in South America, with a greater volume of water than Niagara.

Burnham (Somerset).—E.L. Inaugurated.—On Wednesday, last week, the electrical street lighting was switched on for the first time; the lamps are attached to the old ga standards.

Canada.—The Westmount (P.Q.) City Council has been authorised to borrow $125,000 to improve its electric lighting system; all the present overhead wires are to be placed underground.—*Canadian Electrical News.*

Cleveland.—L.G.B. Inquiry.—An inquiry was held by Mr. H. R. Hooper last week into the application of the Skelton and Brotton U.D.C. for powers to borrow £9,250 for the purpose o installing an E.L. system.

Continental Notes.—Spain.—A syndicate of French and Spanish capitalists has been formed to generate hydro-electri power in the little Republic of Andorra for transmission across th frontier to France.

Germany.—The erection of a large power station and distribution network is about to be commenced in the Bochum distric of Westphalia. The first installation in the power house wil comprise three 13,700-k.v.a. 5,000-volt turbo-generators eac coupled to a 14,000-k.v.a. transformer, wound for 50,000 volt mesh, or 86,500 volts star.

Dartford.—Mr. J. F. C. Snell has been appointed t report on the proposed extension of the electricity works in orde to give a supply to Crayford.

Devonport.—L.G.B. Inquiry.—Mr. P. M. Crosthwait held an inquiry last week into the application of the T.C. fo sanction to the following extensions at its electricity undertaking New offices, £1,237; one turbo-alternator, with condensing plan foundation, &c., £7,900; mains, £6,000; and services, £1,600; total of £15,500.

Dublin.—Year's Working.—The accounts of th Corporation electricity department show that the surplus for th past year was £11,861, instead of the estimated surplus of £26,07 Owing to the strikes in the December quarter the accounts factories and small shopkeepers decreased by over £4,000 as compared with previous years.

Durham.—School Lighting.—The C.C. has referre to a Special Committee for consideration a proposal made by th County of Durham E.P.D. Co., for the installation of E.L. at th County Industrial Schools.

Electric Cooking.—Speaking at a meeting of th Institution of Municipal and County Engineers at Torqua recently, the Torquay borough surveyor, in commenting on th success of the electric cooking apparatus at the municipal caf intimated that further extensions were under serious consideratio to meet the demands made during the summer season. We unde-stand that the Staffordshire Joint Small-Pox Hospital Board h decided to install an electric cooker at that institution.

Fife.—A new factory is to be erected by the Britis Aluminium Co. at Burntisland, on a site of 38 acres. Electric power is largely used in connection with these works, and extension of the manufactory at Kinlochleven is being made f the making of carbon electrodes.

Glasgow.—A commencement is being made with th erection of the new municipal power station at Dalmarnock Bridg The foundations are now in hand, and all plans have been prepare

Halifax.—Proposed New Plant.—The Tramwa Committee has resolved to apply to the L.G.B. for sanction borrow £2,800 for plant required at the electricity works, follows:—Cooling tower, £1,500; fan, £850; d.c. feeder pan £200; and test room equipment, £250.

Itchen.—Prov. Order.—The U.D.C. has decided adjourn discussion as to the working of its prov. order *sine die.*

Keighley.—Proposed Extension of Supply.—T T.C. is considering the question of applying for a prov. order supply electricity to districts outside the borough. including t area of the R.D.C.

Liverpool.—Loan Sanction.—The City Council b received sanction to borrow £10 000 for electric sub-stati equipment.

Leeds.—Electricity Works Extension.—Important proposals were to come before the Leeds City Council on Wednesday, for increasing the plant at the electricity works in Whitehall Road. The scheme is estimated to cost £200,000, by neans of which the capacity of the station will be more than loubled. The Committee proposes to install a 12,000-kw. turbo-lternator and condensing plant, six boilers, switchgear, &c. Part f the present plant will be abolished, and, if possible, sold. At resent there are three engine houses, and two of these will go; lso a switch room, and one of the boiler houses. The full scheme vill involve the purchase of adjoining land and premises for xtension of the generating station.

London.—Woolwich.—Bulk Supply to Foots Cray.—The Foots Cray E.S. Co. has applied to the Woolwich B.C. for a ulk supply of electricity within its area, and the Electricity Comnittee has recommended the B.C. to submit terms, and, subject to he offer being accepted, to apply to the L.C.C. for a loan of £4,290 or the necessary mains, switchgear and transformers.

Luton.—Workhouse Lighting.—The B. of G. has ppointed a Committee to consider the advisability of installing an ndependent E.L. plant at the Workhouse, which arrangement it is onsidered will be cheaper than the public supply.

Passage West (Co. Cork). — Proposed E.L.—A ublic meeting has unanimously approved of a proposed E.L. cheme, and appointed a Committee to proceed with the underaking. The cost is estimated at £3,000.

Queenstown.—Street Lighting.—The U.D.C. has ecently opened tenders for the street lighting, that for gas lightng in the outside area showing a considerable increase, while the lectric Lighting Co.'s tender for arc and incandescent lighting emained as previously, with the offer of a reduction if 24 gasghted lamps in its area are transferred.

New Zealand.—The Hastings Council has been ıthorised to borrow £68,250 for public improvements, including ıe installation of electric lighting.—*Tenders.*

North Bierley.—Workhouse Lighting.—The B. of G. as decided to install electricity at the workhouse at Clayton, in lace of gas. The cost is estimated at £1,000, and the annual ving at about £70; the present gas bill amounts to £450 per nnum.

Rawtenstall.—L.G.B. Inquiry.—Mr. H. R. Hooper eld an inquiry last week into the application of the T.C. for ermission to borrow £10,000 for the electricity undertaking, and 1,000 for public lighting.

Redditch. — New Plant. — The report of Messrs. andcock & Dykes on the electric light undertaking, has been nsidered by the E.S. Committee. The report met with approval, ıt before arriving at a decision upon the recommendations menoned therein, the Committee decided to obtain from Mr. Handck further particulars relating to the new plant, which he vised must be installed in any case without delay.

Reigate.—Prov. Order.—The R.D.C. has consented to prov. order for E.L. at Banstead, Walton-on-the-Hill and Kingsood, being granted to Mr. G. Allom, satisfactory terms and ices having being arranged.

Salford.—The T.C. is to enter into an agreement with essrs. Willans & Robinson for remedying the inefficiency of two rbo-generators at the electricity station. The Electricity Comttee proposes to enter into agreements with J. Mandleberg & Co., d the Albion Waterproofing Works for the supply of electricity, bject to a minimum demand of 50,000 units per quarter, the arge to be ·9d. per unit for the first 37,500 units in each quarter, d ·75d. for all units in excess.

Saddleworth. — The U.D.C. having applied to the alybridge Joint Tramways and Electricity Board with regard to upply of electricity, the latter has expressed its willingness to ant the supply on terms.

Seaton Delaval.—Overhead Wires.—The Newcastle-Tyne E.S. Co. has obtained the sanction of the local authorities the erection of overhead wires through Longbenton and Seghill Seaton Delaval, for the transmission of electricity at 20,000 ts pressure, and the consent of the B. of T. is being sought.

South Africa.—The Beaufort West (Cape Province) ınicipality has been authorised to expend £10,000 on an E.L. ıeme, the consulting engineer for which is Mr. Chas. G. Trevett, Cape Town.

Southend-on-Sea. — Loan for Diesel Engine b-Stations.—The T.C. is to apply to the L.G.B. for powers to rrow £14,510 for the purchase from Messrs. Belliss & Morcom, l., of five Diesel engines for the Leigh and Thorpe Bay subtions.

Street (Somerset).—E.L. Scheme.—The sum of ,700, which is in excess of the amount required, has been subibed for the proposed E.L. scheme, and ample guarantees having n secured, the scheme is to proceed.

Tunbridge Wells.—New Plant.—The Lighting Comttee has recommended the T.C. to invite tenders for an atmoıeric exhaust pipe, feed water pump, four new switchboard ıels and mechanical stokers for three boilers.

Upper Greetland (Yorks.).—Public Lighting.—The Parish Council has accepted an estimate of the Yorkshire E.P. Co. for the public lighting of the district, through which the company's mains pass.

West Bromwich.—Proposed Mains Extensions.—The Electricity Committee has recommended the T.C. to extend the electricity mains in the Great Bridge district, at an estimated cost of £1,450.

West Wickham.—The West Kent Electricity Co. has informed the B. of T. that it is now in the position to supply electricity to West Wickham.

Worthing.—Year's Working.—The surplus on the electricity undertaking for the past year was £1,008, and it is proposed to transfer £500 to the relief of the rates, leaving £508 to be carried forward. The estimated surplus for the year ending March, 1915, after placing £500 to the depreciation fund and paying £120 income-tax, is £617.

TRAMWAY and RAILWAY NOTES.

Australia.—Mr. T. B. Molomby, the passenger superintendent, and Mr. E. B. Jones, the secretary of the Victorian Railways, have left for Europe and America to study the working of electric railways in order to be in a position to deal with the electrified Melbourne suburban railways, which will commence running next year.

Blackpool.—Year's Working.—The receipts of the Corporation Tramways Department for the past year showed an increase of £12,700 over the preceding year. It is anticipated that £15,000 of the profits will be allocated to the relief of the rates.

Burnley.—Goods by Tramway.—The experiment of carrying heavy goods on the Corporation tramways is to be abandoned, owing to the business obtained being insufficient to warrant its continuance.

Colne.—Light Railway Purchase.—The Corporation took over the undertaking of the Colne and Trawden Light Railway Co. on Tuesday midnight, last week.

Continental Notes.—Germany.—It is reported that the Prussian Government is considering the question of establishing a State-owned electric power station to supply the Berlin Metropolitan and District Electric Railways.

For the North-South Underground Railway of the Berlin Municipality, now under construction, a direct current pressure of 1,000 volts has been adopted; trials of the new rolling stock are in progress. The existing underground railways work at 650-700 volts, the tramways at 500 volts, and the Prussian State railways have adopted the single-phase system.

With the financial support of the Hessian Government, the Siemens-Schuckertwerke are to construct a tramway between Bensheim and Sindenfels, near Darmstadt.

An electric railway is to be constructed from Danzig to the seaside resort of Brösen.

Sweden.—Electric traction has been adopted on the Stockholm-Saltsjobaden suburban railway, a single track line, 9½ miles long, with only two cross-overs. The trains consist either of one or two motor vehicles and trailer cars. The trailers consist of old railway carriages carrying from 72 to 90 passengers. The motor vehicles, which seat 64 persons, run on two four-wheel bogies; they are fitted with two 110-kw. motors geared to the bogies with a ratio of 1 to 4. The motors are controlled by a master switch, operating on 65-volt current delivered by a transformer mounted on the vehicle, and which also supplies the current for the lamps. The cars are also fitted with electric heaters. Alternating current at 6,000 volts, 25 cycles is taken from the Stockholm municipal power station and converted to direct current at 1,350 volts at a transforming station located about mid-distance on the line.

Luxemburg.—The Chamber of Deputies has decided to grant a subvention of £40,000 towards the cost of an electric tramway between Luxemburg, Hollerich and Esch-sur-Alzette. The line will be worked by the Continentale Eisenbahnbau und Betriebs Gesellschaft under a 20 years' concession.

Spain.—The Trans-Pyrenean Railway Committee has been ordered to study a preliminary scheme for a double-track electric railway from Madrid to the French frontier through the Roncal Valley, Sangüesa and Soria, to be worked by the State.

Croydon.—Electric Vehicles.—On Thursday, last week, a demonstration of electric vehicles took place outside the Town Hall; both pleasure and commercial vehicles were shown, including the Edison, Lloyd and Torpedo types, of which particulars and illustrations have appeared in our pages.

Dover.—A report states that the reconstruction of parts of the tramway track will cost £3,477, and the Tramways Committee has decided to expend £1,500 this year on the most urgent repairs, and will carry out the remainder as soon as possible.

Mexborough.—Railless Traction.—It is stated that the Mexborough and Swinton Tramway Co. is shortly to construct a system of railless electric traction between Mexborough Toll Bar and Conisborough.

New Zealand.—Electric Vehicles.—The Wellington City Council has decided to purchase two electric vehicles, one for the collection of parcels and the other for the use of the tramways department.

Oldham.—Year's Working.—The total receipts of the Corporation tramways department for the year ended March 25th, 1914, showed an increase of £7,710. During the year the car-mileage increased by 24,364 miles, and the passengers carried by 1,341,233, while the current consumption decreased by 143,601 units. Wages increased by £4,750, and from £10,000 to £12,000 had been spent on the permanent way. The profit on the year's working was about £5,220.

Shipley.—Track Renewal.—The U.D.C. has decided to let out to contract the reconstruction and renewal of the tramway track, the Council providing the cement for, and supervision of, the work of laying the foundation. Using direct labour the surveyor estimated the cost at £8,365.

U.S.A.—According to the *Railway Gazette* it has now been decided to electrify the Chicago, Milwaukee and St. Paul Railway for part of the distance between Harlowtown, Mont., and Avery, Idaho, some 440 miles across the Belt, Rocky and Bitter Root mountain ranges. The first section to be undertaken will cover 113 miles of route, and it has been decided to adopt 2.400-volt direct-current traction, utilising regenerative electric braking instead of air brakes. It is expected to operate the section with 12 200-ton freight, four 200-ton through passenger and two 100-ton local passenger locomotives. The cost of installation is estimated at about £300,000, exclusive of locomotives. The above railway joins the Butte, Anaconda line, also a 2,400-volt D.C. system, which is described in this and the preceding issues of the Electrical Review.

TELEGRAPH and TELEPHONE NOTES.

Automatic Telephony.—Messrs. Davidson & Co., Ltd., have installed a system of automatic telephones throughout their Sirocco Engineering Works, Belfast. The apparatus was supplied by the Automatic Telephone Manufacturing Co., Ltd.

Cable Concession.—The concession granted to the India-Rubber and Gutta-Percha Co. for establishing submarine cables between Pernambuco and the West Coast of Africa by way of the Island of Fernando Noronha, has been transferred to the South American Cables Co.

Constantinople.—The newly-opened telephone exchange was recently thrown out of action for several days by a violent thunderstorm.

Dartford.—The U.D.C. will apply to the L.G.B. for sanction to the borrowing of £364 for the purpose of installing a system of public fire alarms and call bells.

Dundee.—Col. A. M. Ogilvie has intimated to a meeting of the Telegraph and Telephone Advisory Committee for Dundee that a scheme which will meet the requirements of the district for the next 15 years has been arranged. Fifteen miles of pipe line and about 3,600 miles of wire will be laid down at a cost of £14,000. It has also been decided to proceed with the construction of a new central exchange, which will be available in two years' time. The cost of the P.O. extension, in which the new exchange will be housed, will be about £18,000. Two additional lines will be laid, to Edinburgh and Glasgow. The cost of the new switchboard will be from £25,000 to £30,000, according to the system adopted, while from £6,000 to £14,000 will be expended upon new telephones.

Edinburgh.—Colonel A. M. Ogilvie stated at Edinburgh that they had made an estimate for the expected growth of the system for the next 15 years, and would have to establish a new exchange service in the south side of the city. In connection with that they would have to have a very extensive system of underground lines. The scheme would cost from £50,000 to £100,000, and probably the exchange and switchboard would cost from £70,000 to £80,000. He mentioned that the estimates for next year involved an expenditure on the national telephone system of £4,500,000.

Imperial Wireless System.—The idea of situating the Indian station of the chain at Bangalore has been abandoned, owing to the fact that the station being a long-range station, the transmitting and receiving stations have to be some 20 miles apart, and consequently, if Bangalore were chosen, the receiving station would be in British territory and the dispatching station in Mysore territory, or *vice versa*, which is considered to be undesirable. The authorities are investigating the possibilities of Poona as a site for the Imperial station; should this be found to be unsuitable, Ootacamund might possibly be chosen

On Thursday last week the cross-examination of Lord Murray before the Select Committee of the House of Lords was continued. The charge that Lord Murray had used his influence as Chief Whip to prevent discussion of the contract with the Marconi Co. was withdrawn. The evidence was concluded, and the Committee adjourned until Tuesday, but owing to the illness of Lord Halsbury, no sitting took place on that day.

Intercepting Wireless Messages.—A Russian telegraph engineer camed Jhidkovsky stationed at Zhonerinka, has been arrested on a charge of intercepting wireless messages between Government military stations and communicating them to a foreign Government.

London Telephones.—A Special Committee has been appointed by the London Chamber of Commerce, including members of the City Corporation, the County Council, and the Port of London Authority, to advise the Postmaster-General with regard to the telephone service. The Committee has appointed Sir C. J. Owens chairman.

P.O. Telegraphs and Telephones.—A White Paper has been issued showing the amounts received and expended on account of the telegraph and telephone services for the year ended March 31st, 1913. It shows that the gross amount received by the Post Office in respect of telegrams, telephone rentals and fees, private wire rentals, newspaper wire rentals, &c., was £9,656,671. With the sum of £811,889 deducted (£808,690, the amount paid to cable companies, foreign companies, &c., and £3,198, the amount of telegram moneys refunded), the gross amount received was £8,844,782. The gross amount received by the Post Office in respect of royalties payable by the National Telephone Co., Ltd., and other licensees was £1,659, and the value of telegraph and telephone services performed for other public departments without remuneration was £106,670. The balance of expenditure over receipts was £377,547. For the transmission of telegrams the sum of £3,909,608 was received. The administrative and operating expenses amounted to £3,025,036. The report of the Telephone Finance Committee shows that the surplus on the year's working, after allowing for interest on capital, amounted to £303,343, equal to 1·47 per cent. on the capital. The revenue for the year in relation to telephones amounted to £5,791,988. The administrative and operating expenses came to £1,469,266.

Rapid Telegraphy.—Messrs. Siemens & Halske are developing a new system of automatic telegraphy in which a perforated strip, having five parallel rows of holes, is used at the transmitting end, with five corresponding relays at the receiving end. Very high speeds are obtainable.

Wireless Telephony.—Successful transmission of the singing voice, but not the words sung, has been effected from the station at Laeken, near Brussels, to the Eiffel Tower, 225 miles away.

The Reineke system of wireless telephony is being installed at the Lindsay Colliery of the Fife Coal Co., Ltd., and will enable communication to be maintained with the innermost workings, even in the event of a disastrous explosion occurring.

Wireless Weather. — A wireless service has been organised, since November last, along the Austro-Hungarian coasts. Wireless meteorological reports are transmitted by the coast stations at Castelnuovo, Sebenico, and Trieste to ships asking for them for a fee of 4 kronen.

Meteorological reports are transmitted in Russia by the coast stations at Reval, Riga and Libau regarding atmospheric conditions in the Baltic. Information is supplied from the Nikolaiewski Observatory at St. Petersburg.

A wireless station has been constructed at the Royal Aeronautical Observatory at Lindenberg for the twofold purpose of disseminating weather reports throughout Germany for the benefit of airships and others, and of apprising airships of the occasions when captive balloons and kites have ascended from the Observatory. The captive balloons and kites, to the number of six or eight at a time, are fastened to strong steel wires, and as they rise often to heights of 6,000 metres, when deflected by a strong wind, form a serious danger zone to air navigation.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—April 15th. Installation of electrically controlled clocks in the new station for the Joint Station Committee. Specifications (10s. 6d.) from Mr. J. A. Parker, 80, Guild Street.

Austria.—Simmering.—April 8th. Supply of an electric motor wagon for a sliding platform, and three electrically worked capstans for the railway workshops at Simmering. Particulars, drawings, &c., (3 kronen), from Abteilung IV/6, Zugförderungs und Werkstä Hendienst der K.k. Staatseisenbahn Direction in Vienna.

Australia. — May 12th. P.M.G.'s Department. Standard batteries for all States: Schedule No. 1,010. See "Official Notices" to-day.

VICTORIAN RAILWAYS.—May 13th. One hundred enclosed arc lamps. Deposit £5. Mr. E. B. Jones, acting secretary.

VICTORIA.—May 20th. Victoria Railways Commissioners. One three-phase slip-ring electric motor and accessories. Deposit £1. Local representation. A specification can be seen at the B. of T. Commercial Intelligence Department in London.

MELBOURNE.—April 27th. Overhead travelling cranes for sub-stations and lifting tackle for power stations, for Melbourne Suburban Railways. See "Official Notices" to-day.

Ballymena.—April 11th. B. of G. E.L. installation at workhouse and supply of steam engine, 20-KW. dynamo and steam pumps. Specification from Mr. F. D. Brown, Engineer, 93, Ann Street, Belfast.

Belgium.—April 16th. Electric lighting installation on the Bassin Canal and the new subsidiary basins. Some particulars (in French) can be seen at the B. of T. Commercial Intelligence Department in London.

Bootle.—April 22nd. Corporation. Supply of two 500-600-KW. rotary converters, transformers and switchgear for the electricity department. Forms of tender from the Borough Electrical Engineer, Electric Light Station, Pine Grove.

Bosnia.—DOBOJ.—April 20th. Municipal electric light installation for Doboj and Usora, comprising supply and erection of driving machinery, electrical equipment of the generating station, supply and erection of pumps and motors, complete distribution network for Doboj and Usora. Particulars from the Stadtgemunde, Dodoj, Bosnia.

Bray.—April 7th. U.D.C. General stores and stores for electric light works. See "Official Notices" March 13th.

Bristol.—April 15th. Arc lamp carbons and incandescent electric lamps for a year for the Docks Committee. Mr. W. W. Squire, Engineer, Cumberland Basin.

Colwyn Bay.—April 4th. U.D.C. Twelve months' supply of engine-room stores for the electricity works. Forms of tender from Mr. A. R. Tudman, Electrical Engineer, Ivy Street.

Devonport. — April 8th. 1,250-KW. turbo-alternator, with condensing plant, two 500-KW. rotary converters and switchgear, for the Borough Electricity Department. See "Official Notices" March 20th.

April 27th. Corporation Gas Department. Electrically-driven jib crane and coal hoppers. Specification, &c. (£1 1s.), from Mr. I. Carr, Widnes.

Dublin.—April 17th. Corporation. Twelve months' supply of arc lamp carbons. See "Official Notices" to-day.

Edinburgh.—April 6th. Midlothian and Peebles Asylum. Six months' supply of electric fittings. Forms of tender from the Clerk and Treasurer, 19, Heriot Row.

April 20th.—Corporation. Extension switchboard, for McDonald Road station. See "Official Notices" to-day.

Farnworth.—April 18th. U.D.C. Switchgear and cables. Mr. H. J. Hutchinson, Engineer, Electricity Works.

Germany.—April 20th. The municipal authorities of Bremen are inviting tenders for the supply and erection of six alternators.

Glasgow.—April 7th. Twelve months' supply of stores, fuel, &c., for the Tramways Department. Specification from Mr. J. Dalrymple, General Manager, 46, Bath Street.

APRIL [illegible].—Corporation. Rewiring the electrical installation at Haghill Works and Stables, Dennistoun, for the Corporation. Specification from Mr. D. McColl, 20, Irongate.

Gloucester.—Low-tension, paper-insulated cable, for the Electricity and Tramways Committee. See "Official Notices" March 27th.

Hyde.—April 6th. Corporation. Telephone installation in the new Town Hall extension. Mr. J. H. Fletcher, architect, Clarendon Place, Hyde.

Leeds.—May 11th. Corporation. Steam turbine, three-phase alternator and exciter, 12,000-KW., 1,000 to 1,500 R.P.M., and condensing plant. See "Official Notices" to-day.

Limerick.—April 17th. Corporation. Electrical accessories, service boxes, cables, &c. See "Official Notices" to-day.

London.—L.C.C. April 9th. Installation of 65 wiring points, 85 lights, and two power points, at Moxey Road centres, Woolwich. See "Official Notices" March 20th.

April 22nd.—L.C.C. Installation, 218 wiring points, 283 lights, at Wilson Street Elementary School, Islington, N. See "Official Notices" to-day.

Morocco.—April 18th. Four electric cranes and electric power plant. Firms desiring to tender should communicate with Mons. le President de la Commission Générale des Adjudications et des Marches, Dar-en-Niaba, Tangier. Moroccan contract regulations may be seen at the C.I. Branch of the B. of T., London.

New Zealand.—May 11th. Hydro-electric and sub-station plant for Tauranga. Specification, &c., from Messrs. H. W. Climie & Son, engineers, Tauranga. Deposit £2.

WELLINGTON.—City Council Tramways Department. Two electric motor vehicles, one for parcels collection, and one for departmental use.

Nottingham.—April 16th. Twelve months' supply of stores for Corporation electricity department. See "Official Notices" to-day.

Portsmouth. — 2,000-KW. turbo-alternator complete, for Borough Electricity Department. See "Official Notices" March 27th.

Portugal.—May 16th. Electric railway between Lamego and the left bank of the River Douro (7½ miles). Construction and working. Direccao Geral das Obras Publicas e Minhas, Lisbon.—*Board of Trade Journal.*

Rathkeale (Co. Limerick).—April 18th. Gas engines and suction plant, dynamos, storage battery, switchboard, overhead lines and street lamps, for Rathkeale Electric Lighting and Power Co. See "Official Notices" March 27th.

Rochdale.—April 15th. Corporation. Boiler feed pumps and crane. See "Official Notices" March 27th.

Rosslynlee.—Mid-Lothian and Peebles District Asylum invite offers for supply of electric fittings. The Clerk, 19, Heriot Row, Edinburgh.

Salford.—April 6th. Corporation. Supply of one 10-ton travelling crane at sub-station for the Electricity Committee. Particulars from the Borough Electrical Engineer, Electricity Works, Frederick Road, Pendleton.

Spain.—The municipal authorities of Guejar Sierra (Province of Granada) have just invited tenders for the concession of the electric lighting of the town.

The Spanish Post and Telegraph authorities in Madrid are about to invite tenders for the establishment of telephone lines between Aranda de Duero and Irun, and between Burgos and Santander.

Torquay.—April 20th. Corporation. Two water-tube boilers, fuel economiser, steam pipes, valves, &c. See "Official Notices" to-day.

Tunbridge Wells.—April 30th. Corporation. 4,000 tons of small coal for use with Underfeed stokers. Borough Electrical Engineer.

April 22nd.—Corporation. 300-KW. steam prime mover, alternator and exciter, condenser with air and circulating pumps. See "Official Notices" to-day.

Tyrol.—HALL.—May 2nd. Installation, complete, of a single-phase mine railway in the State salt mines; also supply of a single-phase alternate current locomotive and 15 iron mine trucks and a revolving tipper. Particulars of the K.k. Salinen-verwaltung, Hall, Tyrol.

Wallasey.—April 7th. Steam and electrical plant, &c., for the Borough Electricity Department. See "Official Notices" March 13th.

Walthamstow.—April 24th. U.D.C. One water-tube boiler and pipework, overhead bunkers and conveying plant, cast-iron circulating water pipes, for the Electricity Department. See "Official Notices" to-day.

Warrington.—April 14th. One year's supply of motors and transformers, for the Borough Electricity Dept. See "Official Notices" March 27th.

Wigan.—April 18th. Corporation. Electrical accessories, service boxes, cables, &c. See "Official Notes" March 27th.

April 18th.—Corporation. Tramcar accessories, brake blocks, overhead line material, &c. See "Official Notices" to-day.

April 20th. Corporation. H.T. feeder cable, transformer and switchgear. See "Official Notices" March 27th.

CLOSED.

Admiralty.—The Aster Engineering Co. has recently received orders from this department for two engines for 35 H.P. generating sets (22 KW.) for lighting, and one for a 28-H.P. marine engine set.

Australia (QUEENSLAND).—P.M.G's. Department.

112 microtelephones and accessories, £125.—Western Electric Co. (Australia), Ltd.

Victorian Public Works Department.—

Four electric motors, £198.—Siemens Bros. Dynamo Works, Ltd.

Sydney Harbour Trust.—

Eight pairs electrically-operated conveyors, for Wooloomooloo Bay.—Gilson, Battle & Co., Ltd.—*Tenders.*

Birmingham.—The Corporation Tramways Department has accepted a tender for 25,000 Osram traction lamps for use on its cars.

Blackpool.—The Tramways Committee has accepted the tender of the United Electric Car Co. for the supply of six new "toast-rack" cars.

Bridlington.—The T.C. has entered into an agreement with the Chloride Electrical Storage Co., Ltd., for the entire replating of the negative plates in the battery, the Council to pay £250 for the replating, and £100 a year for maintenance for the remainder of the present agreement for 12 years.

Bristol.—The Docks Committee of the T.C. has accepted the tender of Messrs. Herbert Morris, Ltd., for a second overhead electric travelling gantry, for Bathurst Wharf.

Brussels.—Four firms tendered for the supply to the Société Nationale des Chemins de Fer Vicinaux, of Brussels, of tubular telescopic metal posts for electric traction lines, in four lots, the lowest offers being :—First lot, Thyssen et Cie., 16,400 fr. ; second lot, same firm, 14,700 fr. ; third lot, Mannesmann Rohrenwerke, 21,377 fr. ; and fourth lot, same firm, 12,826 fr.

Canada.—The Winnipeg City Council has awarded the Canadian Westinghouse Co. a contract for switchgear at the King Street sub-station, the estimate for which was $16,828.—*Canadian Engineer.*

Croydon.—The B.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for electric cables for one year.

Darwen.—The Education Committee has accepted the tender of Mr. W. V. Fairhurst, for electric lighting at Spring Bank School.

Derby.—The T.C. has accepted the following tenders :—

Babcock & Wilcox, Ltd.—Boiler, £1,900.
F. W. Brackett & Co., Ltd.—Water screen, £278.
E. Morley & Sons.—Extension of flooring and turbine bed, £330.
J. H. Fryer.—Trench work, £448.
B.I. & Helsby Cables, Ltd.—High-tension cable, £887 ; and hard-drawn copper.

Egypt.—According to a statement in the *Times*, the Egyptian Government has placed a contract with Messrs. Sulzer Bros., Switzerland, for a large pumping installation to be erected near Baltim, in the Delta of the Nile. The contract includes four water-tube boilers, eight 400-B.H.P. Sulzer-Diesel engines, six 475-B.H.P. Sulzer-Uniflow steam engines, each set of engines being direct-coupled to a pump. A Diesel electric lighting installation and other equipment are also included.

Germany.—Messrs. Mossay & Co., Ltd., of Westminster, state that their works have received an order for two Lloyd street-washing machines from the City of Leipzig.

Hereford.—The contract for the whole of the electrical installation work for the New Theatre has been secured by Messrs. Walker & Co., Hereford.

Ilford.—The following tenders have been accepted by the U.D.C. Electricity Committee for annual supplies :—

C. Macintosh & Co., Ltd.—Cables.
Union Electric Co., Ltd., and the Sloan Electrical Co., Ltd.—Conradty arc lamp carbons.
Cryselco, Ltd. ; Electrical Manufacturing and Supplies Co., Ltd., ; and Pope's Electric Lamp Co.—Incandescent lamps.
Ferranti, Ltd. ; Siemens Bros. and Reason Manufacturing Co., Ltd.—Meters.
W. Lucy & Co., Ltd., and Reason Manufacturing Co., Ltd.—House service fuse boxes.
W. Lucy & Co., Ltd.—Joint boxes.
Edison & Swan Co., Ltd.—Main switches.

Leyton.—The U.D.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for Mansfield nutty slack for the electricity works for a year, at 11s. 10d. per ton.

Llandudno.—The Electricity Committee has accepted the tender of the Tudor Co., amounting to £1,215, for replating the battery.

London.—L.C.C.—The Education Committee reports that tenders for electric lighting the undermentioned schools are expected to be received during the Easter recess, and recommends that the chairman, and vice-chairman of the Council, with the chairman and vice-chairman of the Education Committee, and of the Building Sub-Committee of the Education Committee, be authorised during the recess to accept the lowest satisfactory tender in each case : Wilson Street, Islington ; Furzedown Training College and Hostels, Wandsworth ; Bloomfield Road, Central (Maxey Road centres) Woolwich.

The following tenders have been received by the Education Committee for installing electric light in the Upper Marylebone Street School :—

Napier, Kimber, Ltd. (accepted)	£257	C. H. Cathcart & Co.	£315
Lund Bros. & Co.	281	Malcolm & Allan, Ltd.	[illegible]
Arthur Newman, Ltd.	297	W. Dickinson & Co.	[illegible]
Alpha Manufacturing Co.	303	J. and F. May	[illegible]
R. H. and J. Pearson, Ltd.	[illegible]	G. P. Allan & Co.	[illegible]
		G. Weston & Sons, Ltd.	350

The Highways Committee reports for the supply of eight motor wagons for use in connection with the renewal and repair of the tramways permanent way, that the following tenders have been received. For six 5-ton steam motor wagons :—

	Steel tyres.	Rubber tyres.
Foden's, Ltd. (recommended)	£[illegible]	£1,110
Mann's Patent Steam Cart and Wagon Co., Ltd.	1,542	1,402
Leyland Motors, Ltd.	1,636	1,590
R. Garrett & Sons, Ltd.	[illegible]	1,600
Yorkshire Commercial Motor Co.	[illegible]	1,572
Clayton & Shuttleworth, Ltd.	1,110	[illegible]
W. Allchin	1,200	1,770

For two 2-ton petrol motor wagons :—

Alldays & Onions Pneumatic Eng. Co., Ltd. (recommended)	£965
J. I. Thornycroft & Co.	1,002
Commercial Cars, Ltd.	1,050
Leyland Motors, Ltd.	1,055
„ „ (alternative for 2½-ton wagons)	1,220
Dennis Bros (1913), Ltd.	1,090
J. & E. Hall, Ltd.	1,126
Albion Motor Car Co.	1,134
Daimler Co., Ltd.	1,183
Wolseley Tool & Motor Car Co., Ltd.	1,390

The Committee recommends that Foden's, Ltd., be allowed to sublet to H. Morris, Ltd., the jib cranes required in connection with the supply of the six 5-ton steam motor wagons, and that Alldays & Onions Pneumatic Engineering Co., Ltd., be allowed to sublet to the Atlas Resilient Steel Wheel Co., the steel wheels required in connection with the supply of the two 2-ton petrol motor wagons.

Stepney.—The Electricity Committee recommends that the offer of Messrs. Reyrolle & Co. (patentees of the type of switchgear used by the Council) be accepted for the extensions to the high-tension switchgear at the Limehouse Station and Osborne Street sub-station at £900 ; also that the offer of Messrs. Strachan and Henshaw be accepted for providing a second telpher for handling coal and ashes at the Limehouse Station for use on the existing apparatus, at £585.

Plymouth.—The T.C. has accepted the tender of the Lorain Steel Co. for 100 tons of tram rails, with fishplates and joints, at £746. The only other tender was that of Walter Scott, Ltd., Leeds, at £747.

Salford.—The T.C. has accepted the following tenders for supplies to the Tramway Department—biennial supplies :—

Car Accessories (Electrical) Insulating Materials.

British Westinghouse Co. (approx. value of contract)	£1,080	Micanite and Insulators Co.	£148
General Electric Co.	17	Wm. Geipel & Co.	400
Wm. McGeoch & Co.	99	Manchester Armature Repair Co.	529
John Hall	12	Fleming, Birkby & Goodall	69
L. Andrew & Co.	110	W. Boydell & Sons	144
C. Macintosh & Co.	27	Tramway Supplies	17
Ward & Goldstone	54	Gabriel & Co	18
Reddaway & Co.	46	Le Carbone	78
North British Rubber Co.	74	B. Norbury & Co.	218

Car Accessories (Mechanical).

John Hall	£69	Tandem Smelting Co.	£572
R. & H. F. Phillips	28	Shotton Bros., Ltd.	306
Brown, Bayley's Steel Works	387	Tramways Supplies	54
Brecknell, Munro & Rogers	357	Vaughan Bros.	250
Gabriel & Co.	52	Malleable Steel Castings Co.	42
National Rail and Tramway Appliances Co.	1,132	Watlington & Co.	27
G. B. Allsop	550	John Baker & Co.	1,625
Phosphor Bronze Co.	20	British Hele-Shaw Patent Clutch Co.	943

Special Car Accessories.

British Westinghouse Manufacturing Co., and Dick, Kerr & Co.

Special Paints, Varnishes, &c.

Nobles & Hoare, Ltd.	£238
Docker Bros.	149

Ears, Frogs, Pull-Offs, &c.

Alfred Wiseman, Ltd.	£17	B.I. and Helsby Cables Co.	£19
Brecknell, Munro & Rogers	94	Forest City Elec. Services Supply Co.	16
John Hall	13	Brit. Westinghouse Co.	10
Watlington & Co.	94		

Glass.

S. Gratrix, Jun., Bros., Ltd.	£165
Pilkington Bros.	136

Special Overhead Equipment.

B.I. and Helsby Cables Co.

Wire, Solder, Lead, Tin, &c.

John Hall	£150
J. Bassett	34
L. Andrew & Co.	96

Special Car Accessories.

British Westinghouse Co.	£903

Annual supplies :—

Insulating Materials.

Siemens Bros. Dynamo Works	£684

Paints, Oils, &c.

British Petroleum Co.—Petroleum	£106
Anglo-American Oil Co., Ltd.—Petroleum and petrol	684

The following tenders have been accepted for annual supplies to the electricity department :—

Sloan Electrical Co.—Arc lamps, carbons	£71
Dussek Bitumen Co.—H.T. joint-box compound	16
W. T. Glover & Co.—Fuse wire	

The following tenders have also been accepted :—

Lancashire Dynamo and Motor Co., Ltd.—40-H.P. slow-speed motor to drive combined air compressor at the electricity station, £131.

Thos. Wragg & Sons, Ltd.—1,500 yd., three-way stoneware conduits, 1s. 11d. per 2 ft. 6 in. length.

J. Chapman & Sons.—Erection of transformer sub-station in Pump Street, £[illegible].

Bertram Thomas.—Main traction switchboard, £1,517.

Southampton.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a contract from the Harbour Board for Wotan, tantalum and carbon lamps, and glassware, for the ensuing 12 months.

Swindon and Highworth.—The Guardians have accepted the tender of Messrs. J. Lott & Sons for six months' supplies of electric cable, flexible electric cord, and Phlatta switches.

Trimdon.—The P.C. has accepted the tender of Reid, Ferens & Co. for poles, brackets, cables, &c., for public lighting; and that of Walter Scott, Ltd., of Newcastle, for the electrical supply.

Wakefield.—The B. of G. has appointed Mr. W. Robb to supply electrical appliances required during the ensuing six months.

York.—The General Electric Co., Ltd., have secured the contract for Osram metal-filament lamps required during the ensuing year by the Corporation.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Newcastle Local Section).—Friday, April 3rd. At 7 p.m. At Hugh Bell School, Middlesbrough. Address on "Ozone," by Mr. E. L. Joseph.

(Manchester Local Section).—Tuesday, April 7th. At 7.30 p.m. At the University (Physical Laboratory). Paper on "Current-Limiting Reactances on Large Power Systems," by Messrs. K. M. Faye-Hansen and J. S. Peck.

(Yorkshire Local Section).—Wednesday, April 8th: At 7.15 p.m. At Philosophical Hall, Leeds. Paper on "The Bonecourt Boiler," by Mr. C. D. McCourt.

(Birmingham Local Section).—Wednesday, April 8th. At 7.30 p.m. At the University, Edmund Street.

Royal Institution of Great Britain.—Friday, April 3rd. At 9 p.m. At Albemarle Street, W. Paper on "Further Researches on Positive Rays," by Prof. Sir J. J. Thomson, F.R.S.

Saturday, April 4th. At 3 p.m. Paper on "Recent Discoveries in Physical Science," by Prof. Sir J. J. Thomson, F.R.S.

Association of Engineers-in-Charge.—Saturday, April 4th. Bohemian Concert.

Wednesday, April 8th. At 7.30 p.m. At St. Bride's Institute. Paper on "Intercommunication Telephones," by Mr. A. F. Cannon.

North of England Institute of Mining and Mechanical Engineers.—Saturday, April 4th. At 2 p.m. At Newcastle-upon-Tyne. General Meeting.

Salford Technical and Engineering Society.—Saturday, April 4th. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "Mechanical Ventilation," by Mr. M. Sutcliffe.

London Association of Foremen Engineers.—Saturday, April 4th. At 7 p.m. At Cannon Street Hotel. Paper on "The Heating of Factories and Workshops," by Mr. A. H. Barker.

Society of Engineers.—Monday, April 6th. At 7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment. Ordinary Meeting.

Institution of Mechanical Engineers (Graduates' Association).—Monday, April 6th. At 8 p.m. At Storey's Gate, S.W. Paper on "Chains," by Mr. W. Clewes Garner.

Illuminating Engineering Society.—Tuesday, April 7th. At 8 p.m. At the Royal Society of Arts, Adelphi. Discussion on "The Lighting of Railway Carriages and other Public Vehicles," opened by Mr. E. Kilburn Scott.

Institution of Civil Engineers.—Tuesday, April 7th. At 8 p.m. At Great George Street, S.W. Ordinary meeting.

Rontgen Society.—Tuesday, April 7th. At 8.15 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "The Energy of the Rontgen Ray," by Dr. R. T. Beatty.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week —

Monday, April 6th.—"A" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Tuesday, April 7th. "B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Wednesday, April 8th.—Recruits only. Recruit instruction, 7 to 10 p.m. Rating examination for all Companies, 7 to 9.30 p.m.

Thursday, April 9th.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Friday, April 10th, to Monday, April 13th, inclusive.—Headquarters will be closed for the Easter Holidays. Business of an urgent nature will be attended to on Saturday, the 11th inst., from 10 a.m. to 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

NOTES.

The 25 Club.—The next dinner of this club will be held at the Connaught Rooms, Great Queen Street, London, W.C., at 7.15 for 7.30 p.m., on Wednesday, April 22nd.

Institution and Lecture Notes.—The Association of Electrical Station Engineers.—We have received a copy of the printed rules of this Association. The constitution and objects of the organisation are described and full rules appear relating to membership, government of the Association, executive Committee, their election, powers, and duties, the general secretary and his duties, the funds, branches, &c. Those interested in the movement, but not yet in it, can find all the information they require in this booklet of 24 pages. Secretary, Mr. W. J. Ebben, 41, Warren Road, Leyton, London, N.E.

Manchester Association of Engineers.—At the annual general meeting of the Association on Saturday, Mr. E. G. Hiller was elected president in the place of Dr. Edward Hopkinson. The annual report of the Council showed steady progress. The number of members on the roll is 647, and there was a surplus of receipts over expenditure for the year of £251, and a net cash balance of £6,547.

Association of Engineers-in-Charge.—On Thursday last week the Ponder's End, Middlesex, Works of the Edison & Swan United Electric Light Co., Ltd., were visited by over 100 members of the Association and their lady friends. Demonstrations and regular work were carried on during the tour, and explanations were given of the various processes by the most experienced members of the staff. In addition to carbon and metal-filament lamps, the visitors were shown the complete manufacture of holders, switches, plugs and other electrical accessories, high-tension switchgear, electric fans and heating apparatus, and iron and brass castings. Tea was served, during which the chairman of the Association's Education Committee moved a vote of thanks for the cordial reception of the visitors, and Mr. E. Gimingham briefly replied on behalf of the directors and staff.

Institute of Locomotive Engineers.—In connection with the proposed London Goods Clearing House scheme, Mr. Louis Rottenburg, a director of the New Transport Co., Ltd., read a paper before the Institute on Saturday last, on "Locomotive Costs in Relation to Total Cost of Railway Transport."

Association of Mining Electrical Engineers.—At a meeting of the Notts. and Derbyshire branch at Nottingham, on Saturday, two papers were discussed, one by Mr. F. Church, Tibshelf, on "The Breakdown of a D.C. Motor Armature," and the other by Mr. H. J. Wroe, of the London branch, on "The Electric Pumping Plant at Tilmanstone Colliery."

On Saturday last 50 members of the East and West of Scotland branches visited the Breich pit of the Pumpherston Oil Co., where there is in operation an electrical winding set of the newest type. The winder, which is of the Siemens-Ilgner type, has been in operation for nearly a year. At present it is running at little more than half load, and the expectation is that when it is loaded to its full capacity the results will be still better. In the course of the afternoon the party were entertained to luncheon. Mr. James Caldwell, who presided, said he would not recommend the winding set for a small pit with an output of, say, 300 tons a day, but for a large pit, with an output of 900 tons, where it was possible to generate their own electricity, such an installation as they had at the Breich pit would pay in the long run.

Institution of Electrical Engineers.—The following are the Council nominations (in italics) for election to the Council for the year commencing October 1st, 1914. Members whose names are printed in roman type remain in office :—

President (one vacancy).—*J. F. C. Snell.*

Vice-Presidents (two vacancies).—*J. S. Highfield, C. H. Wordingham*, W. Judd, C. H. Merz.

Honorary Treasurer (one vacancy).—*R. Hammond.*

Ordinary Members of Council.—Members (six vacancies).—*Prof. B. Hopkinson, F.R.S., G. W. Partridge, W. H. Patchell, W. Ll. Preece, G. S. Ram, W. Slingo, A. A. C. Swinton, W. B. Woodhouse*, R. A. Chattock, F. Gill, Dr. A. Russell, W. Rutherford, A. H. Seabrook, Roger T. Smith.

Associate Members.—F. E. Berry, Captain E. O. Henrici, R.E., A. W. Martin.

Associates.—A. B. Anderson, E. Russell Clarke, A. M. J. Ogilvie, C.B.

At the meeting of the Birmingham Local Section, on Wednesday last, a paper by Messrs. K. M. Faye-Hansen and J. S. Peck, was read by Mr. H. K. Faye-Hansen on "Current-Limiting Reactances on large Power Systems." The discussion was closed.

Royal Institution.—The following are among the Lecture arrangements after Easter :—Dr. Walter Wahl, two lectures on "Problems of Physical Chemistry : (1) Study of Matter at High Pressures ; (2) Structure of Matter at Low Temperature (experimentally illustrated)." Prof. Silvanus P. Thompson, two lectures on "Faraday and the Foundations of Electrical Engineering."

On March 27th, Mr. P. Schilowsky gave a lecture on his experimental gyroscope.

Appointments Vacant.—Resident engineer for wireless telegraph station in Egypt (£50 month), Imperial wireless chain ; shift engineer for Ilkeston power station (35s.), for Derbyshire and Nottinghamshire Electric Power Co. ; electrical engineer and gas manager (£350), for Malvern U.D.C. ; shift engineer (£156), for St. Ann's power station, Nottingham. Particulars are given in our advertisement pages.

(*Continued on page 583.*)

The 2,400-Volt Direct-Current Electrification of the Butte, Anaconda and Pacific Railway, U.S.A.

(*Concluded from page 510.*)

The 1,200-volt generators in the sub-stations are provided with heat-proof insulation, and owing to their unusually good commutating characteristics, will carry three times normal load for periods of five minutes, as well as the usual 50 per cent. overload for two hours.

An automatic voltage regulator is used to maintain an approximately constant voltage at the terminals of the motor by power-factor regulation. The motors are protected against overload by inverse time-limit relays, which are set to open at four times normal load. These relays have been adjusted to open under sustained overload in about two seconds, and upon short-circuit their action is practically instantaneous.

Excitation for the two generating units in each substation is obtained from two induction motor-driven sets, rated at 50-KW. each at 125 volts. One set is used for supplying current to the synchronous motor fields and is controlled by the automatic voltage regulator. The second unit supplies current to the separately excited fields of the direct-current generators.

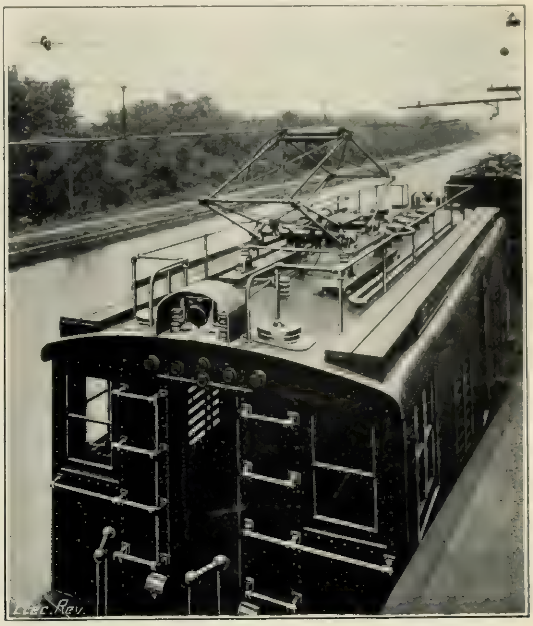
The 2,400-volt switchboards for controlling these sets are similar to the standard 600-volt types, with increased insulation and special provision for interrupting the 2,400-volt current. The circuit-breakers and switches are also arranged for remote control, and all apparatus on the panels is provided with ample insulation to ensure safety to operators.

The 2,400-volt circuit-breakers and switches are installed on separate panels above and behind the main panels, and are operated by connecting rods from handles mounted on the front of the main switchboard. These handles are similar in appearance, and to avoid confusion, the circuit-breaker handles are inverted. The breakers are equipped with special magnetic blow-outs and arc chutes, and provision is also made for automatically inserting a high resistance in the generator field at the same instant that the main circuit-breakers open, thus reducing the generator voltage.

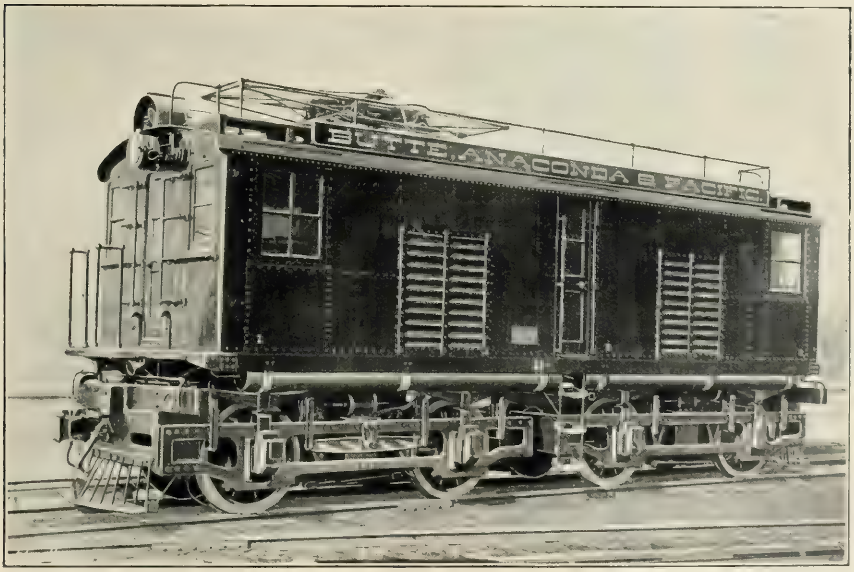
The alternating-current switchboard contains two panels for controlling the synchronous motors by means of remote-controlled solenoid-operated oil switches; two panels for the motor fields, and a panel for the automatic voltage regulator. These panels also contain other necessary instruments, including frequency and synchronism indicators, ammeters, wattmeters and relays.

The overhead construction for this system was especially designed to give the flexibility necessary for satisfactory operation of the pantograph trolleys used on the locomotives. The 4/0 grooved copper trolley used over all tracks is supported by an 11-point catenary suspension from a stranded steel messenger cable. Both side-bracket and cross-span construction are used, as required by the local conditions. There is a large amount of special work, on account of the many yards and sidings, and in one case 12 tracks are spanned. The cross-span construction used at this point is supported by a third pole between the eighth and ninth tracks. The hanger used on the straight-line construction is a rolled-steel strap looped over the messenger wire. This loop is closed at the ear, and the wire is clamped in place by a single bolt. Special pull-offs are used to increase the flexibility of the suspension.

The section breakers were designed for the 2,400-volt service, and at six points insulated crossings are necessary at the intersection of

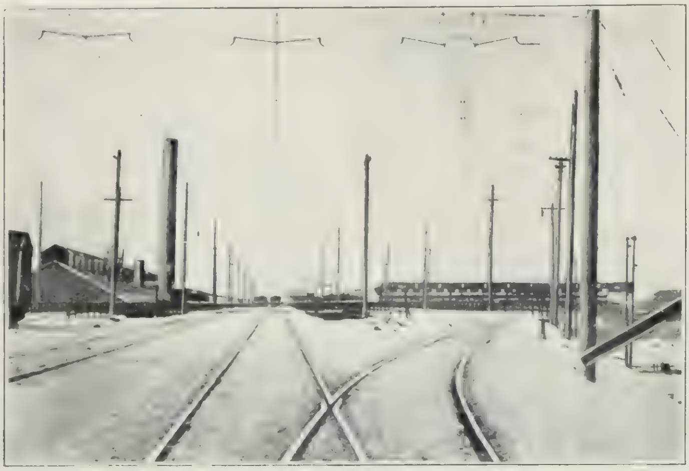


Roof Equipment of 2,400-volt D.C. Locomotive, Butte, Anaconda Railway.

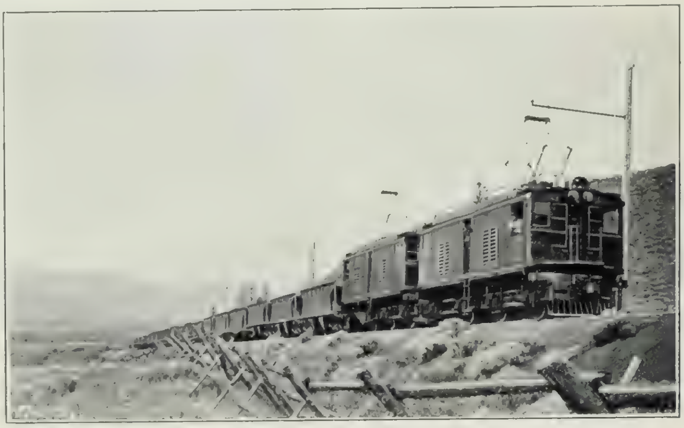


One of 17 80-ton 2,400-volt D.C. Locomotives on the Butte, Anaconda and Pacific Line.

the 2,400-volt trolley line with the 600-volt trolley line of the city system. On the main line a very simple-section insulator is used. This consists of paralleling the two trolley wires from the ends of each section at a suitable distance for insulation, so that the pantograph bridges the two circuits for a short distance, thus avoiding interruption of the power supply to the locomotive. The construction in the yards and sidings is simplified by paralleling the trolley from the side tracks for a short distance along the main line. This avoids the use of switch-plates or similar devices. At some of these junction points the pantograph engages as many as six trolley the wires.



Catenary Pull-offs in Switching Yard.



Double Locomotive hauling Freight Train, Butte, Anaconda and Pacific Railway.

The overhead lines are protected from lightning by 2,400-volt D.C. arresters installed on poles at intervals of one-third of a mile, along the entire length of system.

As regards the feeders, the 4/0 trolley is reinforced between the sub-stations with two 500,000 c.m. bare copper cables tapped to the trolley at intervals of 1,000 ft. A 4/0 negative return wire is also installed between Rocker and East Anaconda. This wire is carried on the trolley-poles, and is connected to the cross-bonds at intervals of 1,000 ft. The rails are connected by 4/0 bonds at every joint. The sub-stations are normally connected together by these feeders, allowing an interchange of current. In emergency either station can supply current to the entire system.

The locomotive equipment consists of 17 80-ton units (2,000 lb. to the ton), 15 for the freight and two for passenger service. The freight locomotives are geared for slow speed and are operated in pairs for the main line service. The maximum free-running speed is 35 M.P.H.

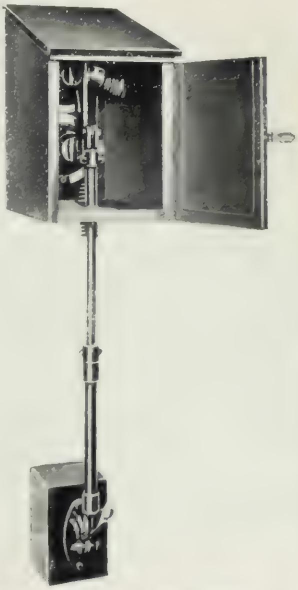
The two passenger locomotives are of the same construction as the freight units, but are geared for a maximum free-running speed of 55 M.P.H. A speed of 45 M.P.H. is obtained with three passenger coaches on straight level track.

The continuous tractive effort of a single 80-ton freight locomotive is 25,000 lb. at 15 miles per hour. The maximum tractive effort for a period of five minutes is 48,000 lb., based on a tractive coefficient of 30 per cent.

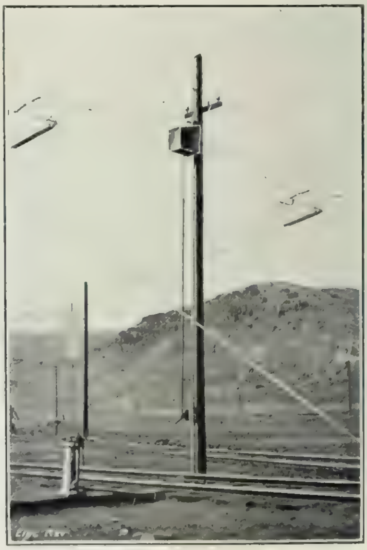
These locomotives are of the articulated double-truck type, with all the weight on the drivers. The entire weight of the locomotive is carried on semi-elliptic springs suitably equalised.

The central channels forming a part of the underframe are enclosed and are utilised as a distributing air duct for the forced ventilation of the motors. The air is conducted through the centre pins, which are hollow, into the truck transoms and thence to the motors. The engineer's compartment at either end of the car contains the operator's seat, controller, air brake valves, bell and whistle ropes, ammeter, air gauges, sanders and other control apparatus within immediate reach of the engineer.

The contactors, reverser and rheostats, which are all located in the central portion of the cab, are mounted in two banks running lengthwise of the compartment, and are conveniently arranged for cleaning, inspection

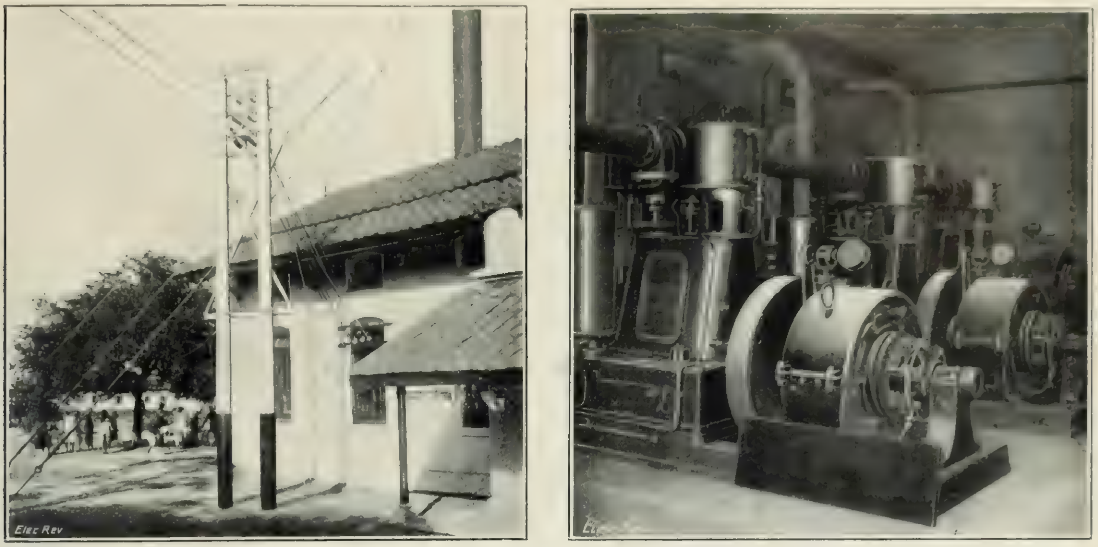


Section Switch and Operating Lever.



Insulated Section at Crossing of 600-volt Trolley Line and 2,400-volt System.

and repair. All apparatus and circuits carrying 2,400 volts are thoroughly protected from accidental contact.



Double Terminal Pole, with Lightning Arresters, at Power Station.

Interior, showing Generating Plant.

Nagpur Electricity Supply Works. (See page 583.)

The motors are of the commutating-pole type, wound for 1,200 volts, and insulated for 2,400 volts. This motor was designed for locomotive service, and is provided with forced ventilation. The method of ventilation is similar to that of the well-known ventilated motors, but the volume of air circulated is increased by the use of an auxiliary blower mounted on an extension of a dynamotor shaft. The gear reduction on the freight locomotive is 4·84, and on the passenger locomotive 3·2. The double unit, 160-ton locomotive is capable of giving a continuous-sustained output of 2,100 h.p. The motors are connected to the driving wheels by twin gears similar to those used on the Detroit River Tunnel, Baltimore and Ohio, and the Great Northern locomotives.

The control equipment is of the Sprague-General Electric multiple unit type, operating the four motors in series and in series-parallel. Two 1,200-volt motors are permanently connected in series. The controller provides 10 steps in series, and nine in series-parallel. The transition between series and series-parallel is effected without opening the motor circuit, and there is no appreciable reduction in tractive effort during the change. The transfer of circuits at this point is made by a special change-over switch, which is operated electro-pneumatically.

Pole Types Employed in Distribution Network, Nagpur Electricity Supply. (See page 583.)

The 2,400-volt contactors are operated from the 600-volt control circuit, and are specially constructed to separate the 2,400-volt parts from the coils and interlocks which carry the 600-volt current. The necessary insulation is obtained by large clearances, and by the use of porcelain and mica insulation. The armature is connected to the contact lever by a wooden rod. The contacts, magnetic blow-out and arc chutes are also especially designed to rupture the 2,400-volt arc.

Locomotive Data.—The principal data and dimensions applying to the locomotives are the following:—

Length inside of knuckles	37 ft. 4 in.
Total wheel base	26 ft.
Rigid „ „	8 ft. 8 in.
Track gauge	4 ft. 8½ in.
Total weight	160,000 lb.
Weight per axle	40,000 lb.
Wheels, steel tired	46 in.
Journals	6 in. × 13 in.
Gears, forged rims, freight locomotives	87 teeth
„ „ passenger locomotives ...	80 teeth
Pinions, forged, freight locomotives	18 teeth
„ „ passenger locomotives	25 teeth
Tractive effort at 30 per cent. coefficient... ...	48,000 lb.
„ „ at one hour rating...	30,000 lb.
„ „ at continuous rating	25,000 lb.

The locomotives have been maintained by the regular shop force with the assistance of one man experienced in electrical apparatus.

Current is collected by overhead roller pantographs, pneumatically operated and controlled from either engineer's compartment by an air valve. A 2,400-volt insulated bus-line runs along the centre of the cab roof. These bus-lines are connected together by couplers between the two locomotives, so that current may be obtained from either one or two collectors. The air brakes are the combined straight and automatic type, and the compressor is of the 600-volt type, having a piston displacement of 100 cb. ft. of air per minute when pumping against a tank pressure of 135 lb. Radiating pipes are provided on the roof of the cab for reducing the temperature of the compressed air before it reaches the high-pressure cylinder.

Main Switchboard, Nagpur Electricity Works. (See page 583.)

For operating the control equipment and air compressor, and for lighting the locomotive and cars, 600-volt current is supplied from a 2,400 / 600-volt dynamotor installed on each locomotive. This machine is similar in construction to the 1,200-600-volt dynamotor, having two distinct sets of armature coils wound on the same core, and brought out to a commutator at each end. One of these windings is designed for 1,800 volts and the other for 600 volts, the two commutators being connected in series across the 2,400-volt circuit. The load current is taken from the 600-volt commutator.

The mechanical load furnished by the direct connected blower supplies sufficient current in the series field windings to provide for the necessary excitation, so that no shunt windings are required. The blower which supplies ventilating air to the motor consists of a multivane fan mounted on an extension of the dynamotor shaft. It has a capacity of 7,200 cb. ft. per minute at 4-in. pressure.

Typical Views in Native City and of Construction and Opening of Electricity Works, Nagpur, India. (See page 583.)

Standard 600-volt lighting fixtures will be used on the cars, and each passenger and baggage coach will be wired for five groups of five lamps in series. The lights in each car will be controlled by a suitable master switch and fuse with snap switches in the individual circuits. Thirty-six-watt railway-type Mazda lamps are used, giving about 26 c.p. at 110 volts per lamp. Lighting current will be taken from a 600-volt train line-bus, which is connected to the dynamotor on the locomotives.

All of the passenger and baggage cars now used between Butte and Anaconda will be heated as well as lighted by electricity as soon as the equipment can be installed. Each car will be heated from a single heating unit installed underneath the car floor, and supplied from a 2,400-volt bus connected directly to the 2,400-volt bus on the locomotive. This unit will have a maximum capacity of 25 kw., and will be used to heat the air, which is distributed to different parts of the car by means of a small motor-driven blower. Cool air will be drawn into the insulated case enclosing the heating units from some point on the roof of the car. After passing over the heating coils the air will be carried through ducts under the floor of the car to radiators placed between alternate seats. The blower has a capacity of from 500 to 1,000 cb. ft. of air per minute, and the motor is connected in series with the heating units.

In order to increase the range of the heating equipment to meet the requirements of varying temperatures, provision is made for connecting the coils to give a total consumption of 10, 15, 17·5, or 25 KW. The temperature of the car is regulated at all times by a thermostat.

All the apparatus for the electrification of this railway was furnished by the General Electric Co., of Schenectady, N.Y., U.S.A., whose allies in this country, the British Thomson-Houston Co., Ltd., of Rugby, have kindly furnished us with the foregoing particulars.

ELECTRIC SUPPLY AT NAGPUR, INDIA.

Nagpur, the chief town of the Central Provinces and seat of the Central Provinces Government, with a population of 130,000, has recently been provided with an up-to-date electricity supply undertaking.

In 1911, with the assistance of Messrs. Crompton & Co., Ltd., the Nagpur Electric Light and Power Co., Ltd., was formed, with a native directorate and a capital of 5 lacs of rupees; Messrs. Crompton transferred the electric lighting licence which they had obtained to this company, remaining the contractors for the plant and installation.

The undertaking was formally opened by Sir Benjamin Robertson, the Chief Commissioner of the Central Provinces, in November last.

A brick power house structure has been erected, which, in addition to engine and boiler houses, also contains the offices of the company.

The plant installed includes one 50-KW. and two 100-KW. Crompton shunt-wound multipolar dynamos, fitted with interpoles, and wound for 450-550 volts, which are driven by direct-coupled Belliss compound non-condensing engines. The smaller engine is of 75 B.H.P., with a speed of 575 R.P.M., and the larger ones develop 150 B.H.P. at 475 R.P.M.

There are also installed two C.M.B. balancers, each to deal with an out-of-balance of 40 amperes, and a 14-panel Crompton switchboard in black enamelled slate containing the requisite switchgear and instruments for generator and feeder control.

Steam for the above plant is supplied from three Babcock and Wilcox boilers, each with a rated evaporation of 5,000 lb. of water per hour at 180 lb. per sq. in. pressure; each boiler is complete with an 80-ft. steel chimney, 3 ft. in diameter. Three direct-acting Weir steam feed pumps are provided, working in conjunction with a Worthington water heater.

The distribution system consists of bare copper wires carried on white porcelain insulators fixed to the steel cross arms of weldless tubular steel poles; the latter are painted white with a dark green base and set in a heavy concrete foundations, which were necessitated by the loose character of the soil. The positive and negative wires occupy the upper arms of the poles; the two wires on the bottom arm constitute the neutral of the three-wire system, and are linked together twice in every 50 yd. span to form a cradle under the upper wires. Two feeder boxes and 12 disconnecting boxes, fitted with switch fuses, have been provided in the mains network, the boxes being attached to the poles beneath the cross-arms and coupled to the line with insulated cable.

A special double-pole terminal has been provided at the power house, which carries lightning arresters and choking coils, and horn type arresters are fitted on all angle poles throughout the overhead system.

For the street lighting 40-watt metal lamps are employed, in iron brackets attached to the transmission poles at 12 ft. above the ground—singly, except at corners, where two or four-light brackets are used. Some 600 lamps are in use, divided up into groups of 40, controlled from a cast-iron watertight switch attached to the pole, and connected between the neutral and an independent street lighting wire carried along the top of the poles. The lighting wire is divided into alternate positive and negative sections through the switches.

Twelve miles of distributor and street lighting mains have been erected in the civil station, and 5 miles of street lighting wires only in the native city, where no private lighting distributors have as yet been installed, although these will be added in the future.

The lighting of the streets in the native city was rendered difficult by their narrowness, as in many cases they are not more than 12 ft. wide.

Native coal, costing Rs. 9-8-0 per ton, is used in the boilers, and the company's principal source of revenue is expected to be derived from the sale of energy for driving punkah fans, of which about a thousand are in use in offices and bungalows.

The price charged at present for lighting and fans is 6 annas per unit. The capital of the undertaking has now been fully subscribed, and by agreement the municipal authorities guarantee 4 per cent. interest on not exceeding 4 lacs of rupees for the first seven years, on condition that half the profits over 6 per cent. during that time revert to them, and that the company supplies and maintains the 600 street lamps for 11,000 rupees per annum during that time. The Chief Commissioner in the course of a speech at the inaugural ceremony, complimented the company on the excellent appearance and ornamental effect of the standards for the overhead wires.

In conclusion, we are indebted to Messrs. Crompton & Co. Ltd., for the particulars and views here given; the installation was carried out by them under the supervision of Mr. T. F. Raven, their local representative.

NOTES.

(*Continued from page* 578.)

Educational Notes.—A free scholarship of the value of £30, tenable at the Northampton Polytechnic Institute (London), is being offered to students of optics.

Smoke Abatement Inquiry.—Moving the second reading of the Smoke Abatement Bill in the House of Lords on Tuesday last week, Lord Newton said that under present conditions London received only one-third of the winter sunshine; the annual sootfall in London was 76,000 tons, and the damage cost at least 9 millions a year. Lord Curzon stated that as the result of legislation in India, in less than three years the emission of black smoke from factory chimneys at Calcutta had been reduced by over 80 per cent. Equally good results were obtained at Bombay. The Local Government Board agreed to appoint a Departmental Committee of Inquiry, of which Mr. Russell Rea, M.P., will be chairman.

Dinners and Socials. — The employés of Messrs. Anderson & Munro, Ltd., Glasgow, held their annual whist drive and dance on Friday evening, March 27th, in the Burlington House. There were about 60 couples present, and a most enjoyable evening was spent. The whist prizes were presented by Mrs. Wright, the wife of the chairman, and Mr. Wright referred to the pleasure which it gave the directors to be present, and to the good fellowship which existed amongst all grades. We understand that the firm have at present a very large amount of work in hand.

The employés of the Perth Corporation Tramway Department held their ninth annual social and dance recently, ex-Bailie Calderwood, convener, presiding.

The staff of the Willesden Electricity Department held their second annual dinner on March 14th, at Kilburn. Councillor H. Davey Turner, chairman of the Electricity Committee, presided. Mr. A. W. Blake, chief engineer, responded to the toast "Our Chief."

Mr. A. C. Cramb, borough electrical engineer, presided at the annual dinner of the Croydon electricity works staff, held recently. He proposed the "Corporation of Croydon," and the Mayor responded. He next gave "The Chairman and Members of the Electricity Committee," and Mr. Alderman Miller, who responded, referred to the fact that, as chairman of the Electricity Committee, he had just come of age. The toast "Our Engineer" was proposed by Mr. W. Burr, and suitably replied to by Mr. Cramb.

The Cryolite Athletic Association (London staff of the British Aluminium Co., Ltd.), maintained its quickly-gained reputation for enterprise by holding a most successful whist drive on March 28th, when about 160 members and friends spent an enjoyable evening. The president of the Association, Mr. W. Murray Morrison, was present, accompanied by Mrs. Morrison, who kindly presided over the distribution of the prizes. The president referred to the satisfactory progress made by the Association since its formation six months ago.

The Witton Works of the General Electric Co., Ltd., held their twelfth annual dinner at the Old Royal Hotel, Birmingham, on Friday, March 20th, Dr. Railing being in the chair, supported by Mr. Railing, and the attendance numbered over 250. The works manager, Mr. W. H. Heaton, proposed the toast of the General Electric Co., Ltd.; responding, Dr. Railing emphasised the necessity for co-operation amongst the workmen and staff, which would benefit not only the firm, but also the workmen themselves. For his own sake, a man should apply himself to turning out apparatus of the highest possible grade of workmanship. It was only thus that they would be able to compete abroad with those large foreign electrical companies which made such strong bids for the world's electrical orders. The firm which failed to turn out the highest class of plant would go under, and its employés with it. As a mark of the interest which the directors of the General Electric Co. took in their employés, the board had just voted a sum of £10,000 for the erection of the new club house at Witton, which would be equipped on the most up-to-date lines. Mr. Railing supplemented Dr. Railing's remarks by announcing that the board were just completing arrangements for a pension scheme for G.E.C. employés. The healths of Dr. Railing and Mr. Railing were drunk to musical honours, and an entertainment followed, contributed mainly by the Witton staff, which included vocal and instrumental music and gymnastic turns.

Wireless Associations.—The formal opening of the Newcastle and District Amateur Wireless Association took place on March 21st, at 29, Ridley Place, Newcastle-upon-Tyne, the headquarters of the Association. Mr. N. A. Collard, the chairman of the Association, occupied the chair, and called upon Prof. W. H. Thornton, who was accompanied by Prof. H. Morris-Airey, both of the Armstrong College, Newcastle, to open the Association's premises. Dr. Thornton gave a brief outline of the history of wireless telegraphy, and at 4 p.m. transmitted the first message: "Full attendance, going strong," to the North-Eastern School of Wireless Telegraphy in Eldon Square, Newcastle, which replied: "Message received O.K. Wish you every success." Following the formal opening an exhibition of telegraphic (wireless and otherwise) apparatus was held, which remained open until 10 p.m. Among the exhibits was a very fine portable transmitting and receiving set kindly lent, together with other apparatus, by the Marconi Co., as well as apparatus by Messrs. A. W. Gamage, Ltd., London, and Messrs. S. Gillett & Co., Ltd., of Newcastle, and apparatus made and lent by members of the Association. The visitors numbered about 500. The Association has a membership of about 50. As before stated, Mr. N. A. Collard (departmental manager at Elswick Shipyard) is chairman, and Mr. F. S. Gibson (Eastern Telegraph Co., Ltd.), secretary, *pro. tem.*; these two, with Mr. G. H. Mann (principal), and Mr. N. Hall, of the Wireless School, form the Technical Committee. On application to the secretary at the Association's headquarters, amateurs in the North-East of England may obtain forms of application for membership and any other information they desire.

Birmingham Wireless Association.—The first Annual Exhibition of this Association was held on Thursday and Friday last week at Queen's College. There was an excellent attendance each evening. The platform in the Hall was occupied by four model aerials—Eiffel Tower, Nauen, Poldhu, and a reproduction of the "wireless compass" aerial, as applied to a ship. An interesting exhibit, from an historical point of view, lent by Dr. J. R. Ratcliffe, consisted of the first receiving set which was ever demonstrated in Birmingham. The detector is one of the original filings coherer type, and the set was sent to Dr. Ratcliffe by Mr. Marconi. The Marconi Co. exhibited the instruments used in connection with the "wireless compass," a multiple tuner and a magnetic detector. Amongst other notable exhibits were apparatus by Messrs. Gamage, the Ludgate Wireless Co., Graham & Latham, International Railophones, Ltd., Dennison Watch Case Co., Western Electric Co., Marks & Co., Mr. S. G. Brown (Brown's relay), and Messrs. Beresford Bros. The annual meeting will be held on Monday next.

The I.M.E.A. Convention, 1914.—The preliminary programme for the 1914 Convention of the Incorporated Municipal Electrical Association has been issued. The headquarters are to be at the Grand Hotel, Birmingham, and the proceedings may be summarised as follows:—

June 15th.—Informal reception and concert in the evening at the Grand Hotel; distribution of tickets, badges, &c., which will not be posted as hitherto.

June 16th.—Presidential address by Mr. R. A. Chattock, and paper on "The Commercial Development of Electrical Supply in Towns of Moderate Size," by Mr. W. A. Vignoles, Grimsby; visits to works in the afternoon and annual dinner in the evening.

June 17th.—Meeting at Coventry; paper on "The Design and Operation of Modern Boiler-House Plant," by Mr. S. E. Fedden, Sheffield; visits to works at both Coventry and Rugby in the afternoon; reception and dance in the evening.

June 18th.—Meeting at Stratford-on-Avon; paper on "The Standardisation of Tariffs." by Mr. J. H. Bowden, Poplar; visits to Warwick Castle and Kenilworth in the afternoon; open-air fête and concert, Botanical Gardens, in the evening.

June 19th.—Annual business meeting; election of officers, &c.

June 20th.—Proposed visit to Worcester.

Information regarding the Convention can be obtained from the Secretary, I.M.E.A., 28, Bedford Square, W.C.

An "Information Bureau."—The zeal of our daily Press in the dissemination of intelligence is one of its most admirable characteristics; it sometimes, however, involves the arrogation of an inexhaustible store of knowledge, universal in its range and infallible in its wisdom, an assumption which is not invariably justified by the facts. Our very "live" contemporary, the *Evening News*, of course, is without the scope of these remarks, but even Jove sometimes nods, and we may be excused for drawing attention to a recent item in the "Information Bureau" which it conducts.

The query related to the erratic behaviour of a watch, which was said to be magnetised, though the owner had not been near any electrical machinery (but does he never travel on a tramcar?) The reply stated that this was not a necessary condition—"A 'short-circuit' within a short distance of the watch will often produce the result." It is well, therefore, when short-circuits are knocking about, to leave your watch at home. "The hair-spring when thus magnetised sticks to the balance, or is attracted to the escape wheel if either is made of steel, just as a piece of steel is attracted by a magnet." We like that "either." Both being, as a rule, pieces of steel, and both when magnetised being magnets, this is not improbably correct, and it is not surprising that under such circumstances the watch "either stops altogether, or commences to behave in a most erratic fashion." The recommendation is, quite properly, to have it demagnetised by a watchmaker. Unfortunately, the writer adds the following astounding paragraph:—

"There are on the market many non-magnetic watches which are unaffected by electricity, but if you are in the vicinity of electrical machinery while wearing an ordinary watch, a precaution usually effective is to wrap the watch in a silk handkerchief."

It is quite true that non-magnetic—and other—watches are unaffected by electricity; but although silk is a good electrical insulator, we are not aware that it insulates magnetism. The serene confidence of the writer, who declares that this precaution is "usually effective," commands our admiration. Under the circumstances, we hardly dare venture to suggest that it would be well, in answering such a question, to obtain the advice of someone who really knows something about the subject—a Boy Scout, for example.

Electrical Engineers' Price Book.—"Erg" writes: "Can any of your readers suggest a really reliable pocket price-book, dealing specially with the electrical engineering industry? During the course of my business I am constantly requiring approximate figures for cables, lamps, generators, A.C. and D.C. motors, gas engines, storage batteries, and a thousand and one other things. In the absence of a really reliable price book, I have to write to the various manufacturers, thus wasting much valuable time and disappointing innumerable commercial representatives, who always want to 'follow up' such inquiries."

So far as we know, there is no such pocket-book in print.

Inquiries.—Makers of tin binding clips for armatures, in Birmingham; soluble mica for filling gaps in the mica segments of commutators; machinery for making small sizes of lead covering for insulated wires; and British makers of "duplex metals" (copper-clad steel), are asked for. Particulars of a simple method of creosoting poles in the tropics are wanted by a reader.

For Sale.—Maidstone Corporation has for disposal by tender a quantity of steam piping and valves. The goodwill, stock-in-trade and plant of an electrical contracting and mill furnishing establishment in Lancashire are to be sold by private treaty. Particulars are given in our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Heston and Isleworth have decided to revise the salaries of the employés at the Electricity Works. This proposal will have the effect of raising the wages bill by £70 per annum, and fixes the engineer's salary at £162 10s., rising to a maximum of £200; the clerk's at £110 (maximum, £130), and the shift engineer's at £8 per month, rising £1 a year to £10.

The Shipley District Council has advanced the salary of the electrical engineer (Mr. W. Redman) from £175 to £210 per annum.

Keighley T.C. has been recommended to increase the salary of Mr. H. Webber, borough electrical engineer, from £300 to £400 a year.

Mr. G. H. Bellwood, assistant electrical engineer to the Wishaw Corporation, has been appointed mains superintendent to the Rawtenstall electricity undertaking.

Mr. A. Redfern, assistant electrical engineer at Darlington, who is leaving to take up another position, has been presented by the staff with an oak writing desk.

Mr. J. A. Robertson, borough electrical engineer of Greenock for the past 10 years, has been selected by the Electricity Committee at Salford, for the appointment of city electrical engineer, Mr. Richardson having decided to remain at Dundee.

Tramway Officials. — The Highways Committee of the London County Council recommends that Messrs. M. H. Bates, D. Brown, W. Munro, H. Davidson, T. R. Ierland, and A. B. Cox, assistants in the fourth class, section (*a*) in the tramways department, be promoted to the third class at the commencing salary of £160 a year as from April 1st, 1914.

General.—The Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways and Electricity Board has decided to advance the salary of Mr. F. Schofield, commercial manager, by £50 per annum.

Mr. O. Barnes has been presented with an electric candelabrum, in recognition of his services as chairman of the Electricity Committee of the Atherton District Council.

Mr. G. S. Corlett, for 22 years managing director of the Corlett Electrical Engineering Co., Ltd., of Wigan, has just severed his connection with the company, and will in future devote himself exclusively to electrical consulting work. The company will continue to carry on the same class of business as before, with the exception of the consulting department, which has been entirely taken over by Mr. Corlett, whose address is Midland Bank Chambers, Wigan.

Mr. H. C. Crews, M.I.E.E., consulting electrical engineer, of Manchester, has opened a branch office at 19, King Edward Street, Macclesfield; Telephone No. 219.

Obituary.—The *Review of the River Plate* refers to the death of Mr. George Newbery, "Argentina's foremost aviator, which occurred on Sunday last in Mendoza while he was making a short flight with a passenger. He was the son of the late Dr. Ralph Newbery, and was educated in Buenos Ayres and the United States, and took up electrical engineering as a profession. After his return from college he became chief electrical engineer to the Argentine Navy, and after holding one or two other positions, he was appointed, about 10 years ago, head of the public lighting department of the Buenos Ayres Municipality. He died at the early age of 38 years."

On March 23rd, Prof. G. M. Minchin, F.R.S., died at Oxford, at the age of 68. He was known principally in connection with mathematics, but in his younger days he carried out a good deal of research on photoelectric phenomena, with a view to transmitting pictures by telegraphy.

The death is announced of Prof. J. H. Poynting, F.R.S., Professor of Physics at Birmingham University, at the age of 62; he was a distinguished mathematician, and was noted for his experimental researches in connection with the determination of the mean density of the earth.

CITY NOTES.

Metropolitan Electric Tramways, Ltd.

The annual meeting was held on March 25th, at Electrical Federation Offices, Kingsway, under the presidency of Mr. E. Garcke.

In proposing the adoption of the report (see Elec. Rev., page 545), the Chairman said that on those occasions he had usually made a statement in relation to the general traffic problems in London, but since the last meeting upwards of 93 per cent. of the shares of the company had been converted into capital of the London and Suburban Traction Co., and as the majority of the shareholders therefore were now interested in that concern he thought his duty would be discharged if he simply explained the accounts and left explanations with regard to policy to be settled by the directors of the London and Surburban Co. The conversion of the shares had produced some marked changes in the position of the company. The policy was now quite properly and necessarily directed by the board of the London and Suburban Co.; but the duties and responsibilities of the officers of their company had been largely increased. They had now taken over, in addition to the management of the operations of that company's tramways and power business, the tramways of the London United Tramways Co. and of the Metropolitan Omnibus Co.; in addition to attending to the affairs of the controlling company. He was glad to be able to bear testimony to the fact that the enormous accession of work and responsibility had been fully met by the staff—in fact, it had been a matter of surprise to note how very ably Mr. Devonshire, the managing director, Mr. Barber, the secretary, and the other officers had shouldered the additional duties and responsibilities which had been suddenly thrown upon them. Another result, which had been produced, was marked economy in the administration. The figures did not fully display all those economies, but when he told them that the item of office and general expenses, which in 1912 was £8,173, was last year reduced to £6,253, they would see the reduction which had been effected in expenses. On the other side, however, the dividend on the ordinary shares had fallen from 5½ per cent. to 3 per cent. He wished to assure them that the reduction of profit was not the result of the consolidation of the interests of the two companies, but was in spite of the amalgamation. The underlying cause of the fall in their profits was, undoubtedly, the motor omnibus competition, but a large part of the damage which had been caused to the tramway revenue had been made good to the shareholders who had converted their shares into capital of the London and Suburban Traction Co., because they had participated in the profits of the motor omnibuses. The preference shareholders who had converted, had for the past year received a return of £5 6s. per cent. instead of 5 per cent. as formerly, and the ordinary shareholders who had converted had received 5 per cent. as compared with 5½ per cent. for the preceding year, while those ordinary shareholders who had not converted had received only 3 per cent. The result was better all round than would have been the case if the consolidation had not taken place. If they had had unsympathetic competition the result would have been very different. They hoped for better results in the future for the divergent interests were now in course of being adjusted, and wasteful competition would, they hoped, be still further reduced to the benefit of the public and to the advantage of the company. The receipts on the tramways had improved by over £15,000, but on the other hand, running expenses had increased by some £16,000 or £17,000. It was satisfactory to know that the revenue from dividends and interest in respect of their holding in the North Metropolitan Electric Power Supply Co., showed a steady improvement. For the past year the dividend amounted to £48,600, against £35,800 in the preceding year. Their through-running arrangements with the L.C.C. had been extended much to the advantage of the travelling public, but he was sorry to say that they had not benefited very largely by these arrangements. The effect had been that a larger proportion of passengers from their district had travelled over the lines of the L.C.C. than before, but the number of passengers they had brought into their district had not correspondingly increased. They were not proceeding with their powers for the construction of tramways in the Watford and Bushey district. The reasons were that, owing to changed conditions, the route was not likely to prove as profitable as they thought likely many years ago when the powers were obtained. The reason why they were not carried out at that time was due to difficulties about street widening, and there was a gap between the Bushey line and their Cricklewood lines and they had never been able to overcome these difficulties. Taking everything into consideration they thought that the better policy would be not to go on with the construction of those lines, and so by an agreement with the L.C.C. and the local authorities concerned, it had been decided to abandon them, but their own 'buses were serving the district adequately.

Mr. J. Devonshire seconded the motion and the report was adopted.

Slough and Datchet Electric Supply Co., Ltd.

The capital expenditure during the year 1913 was £6,315, making the total £64,346. The additional expenditure chiefly represents the installation of a 400-k.w. steam turbine, and a water cooling tower. The following table shows the progress of the company, the equivalent of 1,716 additional lamps of 8-c.p. having been connected last year:—

Year.	Lamps and Motors connected.	Units Sold.	Revenue.
1911	24,115	426,136	£6,775
1912	25,914	819,733	£8,546
1913	27,630	842,389	£8,900

The total net profit available for distribution is £4,993, out of which the directors purpose setting aside £1,250 to the depreciation fund, bringing it up to a total of £7,305. Out of the remaining net profit a dividend of 6 per cent., less income tax, has been declared, and £377 is to be carried forward.

Oriental Telephone and Electric Co., Ltd.—The directors recommend, subject to final audit, dividends at the rate of 6 per cent. per annum (less income-tax) on the preference shares for the December half-year, and a final dividend of 6 per cent. on the ordinary shares (free of income-tax), making a total of 10 per cent. for the year. The transfer books will be closed from April 14th to 27th.

Canadian Bell Co.—The annual report of the Bell Telephone Co., of Canada, shows for 1913, an increase of 16 per cent. in gross earnings, and of 17 per cent. in net earnings over 1912. The total revenue was $8,850,448, and the balance $1,793,522, of which $1,289,790 was distributed, at the rate of 11·124 per cent. on the stock. The total investment of the company is now $35,572,902.—*Telephony.*

Marconi Wireless Telegraph Co., of America.—According to the New York correspondent of the *Financial News*, the annual report of this company, which covers a period of 11 months to the end of December, shows a surplus of $178,000. The company has received many inquiries from officials of railroad companies for equipment, and the directors announce that they expect to build up a substantial business in the supply of wireless installations for trains. It is declared that profits are assured by the Government orders for the coming year.

British Aluminium Co., Ltd.

Mr. A. W. Tait presided on March 27th at the annual meeting of the above company, held at Winchester House, E.C.

The Chairman, in moving the adoption of the report (see Electrical Review, p. 545), said that the trading profit, etc., for the year as mentioned in the report was £268,720, as compared with £194,824 for the previous year, an increase of £73,896. These results were satisfactory, and were far and away the best which the company had ever produced since its inception in the year 1894. The increase in the net profits was entirely due to trading, and not to any extraneous reasons. It was accounted for by an increase in tonnage, some economy in the cost of production, and also largely by an increase in price over that ruling in the previous year. He did not, however, wish the shareholders to form the impression that prices for aluminium during the past year were in any way abnormal. The price had only returned to a reasonable level after the severe depression of the last four or five years, which was brought about by the keen competition between the large producers and the relatively large difference between the productive capacity of the various works and the demand for the metal. This position had each year been gradually improved, and this was due to the fact that there had been no large increase in productive capacity, while all over the world there had been a considerable expansion in the demand for the metal. When they considered the uses to which aluminium could and should be put with advantage as compared to the metals which were at present employed, there was every reason to believe that this expansion would continue. Considerable development and missionary work had been done to open up new lines and uses for the metal, and the progress which had been made encouraged the continuation of this development work, which would in time mean a considerable increase in the annual consumption of the metal. There would and must be the usual periods of activity and depression, because no progress could be made in an absolutely straight line, and at present, in common with all other industries, there was a temporary set-back in the demand; but, in their opinion, it was only a matter of time before the position showed considerable improvement, and he saw no reason at present to anticipate that there should be any falling off in the results during the present year. The whole of the works had been operated satisfactorily during the year, and these operations had not been affected by any serious labour disturbances, either in their own business or in the general commercial world. Owing, however, to the general industrial prosperity which prevailed during the year, their cost was somewhat affected by the high prices of coal and the increased rates ruling for freights. There were, however, indications that during the present year these items would show a reduction. Additional plant had been installed at the Aluminium Works at Vigelands, Norway, which would have the effect of increasing the productive capacity of these works. In reporting the circumstances connected with the acquisition of these works from the Anglo-Norwegian Aluminium Co. at the last general meeting, he stated that the balance of the purchase price would be paid within a few months from that time. When he made that statement he expected that they would be able to accelerate the arrangements with regard to the payment of the final instalment, which was not due until this year, but, owing to legal necessities, this could not be carried out. A further payment in accordance with the contract was made during the year 1913, and the final payment would be made in June next. Owing to the large increase which had been made in the productive capacity of the company's aluminium works and the further increase which he had mentioned, it had become necessary for them to increase the capacity of their works for the production of alumina. Last year he mentioned that to provide for this in part the company had taken a one-half interest in the works of the Bauxite Refining Co. at Hebburn-on-Tyne, and while they were now obtaining a certain output from these works, that increase was not sufficient to provide for present, or immediate future, requirements. Lengthy investigations had been made as to suitable sites all over the United Kingdom, and arrangements had been finally completed for the acquisition of a site of about 38 acres at Burntisland, Scotland. The site was well situated, not only in respect of labour supply and shipping facilities—particularly to their works in Norway—but was also within a stone's throw of the Fife coalfields, which ensured an abundant and cheap supply of fuel, coal being one of the most important items in connection with the manufacture of alumina. These works, when complete, would provide not only for their present requirements, but also for their requirements for some time to come, and would allow them to have the necessary margin in case of temporary breakdown or stoppage at their other works. They would appreciate that increase in their productive capacity of aluminium must mean an increase in their capacity to manufacture the materials used for its production, and it had therefore been necessary to make arrangements to proceed with the extension of their works at Kinlochleven for the manufacture of carbon electrodes. The plans and specifications for these works had been prepared and the work had been begun, but they could not expect that either these works or the works for the production of alumina would be completed in the course of the present year. In order to ensure a large supply of bauxite, arrangements were completed in the early part of last year to take over from the Union des Bauxites a considerable tonnage of bauxite of good quality. This had now been done, and the material had been deposited upon land in the name of this company. This stock would be kept as a reserve and would only be used if and when required to supplement the supplies which they regularly obtained from their subsidiary company under existing contracts. It was important that this company with its large productive capacity should always carry a considerable reserve of raw material. The company's rolling mills at Milton, Staffordshire, had been kept employed up to their full capacity during the whole of the year, and arrangements were made for the acquisition of land and buildings at Warrington, Lancashire, for the erection of new mills. These mills had now been completed, and commenced partial work in the beginning of this month. The extension of this part of the company's business was desirable and necessary, not only from the point of view that it was profitable in itself, but it also enabled the company to find an outlet for a substantial portion of its production outside of the market for ingot metal, for which they were necessarily in competition with the other large producers. The demand for manufactured aluminium continued to grow in a satisfactory manner, and there was every reason to believe that the new works would be kept fully employed and that in time the extension of which they were capable would also be carried out. For the efficient operation of these works, it was necessary that the company should provide for its own power supply, and arrangements had been completed for the erection of a power house and the work was well in hand. In the meantime, arrangements had been made with adjoining works for a temporary supply of power until their own plant was available. With regard to the Orsières Power Scheme, there was nothing new to report. The works were being efficiently maintained and supervised, and no new development work was being carried out. The Martigny-Orsières Railway was in operation for general traffic, but the receipts obtained were only sufficient to meet operating expenses. The Chairman proceeded to deal with the various items in the balance sheet, and said that the profit for the year, after providing for the service of the prior lien debentures and debenture stock, and allocating sums to the depreciation and general reserve accounts, was sufficient to justify the directors in recommending the payment of the full dividend on the preference shares and a dividend at the rate of 5 per cent. on the ordinary share capital of the company. This was the first time that a dividend had been paid on the ordinary shares since the reconstruction of the company, and it was with great pleasure that the directors recommended this, while still making ample provision for reserves which were required for the general development of the business.

Mr. S. H. Pollen seconded the motion.

Mr. Poole complimented the Board on the way they had pulled the company round, and said that so long as they showed good results the shareholders would not mind paying them what looked like a liberal remuneration.

The report was then adopted.

Mr. R. W. Cooper, in proposing the re-election of the retiring directors, said the company owed a great deal of its recovery to Mr. Tait. In Mr. Romnel again they were fortunate, having one with a knowledge of the technique of the industry.

Mr. J. Taylor seconded the motion and it was carried.

South Metropolitan Electric Tramways and Lighting Co., Ltd.

The annual meeting was held on March 25th last, at Electrical Federation Offices, Kingsway, Mr. J. Devonshire, the managing director, presiding.

The Chairman, in proposing the adoption of the report (see Elec. Rev., page 547), said the result of the year's operations showed a surplus of £15,026 as compared with £15,493 in the preceding year, including £922 brought forward. That provided a balance available for distribution of £15,949. They proposed to place £5,000 to reserve, which was the same amount as last year, and to pay a year's dividend on the preference shares which would require £10,174, and leave £775 to be carried forward. They would remember that the chairman, who he was sorry to say was absent through ill-health, at the last meeting unfolded to the shareholders proposals for consolidating the interests of the company with those of the London and Suburban Traction Co., Ltd., by exchanging their holdings for fully-paid shares of that company. Those proposals were duly accepted by a very large majority of the shareholders of the company, and a circular was sent out last June informing them that the offer made by the London and Suburban Traction Co. had become binding. The exchange of shares had since taken place, the result of which was that the control of the company had now passed into the hands of the London and Suburban Traction Co.

Mr. E. Garcke seconded the motion which was adopted unanimously without discussion

London and Suburban Traction Co., Ltd.

The annual meeting was held on March 25th, at the Holborn Restaurant, Mr. C. B. Stuart Wortley, K.C., M.P., in the chair.

In moving the adoption of the report (see Elec. Rev., page 546), the Chairman said that was the first annual meeting of the company, which existed not for the purpose of themselves operating transport and other public services, but for the purpose of controlling—and by controlling, harmonising the work of certain companies which did operate such services. The company's function was to promote co-operation and to prevent waste. But it was none the less their business to satisfy the public. The public looked for regular, cheap and efficient services; and, so long as those were supplied to them, they had no reason to care whether it was competition or co-operation that had produced the efficiency. Those who had studied the circulars by which shareholders were invited to exchange their holdings in one or other of the subsidiary companies for London and Suburban Traction stock had doubtless got a fairly complete idea of the organisation and aims of the new company. It might, however, be convenient to survey, with more completeness and accuracy than was possible at previous stages, the field which the company occupied. The company held the following proportions of the issued share capital in the following operating companies, namely:—93 per cent. in the Metropolitan Electric Tramways, Ltd., 97 per cent. in the London United Tramways, Ltd., 100 per cent. in the Tramways (M.E.T.) Omnibus Co., Ltd., 99 per cent. in the South Metropolitan Electric Tramways and Lighting Co., Ltd., 29 per cent. in the Gearless Motor Omnibus Co., Ltd. Those holdings were in the company's direct ownership. He must, however, add that through their holding in the M.E.T. they were indirectly owners also of controlling interests in the North Metropolitan Electric Power Supply Co. and its subsidiary, the North Metropolitan Electrical Power Distribution Co., Ltd. They had thus acquired a share of the profits (in most cases they got practically all the profits) of seven different companies, which between them conducted two different classes of business, namely, tramway and omnibus services, and electric light and power supplies. The Metropolitan Electric Tramways, Ltd. was at present working 56½ route miles of tramways and light railways mainly on the north side of London. By arrangement with the L.C.C. the company's cars and the L.C.C. cars provided mutual through-running services over certain sections of the company's system and the L.C.C. system. The Metropolitan Electric Tramways Co. had an important asset in the shares they held in the North Metropolitan Electric Power Supply Co. This was a statutory company incorporated in 1900 which supplied electrical energy in bulk over a supply area of 325 square miles in Middlesex, Hertfordshire and Essex. It supplied electricity for working the whole of the Metropolitan Electric Tramways Co.'s system. It also gave bulk supplies to various local authorities for lighting and power purposes. Its ordinary shares were all held by the Metropolitan Electric Tramways Co. and for 1913 they paid 12 per cent. or a sum of £42,000 to the revenue account of the Metropolitan Electric Tramways Co. It was, moreover, itself the holder of the whole of the share capital of a subsidiary company called the North Metropolitan Electrical Power Distribution Co., Ltd., which operated electric lighting orders in Barnet, Hertford, Enfield and St. Albans, and which paid for 1913 a 6 per cent dividend amounting to £3,000. The Metropolitan Electric Tramways results for 1913, including the results of the Power Supply and Distribution companies showed a revenue (including £604 brought in) of £539,850 and charges (including renewal reserve) of £487,568. The resulting balance of £52,282 was disposed of by paying a sum of £12,000 to reserve, a full preference dividend of £25,000, a 3 per cent. ordinary dividend of £14,230 and carrying forward £1,052. The London United Tramways had a system comprising 53½ miles of tramways in the counties of Middlesex, London and Surrey. It had in recent years suffered even more seriously than the Metropolitan Electric Tramways from competition. It nevertheless played a very important part in the transport business of greater London, and it was difficult to believe that that part would not increase in importance as London extended in the district that the company served. The company's next asset was their holding in the South Metropolitan Electric Tramways and Lighting Co., Ltd., which owned and worked 13 miles of tramways in districts immediately to the west and north-east of Croydon. The undertaking also operated a thriving and progressive electric lighting service in Sutton, Cheam and neighbouring areas. Next came the Tramways (M.E.T.) Omnibus Co., Ltd., in which they held the whole of the shares, and it was a fair inference that the satisfactory revenue obtained in 1913 would be largely increased in 1914. The company also had a small holding in the Gearless Motor Omnibus Co., Ltd. To sum up, the total traffic receipts of all the traction and omnibus undertakings to which he had referred, were £1,152,619. A total of 219,000,000 passengers were carried in 1913, and 37,000,000 units of electricity were sold. He could add little to the particulars of their own financial results given them in the accounts appended to the report. They had an income of £98,925 from their holdings in the subsidiary companies, and £6,309 from interest on money lent to some of those companies. Including sundry receipts their total revenue for 1913 was £105,370. Not being an operating company they had no operating expenses in the ordinary sense. Administration and general expenses accounted in all for £1,980. Interest on debenture stock was £8,094 and on loans £7,043. Their total expenses therefore amounted to £17,118. The disposal balance provided £[illegible],655 for full interest at 5 per cent. on their preference shares and £[illegible] for the carry over. They owed £[illegible] to two of their subsidiaries, and were owed £113,250 by three others of them. This method of financing each other according to needs was equally favourable to the borrowing and the lending company. The borrowers paid a lower rate of interest than would be exacted from them by an expert market lender, while the lender received a higher rate than he could get by placing his surplus cash out on deposit. They had lately created £350,000 of 5 per cent. "A" debenture stock which they had sold on what they considered advantageous terms. With the proceeds of this sale, the particulars of which appeared in the prospectus of the International Financial Society, they would be able to pay off all their short-dated loans and provide working capital for the subsidiary undertakings. A paragraph in the report stated what hopeful prospect there was of substantially increased receipts from their investments in future years. To this he might add that the terms of the arrangement with those to whom they had sold the £350,000 of "A" debenture stock, was such that the whole sum would be paid off at the end of 20 years.

Mr. E. Garcke seconded the motion.

The Chairman, in reply to questions, said that their agreement with the L.G.O. Co., limited their M.E.T. 'buses to 350. They were discussing the question of competition with the L.G.O. Co., as they considered that to run empty or half-empty tramcars or omnibuses along the same lines of route was good neither for the public nor for the companies concerned. Regarding the appointment of a controlling authority for London traffic he thought they would all be agreed that it would not be fair to the existing companies if the power of licensing or regulating was given to any authority in London owning tramcars of its own. As an old Parliamentarian he was in favour of the Metropolitan police, which was the only authority which had jurisdiction for as great a distance as 15 miles from Charing Cross, being the traffic authority, for that body carried out its duties with tact and discretion.

The report was adopted.

London United Tramways, Ltd.

Mr. W. M. Acworth presided on March 25th over the annual meeting, held at Electrical Federation Offices, Kingsway.

In proposing the adoption of the report (see Elec. Rev., page 544), the Chairman stated that as most of the shareholders knew, more than 97 per cent. of the shares of the company, had been exchanged for shares in the London and Suburban Traction Co., which was now the operating company. With regard to the accounts there had been an increase in the gross traffic receipts of £5,662. In view of the severe nature of the motor-bus competition he thought they must regard that as satisfactory. On the other hand, owing to the increased cost of coal, and other material; exceptional expenditure on the permanent way and overhauling on their rolling stock, their expenses had increased by about £12,000, so that the net result showed a falling off in the profits of about £5,635. He thought, however, they might look forward to a reduction in expenses in the current year. Their coal contract had been placed at improved prices and the cost of material showed an easier tendency. The special overhaul of rolling stock was nearly through, and the charge on their reserve fund for cast-welding rail joints was completed. On the whole, his own opinion, for what it was worth, was that the company had touched bottom. They had had to face the competition with the electrified railways and more especially with motor omnibuses. That competition could not have been foreseen when the undertaking was originally started, but he thought that competition had done its worst, and while they were never likely to see the prosperity that was reasonably anticipated when their undertaking was started, the fact that they carried over 60 million passengers last year (a small increase over 1912), showed that there was still room for them and that their services met a real public need. It was with that feeling, that instead of feeling it imperative as in the previous four years, to ask them to carry the whole of the net revenue to reserve, they were able on that occasion to recommend a small dividend of 1 per cent. on the preference shares on account of the arrears for one year, 1908. While every care was taken to keep the expenses down to a minimum the directors felt that they had at all times the support of the shareholders in considering any reasonable modifications in regard to the rates of pay and hours of labour of their employees. Amongst other concessions made during the year was an increase in the rate of pay to conductors. In conclusion, he said that they could not yet say anything as to the proceedings between themselves and the L.C.C. in reference to the taking over by the Council of their lines in Hammersmith. The matter had been constantly before the directors during the past 12 months and they had given it most anxious and careful consideration, but nothing had yet been definitely settled.

Mr. J. Devonshire seconded the motion which was carried.

Liverpool District Lighting Co., Ltd.

THE directors' report for the year ending December 31st, 1913, shows that the supply of electricity continues to make satisfactory progress, 5,101 lamps having been connected during the year. The total number supplied at December, 1913, was 40,310. The total quantity of electricity sold during the year was 504,247 units compared with 445,688 for the year 1912. The sales of electricity have, for the first time in any year, exceeded the half million units. A new engine and dynamo has been installed at the generating station at Waterloo, with a normal output of 500 KW. This increases the capacity of the generating plant from 630 KW. to 1,000 KW., after allowing for the removal of three old engines and dynamos which are now too small for economical use. The new plant will show considerable economy in fuel as compared with old conditions. The profits for the year, together with the balance brought forward from 1912, after payment of the final dividend for that year and the interest on the special account, leave an available balance of £4,446. Out of this an interim dividend has been paid at the rate of 4 per cent. per annum, and £1,125 set aside for depreciation, leaving a balance of £2,191, out of which it is recommended that a dividend be declared for the half-year ending December 31st, 1913, at the rate of 4 per cent. per annum less income-tax, amounting to £1,130, that £900 be placed to reserve, and that the balance of £162 be carried forward.

MR. HOLBROOK GASKELL, deputy chairman, presiding over the annual meeting at Liverpool on Monday, said the past year had been a record one in more than one respect. The increase in units sold—58,000 units—had beaten last year's record of 54,000 units, which itself had been a greater increase than the previous five years added together. There was also a record in the matter of profits. Last year the increased profits amounted to almost 1 per cent. of the capital of the company. This year the increased profits had amounted to 1½ per cent. of the capital. The total profit for the year, after paying interest on bank overdraft, was £4,279, which represented 7·13 per cent. of the ordinary paid-up capital of the company. The directors had decided that the wisest policy was to build up a reserve fund to meet any contingencies that might arise, rather than pay a higher rate of dividend. They had therefore recommended the payment of a dividend of 4 per cent., with 1½ per cent. placed to reserve, after providing 2 per cent. for depreciation of plant and cables. The chief expenditure on capital account to be provided during the next few years was the continuous laying of new cables in the streets. It would be necessary to spend about £6,000 in this way during the next three years. Under existing conditions it was necessary for consumers who wished to adopt electric heating in their houses at the reduced rate of 1½d. per unit to go to the expense of installing separate wires and meter for this purpose, but the directors now had under consideration an alternative method of charging for the current used, which would allow consumers to attach radiators to the ordinary lighting wires, and still have the benefit of the reduced rate. For this purpose a fixed charge per annum would be made, which would vary in accordance with the size of the house, or the requirements of the tenant, all electricity consumed being charged for at 1½d. per unit.

The report and accounts were adopted, and Mr. T. A. von Sobbe and Mr. W. A. Coolison were re-elected directors.

British Westinghouse Electric and Manufacturing Co., Ltd.

THE annual report for the year ended December 31st, 1913, states that since the last annual general meeting the scheme for the reduction of capital approved by the shareholders has been duly sanctioned by the Court, and the year's accounts are based thereon. The directors report a continued improvement in the business with an increased volume of work. The gross profit amounts to £223,103. From this there are deducted :—Depreciation on works, machinery, plant, &c., £44,100 ; redemption of 6 per cent. prior lien debentures, £6,728 ; interest on 6 per cent. prior lien debentures, £13,272 ; interest on 4 per cent. mortgage debenture stock, £49,654 ; expenses on surplus land and buildings, £2,856, leaving a net profit for the year of £106,494. This is appropriated as follows :—To general reserve, £50,000 ; to dividend on preference shares at the rate of 5 per cent., £50,000 ; carried forward, £6,494. The balance of £66,899 to the credit of profit and loss account at December 31st, 1912, was absorbed in the reduction of capital. As in previous years, a substantial amount for the maintenance of works and plant has been charged against revenue, in addition to which £50,800 has been applied to depreciation. The directors refer to the death of Mr. George Westinghouse, the founder and former chairman of the company. "He was a man of great organising capacity and extraordinary inventive powers, which had made his name famous all over the world." The board has appointed Mr. Ph. A. Lange to be managing director of the company.

South Metropolitan Electric Light and Power Co., Ltd.—The new issue of 25,000 6 per cent. cumulative second preference shares was largely over-subscribed.

Cleveland and Durham Electric Power.

THE ordinary general meeting of the Cleveland and Durham Electric Power, Ltd., was held on March 30th at Newcastle-on-Tyne, Mr. R. W. Armstrong presiding in the absence of the chairman, Mr. James Falconer, M.P.

The CHAIRMAN, in moving the adoption of the report, read the speech Mr. Falconer had prepared. He explained that in accordance with a special resolution passed in December, and confirmed in January, the end of the financial year had been changed from June 30th to December 31st. The directors therefore submitted a report and statement of accounts for the six months ended December 31st. During that period the capital expenditure on works had amounted to £14,589, which had been expended on the construction of sub-stations in connection with the new business they had secured. The gross profit for the whole year ended December 31st amounted to £25,714. After providing for debenture and other interest there remained a net profit of £16,175, which, together with the sum of £2,466 brought forward from the last account, gave an available balance of £18,641, which the directors recommended should be appropriated as follows :—Dividend at the rate of 5 per cent. per annum for the six months on the preference shares, £8,342 ; to depreciation and renewals, £1,000 ; in reduction of expenses of the issue of debentures, £500 ; and carry forward £8,798.

The HON. ROBERT JAMES seconded the report.

MR. A. GEMMELL said that if the directors paid the preference dividend they proposed, either with or without the shareholders' sanction, they would be running the risk of having to refund the amount out of their own pockets when a Parliamentary inquiry took place. He alleged that every year since 1908 the control they had exercised over Parliamentary undertakings had been condemned by the Board of Trade.

The CHAIRMAN asked Mr. Gemmell to confine his remarks to the report with which they were dealing.

MR. GEMMELL said the recent dividends they had paid, and were seeking to pay, had been entirely derived from the Cleveland Parliamentary Co. The ordinary shareholders, after 7½ years, were not in sight of a dividend with £58,000 preference dividend in arrears. Mr. Gemmell urged that the time had come when a Parliamentary inquiry was imperative, not only in the interests of investors, but in the wider interests of a large industrial community to whom the cheapest possible supply of power was vital if the home manufacturer was to hold his own against foreign enterprise and successfully compete in the markets of the world.

The report was adopted, and the CHAIRMAN, in reply to a question, said it would be quite possible in future for separate accounts to be presented of the Parliamentary Co., the Cleveland Co., and the Northern Counties Co.

Windsor Electrical Installation Co., Ltd.—The capital expenditure during 1913 was £435, making the total £93,233. The profit for the year (including £451 brought forward) was £7,012. From this are deducted debenture and other interest, £791 ; dividend on 5 per cent. preference shares, £1,108 ; depreciation, renewal and reserve fund, £2,000 ; directors' fees, £350, leaving £2,763 available for dividend on the ordinary shares. The directors recommend that a dividend of 5 per cent., less income-tax, be paid on the ordinary shares, £408 being carried forward. During the year new lamps were connected equivalent to 1,650 of 8 C.P. : the total connected to December, 1913, being 52,726 lamps.

Dublin and Lucan Electric Railway Co.—Presiding at the annual meeting, Mr. J. W. Hill, J.P., said the gross receipts for the past year were £7,408, being £97 less than in the previous year. In August they were £205 up, but the tramway strike in Dublin which then took place prevented many city folk from using their cars. For the same reason autumn excursions had to be abandoned, and altogether the strike affected their income to the extent of between £400 and £500. Their expenses had increased by £578. The report was adopted.

Stock Exchange Notices.—The Committee has appointed special settling days as under :—

Wednesday, April 8th.—Constantinople Telephone Co.—Scrip fy. and ply. (£25 per cent.) paid for £200,000 6 per cent. obligation bonds.

And ordered the following to be quoted in the Official List :—

Metropolitan Railway Co.—£975,000 consolidated ordinary (deferred divisible) stock, and £75,000 3½ per cent. ("A" preference stock (ranking for dividend from July 1st, 1916).

Western Canada Power Co., Ltd.—Further issue of £90,000 5 per cent. 40-year 1st. mortgage bonds of £100, Nos. B2,055 to 2,954.

Companies Struck off the Register.—The following companies have been struck off the Register, and are accordingly dissolved :—

Anglo-Russian Refuse Destructor Co.
Electricity Generating Co.
Ferabin Lamp and Electrical Accessories.

Isle of Wight Electric Light and Power Co., Ltd.—The directors' report for 1913 states that the year's trading, including £2,799 brought forward, shows a profit of £17,202. The directors propose that a dividend at the rate of 2½ per cent. per annum be paid on the ordinary shares, that £3,500 be placed to the renewal fund account, and £1,000 to the reserve account, carrying forward £3,428.—*Financial Times.*

Newcastle-on-Tyne Electric Supply Co.

A meeting of this company was held on Tuesday to consider proposals for increasing the capital by £330,000, divided into 165,000 preference shares and 165,000 ordinary shares of £1 each, in connection with the acquisition of the business of the County of Durham Electrical Power Distribution Co.

Dr. J. T. Merz presided over a large attendance.

The Chairman moved the confirmation of the following resolution :—

> That each of the existing £5 preference shares in the capital of the company, whether issued or unissued, be subdivided into five preference shares of £1 each, and that each of the existing £5 ordinary shares in the capital of the company, whether issued or unissued, be sub-divided into five ordinary shares of £1 each.

Mr. J. H. Armstrong seconded, and the motion was agreed to.

The Chairman next proposed the following resolution :—

> That this extraordinary general meeting of the N.E.S Co., Ltd., sanctions the creation by the directors of £330,000 additional capital, divided into 165,000 preference shares of £1 each, and 165,000 ordinary shares of £1 each. That the said additional preference shares shall rank *pari passu* in all respects with the existing preference shares, and shall accordingly be entitled *pari passu* with such shares to a preferential dividend of 5 per cent., and also to any surplus profits available for dividend, after 8 per cent. has been paid on the ordinary shares, until all the preference shares shall have received 8 per cent., when such shares shall rank *pari passu* with the ordinary shares for any further dividends which may be declared exceeding 8 per cent. The preference shares will be preferential as to dividends only. That the directors may, instead of offering such shares to the members, as provided by the articles of association of the company, dispose of the same at such time, in such manner and upon such terms and conditions as in their discretion they may consider to be in the best interests of the company.

This motion also was seconded by Mr. Armstrong, and carried without comment.

The Chairman, at the close of the business, said they had given the finishing stroke to an arrangement which he believed would be of benefit to the shareholders concerned.

Gateshead and District Tramways Co.—The annual meeting of this company was held on Monday. The report, which was then adopted, showed that for the year ended December, 1913, the total revenue amounted to £62,199. After deducting all expenses chargeable to revenue, including provision for renewals, £2,860, and writing off depreciation of investments, £1,537, there remains a balance on the year's working of £26,158, plus £1,828 brought forward. The directors propose to apply to reserve £4,500 ; to sinking fund for redemption of mortgages, £2,222 ; to dividend on the 6 per cent. preference shares, £756 ; to dividend for the year on the 5 per cent. preference shares, £6,000 ; to dividend on the ordinary shares at the rate of 6 per cent. per annum, £8,100 ; to bonus of 4s. each on the ordinary shares, £2,700 ; leaving to be carried forward £3,708. Expenditure chargeable to the tramway capital account during the year amounted to £2,203, making the entire capital outlay £336,646. The Northern General Transport Co., Ltd., made an offer to the shareholders respectively of the Jarrow and Tynemouth companies and this company to exchange their holdings for fully-paid holdings in the Transport Co. Holders of 94 per cent. of the total issued share capital of this company accepted the Transport Co.'s offer, and the Transport Co. has purchased the motor-omnibus undertaking of the company. The profit on the sale has been transferred to reserve. Consequent upon fine weather and good trade in the district, the traffic receipts show a satisfactory increase of £5,867.

South Wales Electrical Power Distribution Co.—The report for 1913 states (according to the *Financial Times*) that as under the working arrangement with the Treforest Electrical Consumers' Co., Ltd., the whole of the working expenses in connection with the undertaking are now borne by that company, there is for the time being no revenue account to be submitted. The business of the company has materially increased during the year, the units sold amounting to 25,812,031, as compared with 19,689,656 sold in 1912, an increase of 6,122,375 units. Owing, however, to the higher working cost, due principally to the increase in the cost of coal, the surplus is not so large as had been anticipated. The surplus, after payment of all working expenses and interest on prior lien debenture stock, and making due provision for depreciation of new plant, amounts to £2,915, which, together with the surplus accumulated in previous years, makes £10,379 towards discharging the indebtedness to certain consumers of the Treforest Co., amounting to £13,500. Application is being made to the Board of Trade for prov. lighting orders for the district of Abercarn and for the Borough of Cowbridge and parts of the rural districts of Cowbridge, Llantrisant, Llantwit Fardre and Penybont.

North of Scotland Electric Light and Power Co., Ltd.—The directors' report for the year ended December 31st, 1913, states that the company has made substantial progress during the year. The lamp connections in Montrose have increased from 24,765 to 30,192, equivalent 8-c.p. lamps ; in Brechin, from 19,307 to 21,506, and in Inverness from 32,810 to 35,872, making a total of 87,570, connected in the three towns. The gross profit, including £2,221 brought forward from last year, is £9,295, and after meeting interest on debentures and loans, amounting to £2,880, and writing off £57 from suspense account, there remains a net profit of £6,359. The directors recommend a dividend at the rate of 3 per cent. for the year, which will absorb £1,500, that £2,000 be placed to renewal reserve account, that £1,000 be placed to a general reserve account, and that the balance, £1,859, be carried forward.

Tynemouth and District Electric Traction Co., Ltd.—The report for 1913 gives the total revenue at £15,028 The traffic receipts amounted to £13,973, an increase of £1,277. After providing for all expenses chargeable to revenue, including a provision of £1,600 for renewals, there is a surplus on the year's working of £5,215, making, with £298 brought forward, a total of £5,513. It is proposed to put to reserve £1,250 ; to dividend on the cumulative preference shares (5 per cent.), £1,525 ; to dividend on the ordinary shares (5 per cent.), £2,520 ; to be carried forward, £118. The expenditure chargeable to capital account during the year was £26. The Northern General Transport Co. made an offer to the shareholders respectively of the Gateshead and District Tramways Co. the Jarrow and District Electric Traction Co., Ltd., and this company, to exchange their holdings for fully-paid holdings in the Transport Co. Holders of 71 per cent. of the total issued share capital of this company have accepted the Transport Co.'s offer.

Prospectus.—*Electro Bleach and By-Products, Ltd.*—The list is to close to-day in an offer of £60,000 6 per cent. first mortgage debentures at 97½ per cent., and 100,000 7 per cent. participating preference shares of £1 each at par. The company has been formed to acquire the properties and assets of the Electrolytic Alkali Co., Ltd., in liquidation, and to carry on the manufacture of bleaching powder, soda compounds, salt, and numerous by-products. The works are divided substantially into two departments—namely, the electro-chemical plant and the power plant. Experts have prepared reports showing that the power plant is obsolete, and it is to be replaced by a modern installation enabling a saving in working cost of approximately £30,000 per annum to be effected. The old plant consists of 18 boilers, 1,500-h.p. gas plant, 10 steam engines and six gas engines. The new power plant will consist of three Parsons steam turbines and four Babcock boilers. The purchase price is £85,000, as to £75,000 in cash, £5,000 in ordinary shares, and £10,000 in cash or fully paid preference shares.

Milford-on-Sea Electric Supply Co., Ltd.—The directors report that, after charging all working expenses, writing £10 off preliminary expenses, and placing £155 aside for depreciation of plant, there remains a net profit of £314. A dividend of 5 per cent. is to be paid on the ordinary shares. At the annual meeting, the chairman (Dr. V. D. Harris) stated that that was the same dividend as had been declared by the company for the past five years. In explanation of the profits not having been quite so much, he attributed it partly to the introduction of the metallic-filament lamp, and to customers being more economical ; also, two large houses had been empty for nine months, which made a difference of nearly £40. A special vote of thanks was accorded to Mr. Nicholson, the company's local representative.

Bromley (Kent) Electric Light and Power Co., Ltd.—The directors' report to December 31st, 1913, states that the lamp connections have increased from 107,649 to 115,518. The sale of current has increased from £16,651 to £17,097. The works have been maintained in good order and repair. The result of the year's trading, including £1,544 brought forward, shows a profit of £14,100, and after payment of debenture interest and trustees' fees, &c., amounting to £3,045, there is a balance of £11,055. An interim dividend at the rate of 4 per cent. per annum was paid for the half-year in October, and the directors recommend the payment of a further dividend for the second half-year at the rate of 10 per cent. per annum, making a total of 7 per cent. for the year, £4,000 being placed to general reserve account, and £1,805 carried forward.

Lancashire Dynamo and Motor Co., Ltd.—The report, as published in the *Financier*, states that, after providing for interest, and charging full depreciation, the profit for the year amounts to £16,192, plus £1,631 brought forward, making £17,823. It is proposed to pay a final dividend on the ordinary shares of 5 per cent., making 8 per cent. for the year, pay £700 in directors' fees, place to reserve £5,000, and carry forward £1,811. The output for the year quite reached expectations, but the cost of materials and the rates of wages both tended to reduce the margin of profit. The Canadian business has been somewhat troublesome, and has resulted in a loss on the year's working, but steps are being taken which, it is hoped, will result in an improvement in the current year.

Lymington (Hants.) Electric Light and Power Co., Ltd.—The directors report that the company continues to make satisfactory progress, the total proceeds from the sale of current having been increased from £2,636 to £2,781. The result of the year's trading, including £482 brought forward, shows a profit of £2,540, less interest on debentures, amounting to £450. £1,000 is to be placed to reserve, and a dividend at the rate of 5 per cent. per annum is to be paid on the preference shares, leaving £769 to be carried forward. During the year the company has purchased £400 first mortgage debentures.

Beauly Electric Supply Co., Ltd.—Mr. Daniel Grath presided at the annual meeting recently. When the supply was started they expected to have 500 lamps connected in the first year, but they had 700, in addition to a couple of motors and a number of irons. Steps were being taken to put down a 30-h.p. petrol stand-by set. The year's working showing a profit of £87, After putting £50 to reserve and paying 5 per cent. on the capital they carried forward £2, after paying 5 per cent. on the sum owing to the contractors.

STOCKS AND SHARES.

Tuesday Evening.

It is hardly necessary to say that finance is superseded for the time being by politics. Interest in the latter is so much greater than in the former that the public are minded to do neither investment nor speculation just now. The result is that prices are at the mercy of comparatively few cliques of operators, who run quotations up and down according to the political mood of the moment, the remarkable cheapness of money being the only underlying factor which has any influence other than the all-pervading one just mentioned.

How plentiful money is may be gauged by the fact that the Lombard Street market did not have to borrow from the Bank of England yesterday (Monday), notwithstanding the close of the quarter. This is said, by some of those who closely follow the course of the money market, to be unique in their recollection. New issues are being treated in the fashionable way; that is, the public refrain from applying for the stock on prospectuses, and, instead, leave orders with their brokers to pick it up as soon as allotments are out and the underwriters start the market at a discount below the issue price. The strength of Consols reflects the ease of the money market.

Several important electric lighting issues are on the way. Reference has already been made here to the probable offer of a substantial amount in Ordinary and Preference shares by the General Electric Company, and this may be out before we are. The South Metropolitan Electric Supply Company found all its 7 per cent. Preference shares readily subscribed by the public, and the price is about the par value of 20s. The South London Electric Supply intends to offer its new Preference shares, by way of rights, to the existing holders, who should get their allotments within the next 48 hours. The new Ordinary and Preference shares offered by the County of London Company are quoted at ¼ premium. The over-subscription of this issue is a pleasant compliment to the County of London board; a practical vote of confidence that the directors are the more likely to appreciate after the criticism launched at their scheme of a holding company.

The principal movement in the lists of prices overleaf is a nominal drop of 17 points in Central London Deferred Non-Assented stock. As this returned only £3 4s. 6d. per cent. on the money, as compared with the £4 18s. 7d. which the Assented yields, it was obvious that a sharp fall would take place if any stock came to market. There is little more than £32,000 of the Non-Assented left, so that it is hardly everybody's investment, even at the present price, which still leaves the return below that afforded by the Assented stock. Metropolitans and Districts are both lower. The Home Railway market is slightly nervous as to what may be the outcome of the threatened strike in the South Yorkshire coalfields; but prices, after being weak, recovered part of their previous losses. Metropolitan Surplus Lands is 2 points higher at 64. Underground Electric Railways issues shows no further changes.

Brazil and Mexico keep in the limelight so far as foreign politics are concerned. The news from Brazil has latterly been better, the rate of exchange hardening to nearly 16d., after being down to 15½d. Seeing that a thirty-second of a penny in exchange makes a very considerable difference, it may be well understood how prices hang upon such movements as are now taking place from day to day. Brazil Tractions jumped to 85, some 7½ points above their recent lowest, but the price reacted to 83. Para Electrics are flat, both Ordinary and Preference receding to 4¼, and the Debenture stock dropping to 91½. On the other hand, Rio Tramway bonds have justified the attention drawn to them on their drop, and the 5 per cent. first Mortgage bonds at 98 are 3 points better, while the Seconds have recovered 4 to 92. Sao Paulo Tramway bonds are a point up.

Most of the Mexican issues, where they have moved at all, show advances. Mexican Light and Power Common shares hardened to 45½ and Mexico Trams Sixes to 80½, being improvements of 3 and 3½ respectively. Other foreign issues are mainly steady. Brisbane Ordinary rose to 7¾. Anglo-Argentine Tramways new Debenture improved to ½ premium.

In the Electricity Supply section prices were unsettled towards the end of last week by the threats of a general strike in all parts of the electrical world, including the Tubes. Later, however, these apprehensions subsided to some extent, and prices hardened, on the understanding that the trouble was confined to the contracting part of the trade. Charing Cross are a good spot at 5, showing a rise of ¼. Cities fell to 17, but partially recovered; and Counties, both Ordinary and Preference, are slightly better, allowing for the dividend markings. Urban Preference have again advanced on the improvement in the Company's position, evidenced by the recent report. South Metropolitan old Preference hardened to 1¼, the issue of new shares being a decided success.

The British Westinghouse Company has re-entered the dividend list as regards its preference shares, after an absence of eight years. The bitter sacrifices of shareholders in the past are at last bearing fruit, and the report just out affords solid ground for encouragement to the long-suffering proprietors. Probably many of those who accompanied the concern through the worst of its days have sold their shares; and, as it so often happens, the latter buyers will reap the benefit of the losses endured by original subscribers. The company declares a dividend of 5 per cent. on the Preference shares, and the price is 1/32 up at 1 1/32, the good news having, of course, been discounted in advance to a large extent. The Debenture stock has risen a further 3½ points, but the Prior Liens remain at 103½. Callender's Cable rose ¼, while Telegraph Constructions remain weak, and show another fall of 10s. Babcocks & Wilcox are a trifle easier. The South Wales Electrical Power Company adds £14,000 to its previous debit at profit and loss, as the result of 1913, making the total debit £162,000.

The Telegraph market had a shock on Monday, in the shape of a disappointing report from the American Marconi Company. For 11 months there is a realised surplus of only $178,000, which the market interpreted as meaning no dividend on American Marconis yet, and accordingly the shares fell from a sovereign to 17s. 6d. Canadians dropped to 9s., the parent shares of both classes gave way, and the whole group once more became gloomy. Direct United States Cable shares are a little easier, but otherwise there is no particular change worth mentioning.

The Rubber market is strong, the price of the product steadily advancing and reviving the gossip of a possible shortage before the year is out. Rubber shares have dawdled in sympathy with the line taken by the raw material, business not having been sufficient to galvanise the market into any semblance of activity.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, April 1st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2⅞d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	,,	£6 5	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£17 10	..
a Copper Sulphate	,,	£22 10	..
a Lead, Nitrate	,,	£30 10	..
a ,, White Sugar	,,	£28	..
a ,, Peroxide	,,	£82	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Perchlorate	,,	8¾d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	,,	£8 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70/72 %) ..	,,	£10	..
a ,, Chlorate	per lb.	3⅛d.	..
a ,, Crystals	per ton	£2 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£86	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£112	..
b ,, Sheet, in ton lots ..	,,	£112	..
p Babbitt's metal ingots	,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c ,, Tube (brazed)	,,	9⅝d.	..
c ,, ,, (solid drawn) ..	,,	7¾d.	..
c ,, Wire, basis	,,	7⅜d.	..
c Copper Tubes (brazed)	,,	10d.	⅛d. inc.
c ,, ,, (solid drawn) ..	,,	10d.	⅛d. inc.
g ,, Bars (best selected) ..	per ton	£80	£1 inc.
g ,, Sheet	,,	£80	£1 inc.
g ,, Rod	,,	£80	£1 inc.
d ,, (Electrolytic) Bars ..	,,	£67 10	£1 10 inc.
d ,, ,, Sheets ..	,,	£85 10	£1 10 inc.
d ,, ,, Rods ..	,,	£73	£1 10 inc.
d ,, ,, H.C. Wire	per lb.	8 13/16d.	3/16d. inc.
f Ebonite Rod	,,	4/6	..
f ,, Sheet	,,	4/-	..
n German Silver Wire	,,	1/10	..
h Gutta-percha, fine	,,	7/-	..
h India-rubber, Para fine	,,	3/0	½d. dec.
l Iron Pig (Cleveland warrants) ..	per ton	50/9	9d. dec.
,, Wire, galv. No. 8, P.O. qual.	,,	£14	.
g Lead, English Pig	,,	£20 10	2/6 inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7	10/- dec.
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e ,, ,, ,, medium	,,	8/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	,,	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/3½	..
p ,, ,, rolled bars & rods	,,	1/0½ to 1/2	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10⅜d.	..
r Steel, Magnet, in bars	per ton	£65	..
g Tin, Block (English)	,,	£173 to £174	£2 dec.
n ,, Wire, Nos. 1 to 16	per lb.	2/4	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£25 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations March 31st.	Rise + or Fall –	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ⅞	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	68 — 73 xd	..	6 3 3
Brit. Elec. Trac., 6 % Pref.	100	..	..	15½ — 17½		..
Do. Do. Deferred	100	..	..	6½ — 8½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	8	..	56 — 59	..	5 1 8
Do. 5 % Perp. Deb.	100	5	5	93 — 95 xd	..	5 1 0
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 82	—1	5 9 9
Central London Railway, Ord.	100	8	[illegible]	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	81 — 83	+1	4 16 5
Do. Pref.	100	[illegible]	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 8
Do. Def.	100	2	2	40 — 45	—17	4 9 0
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	93 — 96	..	5 4 2
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1903	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	65 — 70 xd	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 3
Lancashire United, 5 % Deb.	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord.	1	..	..	7/32 — 9/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅝ — ¾	..	6 13 4
Do. Do. 4½ % 1st Deb.	100	4½	4½	79 — 84	..	5 7 2
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	60 — 64	..	[illegible]
Metropolitan Railway Consol.	100	1½	1½	[illegible]	[illegible]	3 16 [illegible]
Do. Surplus Lands	100	2¾	2¾	63 — [illegible]	[illegible]	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 1
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	..	4 5 4
Metropolitan District Ord.	100	Nil	..	[illegible]	— ½	Nil
Do. 6 % Deb.	100	6	6	138 — 141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	84 — 87	1	5 3 6
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 9
Do. 5 % Deb.	100	5	5	85½ — 88½ xd	..	5 13 0
Potteries, Ord.	1	3½	..	[illegible]	..	..
Do. 5 % Pref.	1	5	5	½ — [illegible]	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	[illegible]	66 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	3 — 3¼	..	Nil
Do. "A"	1/-	..	..	[illegible] — 5/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 — 114	..	5 5 3
Do. 4½ % Bonds	100	4½	4½	99 — 101	..	4 9 0
Do. 6 % Income	100	6	6	89½ — 90½	..	6 12 7
Yorkshire (West Riding), Ord.	5	Nil	..	5/16 — 9/16	..	Nil
Do. 6 % Pref.	5	3	[illegible]	4 — 4½	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	83 — 86	..	5 [illegible]

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations March 31st.	Rise + or Fall –	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 11/16 — 4 15/16	..	5 17 4
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 9/16	..	6 0 7
Do. 4 % Deb.	100	4	[illegible]	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	103 — 106	..	4 14 3
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 — 100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	82 — 84	+1	7 2 2
Brisbane Trams Invt., Ord.	5	8	8	7½ — 8	— ⅛	5 0 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 — 101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	116 — 120	+1	6 13 4
Do. Pref. Ord.	100	6	6	104 — 108	..	5 11 1
Do. 5 % Pref.	100	5	5	101 — 104	+1	4 16 2
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	94½ — 96½	+ ½	4 8 1
Calcutta Trams, Ord.	5	7½	5†	6¼ — 6¾	..	5 11 1
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	¼ — ½	..	..
Do. Pref.	1	4⅜d.	6	⅞ — 1	..	6 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 8
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4¾ — 5¼ xd	..	5 14 3
„ Elec. Tr. (1904), Deb.	100	5	5	101 — 103	..	4 17 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ — 100½	..	4 19 6
Mexico Trams Com	$100	7	7	72½ — 75¼ xd	— ½	..
Do. Gen. Con. 5 % Bonds	..	5	5	79 — 83	+1	6 0 6
Do. 6 % Bonds	100	6	6	78 — 83	+3	7 4 7
Para Elec. Rlys. & Lt., Ord.	5	10	10	4 — 4½	— [illegible]	11 2 2
Do. 6 % Pref.	5	6	6	4 — 4½	— ⅛	6 13 4
Do. 5 % 1st Deb.	100	5	5	90 — 93	—1½	5 7 5
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97 — 99	+3	5 1 0
Do. 5 % Mort. Bonds	100	5	5	91 — 93	+4	5 7 5
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	98 — 101	+1	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90 xd	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	94 — 97	—1	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations March 31st.	Rise + or Fall –	Present Yield p.c.
Bournemouth & Poole, Ord.	10	6	7	9¾ — 10¾ xd	..	6 10 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10¼ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 97	..	4 12 9
Brompton & Kensington, Ord.	5	10	10†	8⅞ — 9⅜ xd	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8⅝ xd	..	3 19 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91½ — 94½	..	4 4 8
Charing Cross, West End & City	5	5	6	4¾ — 5¼	+ ¼	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅞	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅜	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4½ — 5 xd	— ⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10	16¾ — 17¾	¼	5 12 8
Do. 6 % Cum. Pref.	10	6	6	12¾ — 13¾	..	4 7 3
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 7 4
Do. 4½ % Second Deb.	100	4½	4½	100 — 103	..	4 8 1
County of London, Ord.	10	6	7	11⅝ — 12⅛ xd	..	5 15 8
Do. 6 % Pref.	10	6	6	11½ — 12 xd	+ ⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	102½ — 105½	..	4 5 9
Do. 4½ % Second Deb.	Stock	4½	4½	100 — 103	..	4 7 5
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4¼ — 4¾ xd	..	6 6 4
Do. 5 % Cum. Pref.	5	5	5	4¼ — 4¾ xd	..	5 5 3
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9
Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 8	..	5 12 6
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1[illegible] — 1[illegible]	⅛	5 2 7
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	— ⅛	5 17 3
Do. 4 % First Mort. Deb.	Stock	4	4	92 — 95	+1	4 4 1
Metropolitan	5	4¼	4½	3⅜ — 3⅞	— ⅛	5 16 3
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10¼	..	5 14 3
Oxford	[illegible]	7	7	[illegible] — 6 5/16	..	5 11 0
St. James' and Pall Mall, Ord.	5	10	12	9¼ — 9[illegible]	— [illegible]	6 3 1
Do. 7 % Pref	5	7	7	6[illegible] — 7⅛	[illegible]	4 18 3
Do. 3½ % Deb.	100	3½	3½	83 — 86	+1	4 1 [illegible]
South London, Ord.	4	5½	5½	2[illegible] — [illegible] xd	..	6 19 4
Do. 5 % First Mort. Deb.	100	5	5	98 — 101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1[illegible] — 1[illegible]	+ 1/32	5 [illegible]
Do. 4½ % First Deb. Stock	100	4½	4½	94½ — 97½ xd	..	4 12 4
Urban, Ord.	£3	Nil	..	[illegible]	..	
Do. 5 % Cum Pref.	5	3[illegible]	4	[illegible]	[illegible]	5 18 6
Do. 4½ % First Mort. Deb.	100	4½	4½	85 — 88 xd	+1	5 12 3
Westminster, Ord.	5	10	10	8½ — 9	..	5 11 1
Do. 4½ % Cum Pref.	5	4½	4½	5[illegible] — 5[illegible]	..	4 [illegible] 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 8s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 31st.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Adelaide, 6 % Pref.	5	6	6	5 — 5½	..	5 14 3
Calcutta, Ord.	5	8½	5†	7⅞— 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5⅜— 5⅝	..	4 13 0
Calgary Power, 1st Mort. Bds. ..	100	5	5	90½— 92½	+ ½	5 8 0
Canadian Gen. El. Com.	$100	7	8	111 —115 xd	..	6 16 9
Do. 7 % Pref.	$100	7	7	119 —124 xd	..	5 9 5
Cordoba Lt., Power and T., Ord.	1	5	..	7/16— ½	..	7 13 0
Do. 5 % Deb.	100	5	5	87 — 90 xd	..	5 11 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87 — 89	—1	6 14 10
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	..	5 5 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32— 3/32	..	Nil
Do. 6 % Pref.	1	6	6†	13/32— 17/32	..	10 11 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1¼— 1½	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	103½—106½	..	4 14 0
Mexican El. Lt., 5% 1st M. Bds.	..	5	5	65 — 70	..	7 2 10
Mexican Lt. & Power, Common	$100	4	4†	44 — 47	+3	..
Do. 7 % Cum. Pref.	$100	7	7	78 — 82	..	8 10 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	78 — 83	+1½	6 0 6
Do. 5 % 2nd Mort. Bonds ..	100	5	5	65 — 69	..	7 4 11
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	54 — 59	..	..
Montreal, Lt., H. and Power ..	$100	9	10†	280 —285	..	4 5 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	245 —255	+10	3 18 5
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	103 —108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	102 —104	..	4 6 7
Shawinigan Water, Capital ..	$100	5½	6†	138 —142	..	4 4 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	101 —103	+1	4 7 8
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	95 — 97	+1	4 12 9
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Victoria Falls Power, Pref. ..	1	6	6	23/32— 25/32	..	7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	101 —103	+1	5 16 8

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 31st.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	23/32— 27/32	..	8 5 0
Do. 6 % Pref.	1	6	6	¾— ⅞	..	6 17 2
Babcock & Wilcox	1	15	14†	3⅛— 3¼	—1/32	4 18 6
Do. Pref.	1	6	6	1 5/16— 1 7/16	..	4 8 6
British Aluminium, Ord. ..	1	..	..	1 1/16— 1 3/16	..	..
Do. 6 % Cum. Pref.	1	6	6	⅞— 1	..	6 0 0
Do. 5 % Prior Liens Debs. ..	100	5	5	96 — 99	..	5 1 0
Do. Deb. Stk.	100	5	5	88 — 93	..	5 7 6
B.I. & Helsby Cables	5	10	13	9¾— 10 xd	+ ½	6 10 0
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	101 —104	—1	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref. ..	2	Nil	5	1 11/32— 1 13/32	+1/32	6 5 0
Do. Deb.	100	4	4	74 — 76	+3½	5 5 3
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	39 — 43	..	10 9 6
Do. 4½ % Second Deb. ..	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	11¾— 12¼	+ ½	6 0 0
Do. Pref.	5	5	5	4 13/16— 5 3/16	..	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	22½	2½— 2¾	..	..
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	⅜— ⅝	..	..
Do. Pref.	1	6	6	11/16— 13/16 xd	..	7 7 8
Edison & Swan, A, £2 paid ..	5	Nil	..	1/16— 3/16	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	62 — 67 xd	+1½	7 9 1
Electric Construction	1	5	..	17/32— 21/32	..	7 12 6
Do. Pref.	1	7	7	15/16— 1 1/16	..	6 11 7
Greenwood & Batley, Pref. ..	10	7	7	6¾— 7¼	..	9 18 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref. ..	10	6	6	10¼— 10½	..	5 14 8
Do. Deb.	100	4	4	84 — 88 xd	..	4 11 0
Henley's, Ord.	5	15	20	13½— 14½	..	6 17 11
Do. Pref.	5	4½	4½	4 13/16— 5 1/16	+1/16	4 9 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	7½	10½— 11½	..	6 10 5
Do. Pref.	10	5	5	8¾— 9¼	..	5 5 3
Telegraph Construction	12	20	20	36½— 38½	— ½	6 5 1
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref. ..	100	..	..	50 — 55	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations March 31st.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾— 6¼	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	122 —125 xd	..	6 8 0
Do. Collat. Trust	$1000	4	4	91 — 94	..	4 5 3
Anglo-American Telegraph ..	Stock	8	8	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	108¾—109¾	+ ¼	5 9 4
Do. Def.	Do.	30/-	30/-	23½— 24	..	6 5 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7⅜— 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80½— 82½	—1	4 17 0
Cuba Telegraph	10	6	6†	8¾— 9¾	..	6 8 1
Do. 10 % Pref.	10	10	10	15¾— 16¾	..	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3½— 4 xd	+ ⅛	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7½— 8 xd	+ ½	6 5 0
Direct United States Cable ..	10	4	4†	6⅝— 7⅛	— ⅛	5 12 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	132 —135	..	5 3 8
Do. 3½ % Pref. Stock	Do.	3½	3½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	10	7	7	12⅜— 12⅞	..	5 8 9
Do. 4 % Deb.	Stock	4	4	94½— 96½	..	4 3 0
Globe Telegraph and Trust ..	10	6	6†	11¼— 11¾ xd	..	5 2 1
Do. 6 % Pref.	10	6	6	12⅜— 12⅞ xd	..	4 13 4
Great Northern Telegraph ..	10	20	5†	82 — 84	..	5 17 8
Indo-European Telegraph ..	25	13	5†	58 — 60	..	5 8 4
Mackay Companies Common ..	$100	5	5	85 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph ..	1	20	20	3 5/16— 3 7/16	—3/16	5 17 8
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2 11/16— 2 13/16	— ⅛	5 15 8
Monte Video Telephone, Ord. ..	1	6	6	13/16— 15/16	..	6 8 0
Do. 5 % Pref.	1	5	5	¾— ⅞	..	5 14 8
New York Telep., 4½% Gen. Bnds.	100	4½	4½	99¾—100¾	..	4 9 0
Oriental Telep. and Elec. ..	1	10	8†	2⅛— 2⅜	..	4 4 3
Do. 6 % Cum. Pref.	1	6	6	1 3/16— 1 5/16	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	87½— 89½	..	4 9 5
Pacific and European Tel., 4% Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	8 — 9	..	11 2 2
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½— 98½	..	4 11 5
United River Plate Telephone	5	8	6†	6⅜— 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5⅛— 5⅜	..	4 9 0
West Coast of America	2½	2½	..	1 3/16— 1 7/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	1½	2⅜ — 2⅝	..	4 15 3
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅝— 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd. ..	10	7	7	13¼— 13¾ xd	..	5 1 11
Do. 4 % Debs.	Stock	4	4	95½— 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 — 99	..	4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

The London County Council and its Employés.—At a recent meeting of the London County Council an agreement arrived at by the Electrical Conciliation Board with regard to the rates of pay of fitters, blacksmiths, fitters' labourers, and hammermen employed in the electrical section in the tramways department, was sanctioned. This agreement gives an increase of pay of ½d. per hour to all fitters and blacksmiths as from March 1st, and a further increase of ½d. in a year's time. This makes the rate of pay 9½d. per hour at present, and 10d. in 12 months, which is to be deemed the maximum for this class of work. Fitters' labourers at the Greenwich power station are to have an increase from 6½d. to 7d. per hour, and hammermen from 7d. to 7½d. This agreement is to remain in force for two years, during which no applications for further rises will be entertained. It was stated that a petition had been received from the coach body-makers, asking for a rise from 9½d. to 10d. per hour. There are 88 of these men in the employ of the Council's tramway department, and the cost of increasing the rate would be £510 per year. It was decided to refer the matter to the Conciliation Board for consideration. Although efforts are being made to reduce as much as possible the number of men employed seven days a week, it was reported that in the past four weeks 83, 105, 139 and 195 men — principally motormen and conductors—had been so kept on duty. This was largely due to illness, shortage of men, and to emergency work.

MOTOR AND CONTROL EQUIPMENTS FOR ELECTRIC LOCOMOTIVES.

(*For abstract of paper read by* Mr. F. Lydall *before the* Institution of Electrical Engineers, *see* Electrical Review, p. 421.)

Opening the discussion at Manchester on March 10th, **Dr. E. Rosenberg** said the list of geared and gearless motors printed in the paper showed the great difference between natural and forced ventilation. In motors of the order of 200 H.P., although the difference on the one-hour rating was slight, there was a great difference on continuous rating. In some cases the difference was given as 25 per cent. The author had stated that liquid resistances were seldom used; but on the Italian State Railways, where there were 140 locomotives of over 300,000 H.P., liquid resistances were employed. On certain rack and pinion railways in Switzerland the energy developed by the train going down hill, and running the motor as a generator, was consumed in resistances, which were artificially cooled by means of a large fan mounted in the cab.

Mr. Alderman Walker said that fighting to obtain orders for any particular system was not going to benefit either the country or the manufacturer in the end, and it was not a business proposition to suppose that any railway company would spend hundreds of thousands of pounds in electrifying, only to find that in a few years it was necessary to scrap its system and adopt a better one. It would be better that a central body should be organised to enter into conference with the railway people. This body should comprise representatives of manufacturers, institutions, the Local Government Board and the Board of Trade. It was to be hoped that the question of standardisation would be very seriously considered.

Mr. P. P. Wheelwright said it was regrettable that the British manufacturer was hardly mentioned in connection with railway electrification. He agreed with Alderman Walker regarding the necessity for a system adaptable to the great variety of conditions in this country.

Mr. W. Cramp said that in view of the enormous developments in the manufacture of worm gearing, it was difficult to realise why electric locomotives were designed with reciprocating connecting rods. There appeared also to be a lavish copying of the wheel diameter employed on steam locomotives. Why should the wheel diameter be limited? The author's remarks regarding the impaired radiating capacity of resistance grids when coated with aluminium paint were not supported by expert evidence.

Mr. Maybury asked whether steel bands had been used in place of the usual cog gearing or rods and levers. A paper read recently before the Manchester Association of Engineers stated that steel belts were far in advance of gearing in life and efficiency, and for the same power the width of steel required was only half that of leather.

Mr. Moffet said that an increase in the power of a motor at a given speed could be obtained by an increase in peripheral speed, this being obtained by an increase in gear ratio.

Dr. E. Rosenberg said it was essential that there should be an understanding between all parties concerned so that one system could be adopted, and if all railways would stick to that system the manufacturers could go ahead. Unfortunately at the present day no one could solve the problem of uniting all interests and selecting one system. Some railway engineers fought for single-phase, others low-tension direct current, whilst others swore by high-tension direct current. Regarding experiments, there was no better way of conducting them than by letting everyone have his own way. If an engineer believed in a thing he would put forward his best endeavour to prove that he was right; therefore if railway engineers were permitted to install what they considered best, the resultant experiments would show up the best systems. If railway electrification had been standardised six years ago, no one would have chosen high-tension direct current. The electrification of the British railways would not come to pass within 10 or 15 years, and if experiments were carried out on a small scale there would be no waste, even if the plant had to be scrapped. He fully believed that standardisation would come, but it should not stand in the way at present.

The Author, in reply, said the ratio between one-hour rating and continuous rating for railway motors without forced ventilation was about 2 to 1, whereas with forced ventilation the ratio was nearer equality, and certainly there was much difficulty in explaining some of the figures bearing on this point. Liquid resistances were used extensively on one or two railway systems. Whilst it was correct to say that speeds could be increased by using electric locomotives, it was to be recognised that electric locomotives were not made to run above the moderate speed of 60 to 65 miles per hour. Whilst the steam locomotive would only do 38 miles per hour on a certain gradient, the electric locomotive would do 55 miles per hour. Filtering the air used in forced ventilation was not general practice; the air in front of a railway train was comparatively good, and only the air following the train contained dust and dirt. The skidding point was a very desirable feature, as it limited the power of the driver to overload the motors seriously. Motors designed to give an acceleration of one-third gave all that was necessary. Designers used motors in which the peripheral speed was worked right up to the maximum, and it was a question whether worm gearing would enable this to be done. Single spur reduction gearing was usually sufficient to meet all the requirements of the case. Whilst it was an obvious disadvantage to have as many brushes as were indicated in some of the types of railway motors, the author did not consider that the renewals would be a serious matter, and with the large single phase motors employed on railway work, the brush gear had, as a whole, been very satisfactory. He thought that with such irregular working as was demanded of electric locomotives steel belts would not be likely to give good service on account of slipping.

In the course of the discussion at Birmingham, **Mr. F. W. Carter** said Mr. Lydall mentioned the number of steps in the control system as being dependent on the characteristics of the motor, and especially mentioned that the lower the internal resistance, the greater would be the number of steps. It was not, however the resistance itself that came into the question, but rather the resistance drop, which might be no lower in the large motor than in the small motor, and, in fact, in some cases might be higher. Therefore, as between motors of the same type, there need not be any appreciable difference in the number of control steps. The slope of the speed-torque curve affected the number of steps required, but the effect was only appreciable when comparing motors of different types, such as single-phase and continuous-current motors. The real consideration which determined the number of control steps was indicated by Mr. Lydall, and was this:—That the locomotive must be capable of starting as heavy a load as possible on the heaviest grade, which determined the minimum tractive effort, whilst the maximum was limited by the adhesion of the driving wheels. In order to get as much as possible out of the locomotive, it was necessary to bring the maximum and minimum as near together as was practicable, and a large number of steps was therefore used in the control. Motor-cars frequently had only nine steps, for the above considerations did not apply to these, and the limiting feature was simply the amount of jerking that the passengers would stand when the train started. Mr. Lydall mentioned self-induction of the winding as not affecting the problem of starting. Large numbers of records of train current had been taken by automatic instruments, and had always shown the rise of current, when each step of resistance was cut out, to be practically instantaneous, and consequently the effect of self-induction was inappreciable in any case. Mr. Lydall referred to the bridge method of transition from series to parallel. The fact that the accelerating current of a locomotive was varied according to circumstances of load, grade and condition of rails, made this method of transition less valuable than in the case of motor-cars, where the same accelerating current could be maintained automatically under all conditions; for unless the transition was taken at the current for which the resistances were designed, a shock would be felt at the transition very similar in nature to that felt when less perfect systems were used. In other words, for locomotive work the bridge system was not as valuable as in motor-car work. Mr. Lydall mentioned that in the case where a high-voltage continuous-current supply was taken from an overhead line, it was not advisable to break the current violently by means of a strong magnetic blow-out, otherwise surges might be set up in the line. The speaker had never heard of this before, and believed that the 2,400-volt locomotives used on the Butte, Anaconda and Pacific Railway had circuit breakers fitted with magnetic blow-outs. Very little automatic control apparatus was used on a locomotive because the latter was sometimes required to give all the tractive effort of which it was capable, whilst at other times it was worked with a lower tractive effort. One could hardly adjust resistances to give even peaks under both conditions, and it was felt, in the case of such locomotives, that the control was best left in the hands of the driver

ELECTRIC BATTERY VEHICLES.

This subject was discussed by the Birmingham Local Section of the Institution of Electrical Engineers on March 18th.

Mr. R. A. Chattock said the importance to the electrical industry of the introduction of electric battery vehicles into this country could not be over-estimated. The Incorporated Municipal Electrical Association had formed a Committee called the "Electric Vehicle Committee," which would issue suggestions and advice on all matters electrical connected with such vehicles. The proposed charges for current were under consideration by this Committee, and it was hoped to standardise them in all parts of the United Kingdom. Prices from ½d. to 2d. per unit and over were suggested. His opinion was that 1d. per unit should be satisfactory to all parties, with a possible reduction at night time. From information of what had been done in America and on the Continent, it was obvious that a big demand for these vehicles could be created if they were properly brought before the notice of the public. They would be specially serviceable for carriers of heavy goods, such as railway companies, for large shopkeepers' delivery vans for public services, and for motor-omnibuses. A service of these had been running for some years at Brighton, and it was apparently giving great satisfaction. Delivery vans and lorries of from ½ to 5 tons' capacity seemed to be the most suitable vehicles for the adoption of electric driving. A 5-ton lorry should bring in somewhere about £80 per annum for current at 1d. per unit. It was evident, therefore, that a large revenue might be expected by the supply department if these vehicles came into general use. There was no doubt, however, that the public must be educated before they would recognise their usefulness, and it would cost money to do this. The makers must be prepared to demonstrate the use of these vehicles in all large towns, and to put forward figures giving the cost of operation which could be proved to the prospective buyer. The existing garage proprietors, whose interests were at present bound up in the petrol-driven vehicles, obviously were not likely to provide facilities for charging the vehicles to commence with. The supply stations could help in the beginning by arranging charging facilities for such vehicles at the stations and sub-stations, though it was not considered that they should run garages permanently for this purpose. Assistance given in the early stages of the movement in this way would undoubtedly have a very stimulating effect on the use of the vehicles. The battery was the part of the vehicles about which there appeared to be the greatest doubt in the mind of the user, and, in order to get over this, the maker should be prepared to give reasonable maintenance guarantees over as long a period as possible. It was only by cutting the guarantee charges down to as low a figure as possible that the battery makers could assist in the pioneering work which would have to be done in this country before the public were convinced as to the great utility of the electric battery vehicle.

Mr. W. Fennell said that the Municipal Electrical Association represented only one section of one interest—that of the generation, sale and use of electricity by municipalities. If the Institution of Electrical Engineers had taken up this matter, it would have been possible to form a strong committee of its own members, which included eminent representatives of all the branches of the industry. The I.E.E. could render signal service to this branch of electrical engineering by organising a series of comprehensive papers on the details involved in producing and running electric battery vehicles. The standard price should be that charged to the user for the energy at the standard D.C. voltage which would be fixed for electric vehicle charging. Simplicity was the great thing to be aimed at in dealing with the non-technical public, who knew nothing about peak load times, and would be attracted by a certain reasonable price which they could check against their mileage, rather than a doubtful and varying cost which might be lower on the average. He would suggest 1¼d. per unit into the battery to cover all costs of providing the supply at the standard D.C. voltage. The supply authorities could then bargain with the owners of the charging machinery to give the supply at such a price that they could profitably sell at the standard rate. The charging business would rapidly get out of the hands of the supply authorities, and, if his suggestion were adopted, it would allow a very large margin at the outset to those authorities who did the pioneer work, as they would secure both profits.

Mr. A. M. Taylor said that records were cited of a pleasure car seating two people and carrying some luggage, the weight of which was about 1 ton. This car was equipped with 50 cells giving a discharge capacity of approximately 225 ampere-hours at 60 volts. The cost of such a battery might be taken as £66. From numerous records available from the States, it would appear that 15,000 miles was a moderately safe estimate for the life of the battery. A battery which had been drawing a heavy truck for two years and had covered 17,000 miles, was still in actually better condition that when it started, and was probably good for another 17,000 miles. Taking, then, this figure for the battery and the capital outlay at £66, the expenses for renewals of the battery worked out to only 1d. per mile for a vehicle weighing only 1 ton. On a vehicle of which the gross weight was, say, 5 tons, it would be reasonable to assume that the cost of battery renewals would be 5d. per mile. It would seem from this that the cost for repairs was not at all exceptional. Careful records on the car showed that 542 miles were covered at an expenditure of 108 KW.-hours put into the battery. This worked out at 0·2 of a kilowatt-hour per mile, and per ton mile. From a rough calculation of the energy put into the motor, it would appear that the average traction coefficient was about 53 lb. per ton. At the above figure the cost of energy at 1d. per unit would work out to only one-fifth of 1d., and on a car with a gross weight of 5 tons it would be roughly 1d. per mile. This would be quite a reasonable figure. In Indianapolis a large number of 1-ton lorries (*i.e.*, carrying one ton) took on an average about two-thirds of a unit per mile, and ran some 11,000 to 15,000 miles under all sorts of conditions before the battery required renewing. One battery company had published the most elaborate tests of the performances of its cells under all sorts of conditions. A cell was charged for 15 hours in the wrong direction at the normal charging rate; after it had been re-charged the capacity was hardly altered in the least. A cell had been standing for two weeks fully discharged, without any solution in it and with the plates exposed to the air. After five normal charges and discharges the cell was practically as good as ever. A cell was allowed to stand for six months completely discharged; the performance at the end of the time, after re-charging, was practically the same as at the beginning. Another test was made consisting of heating a cell up to 130° F. and short-circuiting it to exhaustion, and charging afresh, repeating this up to some 500 times. Even after this terrible treatment the cells had as good a capacity as when they started, and after the first 150 or 200 such discharges, they had positively an increased capacity. After 1,000 such discharges the cells had only lost 20 per cent. of their original capacity. Allowing the equivalent of 50 miles per charge we should, on 500 charges, have the equivalent of 25,000 miles' run, and on 1,000 charges of 50,000 miles' run. The same cell was tested for damage due to vibration; after having been dropped through ½ in. nearly two million times, the performance was almost absolutely that at which the cell started. Three cells were taken after having been used for 17,000 miles on a 1-ton delivery van, and were found actually better in performance by 34 per cent. than when originally put in. These tests served to show that, in the case, at least, of the particular battery concerned, there should be no mistake as to the reliability of the results to be obtained, and circumstances had altered enormously since the days, not so long ago, when the failure of the batteries was the persistent cause of all trouble.

Mr. S. T. Allen said he had received from the Electric Vehicle Committee a list of questions asking him, amongst other things, what he proposed to charge in Wolverhampton for electricity supply for charging purposes in private garages (1) during peak times, (2) off peak times. He asked Mr. Chattock what exactly the Committee meant by peak time in this case. What might be considered as the peak time when supplying direct at the works would not necessarily be the peak time for the purposes of charging at private-house garages. The central station peak times might be, say, from 3 p.m. until 6 p.m., but the peak time in an ordinary residential street, where cooking and heating operations were carried on, was about 7.30 p.m. The addition of a load of, say, 250 amperes, due to the charging of half-a-dozen car batteries at such a time, would entail, probably, doubling the size of the mains and services in that street.

Mr. S. H. Bill said his firm ran a fleet of about 20 petrol vehicles, and as they generated electricity as a by-product at less than ¼d. per unit, they were, so far as electric vehicles were concerned, in a much more favourable position than the majority of users, but their difficulty had always been in getting any reliable figures or data that would be guaranteed by the battery manufacturers. Their petrol costs ran out at from 3·88d. to 5·33d. per ton-mile with four-ton lorries, this including one driver and two draymen's wages, garage costs, renewals, insurances, licences, stores and 20 per cent. depreciation and 5 per cent. interest on capital. Even at these low figures they found it impossible to compete with horse-drawn vehicles on journeys of less than five miles. Alhough he believed the battery vehicle would eventually become common, he did not think the time would arrive in the immediate future.

Mr. A. C. Soutter said the lead cell now used for this class of work was an entirely different article to that used for the purpose several years ago, and as a proof of its reliability to-day, he referred to its successful use on the Brighton omnibuses during the past six or seven years.

Mr. R. J. Mitchell said that 1d. per unit should be the standard maximum charge, and wherever possible this should be reduced. Fuel economy afforded such an excellent talking point and such a valuable advertising feature, and, moreover, would be the means of such a large proportion of potential users taking advantage of the low fuel costs of the "electric"—the fuel aspect being the only one that the uninitiated could understand right away—that there seemed even more justification for extending the lowest possible rates to the electric vehicle user than held good with the domestic user of electrical energy. In 1903 Mr. Hibbert gave an interesting paper on the so-called E-type Edison accumulator. The E type was put into commission on quite an extensive scale in the States, and gave, on an average, 3½ years' service in vehicle operation before depreciating to 65 per cent. of its original rated capacity. The Adams Express Co. had in operation 200 trucks thus equipped, and got an average life of over three years from them. The present type of cell was brought out in 1909, and in 1912 the Adams Express Co. equipped 88 trucks with it. When subjected to a particular process of charging and discharging at very high rates, conducted at a very high electrolyte temperature—a combination of conditions well known to be very destructive—the E-type cell depreciated to 65 per cent. of its rated capacity after 200 cycles of this treatment, whereas the A-type, when put through the same process of abuse, indicated *4 per cent. above rated capacity*, after *eleven hundred* cycles; hence it was pretty plain that the A-type cell would very far outlive its guarantee period of four years, during which time it was warranted to give 100 per cent. of its rated output. On an average, the Edison cell might be relied upon to give 12 watt-hours per pound of complete assembled battery, at the discharge rates ordinarily met with in vehicle service. It would be of advantage if the technical colleges would get some of their research students to make reasonably complete accelerometer measurements of tractive resistance per ton over various road surfaces immediately in their own districts. It would then be possible for electric vehicle users and manufacturers to estimate beforehand in any projected service, the available mileage of any given type of electric vehicle per charge, and to figure out beforehand the working conditions with a great degree of accuracy. Another most useful work which our Universities could undertake would be research into the cost of operation of typical vehicles, including horse, petrol, steam, and later on, electrics, in our large cities. Such work had been undertaken very effectually by the Massachusetts Institute of Technology, and to the results gained very much of the enormous progress of the electric vehicle in America was due, since the analysis in question revealed the undoubted fact that in its own special sphere of utility, namely, that of carrying goods on hard town roads, the electric had been proved to be cheaper by 15 per cent. to 25 per cent. than any of its competitors.

Mr. E. Stubbs said that one of the greatest difficulties in the way of introducing electric vehicles was the first cost of the vehicle; something over £600 was given as the cost of a small delivery van. Few firms could be expected to face such an expenditure. The battery makers stood to gain quite as much as the supply authorities by the introduction of this system of transport; they should, therefore, be prepared to supply vehicles and maintain the batteries either for a fixed charge per annum or a fixed charge per mile. The actual cost of the supply for charging purposes was relatively unimportant, as it was a very small proportion of the total cost of running these vehicles.

THE MANUFACTURE OF TUNGSTEN FILAMENTS.

An interesting article appeared in *La Technique Moderne* recently, describing the manufacture of drawn-wire tungsten filaments, from which we derive the following particulars and illustrations.

Pure tungsten, although very fragile at a forging temperature can nevertheless be hammered, rolled and drawn at a white heat, and thus by degrees can be rendered malleable. The principal conditions which must be fulfilled in order to effect this transformation are as follows.—The metal must be free from oxide. The carbon content must not much exceed 0·05 per cent. (2·3 per cent. of W_3C). The metal must contain neither iron nor nickel, and must be almost free from sulphur, phosphorus, arsenic, antimony, selenium and tellurium. It must be heated almost to the melting point, before being worked in a cautious and very gradual manner; and finally, it is necessary to keep it out of contact with air as far as possible during the various stages of its manufacture.

The process comprises six operations :—

1. The production of a sufficiently pure metallic powder.
2. The agglomeration of this powder into bars.
3. The consolidation of the compressed bars.
4. The "burning" of the bars.
5. Working the bars by hammering or rolling.
6. Drawing the bars into wire.

1. To begin with, trioxide of tungsten is converted into metallic tungsten by heating it to a white heat in a current of pure hydrogen. This operation is carried out at a temperature of, say, 1,000° C., and results in a very fine powder of black tungsten, containing 1 to 2 per cent. of oxygen.

2. Agglomeration of the powder is effected with the aid of an hydraulic press, capable of exerting a pressure of about 5,000 kg. per cm^2. The bars thus obtained are exceedingly fragile, and their formation always requires very great skill. Fig. 1 show the press and mould employed. The latter is made to give bars 4 mm. thick and 130 mm. long. The powder which yields the best bars is that of medium fineness; if it is too fine or too coarse, the bars readily crumble after compression.

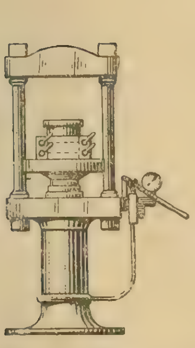


Fig. 1.—Hydraulic Press and Mould.

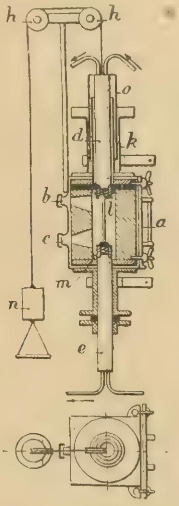


Fig. 2.—Electric Furnace.

3. The bar is still so fragile that it breaks if laid on an uneven surface, or if it is picked up carelessly. It is given the desired firmness by heating it in a tubular furnace, in a current of hydrogen, for an hour, during which the temperature is gradually increased to red heat; an equal period is then allowed for raising the temperature to a degree a little higher than that which was used in producing the tungsten powder.

4. The "burning" process is intended to create an intimate union between the small tungsten crystals of which the bar is composed.

It must be carried on slowly and cautiously, for the quality of the filaments to be made later on depends upon this process. The final temperature to which the bars are heated is very near the melting point of tungsten, and must reach 2,850° C. In order to accomplish this, special apparatus must be used, and fig. 2 shows the kind of furnace most usually employed. The casing of the furnace, provided with small tubes *l* and *m* for the admission and discharge of hydrogen, is of cast-iron and is coated on the inside with graphite. The wall *a* of the furnace is removable, and is normally attached with screws and wing nuts. The opposite wall has two windows, *b* and *c*, to permit of supervising the operation. The copper electrodes *d* and *e* are provided with means for the circulation of water. The lower one *e* is fixed; the other, suspended from a cable passing over the pulleys *hh*, is balanced by a counterpoise *n*, and can slide in the insulated cover of the furnace. It carries a bell *o*, which plunges into a cylinder *k* filled with mercury. The bar to be treated is fixed to the electrodes by spring grips; when it is thus mounted in position, the furnace is closed and filled with hydrogen, and the heating current is turned on, oxygen being first carefully driven out of the apparatus. The contraction of the bar during burning is about 11 per cent. In order to heat bars of 16 to 20 mm.^{2} cross section, a current of about 53 amperes per mm.^{2} is required for 2,650° C., and 57 amperes per mm.^{2} for 2,730° C.

5. The sintered bars are still brittle enough to break if dropped from a height of 30 to 40 cm., although one can hardly break them by hand. They can be properly worked only at a temperature of 1,200-1,300° C. but as they oxidise very rapidly at this temperature, it is necessary to carry out the hammering or rolling as far as possible in a current of hydrogen. The most suitable machine for this purpose is illustrated in figs. 3, 4 and 5.

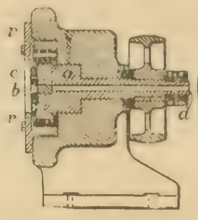


Fig. 3.—Section on A B.

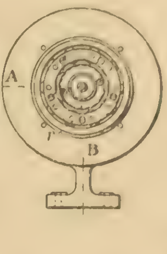


Fig. 4.—View with Cover Removed.

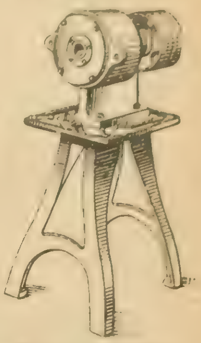


Fig. 5.—Complete Machine.

The dies *b* have, on their interior surface, a tapering groove of the same size as the bar; they are mounted with the hammers *c* in a recess in the hollow shaft *a*. The hammers, which have rounded external ends, are carried by the rotation of the shaft in front of the rollers *r*, which are arranged in a ring. Thanks to the rapid revolution of the shaft, the hammers are driven outwards by centrifugal force, but are forcibly thrown inwards on contact with each roller and transmit the blows to the dies. At 400 r.p.m. the hammers give about 4,000 blows per minute, which are distributed regularly over the surface of the bar. The latter, heated to 1,300° C. in a hydrogen atmosphere in a furnace, is quickly taken out and thrust into the machine, while the hydrogen necessary to prevent oxidation of the metal during the hammering is led in at *d*. The diameter of the bar can be reduced 4 per cent. at each pass into the machine, so that to obtain a wire of 1 mm. diameter from a bar 6 mm. square, some 50 passes are necessary. At every third pass the dies are replaced by others with a smaller groove, so that for the reduction of section above mentioned, 16 pairs of dies are needed. When at length a diameter of 0·75 mm. is reached, the tungsten has become ductile to a degree allowing of its being bent and worked at the ordinary temperature.

6. Drawing, however, is facilitated by heating the draw-plate, and fig. 6 shows an arrangement which gives good results. The draw-plate *a* consists of a cylindrical block in which the diamond is fixed in the usual way. Lighting gas is brought by the pipe *c* to a burner *e* arranged in an arc of a circle and pierced with little holes, to direct the flames upon the periphery of the plate. Before entering the die, the wire passes through a cylindrical bar which is also heated by a flame. Any type of draw tongs *b* can be used that is usually met with in steel wire drawing. The drawplate is lubricated with a mixture of Atcheson deflocculated graphite and water. As the wire must be pointed in order to be able to enter the die, chemical processes must be employed, because of the extreme hardness of the tungsten and of the very small diameter of some of the wires. The ends of the thick wires are plunged into melted potassium nitrate, and those of thin wires into a solution of potassium cyanide, so as to form the anodes of an electric circuit. By this means they are pointed very regularly, especially in the former case.

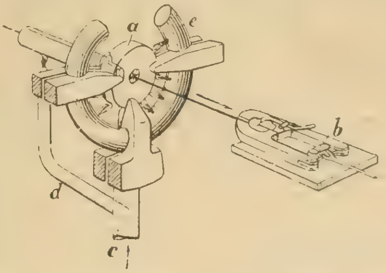


Fig. 6.—Arrangement of Heated Draw-Plate.

The dies employed in succession differ very little in bore. Starting with a wire of 0·65 mm. diameter, the dies decrease by about 0·0125 mm. as far as 0·35 mm.; from this size down to 0·1 mm., the interval is 0·0065 mm.; from 0·1 to 0·075 mm. it is 0·003 mm.; from 0·075 to 0·0375 mm. it is 0·0025 mm., and finally from 0 0375 to 0·025 mm. and below it becomes 0·00125 mm. Thus 100 dies are necessary. During the drawing between 0·65 and 0·45 mm., the temperature should be from 600 to 650° C.; from 0·45 to 0·25 it is 500° C., and finally, for the smaller diameters it is about 400° C.

When a wire of the initial diameter of 0·65 mm. has been brought down to 0·18 mm., it can be wound round the finger at the ordinary temperature without breaking. Below 0·1 mm. the wire becomes as ductile as any other metal, and can be drawn at atmospheric temperature, though for the sake of facility it is preferred to heat the dies up to the end.

The wire thus obtained is coloured blue-black by the graphite and by a little oxide. In order to clean it, the wire is heated to dull red by passing it into a glass tube containing hydrogen, and keeping it in contact with two copper cylinders, to which is led an electric current. The finished wire is silver-white, and has an extraordinarily high tensile strength, varying from 420 to 460 kg. per mm^2. It is non-magnetic, and does not oxidise at the normal temperature. It is insoluble in hydrochloric, nitric and hydrofluoric acids; it dissolves slowly in a mixture of nitric and hydrochloric acids, and very rapidly in a mixture of concentrated hydrofluoric and nitric acids. Pure sulphuric acid attacks it only at a high temperature. The nitrate and chlorate of potash transform it quickly into trioxide of tungsten.

ELECTRIC WINDING AT COLLIERIES.

A meeting of the West of Scotland Branch of the Association of Mining Electrical Engineers was held on March 20th, at Glasgow, when discussion was resumed on the paper contributed by Mr. James Gillespie on "Electric Winding at Collieries."

Mr. S. A. Simon (Glasgow) said he felt that Mr. Gillespie had not done electric winding full justice. Mr. Gillespie gave the chief factor which governed the running costs of any winder as the cost per shaft H.P.-hour; he was glad to note that the author had appreciated the importance of this basis of comparison, which in former discussions had often been attacked, especially by opponents of electric winding. Unfortunately, however, he did not state the consumption per shaft H.P.-hour of the winders which he described. He did not think that even the staunchest advocate of steam winding denied that the actual steam consumption of electric winders deriving their current from up-to-date electric generating plant was considerably lower than that of steam winders. Their arguments in favour of the latter were invariably based on other considerations, such as lower capital cost, greater flexibility, and, latterly, the advantages of the combination of a steam winder with exhaust or mixed-pressure turbines, driving generators or other rotary machinery. He had met engineers who had argued that it did not matter how uneconomical a steam engine might be if they had a turbine which could utilise the exhaust steam from it, because the more live steam the engine consumed the more exhaust steam was available for the turbine. He need not take up time exposing this palpable fallacy. It should be borne in mind, however, that even in a mixed-pressure turbo-generating plant it was not always possible so to arrange the electrical load as to make it coincide in quantity and time with the available exhaust steam, so that at times steam was blown off the accumulators, and at other times live steam from the boiler had to supplement the exhaust supply. In up-to-date accumulator plants the excess of steam was often used for feed heating, but there were constant losses by radiation as well as drop of pressure between the back pressure of the engine, from which steam was supplied to the accumulator, and the supply pressure to the turbine. This was more particularly the case where a loaded check valve was fitted between the accumulator and the winding engine, to prevent the alterations in pressure in the accumulator going back to the winding engine and affecting its working conditions by altering the back pressure. This drop of pressure generally amounted to 3, and sometimes even to 5 or 6 lb., which, in a total of 12 to 18 lb. absolute pressure, represented a very considerable loss of available energy. He had recently occasion to draw up a comparison for a concrete case between all-electric plant and steam winders with mixed-pressure turbines. The former was based on costly Ilgner winding plant, and with steam winding the capital expenditure was between 25 per cent. and 30 per cent. more than for the all-electric plant, including boilers, pipe work, feed pumps, turbo-generators, condensers, cooling towers and winders—in fact, complete plants, but excluding buildings and foundations, which would be assumed the same for both equipments. With coal costing 3s. 6d. per ton, a saving for the electric winder was shown amounting to 20 per cent. on the additional capital outlay. He would like to add that in the comparative figures a much lower steam consumption was assumed for the steam winder than the average stated in Mr. Gillespie's paper; basing the calculation on the latter figure, a saving of 27½ per cent. would be shown. The conditions were naturally different when there was an existing steam winder which was efficiently and satisfactorily performing its duties; in many such cases the retention of the engine and the utilisation of its exhaust steam in a turbine plant was sound engineering, and could be justified on technical as well as economic grounds. Each case must be considered on its own merits, and a thorough study of all the factors made before a decision was arrived at as to the type of plant best to adopt. The higher the price of fuel the better it paid to increase the capital outlay in order to obtain more efficient plant, and there appeared no doubt that with the increasing burdens placed on colliery owners due to modern legislation and the ever-increasing demands of the working man for higher pay and better social conditions, the cost of coal was more likely to rise than to fall. The argument, therefore, that the cheap price of the fuel used in Scottish collieries did not justify the higher expense of the more elaborate type of electrical winders was likely to lose most of its force. An important advantage of electric winding was the steady and even torque produced by the motor, whereby whipping of the rope as caused by the pulsating action of a steam engine was prevented. The rope was consequently less severely stressed, and, moreover, it was possible to predetermine the stress more accurately, so that higher rates of acceleration and retardation were permissible and higher speeds of winding could safely be employed. This applied more particularly when winding men. In Germany previously when men were being wound a maximum speed of about 30 ft. per second was prescribed. Since the introduction of electric winding double this speed was permitted with electrically-driven winders fitted with the usual safety devices. Electrical engineers had to show mining managers that they could wind coal as well as it was wound by steam and fulfil most, if not all, of the functions of the steam winder in the manner to which those who worked the winder had been accustomed. The electrical engineer must educate the mining engineers so to adopt and alter their methods of working as gradually to adapt them to the new economic conditions and available agents which would give the highest possible efficiency. The introduction of electricity for haulage and pumping, but more particularly for face conveying and coal cutting, had already made a notable change in the working conditions below ground, especially in the Scottish coalfields, and he had no doubt that mine managers and owners would, in due course, appreciate the advantages of electric winding and gradually adapt their winding programme so as to utilise to the best advantage electric power.

Mr. D. B. Baddeley (Crompton & Co., Ltd.) observed that the paper in itself was rather disappointing, as it had only taken into account electric winding on the Ilgner system. In the case of the Breich winder, the consumption was given as 0 6 unit per ton of coal wound from a depth of 72 fathoms. He asked if this included the energy required for accelerating and maintaining the speed of the fly-wheel during the rest period? In the torque-time diagram given the maximum peak load was 383 H.P. input to the motor. Personally, he would consider a fly-wheel a doubtful advantage with such a small equipment. There were very few supply companies of any standing that would object to a peak of 300 or 400 H.P. Although it would, of course, be an advantage wherever possible, from the supply company's point of view, to keep these peaks down, it was difficult to say where the gain came in from the consumer's point of view. A fly-wheel would add considerably to the initial cost of the equipment, and it was very doubtful whether the maximum demands from the mains would be any less with the fly-wheel than with some other system of Ward-Leonard control without a fly-wheel. Another point which should be borne in mind was that the main driving motor had to be designed to take these momentary peaks, and as these peak loads, however momentary, affected the sparking, the motor would have to be very much bigger than with the Crompton system of control where the current was limited. Generally speaking, the fly-wheels were only a necessary evil where the supply companies could not deal with the peaks, and in such cases the consumer had to bear the extra expense. In South Africa fly-wheels were practically unknown, although the winders were considerably bigger than any they had in this country. One consideration that had not been taken into account for electric winders for small pits was the time that would be required to start up an Ilgner system as against a plain Ward-Leonard system. With the Ilgner system, where the motor-generator would have to be kept constantly running, the energy consumed would be much greater than that consumed by an ordinary Ward-Leonard set, which could be started up and the winder got ready for use within three minutes from the time the engineman entered the engine-house.

Further discussion on the paper was adjourned till next meeting.

Prize Competition.—The Société Industrielle d'Amiens has published the subjects of its usual yearly competition for essays on new processes, apparatus, &c., for which sums of money, gold or silver medals will be awarded. The competition is for the most part open to foreigners. Subjects and awards appertaining to electricity are the following:—A gold medal for a mechanical electric generator, chemical or thermic, giving the best and most economical results; a gold medal for an accumulator, realising notable advances as regards capacity, durability, quick charging, cost of repairs, &c.; a gold medal for an electric glow lamp exhibiting material improvements on existing ones, and which may be made for all pressures up to 250 volts; a gold medal for an electric fusible cut-out, easily repairable and cheap; also a gold medal for a simple and cheap dynamometer. Awards will also be conferred on any other novel apparatus affording real services to industry.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Motor Control Panel.

The motor control panel shown in fig. 1 was constructed by the Edison & Swan United Electric Light Co., Ltd., of Ponder's End, Middlesex, for controlling a 600-h.p., three-phase, 220-volt motor. The oil switch, which has a capacity of 1,500 amperes, is fitted with overload release in two phases, with Ediswan time-limit attachment and no-voltage release. No live metal parts are accessible outside the expanded metal screens. Ammeters are placed in two phases, and in addition, a voltmeter, frequency indicator, and a power-factor indicator are mounted on the panel.

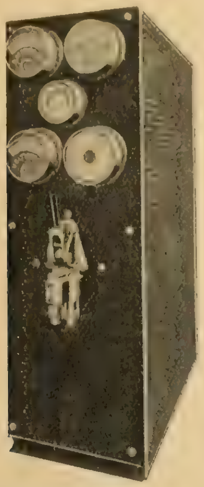


Fig. 1.—Ediswan Motor Control Panel.

Eclipse Cooking Apparatus.

We illustrate in fig. 2 two Eclipse ovens in use at St. Patrick's Hall, Reading, containing all the necessary equipment for dealing with the culinary requirements of a college of 84 persons.

The ovens, which were supplied by the Electric and Ordnance Accessories Co., of Aston, Birmingham, are of the Eclipse restaurant type, and have a double casing, packed with heat-resisting material.

Cast-iron double doors, having faced and polished surfaces, are fitted to the front, the interiors being porcelain enamelled. Each oven base, top and door frame is of cast-iron, the side and back panels being composed of vitreous green enamelled sheet-steel. On the inside are vertical perforated cast-iron gates, which carry the oven shelves, protect the heating elements from damage, and safeguard the cook from shock. These gates can be taken out, cleaned and replaced with the minimum of trouble. The heating elements, which consist of a special resistance alloy wound on a pure mica base, are supported by light framing, and assembled on each side of the oven. This method of side heating has been found to be most popular, and at the same time most effective.

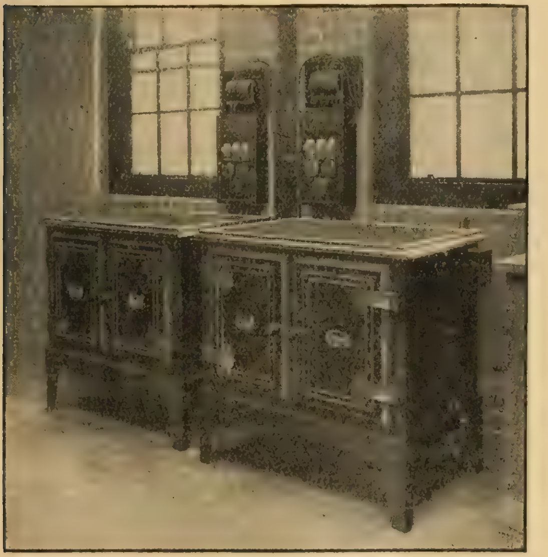


Fig. 2.—Eclipse Ovens in Use.

A complete cooking outfit, consisting of two grid shelves, one sheet iron shelf, one drip pan and meat hook with an adjustable carrier for same, is supplied with each oven.

The total power consumption per oven is approximately 4,800 watts, which is divided into three circuits of 1,600 watts each, for heating up the top, centre or lower compartment of the oven as required. Each circuit can be switched off independently of the other.

The ovens measure internally 22 in. high, 26½ in. wide, 22 in. deep. The switches and other apparatus for controlling and regulating the heat of the ovens are mounted on the two wall switchboards, each in a polished teak case with three 10-ampere "on" and "off" switches; three "Zed" type fuses and three tubular indicating lamps. These three lamps are fitted with brass tubing projecting above the lid of the case, and have a ruby indicating glass with the word "on" appearing above. The lid of the case is pierced so as to permit the switches and fuses to stand out slightly from the board.

The equipment, which is suitable for use on a 200-volt circuit, has given most gratifying results ever since it was installed, the management having expressed themselves as being highly satisfied with the Eclipse ovens in every way.

Electric Searchlight.

The accompanying illustration shows an electric searchlight, pilot-house type, that is being sold by the London Electric Firm, of George Street, Croydon. It will be seen that the beam is directed by means of a lever passing through the deck over the pilot-house.

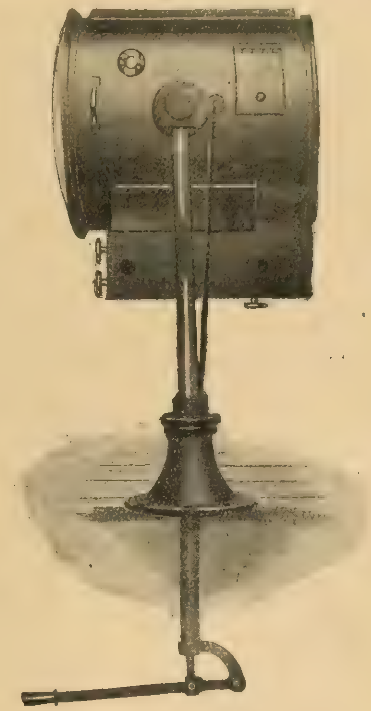


Fig. 3.—Pilot-House Searchlight.

A variety of searchlights for other applications is made by the firm, with mirrors and lenses of any desired type, and either automatic or hand-fed lamps. We note that in addition to the Suez Canal type of equipment, the Panama Canal searchlight is now included in the list of special types.

Electric Screw-jacks.

In *La Lumière Electrique* for March 14th, there is given an illustrated account of an electrically-driven system of screw-jacks for use in railway workshops, where they are employed to lift locomotives, wagons, &c., when removing the wheels. The loads dealt with run to 100 tons, and the height of lift must be at least 2 m. Travelling cranes are provided for this purpose in important depôts, but these would be too costly for minor centres, and the apparatus usually available is slow and clumsy in operation.

Experience shows that a moderate speed of lift is advisable, and in practice a speed of 2 m. in 20 min. has been found satisfactory, at which rate it requires 4·5 h.p. to lift a locomotive weighing 100 tons. It has been found best to drive all the four screw-jacks from one motor, to ensure synchronous operation and to gain portability, the motor being mounted on a wheeled truck and coupled to two of the screw-jacks by a telescopic shaft with cardan joints. The other two jacks are driven from the first two by chain gear; this method has the additional advantage that one motor suffices to operate in turn a number of sets of screw-jacks. The jacks forming a pair are provided with a cross-beam, which receives the weight of the comotive, and the screws of one pair are right-handed, of the her left-handed, the motor being situated between them. The cross-drive chains can be removed at will to permit the wheels of the locomotive to be run out between the jacks. The motor gives 11 H.P. at 1,150 R.P.M., the overall efficiency of the apparatus being little more than 25 per cent. The four jacks weigh 5½ tons; the cross-beams, &c., 2½ tons; the motor, controller and truck, &c., 1½ tons—total, 9½ tons. Many such sets have been recently installed on the French railways.

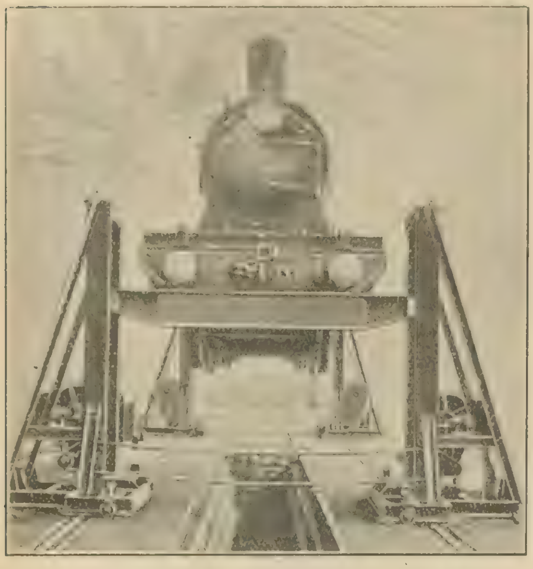


Fig. 4.—Electrical Screw Jacks in Railway Work.

The Vislock Single Lock-Nut.

We have recently had our attention drawn to a patent single lock-nut of unusual construction, which is being put on the market by Messrs. Vislock, Ltd., of 3, St. Bride's House, Salisbury Square, E.C.

An approximate section of this nut is shown in fig. 5, from which it will be seen that a twin formation is employed involving the use of two parts forced together under hydraulic pressure, and subsequently inseparable owing to the shape of the socket. The combination is subsequently tapped as a single nut. The internal conical and socketed portions are in intimate contact, and it is claimed that when the upper section is screwed towards the lower one, the inner section of the nut at the bottom, due to the shape of the bottom of the socket will be forced into close contact with the thread of the bolt, and by the pressure on the extremity of the outer wall, this overhanging outer wall will be urged towards the outside surface of the inner wall, and embrace it tightly. The relative movement is very small, and the interlock can be removed by turning the upper and lower parts to their original position. No doubt the conical internal surfaces do cause interlocking between the nut and thread, whether the nuts are screwed towards or away from each other, and this is stated to have been proved in practice. The nuts have already been applied to numerous purposes, and in vehicle construction particularly, the possibility of combining two nuts and a washer in one unit should be greatly appreciated. Extended trials have been made, and in practice we understand that the claims of the nut have been amply demonstrated.

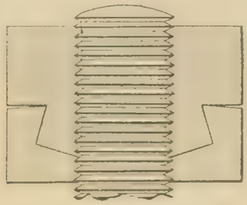


Fig. 5.—Section of the Vislock Lock-Nut.

E.A.C. Motor-Control Apparatus.

In connection with the leaflet recently issued by the Electrical Apparatus Co., Ltd., of South Lambeth Road, S.E., and describing their latest motor-control apparatus, we illustrate in fig. 6 one of their standard direct-current motor-control pillars, with planished-steel housing, which for strength and appearance has much to recommend its use.

The various switchgear is inside the pillar, mounted on black-enamelled slate bases carried in an angle-iron frame.

Doors are provided, both front and back, and a terminal board at the base for line and motor-cable connections. The standard pillars are equipped with double-pole knife switches, handle-type porcelain fuses, and starter and field regulator as required for constant and variable-speed work.

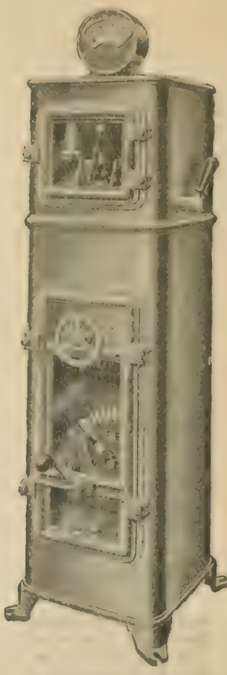


Fig. 6.—E.A.C. Motor-Control Pillar.

A line of "inching" pillars is also supplied, fitted with two double-break contactors, with magnetic blow-outs and the usual releases, the contactors being interlocked with an inching type starter, and with a field regulator for variable-speed work.

Ammeters and voltmeters can be provided for mounting externally or internally.

A series of field regulators, of the pillar type, to give a wider speed regulation than that allowed for in the standard pillar, is also listed.

Approximately 16 different combinations are shown, and any arrangement will be supplied.

Miners' Electric Lamp and Gas Detector.

A recent issue of the *Science and Art of Mining* describes a miner's electric lamp giving 2 C.P., and which it is claimed can be used at will as a gas tester; it is the invention of Mr. Thomas Heaton, a mining electrical engineer, of Wigan.

The lamp consists of a cylindrical lower chamber containing the accumulator, with a top plate which carries the electric lamp and gas detector, both enclosed in a glass cylinder; above the glass cylinder is the lamp top containing double wire gauze cones.

The gas detector comprises a small receptacle containing oil or spirit, and provided with a wick or other suitable burner; across this a piece of high-resistance wire is stretched for ignition purposes.

To use the lamp as a gas detector it is necessary to switch off the lamp and rotate the accumulator on to the contacts of the gas tester, when the wick is ignited.

The lamp gives 2 C.P. for 20 hours, the light being directed horizontally all round; the total weight of the lamp is 4½ lb.

A Motor-Car Switch Light.

An arrangement which has been fitted to some American motor-cars is a signboard switch light made by the H. W. Johns-Manville Co., of New York. It consists of a small electric lamp fitted with a powerful parabolic head-light reflector and a non-rattling glass door, and is mounted on a swivel bracket attached to the side of the car in such a way that the light can be swivelled round by the driver without moving from his seat. A thumb screw is provided in the bracket by means of which the lamp and reflector can be fixed in any position. When turned outwards to its utmost extension the lamp is flush with the overall width of the car, so that there is no danger of fouling. The object of the device is to throw a light on house numbers and road direction signs, and it is particularly useful to physicians and to automobilists who travel in the country at night. Another useful feature is that the lamp is detachable from its bracket, and has 15 ft. of flexible wire connected to it, so that it can be used on emergency as a search lamp for inspecting any trouble about the car at night. The connection plug for this accessory is generally inserted in a socket on the dashboard. It is stated that the lamp, which is of very small current consumption, gives such a powerful light that a newspaper can be read in its rays at a distance of 150 ft. The same firm make a signal system for the rear of motor-cars, which is especially useful on fully-enclosed berline or limousine bodies. An arrow in white light indicating a turn to the right or left is actuated by a contact device attached to the steering gear. The word "stop" appears in red whenever the clutch pedal is pushed out, and is operated by a contact device attached to the pedal. These devices are entirely self-contained and water-proof.

PARLIAMENTARY.

Newport Corporation Bill.

A Select Committee of the House of Lords, presided over by the Marquis of Bath, recently considered a Bill promoted by the Newport Corporation. The major portion of the Bill dealt with other than electrical matters. Clause 20 asked for powers for the Corporation to extend the limits within which they are authorised to supply electrical energy so that they could give a supply of energy for all public and private purposes within the parishes of Malpas, Saint Woollos, Rogerstone, Duffryn and other places.

Mr. Fitzgerald, K.C., who appeared for the Corporation, said that all that it was proposed to do was to extend the area of supply beyond the existing borough boundaries. The opponents to the Bill were the South Wales Electrical Power Distribution Co. and the Newport Gas Co. The petitioners asked that the promoters should insert what was known as the Northumberland clause in the Bill, but that, he contended, would considerably hamper the proposed undertakings.

Evidence was given by Mr. A. N. Moore, the electrical and tramways engineer for Newport, in support of the Bill.

Mr. John Moxon, chairman of the Newport Electricity and Tramways Committee, explained that the Corporation had laid their mains right up to the boundary of the borough, and there was a large population just outside whom they considered they should have the right to supply if it was so desired.

Other evidence was also called in support of the Bill.

Mr. E. H. Hazell, the secretary of the Newport Gas Co., gave evidence in opposition.

The Committee decided that the Corporation had not made out a case to justify the extension outside the borough.

Mr. Balfour Browne, K.C., asked on behalf of the Gas Co. that the Committee should insert the "Northumberland clause" in the Bill, but after hearing the arguments the Committee decided not to accede to the proposal.

The Bill was ordered to go for third reading.

Chesterfield Corporation Bill.—On March 26th and 27th, a Select Committee of the House of Commons, under the chairmanship of Mr. Middlebrook, considered this Bill. The Bill was an omnibus measure, dealing to a great extent with street improvements and so on. Powers were asked for to expend £8,000 on the construction of tramways, and £10,500 for the equipment of tramways and the general purposes of the tramway undertaking. There was no opposition to the proposals, and they were passed by the Committee. The Committee also agreed to a further proposal in the Bill to increase the area of supply of the electricity undertaking, so as to cover the parishes of Brampton, Walton and Tapton.

Standing Orders Dispensed with.—The Standing Orders Committee has dispensed with the Standing Orders in the following cases, so as to allow of the Bills being proceeded with:—Metropolitan and Great Northern Railway, in the case of the petition of holders of ordinary and preference stocks in the Metropolitan Railway; London County Council Tramways, on condition that the tramways 1 and 3 are struck out (these refer to tramways in Farringdon Street and Aldersgate Street); Newcastle-on-Tyne Corporation Bill, on condition that the consent of the Northumberland County Council is obtained to the construction of No. 2 tramway; and the Yorkshire Electric Power Bill, on condition that Clauses 3 and 6 to 12 (inclusive) are struck out of the Bill.

Second Reading.—In the House of Lords, on 26th ult., the Yorkshire Electric Power Bill was read a second time.

Third Reading.—In the House of Commons, on Tuesday, the London Electric Railway Bill was read a third time.

Southport Electricians' Wages.—A settlement has been arrived at in the agitation of the Southport members of the Electricians' Union for better wages. The masters have agreed to recognise the Union, to sign the "Manchester rules" of the Union, and also to a standard rate of wage. The chief contention for a standard rate of pay was the increased cost of living and rents in Southport, while the recognition of the "Manchester rules" covers overtime pay and out-of-town expenses. The concession with regard to a standard rate of wage means that some of the men will receive increases of from ½d. to 1d. an hour.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendment.

JAPAN.—The Board of Trade have been informed by H.M. Commercial Attaché in Japan that the Government has introduced a Bill providing for certain changes in the Japanese Customs Tariff. One modification contained in this measure which affects the electrical trade and which it is proposed shall come into force on April 15th, is that parts of steam turbines shall in future be subject to a duty of 15 per cent. ad. val.

AUSTRALIA.—The High Commissioner in London for the Commonwealth of Australia has issued a notice showing the requirements of the Customs in connection with the question of the valuation of goods liable to *ad valorem* rates of duty on importation. Certain new rulings and amendments have been embodied in this notice, of which the full text is given below; the correct declaration of the value of goods being of considerable importance, the new requirements should be carefully complied with:—

"The following statement shows the requirements of the Australian Customs in connection with the question of the value for duty of goods liable to the imposition of *ad valorem* rates:—

Section 154 (*a*) of the Customs Act of 1901 provides that

> "when any duty is imposed according to the value, the value shall be taken to be the fair market value of the goods in the principal markets of the country whence the same were exported in the usual and ordinary commercial acceptation of the term and free on board at the port of export in such country, and a further addition of 10 per cent. on such market value."

In assessing the "free on board" value of goods subject to *ad valorem* duty in terms of the above-quoted section of the Customs Act of 1901, the following charges are *included*, viz.:

Charges included in value for duty.

Inland carriage—
- (*a*) When the goods are shipped from the country where purchased—the whole inland carriage;
- (*b*) When the goods are bought in one country and shipped from a contiguous country (*e.g.*, bought in Austria, shipped from Germany)—inland freight to the frontier of the country in which the goods are purchased;
- Coastal freight (*i.e.*, when goods are shipped from one port to another in the same country but are not actually consigned to Australia from the first port), and other charges (including lighterage) incurred in conveying the goods to, and placing them on board, the exporting vessel;
- Canal dues (*i.e.*, when canal dues form portion of the inland freight charge to the port of shipment);
- Cost of labour and materials (except outside packages) used in packing, including flock, kapok, straw, and other inside packing*;
- Insurance to port of shipment;
- Inland Revenue duty, only when the goods bear Inland Revenue Duty Stamps affixed to them in the country of export; and
- Royalties.

And the following are *excluded*, viz.:—

Charges excluded from value for duty.

Outside packages (including zinc linings and tarred paper) in which goods are ordinarily imported; agents' charges; bank exchange; buying or indent commission, being a charge made to the importer by the buying or indent agent for services rendered and not an allowance made by the manufacturer to the buying agent; brokerage; dock dues; export duty; inspection fees; insurance—oversea; interest; postage and petties; sea freight—oversea; and stamp duty on bills of lading.

In all cases import duty is chargeable in Australia on the net price at which similar quantities of the goods could be bought by any *cash purchaser for home consumption* in the country of export, plus the charges enumerated above as *included* in the value for duty and plus the statutory 10 per cent. referred to above. Any special discounts allowed, or reduced prices charged, to branch houses or to agents purely by reason of agency existing, and any discounts or reductions in price allowed for export and *not for home consumption* are, therefore, not recognised by the Department in determining the value for duty."

UNITED STATES.—A circular of the authorities states that it is found that in many instances goods subject to a specific rate of duty are invoiced and entered at much less than the foreign market value with a view to avoiding the requirements for Consular invoices on shipments valued at more than 100 dollars. Customs officers are instructed that appraisements should be made of goods free of duty or subject to a specific rate and certified invoices required or a bond for the production thereof whenever the foreign market value of such shipments is in excess of 100 dollars.

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* When flock, kapok, straw, or horse-hair packing is separately invoiced and has a commercial value of its own after unpacking in Australia, such value is not included in the value for duty, and the materials mentioned are dealt with under the appropriate tariff heading.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

6,564. "Means for converting single-phase rotary converters into triple-phase." A. M. Taylor. March 16th.

6,575. "Leyden jars and like condensers." E. Rousseau. March 16th.

6,588. "Movable bodies such as vessels, air-craft, and road vehicles controlled by radiant energy." J. H. Hammond, jun. March 16th. (Complete).

6,622. "Process for banding projectiles." S. O. Cowper-Coles. March 16th.

6,623. "Solder." S. O. Cowper-Coles. March 16th.

6,624. "Process for the electrolytic coating of sheets and plates with other metals." S. O. Cowper-Coles. March 16th.

6,625. "Manufacture of electrolytically coated metal plates." S. O. Cowper-Coles. March 16th.

6,626. "Process for the electro-deposition of iron." S. O. Cowper-Coles. March 16th.

6,628. "Automatic or semi-automatic telephone installations." Siemens and Halske Akt. Ges. March 16th. (Convention date, June 18th, 1913, Germany). (Complete).

6,652. "Composite trolley wheels." E. M. Taunton and Electro-Mechanical Brake Co., Ltd. March 16th.

6,659. "Telephone systems." T. G. Martin. March 16th. (Convention date, March 17th, 1913, United States). (Complete).

6,668. "Means for transmitting and receiving messages and exhibiting signals electrically." T. D. Smith. March 16th.

6,683. "Electric switches." B. Thomas and E. Thomas. March 17th.

6,695. "Portable electrically-driven vacuum cleaners." W. J. Frame. March 17th.

6,700. "Apparatus for radiating and receiving electromagnetic waves on aeroplanes, air-ships and the like." H. Fothergill. March 17th.

6,704. "Miners' electric safety lamp." W. Whitehead. March 17th.

6,726. "Advertising electric bottle or half-bottle." W. Fereday. March 17th. (Complete).

6,731. "Cooling lower electrodes for electrical smelting furnaces." Fried. Krupp. Akt. Ges. March 17th. (Convention date, December 13th, 1913, Germany). (Complete).

6,778. "Insulators for electrical conductors." A. R. Muller. March 17th.

6,800. "Sparking plugs or the like and their terminal covers." H. G. Longford, W. W. Longford and W. A. Clark (trading as Sphinx Manufacturing Co.). March 18th.

6,805. "Magneto-electric machines." F. Westwood. March 18th.

6,811. "Bonding devices for electrical conduit systems." D. L. J. Broadbent. March 18th.

6,823. "Electric make, break or short-circuiting key." C. A. W. Hansel. March 18th.

6,826. "Method of building up loops in winding conductors of electrical machinery, particularly as applied to turbo-dynamos." Brush Electrical Engineering Co., Ltd. and B. Heastie. March 18th.

6,853. "Incandescent electric lamps." W. J. Owen and C. Damey. March 18th.

6,866. "Electrical treatment of ores." F. W. Highfield. March 18th.

6,867. "Combined mechanical support and electrical connexion for electric fans." J. H. Collie. March 18th.

6,868. "Combined electric machine suitable for starting internal combustion engines and generating electrical energy when driven as a dynamo." P. L. R. Fraser. March 18th.

6,892. "Automatic coin-freed devices for automatic telephone installations." Siemens & Halske Akt. Ges. March 18th. (Convention date, July 24th, 1913, Germany). (Complete).

6,918. "Electrical generating and control systems." H. J. Read. March 18th.

6,928. "Apparatus for controlling electric circuits." G. A. Brown. March 19th.

6,953. "Electrical relay apparatus." J. Gardner. March 19th.

6,970. "Silent and balanced electro-magnetic step-by-step driving or synchronizing mechanism particularly applicable to the control of a system of time-indicating units." E. E. Craig. March 19th. (Complete.)

6,977. "Overhead trolley wires and the like system of electric traction." G. G. Glyn. March 19th.

6,982. "Electric bells." W. J. Blenheim. March 19th.

6,992. "Electric ignition systems for internal combustion engines." O. Heins and C. M. Wild. March 19th (Convention date, March 19th, 1913, United States). (Complete).

6,993. "Removal of water from organic or inorganic substances." Elektro-Osmose Akt. Ges. March 19th. (Convention date, June 2nd, 1913, Germany). (Complete).

6,995. "Removal of water from organic or inorganic substances." Elektro-Osmose Akt. Ges. March 19th. (Convention date, July 21st, 1913, Germany). (Complete). (Addition to 6,993/14).

7,007. "Regulators for electric circuits." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitats-Ges., Germany). March 19th.

7,024. "Electrophone systems." S. G. Brown. March 19th.

7,026. "Telephone number recorders." P. A. Grimston. March 19th.

7,029. "Portable electric-battery lamps for use in mines and like purposes." H. F. Joel, jun. March 20th.

7,046. "Tumbler switches." E. Perry and H. S. Fordred. March 20th.

7,079. "Pocket and other electric flash-light batteries." J. W. Mander. March 20th.

7,083. "Dynamos." H. Leitner. March 20th.

7,084. "Device for controlling and regulating electric circuits." H. Leitner. March 20th.

7,131. "Plug for telephone switchboards and the like." P. P. Craven. March 21st.

7,137. "Electric self-switched light and electric windless alarm for attaching to [illegible] clock." D. Davidson, jun. March 21st.

7,145. "Heating elements of electric stoves and the like." O. C. Hawkes. March 21st.

7,165. "Fittings for electric lamps." J. Lutley. March 21st. (Complete).

7,200. "Telegraph or telephone relay." C. Stille. March 21st. (Complete).

7,201. "Electrical connexion for electric relay." C. Stille. March 21st. (Complete).

7,202. "Method of transmitting sounds electrically." C. Stille. March 21st. (Complete).

7,203. "Microphones." C. Stille. March 21st. (Complete).

7,208. "Number instruments for automatic telephone systems." Siemens Bros. & Co., Ltd. and E. A. Petithory. (Siemens and Halske Akt. Ges., Germany). (Complete). March 21st.

7,214. "Trolley or collector wheels for electricity." H. McReynolds. March 21st.

7,215. "Process for electro-plating iron and steel plates and the like." S. O. Cowper-Coles. March 21st.

7,316. "Apparatus for electrolytically coating iron and steel plates with other metals." S. O. Cowper-Coles. March 21st.

7,218. "Electrical impulse transmitters and the like." Betulander Automatic Telephone Co., Ltd. and G. H. Bryant. March 21st.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

27,496. Electric Welding. E. H. Jones. November 29th. (Cognate Application, 12,065/13).

28,086. Electric Storage Batteries. G. O. Davies. December 5th. (Cognate Application, 2,898/13).

30,107. Regulation of Dynamo-electric Machines. British Thomson-Houston Co. (General Electric Co.). December 31st.

1913.

2,409. Selecting Devices for Telephone and other Systems. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). January 29th.

4,901. Automatic Wireless Train-control Apparatus. T. E. Clark. February 26th. (February 26th, 1912).

5,249. Electrical Impulse Transmitting Devices. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). March 1st.

5,295. Systems and Apparatus for Electrically Controlling a Group of Railway Switches or Signals. A. E. Alexander. (Union Switch & Signal Co.). March 3rd.

5,654. Telephone Exchange Systems. Western Electric Co. (Western Electric Co.). March 6th.

5,792. Electric Motor or like Controllers. W. Morrison. March 8th. (January 15th, 1913).

5,805. Telegraphic Transmitters. W. S. Steljes & Rebesi, Ltd. March 8th.

6,806. Electrical Regenerative Motor Control-systems. Crompton and Co., and H. Burge. March 19th.

7,311. Manufacture of Electric Cables. W. S. Smith and H. J. Garnett. March 27th.

8,273. Electrical Indicating Apparatus for Use on Steam Trains. W. White and G. H. Gardener. April 8th.

8,591. Insulating Cases or Tanks for Use with Electric Transformers. H. R. Brain and T. B. Leech. April 11th.

8,624. Automatic Systems of Train Control by means of Separately Actuated Contactors. Siemens Bros. Dynamo Works, Ltd., and A. M. Duke. April 12th.

8,976. Combined Battery Box and Push. R. H. Bye. April 16th.

10,077. Electric Switch having Make and Break Contacts Immersed in a Liquid. Allgemeine Elektricitats Ges. April 29th. (May 1st, 1912).

11,997. Chemical Electro-chemical and Electric Treatment of Plants, Fields, Sown Seeds, Crops, or the like. R. Mies. May 22nd.

12,246. Electric Sad-irons. W. H. Dalton. May 26th.

14,423. Electric Lamps. G. F. Hitzelberger & New British Ever Ready Co. June 21st.

15,059. Electro-magnetic Devices for Actuating an Oscillatory Part or Member Alternately in Opposite Directions. Maschinenfabrik Oerlikon. June 30th. (June 28th, 1912).

15,411. Boxes for Holding Accumulators and Battery Cells. C. H. Worsnop. July 4th.

18,164. Regulators for Galvanic Batteries. E. Lowe. August 9th.

20,591. Power-control System for Automatic Switches. Western Electric Co. (Woodward). September 11th.

21,967. Signalling Devices for Railways. W. Duplock. September 29th.

22,902. Electrical Relays. Siemens Bros. & Co. (Siemens & Halske Akt. Ges). October 10th.

24,117. Oil-insulated Electrical Apparatus, such for instance as Transformers. October 24th. Siemens-Schuckertwerke Ges. (October 24th, 1912).

24,472. Electric Welding Apparatus. J. M. Yount, T. Finigan and E. S. Brannaman. October 28th.

24,458. Utilisation of Oscillating Current Energy Particularly Applicable for Wireless Telegraphy. J. W. Lee and J. L. Hogan. October 28th. (November 16th, 1912).

24,809. Mounting Switches and other Electrical Apparatus in Boxes. A. W. Sclater. October 21st.

24,900. Carbon Electrode Holders. A. Schwarz (Firm of). November 1st. (January 20th, 1913).

24,966. Electric Alarm to Audibly Indicate the Movement of Marine Engines in a Direction Contrary to that Shown upon the Telegraph Dial. F. S. Dubash. November 3rd.

25,208. Incandescent Electric Lamp-holders of the Bayonet Socket Type. S. Morris and W. T. Critcher. November 5th.

27,472. Electrically-driven Vehicles. Siemens Schuckertwerke Ges. November 28th. (November 28th, 1912).

27,541. Electric Alarm Clock. I. Pillersdorf. November 29th. (December 23rd, 1912).

28,822. Arrangements for Setting Apparatus from a Distance by Electricity. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). December 13th.

A Radium Accident.—A patient at Preston, who was under treatment with radium for deafness, accidentally swallowed the cylinder containing the radium, and it was located by the X-rays in the stomach. Other means having failed to effect its recovery, it became necessary to perform an operation, as the cylinder was stationary, and the radium would in time cause serious injury or death. The operation was successful, but the patient ultimately died from the effects of drugs employed to facilitate the operation.

THE
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THE MINIMUM WAGE IN YORKSHIRE.

WHATEVER may be the outcome of the strike now proceeding in Yorkshire, one thing is absolutely certain: that unless an end is put to interfering legislation, undertaken by the Government at the instigation of a number of weak-kneed workmen, termed labour leaders—men who do not labour, and who *dare not* lead, even if they could—the coal trade in this country is going to be, if not exactly ruined, at least seriously crippled. So many other industries depend upon the coal trade, that it behoves everyone to take some interest in this question.

Previous to the passing of the Minimum Wage Act, the British miner was the most down-trodden slave on this earth! He was forced down a mine and along a close subterranean passage into a working place and ordered to dig enough coal out to earn his daily wage. If he did not he could starve. The man who was not inclined to work did not exactly starve, but he perhaps had not so much pocket-money as his brother workman who really did work. Why was it that one man had more money than the other? It was because the better-paid man had an easier place to work in—not that he worked any harder. Oh, no! if anything, in fact, the poorer-paid man worked the harder; yet when they changed places, such are the changeful conditions of a coal mine that the places changed too. In other words, an "abnormal" place was abnormal or otherwise depending upon the workman in it. Unfortunately, this tale won a lot of sympathy from the British public and the British Government, and, as a result, the miner got his minimum wage, which, as many anticipated, has proved to be a most demoralising and dangerous experiment in legislation. It is demoralising because it has made the poor workman into a pauper, and as such he is losing the little self-respect he had when he knew his livelihood depended somewhat upon his own efforts; it has made the good workman careless and discontented; and—and this is probably the worst feature of the Act—it is spoiling the youths engaged in the mine, by teaching them that if they only make themselves sufficiently obnoxious to the community they can enforce any demand they care to make. Where is it going to end? In the County of Durham, for instance, the officials of the Durham Miners' Association are not sufficiently advanced for many of the members, who have started what is called a "Forward movement," but which, to give it its proper appellation, is neither more nor less than "Syndicalism," and this party is issuing circulars containing the most foolish twaddle, spreading discontent in both the Counties of Durham and Northumberland.

Much the same thing is happening in Yorkshire, where the present strike was entered upon against the advice of the men's leaders, and at a time when negotiations were in progress. Certainly there ought to have been no strike, and it will be most unfortunate if the owners give way to the demands now being made. It may be given as an excuse that the public are suffering, which is no doubt true, but if things are allowed to go on as they are, the public eventually will be very much worse sufferers than they are now, and it is for the community to give some encouragement to the coal owners who are fighting the battle on behalf of every other industry in the country. What are the facts? In May, 1912, Sir Edward Clarke fixed the minimum wage for the Yorkshire district at 6s. 9d. per day when the basis rate of wages was 50 per cent. above the 1888 standard. Every rise in wages, we may explain, is given as upon this standard, and thus the three successive advances in wages of 5 per cent. each brought the rate up to 65 per cent. above the standard; the monetary value of the three 5 per cents. is 7½d., which added to the 6s. 9d. gives 7s. 4½d. But the actual minimum is only 6s. 9d., and any workman not earning this amount is only entitled to be made up to 6s. 9d. In January last, however, Sir Edward Clarke was asked to revise the position, and taking into consideration that the basis rate was then 65 per cent. above the standard, he fixed a new minimum wage at 7s. 3d. The men had already obtained their rise in wages, but no sooner does the award of Sir Edward Clarke appear, than they take it upon themselves to assume that this is a new basis wage, and that the three 5 per cents. or the 7½d. must be added to the 7s. 3d., and that the basis wage must be not 7s. 4½d., but 7s. 10½d. To us it seems most unfortunate that the question of revising the minimum rate was ever allowed to be raised. The men say that if a man was earning 7s. 3d. a day under the old minimum rate, under the new he gets no advance at all. Of course not, why on earth should he? He receives what he is entitled to receive—a rate of pay 65 per cent. above the 1888 standard, and he cannot receive less than 7s. 3d., and we presume if wages were to drop 5 or 10 per cent. the minimum would still remain 7s. 3d. until this was again revised, but to say that because the minimum rate is raised the basis rate is therefore raised is absurd.

We do not think—though there has been a lot of talk in this direction—that there will be any national stoppage, but the workmen of other districts are keenly awaiting the outcome of this strike, with a view to taking action should the men succeed. Apparently it would appear as though this were an attempt on the part of the men to fix their own rate of wages in addition to the amount of work they shall do for such wages. Truly it would seem as though the day were not far distant when, as predicted by Mr. Hartshorn, the "Syndicalist" leader of the Welsh miners, "the employers shall have no voice in the settlement of wages."

The outlook in the coal trade from a labour point of view is anything but bright, and the coal owners of Yorkshire deserve the moral support not only of every employer of labour, but also of every right-minded citizen in the country.

Cottage Lighting.

Elsewhere in this issue we reproduce, almost *in extenso*, an interesting paper in which Mr. W. Fennell describes his experiences in the endeavour to extend the blessings of the electric light to the humblest class of citizens in Wednesbury, where well-to-do residential consumers are scarce. The results of his experiment are highly satisfactory. The consumers are found to be exceptionally prompt and regular in payment, therein setting an admirable example to their more prosperous fellow-citizens; their load curve is very favourable, as their maximum demand occurs later than the station peak; they apply for connection without the need of canvassing or advertising, and, most striking fact of all, they return a larger rate of profit than any other class of consumer. Moreover, the system has proved successful in spite of the cheapness of the local gas supply.

Mr. Fennell's ingenious methods of reducing the cost of installation deserve commendation; the system of looping-in from an external service wire is, of course, familiar, and other points demonstrated by Messrs. Handcock & Dykes, in their I.E.E. paper some years ago are here again in evidence, such as the unimportance of waste of energy, where it occurs off the peak; but waste appears to be but little met with. The use of a plug and socket as the main switch is unorthodox, but quite unobjectionable, especially as it would rarely, if ever, be employed to break the circuit, and then only a maximum of 120 watts; and the use of screw-capped lamps is a stroke of genius.

One very significant point crops up incidentally in connection with this scheme—the difficulty of introducing the electric light into houses of the class which employs gas cooking stoves. This emphasises the urgent need for the development of cheap and efficient electrical cookers to deal with this class of consumer.

Patents in 1913.

The annual report of the Comptroller-General of Patents for 1913 shows that the applications numbered 30,077, as against 30,089 in the previous year, a slight decrease; completed specifications were 19,309, as compared with 18,853; and patents sealed were 16,599, as against 15,814. Patents expiring in 1913 numbered 15,356. The receipts from patent fees were £307,054, which was £13,525 better than in 1912; the total receipts, including design and trade-mark fees, and sale of publications, amounted to £346,324, which is an advance of £12,857. The total expenditure was £194,423, or £7,417 less than in the previous year. The surplus of receipts over expenditure thus comes out at £151,901, or £20,274 more than in 1912. The Comptroller, in his survey of the year's doings, comments, as usual, upon the trend of invention as indicated by the number of applications received. The motor vehicle industry, as one might expect, has been greatly favoured, the number of applications having increased by 25 per cent. Particularising in this section, it is shown that special interest has been taken in such matters as life-saving attachments or guards, governors for speed regulation, small dynamos for lighting and starting, in devices for preventing starting while the gears are in mesh, and in silent drive or inverted-tooth type of chain gearing. In the same connection, as well as in their application to aeronautics, internal combustion engine improvements have been markedly under attention. Automatic or partly automatic devices for signalling or for stopping railway trains and signalling methods for winding and hauling in collieries, have attracted many more inventors than usual, the former doubtless consequent upon fatal collisions, and the latter owing to recent legislation. A lively interest in the oil industry and a slight falling off in applications relating to textile industry have been among the features of the year, and the Comptroller also remarks that "the continued popularity of the kinematograph is responsible for an increase of 25 per cent. on the previous year, the projection of pictures in natural colours being still the subject of much ingenuity."

The Rubber Position.

The excellence of the demand at the last series of auctions held in Mincing Lane surprised the trade. It had been thought by most people that the heavy quantities which were to be offered (1,350 tons) would have exerted a damping effect upon enthusiasm, but, as a matter of fact, the demand was strong throughout, and prices ruled at a high level all through. The best demand was for the highest grades, while medium and poorer qualities were a bit off here and there. Taken all in all, however, the sales revealed a degree of buying power which came as a surprise. Not only were the quantities offered at auction taken up greedily, but the demands passing in the private market were very large, and substantial business was concluded, while there is still a fair amount doing. It has to be remembered, of course, that the present is the period of greatest consumption, so that a rush of buying was to be expected, and allowance must be made for this; but then, on the other hand, supplies at this time of the year are also very large.

On the whole, a pretty good opinion is mostly entertained as to the prospects for the near future. Recently prices have shown a very encouraging degree of steadiness. Speculative interest has been of a limited character, both here and in the leading Continental centres, while the demand has been practically entirely confined to the trade, and the opinion is held strongly by some of the Continental dealers that the consuming trades both in Europe and the United States are but poorly provided with raw material. It is expected, indeed, that demands will expand in the early future rather than contract, and the outlook is thus viewed with some confidence. The very unfavourable aspect of affairs in Brazil is bound to have an important bearing upon the position of industry along the Amazon and its tributaries, and this cannot but affect the harvesting of the rubber crop, in addition to which the price is so low as to constitute a very serious impediment to the operations of the collectors. The market position is altogether developing soundly, and it is a matter for congratulation that there is not to be any artificial interference with prices by the withholding of supplies.

The chairman of the Straits Rubber Co., in dealing with proposals which had been put forward, stated a few days ago that while he and his co-directors were prepared to support any scheme which in their opinion was calculated to be of genuine benefit to the industry, they would not give their support to any proposals to raise prices artificially by interference with the ordinary law of supply and demand. Without control of production it would be futile to attempt to control prices, and when the necessity arose it would probably be in the direction of reduced supplies that the remedy would lie. The suggestion that a cessation of tapping during the wintering months would be good for all concerned was receiving the closest consideration, and the suspension of tapping for three months would not, he thought, necessarily cause any disorganisation of the labour force, because the coolies could be employed profitably in cultivating the soil, overhauling the drainage system, and doing other plantation work which could not be undertaken during the harvesting months. Any scheme of this kind, however, would require the co-operation of all the planters, because the tappers, as a rule, objected to do any work other than tapping, and, unless the scheme were generally adopted, there would be a danger of those estates which did suspend tapping operations, losing their most expert tappers, which would later place them at a serious disadvantage. In view of the fact that there has been a good deal of overtapping, the proposals seem to be quite reasonable, and conceived in the best interests of the industry, and it only remains to be seen what result will accrue. Temporarily, however, as has been pointed out, such a process of resting the trees must inevitably lead to an increase in the costs of production, though this would be a matter which would, no doubt, adjust itself in due course. It is a little doubtful, however, whether it would in all cases be feasible to employ tappers in the way suggested while the trees were wintering.

Electrical Trade in India.

On another page we publish certain extracts from an American Government report on the possibilities of increased trade in Simla in electrical goods. This report has been drawn up by a Special Commissioner of the American Government who has recently been inquiring into trade conditions in India. It points to a largely increased trade in electrical specialities as a result of the recent developments of electric supply in that city, and contains some valuable information gleaned from various sources on the spot. We would recommend it to the special attention of our own firms, as its publication in America is likely to lead to renewed activity on the part of American electrical firms in India.

Delay in Giving Possession of a Site for Works.

A case which presents some features of interest to those who are concerned with contracts for large works was decided recently in the King's Bench Division. The question was this: If, through the action of a third party, the employer is unable to allow the contractor to commence the work on the day named, with the result that the contractor sustains loss, who is responsible—the employer or the contractor? In the case in question (Porter *v.* Tottenham Urban District Council) (*Times*, December 22nd) it appeared that the plaintiff had contracted with the defendant Council to build a school for them for £11,043. By the fourth clause the contractor was to be at liberty to enter on the premises immediately after signing the agreement for the purpose of executing the works, to begin the work forthwith, and to deliver up the premises fit for use within ten months after the date of the contract, subject to penalties. The site of the school was in a field so situated that access could only be obtained from a road which was separated from the field by a fence. One half of it had not been made up. The soil of the road was vested in the owner of an adjoining building estate. The defendants, to give the plaintiff access to the site, made an opening in the fence and put a gate in it. The plaintiff began the work on February 20th, but on March 6th he received a letter from the owner of the field claiming the right to prevent carts from passing over what he claimed to be his private property, and threatening an injunction. The plaintiff had no alternative but to give an undertaking not to proceed with the work.

Finally, the defendant Council were obliged to begin legal proceedings to obtain an injunction against the adjoining owner on May 11th. It was in respect of this delay (from March 6th to May 11th) that the present action was brought to recover from the defendants the damages caused thereby.

The Official Referee gave judgment for the plaintiff for £560 12s. 6d., holding that the defendant Council were bound, on making the contract, to give immediate possession of the whole site, and that they had failed to do so.

The Appeal Court, however, has reversed this decision, holding that as the employers were not responsible for the delay in the contractor reaching the site, they were not liable to pay damages.

It was contended that the employer was liable for anything that might happen relating to his title to or possession of the site, and that therefore he was liable in this case for the consequences of the interference of the adjoining owner. The Court held that the employer was no more responsible than he would have been if performance of work had been prevented by *force majeure*, or inevitable accident. The case clearly shows the desirability of providing for a contingency of this kind in the clearest possible terms.

THE MODERN MOTOR.

By E. F. BUTLER.

The present day motor, both in design and performance, is a long way ahead of its predecessor of, say, ten years ago.

After a wide experience of most makes of motors, both English and otherwise, the writer has come to the conclusion that room exists for still further improvements, particularly in regard to brush gear, bearings and accessibility. In the advertisement columns of a technical paper recently, about twenty of the leading makes of motors were advertised, and every one supports this conclusion, as a reference to each will show.

A is a motor largely used by a firm of lift makers. Its most objectionable feature is the bearings. They appear to be pressed into position, and it is almost impossible to remove them without damage. The endplates are held in position by means of rods passing through the carcase. This makes the larger sizes very awkward to take apart; further, unless care be taken to mark both the endplate and the carcase—a point liable to be overlooked—the brush gear will not come in the right position. This motor has one rare virtue—it is accessible.

The worst feature of B is the brush gear. The brush holders are of the claw type, with the brushes gripped at the end. They are mounted on a spindle bent at one end to a right-angle, and then at right-angles again, forming a crank. This crank is covered with insulating material and clamped in the rocker. The simplest way to regulate the tension on the brushes is to move the crank. This moves the brushes out of the correct position and also alters their bedding on the commutator. The leads are brought into the motor under the bottom of the endplate, and connected to terminals fixed therein in such a position that oil, dirt, and carbon dust fall on them. The endplate on the driving side is cast solid without any openings. The good point of this motor is the bearings, which are first-class both in fit and material.

In C the brush gear completely covers the openings in the endplate, cleaning and adjusting being almost impossible. The field coils are held in place by pole tips fitted with countersunk screws; so that to remove a field coil it is usually necessary to rig up a ratchet drill fitted with a screwdriver in place of a drill, often a lengthy job on outside repair work. To examine the oiling arrangements a small hole is provided, usually fitted with a set screw. With difficulty the ring can be seen, the quantity of oil can only be guessed at.

D is a very good motor. Even in 70-H.P. sizes, however, the carcase is cast in one piece, and this makes the removal and replacement of the armature awkward. Two terminal boxes are provided, and the armature and field wires festoon round the outside of the machine and into these boxes. A much neater and safer way would be to take the leads through the carcase and straight into the terminal box.

E is of Continental origin. The plain shunt type is very accessible, but the interpole type is crowded, and sometimes a permanent resistance in series with the field is tucked away inside the carcase. A very bad feature of this motor is the driving end of the shaft, which is of the same diameter throughout. If the journal gets worn, or scored, and has to be turned down, the pulley, or pinion, must be bushed. If the bearing portion only was larger it could be turned down without affecting the remainder, and the bearing, in this case white metal, could be run up and bored out to suit.

F comes from the North, and in the larger sizes is a good motor. The smaller sizes, however, have one bad fault; in the brush gear no radial adjustment is possible. When new the brush-holders form an acute angle to the commutator, and the brushes cover several segments. As the commutator is turned down, the holders must be twisted around the spindles until, finally, they are at right angles to the commutator and only cover about half the original number of segments. This could be avoided by making the holes for the spindle bushes slotted instead of circular, thus allowing the holders to "follow up" when the commutator is reduced in diameter.

G is noted for the number of new types that appear. Of ordinary plain shunt motors, seven different types are in use in one works. In what appears to be the most used type, the carcase is split and the halves are held together by means of set screws, the heads of which fit snugly into recesses. To turn them it is necessary to use a special box spanner with very thin sides to fit the recesses. The recess, or seating, for the commutator end endplate is made sufficient in diameter to admit of the armature being removed without lifting the top half of the motor. But the brush rocker is cast in one piece, and is too big to come out first. As a consequence, if the motor is gear driven and the top half cannot be lifted, it is usually necessary to remove the driven shaft or else to slew the motor round. The simple expedient of casting the rocker in halves with lugs for bolting together would obviate all this, and enable repairs to be made in half the time.

H is notable for the ease with which it flashes over. One type of brush holder consists of flimsy stampings, tension being applied through a stamped worm and wheel. One flash-over usually settles the lot. Some time ago I noticed an emery wheel driven by such a motor. The whole of the brush gear was covered with insulating tape, as a make-shift to keep the machine going.

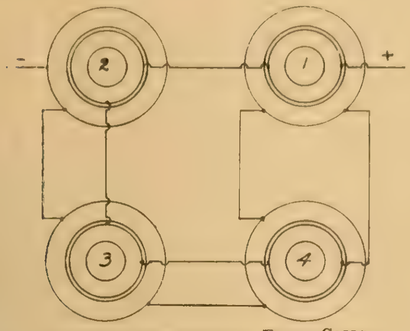
I has the pole tips held on by means of countersunk screws through the face. These sometimes work loose and damage the armature. In the larger sizes, the base is much too small, the 70-H.P. size being only two inches wider than the 15-H.P. size of another make. I once came across a watertight crane motor by this firm. The armature leads were brought through watertight glands in the bottom of the motor and cut off to exact length, no provision being made for moving the brush gear. When the bottom brushes required attention, it was necessary to cut the brush leads in order to turn the rocker.

In the smaller sizes of J it is not possible to alter the pressure on the brushes, and it is practically impossible to clean the commutator even with the block of wood supplied for the purpose.

K is fitted with claw type brush holders. To alter the pressure on the brushes takes ten minutes. It is necessary to remove the commutator end covers, take off the top of the terminal box, remove the "line" and armature cables, also the brush leads, take out two set screws holding the rocker in place, pull the rocker round, and then, if the special spanner supplied for the purpose is not lost, the pressure can be altered.

L is much advertised in small sizes. In a number I have seen, the brush spindles are brought through the endplate and the leads connected to the ends, no attempt being made to cover up the live metal, even on 480 volts. A few months ago the writer came across a motor of about 15-H.P. by this firm, the fields of which call for notice. Each coil was in two portions, an inner one fitting on to the pole piece, and an outer one large enough to slip over it. The coils were connected up as shewn in the diagram, p. 605. It will be noticed that nearly the full voltage of the supply is across the coil marked 2.

M is by one of the largest makers in the world. The means of altering the pressure on the brushes is crude. The inner end of a spiral spring is squared and fits on to a squared spindle. The outer end presses on the brush. To increase the pressure it is necessary to move the spindle through a quarter turn. This puts too much pressure on, and further adjustments have to be made by means of a pair of pliers, to the outer end of the spring. In the traction motors of the same firm, the square spindle has a wheel which gears with a small worm, slotted at the top to fit a screwdriver. This is an ideal arrangement, as the pressure can be adjusted to a nicety, or the spring held clear for changing brushes. In the ordinary shunt motor the field coils are connected together by several very fine wires, quite strong enough electrically, but weak mechanically, and easily damaged, also inconvenient for testing out.



Faulty Connection of Field Coils.

N is another very old make. The earlier machines were most awkward to take apart, as the feet of the motor were cast on the endplates. The present types are much better, but the leads are brought out from holes drilled in various parts of the carcase. Also the gauze covering the openings in the endplates is held in place by screws fixed inside, impossible to get at and dangerous should they work loose.

O is like the curate's egg—good in parts. The brush gear is distinctly poor and of the claw type. The copper strips for shunting the current from the springs get broken off after the brush has been lifted a few times; flexible pigtails should be used. The field coils are very inaccessible, it is impossible to get to the connections, even in the 70-h.p. sizes. The strong point of this make is its commutation. I have in mind a 70-h.p. working on 480 volts and taking 250 amps. without a spark at starting.

Most of the machines mentioned are by the leading makers, and the article is not written in any spirit of complaint, but to indicate the lines along which further improvements may be effected. The designer usually knows and does his work well, but as a rule suffers from lack of operative experience. Let him, when designing a machine, carry out mentally a few simple operations, such as:—disconnect quickly each field coil for individual testing, fill the bearings with oil when the motor is mounted upon a ceiling or inverted, change a set of brushes, clean the inside of a motor from the driving end, tighten up any of the lower pole pieces.

Finally, it would be very convenient if makers would stamp the value of the shunt current on the name plate as a guide for wiring and also the selection of control gear; the best English starters are turned out by a firm that do not make motors.

Liverpool.—Proposed Tramway Goods Traffic.—The City Council has referred back the resolution of the Tramways Committee that the general manager be instructed to enter into negotiations with other tramway authorities with the object of inaugurating a service of one or two motors and trailers for the conveyance of goods. It was agreed, however, to communicate with the Dock Board as to the congestion at the Docks, and to report to the Council on the result of the negotiations.

SUPERHEAT.

By "WHISTLEFIELD."

It is generally recognised that the use of superheated steam raises the efficiency of turbines as well as reciprocating engines. This increase in efficiency is greater than one would expect from a consideration of the heat diagram of expanding steam, so that the cause for the improvement has to be sought in other directions. Figure 1 represents to scale the temperature entropy or heat diagram, for a pound of steam which has been expanded from an absolute pressure of 200 lb. to an absolute pressure of one pound, or a vacuum of 28 inches.

When this expansion takes place the temperature of the steam falls because its heat is being converted into energy, and, if the steam was saturated to begin with, a gradually increasing quantity will condense.

If, on the other hand, extra heat is imparted to the steam as it expands to maintain its temperature constant, no condensation will take place. This expansion at constant temperature is known as isothermal expansion, and is represented by the line C D, but the expansion with falling temperature, that is with no heat either imparted to the steam or extracted from it, is known as adiabatic expansion, and is represented by the vertical line C E. Should heat be taken from the steam during its expansion, by radiation from the cylinder walls, or other similar causes, the expansion will be represented by the dotted line C N, the slope of this line depending on the rate at which heat is being lost. If we consider the expansion of dry steam, without any superheat and without any loss due to radiation, from an absolute pressure of 200 lb. to a vacuum of 28 inches, the amount of heat, and therefore of work, which can be usefully employed is comprised in the area A B C E, and the thermal effciency would be the ratio of the area A B C E to the area H A B C E K.

The area A B C D represents the work that would have been done by the steam had no condensation taken place, so that the area E C D represents the energy lost due to condensation. At the end of the expansion therefore the length of the line A E represents the weight of steam and the length E D represents the weight of water derived from the original quantity of steam.

By superheating the steam from a temperature of 381 degrees Fahrenheit (the temperature of saturated steam at an absolute pressure of 200 lb.) to a temperature of 531 degrees Fahrenheit (150 degrees of superheat), we add the area E C F G to the area of useful work represented by A B C E, but the gain is only apparent because we have also added to the quantity of heat which passes on to the condenser the area K E G L, so that the thermal efficiency now stands as the ratio of the area A B C F G to the area H A B C F L.

Though this gain in thermal efficiency is only very slight, nevertheless there is improvement in other directions, and turbine makers reckon on an average of one per cent. increase in efficiency for every 10 degrees of superheat. Superheat means that there is a lower percentage of moisture in the steam, the length G D now representing the amount of water at the end of the expansion. With saturated steam condensation commenced immediately the expansion took place, but with superheated steam no condensation begins till the line F G has crossed the steam curve C D, so that during the earlier part of the expansion the steam was quite dry.

It has been proved by experiment that wet steam flows through narrow passages far more readily than dry steam, so that the benefit of using superheated steam at the high-pressure end of the steam engine where there are possibilities of leakage past valves and ports is evident.

When saturated steam enters a cylinder, a good deal is wasted because it condenses. The metal surfaces that the steam comes in contact with are colder than the incoming steam because they have just been in contact with the exhaust steam at a much lower temperature; this condensation is in addition to the normal condensation which takes place because of the expansion, and greatly increases the skin friction between the piston and cylinder, besides doing no useful work because the water cannot expand. Superheated steam would have been cooled also for the same reason, but it carries surplus heat which it can give up without causing itself to condense, and the walls, if wet, would probably be dried so that not only is condensation loss eliminated, but sometimes the water on the cylinder walls is evaporated.

It is a well-known fact also that wet metal surfaces conduct heat away far more readily than dry metal surfaces. Even the labourers who work in sugarhouses are aware that the tea cans which they place on hot plates will come to the boil much quicker if they spill some water on the plate and stand the can in the pool. Saturated steam keeps the cylinder walls perpetually covered with a film of moisture, and thus causes a far greater loss by radiation than superheated steam would have done in spite of its higher temperature. We see from the dotted line C N in figure 1 that the radiation loss is capable of cutting off a good deal of the useful heat area.

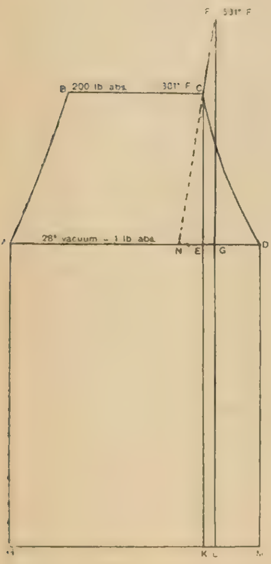


Fig. 1.

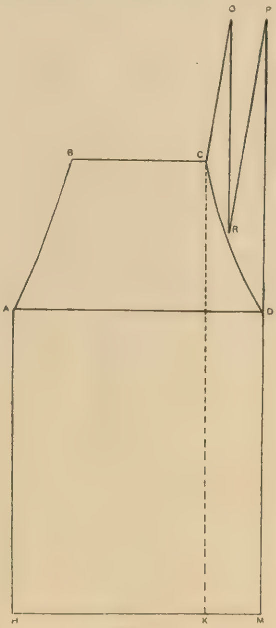


Fig. 2.

These considerations would seem to show that the use of superheated steam improves the efficiency of reciprocating engines by reducing skin friction, initial condensation and radiation losses, thereby enabling the performance to approximate more nearly to the theoretical efficiency than the use of saturated steam is able to do. In the early days of the steam turbine, Mr. Parsons arranged for live steam to be admitted at various points in the turbine to maintain the steam dry throughout its expansion.

The result was that the area E C D in figure 1 was added to the heat area, which was usefully employed when saturated steam was used. The actual thermal efficiency, however, was reduced by this arrangement, because the area K E D M was added to the lost heat area H A E K. By actual measurement it will be found that the thermal efficiency represented by the area A B C D to the area H A B C D M is less than the thermal efficiency represented by the ratio of the area A B C E to the area H A B C E K.

In spite of the fact that the thermal efficiency was less for this isothermal expansion than for the adiabatic expansion of saturated steam, the extra heat supplied produced an improvement in the turbine efficiency, due in this case also to the fact that the dry steam enabled the turbine performance to approach more closely to the theoretical result than wet steam was able to do. With turbines the wetness of the steam acts somewhat differently than in the case of reciprocating engines.

Instead of skin friction on the cylinder walls, wet steam produces friction on the blade surfaces. As the blade area in turbines is very large, the loss due to this water friction is a serious item. Initial condensation due to differences between the temperature of the steam and the temperature of the blades is not very great because the expansion of the steam takes place in far more stages in the turbine than in the reciprocating engine, so that the fall of temperature in each stage is small. Another effect of superheating steam is to increase its volume as compared with saturated steam under the same pressure, for we know that the volume of a gas at constant pressure is proportional to its absolute temperature. At a pressure of 150 lb. by gauge, the temperature of saturated steam is 366 degrees Fahrenheit, or 827 degrees absolute. If this steam is superheated to 560 degrees Fahrenheit, or 1,021 degrees absolute, its volume will be increased by more than 22 per cent.

In the high-pressure end of a reaction turbine, the length of the blades is very small, because the sectional area of the drum on which these blades are mounted must be kept fairly large to ensure rigidity, and the volume of the steam used is comparatively small. This means that the blades are sometimes not more than three-eighths of an inch long, and the area of the clearances at the blade tips bears a large ratio to the blade area. An increase of over 22 per cent. in the volume of the steam used means that the blade lengths can be appreciably increased, so that a large reduction is made in the proportion of steam which leaks past the blade tips without doing useful work.

In impulse turbines where the pressure of the steam is changed into velocity by expansion, superheat reduces the quantity of water which is formed during the expansion, and so reduces the blade friction.

In order to eliminate water completely from the steam, Dr. Ferranti has designed a turbine in which superheated steam is used; after the first expansion and before all the superheat has been exhausted, the steam is resuperheated before doing its work in the next stage.

Figure 2 shows the heat diagram for this method of working. C D represents the dry saturated steam curve, the initial superheat carries the diagram to the point O, the subsequent adiabatic expansion brings the area down to R, then further superheating and expansion produces the area C O R P D. While this heat area produces only a slightly better thermal efficiency than that of saturated steam, the improvement in turbine efficiency is remarkable, and is due entirely to the dryness of the steam throughout the expansion, which enables us to obtain a closer practical realization of theoretical conditions than is possible without superheat.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

The town of Galt, Ontario, together with other surrounding places, is trying to induce the Grand Trunk Railway to electrify the branch which runs to Elmira. It was recently reported that gas-electric cars would be put into service in about a month.

Every week almost sees a new set of towns and villages trying to impress on the Hydro-Electric Power Commission of Ontario the advantages to be gained by running an electric railway through *their* district. The Dominion Government will be asked to grant the usual subsidy ($6,400 per mile) for any such railways as may be constructed by the Commission.

Extensions are to be made to the following street railway systems: Saskatoon and Regina in Saskatchewan, Fort William in Ontario, and Lethbridge in Alberta. An electric line is proposed to connect Thamesville and Sombra, one to run from Galt to Hamilton, another to run from Guelph, through Hespeler, Preston, Galt and Brantford, while the Mount McKay and Kakabeka Falls Railway Co., which operates in the Fort William district, proposes to electrify its road and carry out extensions, the power for which would be obtained from the Kaministiquia Falls Power Co., at any rate at the combeing visited at the present time.

A committee has recently been formed under powers granted by the Legislature of Nova Scotia to inquire into the application of electricity in the coal mines of the Province. This Commission is expected to report this summer; various mines are being visited at the present time.

Anyone who has visited Niagara Falls will know what pains have been taken by the Queen Victoria Niagara Falls Park Commission to make beautiful walks and lawns on the Canadian side of the river. This year it is probable that a magnificent greenhouse will be built close to the brink of the Horseshoe Falls, and some 17 acres of land close to the Brock Mountains will be laid out to form part of the splendid park system which at present reaches from the power houses to the suspension bridge, and will some day probably be continued right down to Queenstown.

The Dominion Government has recently decided to purchase the site on Long Cove, Esquimault, B.C., for the construction of a new dry dock capable of accommodating the largest ocean liners afloat; the cost will be about £800,000. No doubt there will be some electrical work in connection with this scheme.

THE ELECTRIC LIGHTING OF COTTAGES.

By W. FENNELL, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers at *Birmingham, March* 25th, 1914.)

Electricity has for so many years been looked upon by the public—and even by electrical engineers themselves—as a very convenient but rather expensive form of lighting, that it requires considerable imagination, even to-day, to contemplate the installation of electric light in hundreds of cottages inhabited by the poorest people and rented at, say, 3s. to 4s. per week.

Wednesbury, like many Midland towns, is not an attractive residential area; the richer people for the most part live outside, and the workers form nine-tenths of the population. In developing the demand for electricity on the usual lines, most of the larger houses and shops were soon connected. Reduced rates for licensed premises brought almost all these houses on the mains, and the smaller shops followed when a free-wiring scheme was introduced; but not even free-wiring coupled with the rateable-value system of charge, or slot meters, induced the £8 to £18 householder generally to take a supply of electricity. With these small consumers, the convenience of gas for cooking, and the cheapness of the apparatus, are greatly in its favour.

At first sight it seems to be hopeless, having failed to reach the lower middle class, to look to the class below—the labourer, living in a cottage. It was, however, obvious that if this class could be catered for, a very large new field would be opened. In these cottages the gas stove offers no attractions, a fire is always burning in the living-room, the stove provides hot water and has a good oven. Lighting only is required; but not only "free wiring," but free lamps are essential.

Slot meters being out of the question, and quarterly accounts quite impossible, the author considered the possibility of establishing a weekly payment system. He therefore consulted a local tradesman doing a large weekly payment business. The report was practically as follows:—

"The poorer people are the best class of payers. A debt of only one or two shillings is a worry to them, and they will pay much better than the lower middle classes who have more assurance. It will be found that they are more easily pleased and are anxious not to give trouble; and as they are accustomed to weekly payments for rent, clothes, and furniture, they usually set aside their money regularly for this purpose before spending the balance."

In view of this very favourable report, the author felt safe in adopting a weekly payment system for electricity, and the following is a summary of the arrangements adopted.

These small houses are in blocks, and one service will supply from 5 to 15 houses. The plan adopted is to put an ordinary 7/18 S.W.G. service into the most convenient house, terminating it in a service fuse. From the fuse a twin lead-covered cable is carried either inside or outside the houses, along the row, and is looped into each house to be supplied. If any house in a row is not to be connected, a loop is left in the wire ready to insert when the tenant decides to come on, which is almost certain when a change of tenancy occurs. The cost of the service averages 15s. per house, whereas the cost of an ordinary service for a few lights is about £3 8s. The saving in capital charges is therefore very considerable.

Each house is provided with a wall-plug socket, which takes the sub-service wires; the plug itself is connected by means of flexible wires to a pair of bow cut-outs. This arrangement provides a double-pole fuse and switch ample for disconnecting a 120-watt installation, and is cheaper and less liable to corrosion, etc., than an ordinary double-pole switch. The wiring, which commences at the bow cut-out, is quite ordinary and requires no comment.

The cost of the wiring and fittings without lamps averages £1 10s. to £1 13s. 6d. per house. A local switch is at present allowed for each light, but the substitution of key-holders is being considered. Experiment is necessary to see whether the extra consumption due to the absence of easy switching is of more importance than the reduced cost of wiring.

Three lamps are supplied, two being 40-watt metal-filament lamps (one for each of the downstairs rooms), and one an 8-c.p. carbon lamp for the front bedroom. There is no demand for light in the other bedrooms.

To prevent any but authorised lamps being used, the simple expedient of using Edison screw caps and lamp-holders is adopted. This has been quite effective; lamps with this cap cannot be bought in small quantities, yet there is no extra expense for either holder or lamps. The only screw lamps stocked at the works are 40-watt metal-filament or 8-c.p. carbon; no mistake can therefore be made. When lamps are supplied free of charge it is unlikely that consumers will buy lamps by the dozen in order to defraud the supply authority. The weekly visit of the collector also acts as a check.

The charges must cover the cost of supply of electrical energy, free wiring, lamps, repairs, and the expenses of collection. It was estimated that an average of about 7½d. per week per house would easily cover the cost. The cost of supplying electricity at Wednesbury is, including all charges such as interest on and repayment of loans, £7 per kilowatt of maximum load on the power station plus 0.35d. per kilowatt-hour. These figures leave a small margin. The assumption was made that the absence of a meter would mean a certain amount of waste, so a fairly high average consumption has been taken, viz., 6 hours' use of the maximum demand per night throughout the year. It was assumed that the average maximum demand at the time of the peak load, which is between 4 and 5.30 p.m., would be 50 watts; but experience has shown this to be rather too high a figure. The lamps in use are easily counted, without calling at the houses, by taking note of the illuminated windows. Visits show that the number of lamps in use between 4.45 and 5.30 p.m. amounts to 108 per 100 cottages. Later on, after tea, the demand is higher, but that does not matter, because the power load must be "off" when the workmen and women are at home. One is therefore certain of a high diversity factor for this demand.

Based upon a peak-load demand of 45 watts per house, and a 6 hours' use of this load per day, an annual consumption of 100 units is obtained. The cost of electricity supply is 5s. 6d. per annum for the standing charges, and 2s. 11d. for the energy consumed, or a total of 8s. 5d. The revenue at 7½d. per week amounts to £1 12s. 6d. per annum. The 7½d.-per-week average income is obtained as follows: June and July 5d., May and August 6d., April and September 7d., March and October 8d., February and November 9d., January and December 10d., so that consumers pay approximately in proportion to the use at different times of the year, and new consumers may—and do—start taking current on a fair basis at any time.

Collection is carried out on a commission basis, which has been found to be satisfactory. A collector working insurance or other business is engaged, and he knows how to deal with these consumers. Payment is made in advance on the Monday or Tuesday, and the consumer is liable to be cut off on the Monday following a failure to pay. A copy of the application form is given as an appendix to the paper.

The scheme is extremely popular; it has grown from an experimental 25 consumers to 250 within 18 months, and this without any canvassing or pushing. It is quite usual for a poor woman to call for a few forms, say a dozen, and to bring them back again signed within a week. Gas is 1s. 11d. per 1,000 cubic feet, so that it cannot be said that dear gas is the cause of the success of the scheme. The actual experience obtained with regard to the following points is of great importance:—

Arrears keep fairly steady and are on an average about equal to one week's rental. Lamp breakages do not average one lamp per socket per annum. Empties are no more numerous here than in other premises, and further, those houses fitted with electric light are sought after.

Although consumers are in no way bound to continue the supply for a definite period, there have been very few permanent disconnections, certainly not more than 2 per cent.

Bad debts can be kept as low as desired; payments are made in advance. Even with fairly lenient treatment the bad debts have not exceeded 1 per cent.

There are several causes which tend to check waste. The first, and perhaps the greatest, is the sense of fairness which exists in the working class, and the second is the weekly visit of the collector. The consumers live in blocks, and the doings of any one tenant are known to all, so that one person at least will report waste. As a matter of fact, the energy consumed costs so little that any possible waste can be ignored. The important point is not waste of energy, but excess maximum demand. This is easily observed, and it has been shown that it does not occur.

The revenue account works out as follows:—

			Per Ann.
		s. d.	s. d.
Electricity—			
Kilowatt charge (45 watts at £7 per KW.) ...		5 6	
Unit charge (100 units at 0.35d.)		2 11	
			8 5
Lamps—Two metal-filament and one carbon			4 3
Repairs			1 0
			13 8
Income—52 weeks at 7½d.		1 12 6	
Less commission, 7 per cent. ...	2 4		
Less bad debts, etc., 3 per cent. ...	1 0		
		3 4	
			1 9 2
Profit per consumer			15 6

The word profit here means surplus after paying all charges, including interest on and repayment of loans for machinery and mains. If these interest charges were based on the cost of extra plant and mains instead of on the old costs, the result would be even more favourable.

We may take half the profit, say 8s. per annum, and use it to write off the entire cost of wiring in four years, leaving a balance of 7s. 6d. net profit per consumer per annum for four years, and 15s. per annum afterwards.

In conclusion a net profit of 7s. 6d. per annum per consumer, or about 25 per cent. of the income, after paying all expenses is a far better return than can be shown on any other class of consumers. Putting it another way, 1 kilowatt of maximum demand produces a profit of over £9 per annum, and over double that sum after three years. Many of the ordinary consumers barely produce a gross income of £9 per kilowatt of the peak demand, to say nothing of profit.

Discussion.

Mr. R. A. **Chattock** (Birmingham Corporation) thought Mr. Fennell's scheme for lighting cottages of very low rental was ingenious and simple. He confined it to the very poorest people, and indicated that honesty tended to disappear as people rose in the social scale. While agreeing that a scheme of this kind was probably quite workable for a concentrated community, where personal touch could be maintained with the consumer, he was afraid that when applied to a city such as Birmingham, where a figure of 100,000 such consumers could easily be reached, the personal touch would be lost, and it would be impossible to tell whether waste was going on or not. For lighting of this character he considered that the author's estimate of 45 watts per house was far too low. A fair average figure for maximum demand for ordinary class lighting was 60 per cent. of the watts installed, and with this class of lighting, where the diversity factor was very much smaller, in his opinion the maximum would considerably exceed 60 per cent. If this was so, the KW. charge might quite easily be doubled, whilst the unit charge would probably be increased, with the result that the estimated profit practically disappeared. The item of 4s. 3d. for lamp renewals seemed too low in view of the figure mentioned in the paper of 2s. 8d. per metal-filament lamp. He would like to know if Mr. Fennell had any trouble in obtaining wayleaves from the owners of houses who did not propose to use the light.

Mr. **Milns** (Birmingham Corporation) said that such a scheme would doubtless be pushed in a town like Wednesbury, which had a very large power supply but a comparatively small lighting load; while in other towns with a heavy lighting peak no special effort would be made to obtain this class of business. He did not think the plug switch would pass the I.E.E. Rules. Some charge should be made for lamp renewals, say 6d. per lamp, and this charge would be a check on waste of current and breakages of lamps, as the consumer would know that the life of the lamp depended upon the hours of use. The revenue of 16s. per 60-watt lamp per annum seemed very high compared with the revenue from similar houses taking current through prepayment meters, which worked out at 6s. 6d. per 60-watt lamp per annum, and about 4s. 6d. per 50-watt lamp from large houses.

Mr. **Holden** inquired the method employed when cutting off defaulting consumers. He was surprised to hear that current was anywhere so cheap that waste might be ignored. He considered that the expense of meters was over-estimated by Mr. Fennell. A first-class D.C. 1½-ampere meter could be obtained for not much over 30s., and an A.C. meter for less than 30s. Such a meter would certainly last ten years, and could be maintained for 5 per cent. per annum, so that 5s. or 6s. per annum was ample to cover its cost. Electrolytic meters would probably come out cheaper still. The absence of a meter confined the consumer to the use of current for lighting purposes. Although the use of current by cottagers for heating or cooking was not probable just at present, yet if the great advantage and direct saving to be effected by the use of laundry irons was properly explained to these consumers they would adopt them at once, provided they could be obtained on hire at favourable terms.

Mr. S. T. **Allen** considered that a great deal would be done in the future in this direction due to decreased costs, more extensive hiring powers, and also because the health departments of the different local authorities would more and more realise that electricity supply for workmen's dwellings was as important to the welfare of the occupiers as good sanitation and pure food. Mr. Sillar, of Colchester, about eight years ago read a paper before the Municipal Electrical Association, in which he said the supply was metered in each house; prepayment meters were used, and taking 82 consumers, the average number of lamps per house was 5, the average revenue was 10½d., per week, and the average profit obtained was 8s. 2d. per consumer. With the five lamps the average number of units per annum was 100. This seemed to show that Mr. Fennell's estimate of 100 units per annum for 3-lamp installations was a liberal one. He did not consider that a wall plug with a flexible attachment should, for such houses, constitute a main switch, especially considering the class of children and possible trouble due to them. He would strongly recommend an ironclad switch, which would not add much to the expense of the installation. Switch lampholders were not suitable at all for such houses. If the system was to be universally adopted, provision should be made in the scheme for any number of lamps. The time to write off the entire cost of the wiring could well be extended to eight years. He disagreed with Mr. Fennell's scheme in that it did not make any provision in the main services or subservices for cooking, heating, or other loads. There were enormous possibilities in the future in this direction, especially when the cost of electricity supply was still further reduced and when electric cookers, heaters, etc., could be hired out at the same price as gas apparatus.

Mr. F. W. **Foster** thought the final success of any scheme as outlined by Mr. Fennell would depend largely on the development of the ½-watt lamp. The cottages' maximum demand could not coincide with any other station demand. The variable charge for different seasons was a valuable feature, and the "insurance collector" idea was new. The balance-sheet was incomplete.

Mr. W. **Fennell**, in reply, said it was gratifying to find an almost unanimous opinion in favour of extending the benefits of electricity to the artisan; the chief object of his paper was, therefore, served. Mr. Chattock's objection on the ground that Birmingham was too big would disappear if the semi-criminal quarters were avoided. Mere size was no disadvantage; it cost less per consumer to supervise 10,000 than 300, and the profit was shown as so much per consumer. The results of check meters for blocks of buildings were not yet available, but the whole point of the system was that with the low unit costs (.35d.) there would still be a handsome profit if the units used were double the already liberal allowance. His observed figure of 108 lamps per 100 houses must be adhered to as the peak maximum demand on which the standing charges must be reckoned. The consumer's maximum demand was another matter. At times all the lamps would be required, say on Sunday evening and Bank Holidays, which were the "at home" times. This habit of Sunday and holiday visiting helped to fill up the load on the power station on the days of least demand. There had been no serious difficulties in getting wayleaves for the looped services; the tenants wanted the light, and it was in the interests of landlords in general to let them have it, because it reduced the cost of whitewashing and papering. In the only case remembered where a landlord objected, most of the tenants threatened to leave. When a consumer wanted a supply for heating he could have it as a separate matter through a "cheap" meter. Why go to the expense of putting in 300 meters because 30 consumers might want a flat-iron or grill? The slot meter had failed in most places because it did not fit in with human nature. It gave the consumer an exaggerated idea of cost—the money found in the meter never amounted to anything like the amount the consumer imagined had been supplied. It produced less revenue, only 6s. 6d. per lamp against 10s. with the rental system. The success of the rental system was due to the certainty of the charges; the housewife knew exactly how much money to leave out for the collector. There were no extras: nothing to pay for wiring, lamps, and repairs. Several speakers thought the wall-plug switch dangerous to children; he omitted to state in the paper that it was fixed five or six feet from the ground. A 5-amp. plug was not unsuitable for breaking half an ampere. The twin flex surface system was mechanical enough for these houses. In many cases the premises were not very clean and several applications had been refused for this reason. The lead-covered twin system was the most suitable. The risk of consumers using the bedroom lamp as a night light was the one practical difficulty which had arisen. It was forbidden in Wednesbury under penalty of removing the bedroom light, with good results, as the threat of disconnection raised visions of a return to the bad old days of candles or cheap oil lamps. A pearswitch at the bed should be provided. They had purposely avoided collection by the landlord, and often got paid in preference to the landlord. It was usual to owe the landlord for several weeks' rent, and there would be a risk of the landlord claiming payments on account as being for his rent and not for the electricity.

CURRENT-LIMITING REACTANCES ON LARGE POWER SYSTEMS.

By K. M. Faye-Hansen, A.M.I.E.E., and J. S. Peck, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *March* 26*th*, 1914.)

The general effect produced by a series-reactance is a drop in voltage in the circuit, provided the power factor is unity or lagging; and the greater the lag the greater is the drop in voltage. The power factor is also decreased on account of the reactive kilvolt-amperes of the choke coil. Thus it is evident that the introduction of reactance affects the regulation and power factor of the system; and these are two of the factors which determine the sizes that should be placed in generator leads or feeders.

1. Reactance in Generator Leads.

In normal operation the reactances will produce a drop in voltage between the generators and the busbars; but this can readily be compensated for by varying the excitation of the generator.

In the event of a short-circuit upon a feeder, the busbar voltage will drop to zero (provided the impedance of the fault and of the feeder between the fault and the busbars is negligible), and all generators and other synchronous apparatus on the system will feed into the short-circuit. If the system is a very large one, this current may be enormous and may damage or destroy the circuit-breaker in the defective feeder. It may also cause serious damage at the fault. The generators should not suffer, because the output of each is limited by the reactance in series with it; and for the same reason the generator circuit-breakers should not be damaged. The worst feature of this arrangement is that the whole of the busbar being affected, all synchronous apparatus throughout the system may fall out of step and a complete shut-down is likely to occur, as the circuit-breaker requires an appreciable time to operate even when set for instantaneous tripping. However, if the fault occurs at any considerable distance from the generating station, the impedance of the feeder will greatly reduce the current, so that the busbar voltage will drop comparatively little and synchronous apparatus will not fall out of step.

In the event of a short-circuit on a generator, the current which can flow from the busbars to the defective generator will be limited by the reactance, and the circuit-breaker should be able to disconnect the generator from the busbars without difficulty. Also the voltage of the busbars will not fall to zero, and the operation of synchronous apparatus will probably not be affected; it will be evident that reactances in generator leads alone are of little value except for protecting generator windings and circuit-breakers, as they offer no guarantee of continuity of service except in the case of the breakdown of a generator. Assuming that the average generator has a reactance of 6 per cent., and 6 per cent. is added in an external coil, the maximum current that can flow equals 8⅓ times the normal current, or somewhat more. Any generator should be able to stand a current rush of this magnitude. Where a step-up transformer is connected between the generators and busbars, it may be designed with high internal reactance, thus giving the effect of a reactance coil without any appreciable additional cost.

2. Reactance in Feeders.

Each feeder having a reactance coil in series with it, if some feeders are more heavily loaded than others, the voltage drop on the feeders will vary and cannot be compensated for by varying the busbar voltage.

In the event of a short-circuit upon a feeder, the current supplied to the fault will be limited by the reactance and the busbar voltage will be affected to only a small extent. The circuit-breaker should be able to cut out the feeder without difficulty, and only the one feeder will be affected. The generators will not be heavily overloaded, and none of their circuit-breakers should open.

A short-circuit on the busbars will short-circuit all the generators, and if the windings are not properly braced may cause serious damage. Also the whole system will be thrown out of action and each generator circuit-breaker must open the short-circuit current of one generator.

Should a short-circuit occur between the generator and the circuit-breaker, all the generators would feed into the short-circuit, and the circuit-breaker on the defective generator would have to open the short-circuit current of all the other generators. In this case the voltage of the busbars will drop to zero and all synchronous apparatus may fall out of step, and a complete shut-down is likely to occur.

If the generator windings are braced to withstand short-circuits, this arrangement of reactances possesses marked advantages over that of placing them in the generator leads, for the great majority of faults occur on the feeders or on apparatus connected directly to them; and with feeder reactances such faults can do no serious damage to the system. Furthermore, busbars and connecting cables can be so thoroughly insulated that a short-circuit on them is a somewhat remote possibility.

If the rating of a feeder is one-quarter that of a generator, a reactance of 3 per cent in the feeder will pass no more current than will a total reactance of 12 per cent. in the generator, while if there are several generators in parallel, the effect of the feeder reactances is proportionally increased. Thus unless the total feeder rating is very greatly in excess of that of the generators, the total k.v.a. capacity of the feeder reactances may be less than the k.v.a. capacity of the generator reactances, though the number will in general be much larger.

Where step-up transformers form part of the feeders the transformers may be designed with high internal reactance without appreciable increase in cost.

3. Reactances in Busbars.

The only purpose in installing busbar reactances is to limit the amount of current that can flow into a fault on one section of the busbars, and so to confine the disturbance to that part of the system on which the fault occurs. Reactances are chosen of such a value as to permit parallel operation during normal conditions, even with a considerable exchange of energy between the sections; while in the event of a short-circuit occurring on any section, the current rush is limited to such a value as not seriously to interfere with the operation of other sections.

Having decided upon the maximum allowable displacement for parallel operation and the maximum difference in load which is likely to occur between the different sections, the value of the reactance may be determined immediately.

In a very large station the busbars would probably be separated into several groups of from 20,000 to 40,000 kw. capacity each. In a case of this kind the amount of energy that it may be necessary to transfer between sections is assumed and the reactances made large enough to limit the current to a reasonable value in case of a short-circuit, but not too large for satisfactory parallel operation. A size that will give 50 per cent. of normal voltage with the full-load current of one busbar section is usually a reasonable value to choose.

The use of busbar reactances is carried to the extreme when the busbar is divided by them into as many sections as there are generators. Arrangements will always be made for short-circuiting any reactance so that in the event of a generator being shut down the feeders connected to its busbar section may be supplied directly from one of the adjacent generators. Arrangements must also be made for opening the busbar between any two generators in order to isolate any section of the busbars that might develop a fault.

The advantages of busbar reactances are that:—

- Trouble is confined to the particular section on which the fault occurs.
- The amount of current that can be fed into a fault is reduced.
- The danger in the case of bad synchronising is considerably reduced.

The disadvantages are that:—

- No protection to a generator is given when a short-circuit occurs on or near its busbar section.
- The generators coupled to the different busbar sections must be operated with a certain angular displacement in their voltages.

It will be clear that reactances between bus-bar sections may be exceedingly useful for confining any disturbance on the system to that particular section on which the trouble occurs, and thus it is possible to operate a large number of generators or two or more stations in parallel with almost the same factor of safety against a complete shut-down as though they were operated separately. It is seldom, however, that busbar reactances are used except in conjunction with reactances in generators or feeders, and it is proposed now to discuss very briefly their combined use.

Reactances in Generators and Busbars.

Since the principal object of the generator reactances is to protect the generator windings, these will naturally be chosen with reference to the characteristics of the generators, and evidently one will be placed in each generator lead. The more completely the busbars are divided up by reactances, the smaller will be the portion of the system affected, and from this point of view reactance is desirable between each generator and the next; but as this may involve some slight complications in the normal operation of the plant, it may be considered desirable to operate with several generators connected to the same busbar section. The size of the reactances will be determined by the amount of energy that must be transferred from one section to another, and by considerations of successful parallel running.

The advantage of this combination over the use of reactances in generators alone is very great, as it confines the trouble to the particular busbar section affected; it reduces the load on the feeder circuit-breaker, and reduces the damage at the fault. Perfectly satisfactory operation should be obtained with this arrangement.

Reactances in Feeders and Busbars.

This arrangement probably gives the greatest possible freedom from serious operating troubles, for the feeder reactances protect from all troubles outside the station, while the busbar reactances confine any internal trouble to the busbar section on which it occurs.

The objections are that it affords no protection to the generators in case of a short-circuit on the bus-bars, that it requires a large number of reactance coils unless group feeding is adopted, and that it affects the regulation of the feeders, though this will ordinarily be of minor importance. If the generators can safely withstand a short-circuit, or if the chance of a short-circuit on the busbars is considered negligible, some form of this arrangement probably offers the most complete solution of the problem.

When it is attempted to apply this knowledge to a concrete case there are so many factors to be considered that the determination of the best possible combination becomes a difficult problem. For example, if the busbars are divided into sections by reactance coils, and the different sections feed into the same busbars at one or more sub-stations, the impedance of the cables connecting the different sections may be far less than that of the reactance coils, so that much of the advantage gained by using the reactance coils is lost. Also there is the possibility that when one section is more heavily loaded than another, the cables on one section will be overloaded, due to the angular displacement in voltage between the sections. Thus it is desirable when using bus-bar reactances to feed one sub-station from one section of the busbars, rather than from several sections, or, failing this, to use fairly large feeder reactances. When the feeders are very long this may not be of importance. When suitable feeder arrangements can be made, there seems no doubt as to the great desirability of using busbar reactances in large stations as an insurance against a complete shut-down.

In the case of feeder reactances, the greatest flexibility is obtained by placing reactances in each feeder; this is quite feasible where the feeders are of large size and comparatively few in number, but where there are many feeders of small size the number of reactance coils becomes excessive and group feeding must be adopted.

Reactances in generator leads present the simplest problem, once it has been decided to instal them. The only difficulty is to determine whether they are necessary in addition to the busbar reactances. The following points should be considered :—

If the generators will stand a short-circuit, reactances serve very little purpose except to protect the system in case of a generator breakdown and to reduce to a small extent the current that flows into a short-circuit. Busbars may be so thoroughly insulated as to reduce the possibility of a short-circuit to almost a negligible amount. It is now becoming fairly common practice to use single-core cable between the generators and busbars. These cables can be so arranged that an "earth" is almost certain to occur before a short-circuit, and a suitable discriminating device will cut off the generator and open its field circuit the instant that an "earth" occurs. Thus the chances of a short-circuit on the generator terminals may be greatly reduced. But there is still the possibility of a mis-phase where more than one generator is connected to the same busbar section; and if the generator will not withstand such an accident it will be advisable to use reactances in its leads.

In order to show a typical lay-out for a large station, the following conditions have been assumed :—

Total generator capacity, 100,000 kw.
Seven generators (4 of 10,000 and 3 of 20,000 kw.
Feeders of 2,000 and 5,000 kw., the 2,000 kw. feeders being arranged in groups of 10,000 kw. each.

A diagram of connections is shown in Fig 1. In this case, the busbars are divided into five sections of 20,000 kw. each. Each section of the busbar is fed either by one large generator or by two small ones. Between each busbar section is connected a reactance coil, which, with the full-load current of one busbar section, will give a voltage across it equal to 50 per cent. of the normal.

Each reactance coil is arranged so that it may be short-circuited by means of an oil circuit-breaker, and an oil circuit-breaker is also placed between sections of the busbars.

A ring busbar system is adopted, which increases considerably the flexibility of the arrangement.

Each group of feeders will have in series with it a reactance coil, which should be of such a size that with the group fully loaded there will be a voltage across it of approximately 5 per cent. Each 5,000-kw. feeder should have in series with it a reactance coil, which will have a full-load voltage across it of approximately 2½ per cent. In series with each generator there should be a reactance of approximately 5 per cent.

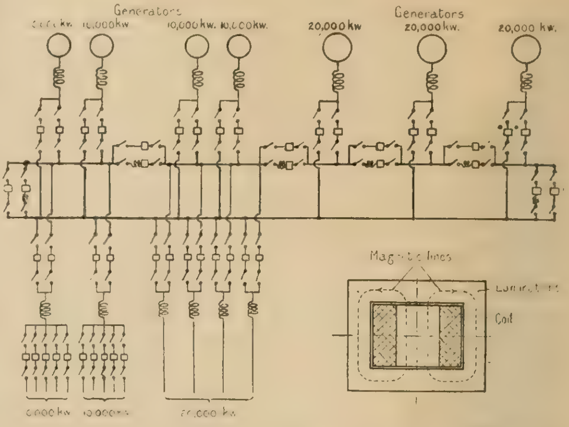


FIG. 1.—STATION LAY-OUT WITH REACTANCES.

FIG. 2.—SECTION OF CHOKE COIL.

It is preferable to have each sub-station fed from one section of the busbars in order that circulating currents may not flow through the cables from one busbar section to another. The ring-main busbars and double set of feeder switches permit any sub-station to be switched over to another section in case of necessity.

Discriminating devices should be provided so that in the event of an "earth" on any feeder it will be cut out. Also each generator should be arranged in a similar manner, so that it will be cut out in the case of an "earth" or other fault developing on it.

The Design of Current-limiting Reactances.

Current-limiting reactance coils have heretofore been designed almost exclusively without iron in the magnetic circuit, upon the assumption that it would not be possible to use an iron circuit and obtain a straight line relation between the voltage and current without increasing the size, price, and losses in the coils. While this may be true for feeder reactances where the maximum short-circuit current is perhaps 20 to 30 times the normal current that the coils must carry without overheating, it is not true in the case of busbar reactances where the maximum current will as a rule not be more than 4 to 10 times the normal current, and under certain circumstances the coil with a partial magnetic circuit will prove more economical than the air core even for generator reactances.

The larger the capacity of a reactance coil and the lower the frequency, the less will be the advantage obtained by using iron in the magnetic circuit.

Fig. 2 shows diagramatically the construction of a choke coil having a partial iron circuit. It will be noted that inside the coil there is no iron, and therefore the air-gap is very large, while the coils are enclosed by a complete iron circuit. This construction has the following advantages compared with air choke-coils :—

1. Under normal working conditions there is no external field, so that the whole coil may be placed in a metal tank without fear of eddy currents, as though it were a transformer.
2. The coil may be operated in oil, thus avoiding the necessity for forced cooling, though the air-blast type can be used if preferred.
3. Less room in the station will be required, as it is possible to place the apparatus in the same position as a transformer and to handle it just as though it were a transformer.
4. The metal containing case may be earthed so that there can be no danger from accidental contact with the coil.

5. It is not essential to use a laminated cable winding, as the direction of the flux is such that a solid winding may be arranged by careful designing to avoid any serious loss.
6. The construction being practically the same as that of a transformer, standard transformer parts may be used to a very great extent, thus reducing development costs and the time required for manufacturing.

Discussion.

Mr. W. B. **Woodhouse**, who opened the discussion, referred to the general tendency of looking on all protective devices with suspicion. Reactance was to be introduced for protecting apparatus and limiting disturbances, but practically all apparatus in an A.C. system, except the switchgear, possessed reactance and if the apparatus could be constructed to withstand short-circuit currents, as it could, additional protection was unnecessary. The author has assumed 6 per cent. reactance for the average generator, but nowadays this should be 10 or 15 per cent; he thought the reduction of momentary currents was not beyond the powers of the generator and transformer designer. Feeder protection was rather a question of switchgear and he reminded them that Mr. Leonard Andrews had described a protective system using reactances some years ago. The amount of power to be absorbed by the switch in opening the circuit depended on the reactance of the circuit as a whole, and it was possible that the switchgear was good enough. He thought it preferable to put sectional reactances in the bus-bars. The cost of introducing reactances was not perhaps great, but the cost of running, and providing apparatus to keep up the necessary pressure regulation might be considerable; it should be regarded as question of insurance. He asked what was the limit of reactance that could be introduced between generators and still preserve satisfactory service. Although high-speed machinery had brought some disadvantages, there were great compensating advantages in its use.

Mr. G. W. **Partridge** said he thought his company was the first to make practical use of reactances in this country, having had them at work for 3 years, with satisfactory results. In their case the turbine plant supplied the Brighton Railway single-phase line, and the trains were connected direct to the station bus-bars, there being no intervening sub-stations. The reactance coils were designed to withstand momentary short-circuits of 20,000 amperes and weighed some 13 to 15 tons. He, with the assistance of the President (Mr. Duddell) had recently carried out some oscillograph tests on the behaviour of switches with and without reactances in series, on the occurrence of a short circuit. The turbines were of 7,500 kw. with high internal reactance. With reactance in series the switch had no difficulty in breaking the circuit; four or five times full load current was flowing, and the time taken was about ⅛th sec. Without reactance the switch arced badly and a considerable amount of oil was thrown out; this was a trouble which, he maintained, would be obviated by using either internal or external reactance. Describing the effect of a short-circuit on the exciter current of the generator, with no reactance, he pointed out that the field voltage was reversed and that the current increased enormously and took the form of an alternating current. He thought reactance in this case would have damped out the disturbances. On short-circuiting two phases of a generator he found no pressure rise in the third one which had been disconnected.

Mr. J. **Shepherd** (L.C.C.) said he estimated the approximate cost of reactances at 10 per cent. that of the generators, and the total expense of installing them at 12 to 15 per cent. that of the generators. He thought some form of relay was more suitable for feeder protection, as there was usually enough time with a short-circuit for a relay to act. Either internal or external reactance was necessary for a generator and if the bus-bar system was extensive there were always risks which might be lessened by inserting reactances. He thought, however, that it would be difficult to house them, without a special building, in most cases. He asked what had become of the large induction generators mentioned by Steinmetz a few years ago.

Mr. A. R. **Everest** said generator windings must be protected, and though it was easy to provide sufficient internal reactance for a 50-cycle machine, it was not always possible with a 25-cycle generator to limit the current to ten times full load value. With feeder reactances there would be a voltage drop, and to use a large number of reactances would be prohibitive as to space and cost, but the grouped feeder and reactance arrangement could be used. Bus-bar reactance also limited the current at a feeder fault as well as protected the generator. He believed that the air-core reactance was a safer construction than many others.

Mr. **Hollis** (whose recent paper on this subject will be found on page 465) pointed out that the use of reactance increased the rating of the switchgear. The objection of bad regulation, with reactance in long feeders, could be got over by the use of synchronous machinery. Internal reactance on a generator did not protect the machine itself when it broke down, but external reactance would do so.

Mr. E. W. **Wedmore** pointed out that reactances in parallel had little influence on the power factor of the system, and he preferred them to reactance in series. He agreed as to the necessity of reactance in the generator circuits, but it would be impracticable to protect the switchgear of a 100,000-kw. station in this manner. This could, however, be effected by the use of bus-section reactances, which would have a limiting effect on the short-circuit current on every switch in the system. Probably large stations would have step-up transformers in the feeder circuits, and their inherent reactance would assist in limiting short-circuit current outside the station. The protection afforded by sectioning the bus-bars could be increased by reducing the size of the section or increasing the ohmic value of the reactances. The author's suggested ohmic value giving a 50 per cent drop, appeared much too high; it would reduce the short-circuit current to about 13 times the output of the section, which nearly approached the result obtained with an infinite reactance. The first 5 per cent. reactance was much the most effective. He found that an ohmic value of 20 or 25 per cent. gave a more satisfactory commercial solution in this case. Rather than employ 50 per cent. ohmic value it would be better to limit the size of the section; the furnishing of magnetising current for such a reactance would seriously limit the output of a machine, which was being assisted from adjoining sections. The size of section was limited by the number of machines, and it was important that the size of section should be kept down in the interests of consumers' apparatus in case of short-circuit currents. A mile of .1 square inch cable had a useful effect in limiting short-circuit current to the individual consumer if there were not other parallel feeders, and this feature was utilised for protecting distribution switchgear, the trunk cables leaving the station being sub-divided into smaller sections leading to distribution boards and the consumer's switch being supported by several switches in series before the station was reached. An alternative arrangement for protecting an individual feeder was to use two switches in series, one of which cut in reactance and the other opened the circuit. He concluded by urging that as bus-bar reactance was really a long extension of the bus-bars, it should be treated with great respect.

In replying, Mr. **Faye-Hansen** pointed out that Fig. 1 showed reactances used in every possible position, but it was not suggested that this was necessary, especially as regarded generator reactances, if the machines were suitably designed.

TESTS ON A KAPP VIBRATOR.

Last year Dr. Gisbert Kapp read a paper before the Institution of Electrical Engineers (abstracted in our issue of May 9th, 1913), in which he described a new form of phase advancer invented by him and called the "Kapp Vibrator." Messrs. Sandycroft, Ltd., obtained a licence for the manufacture of

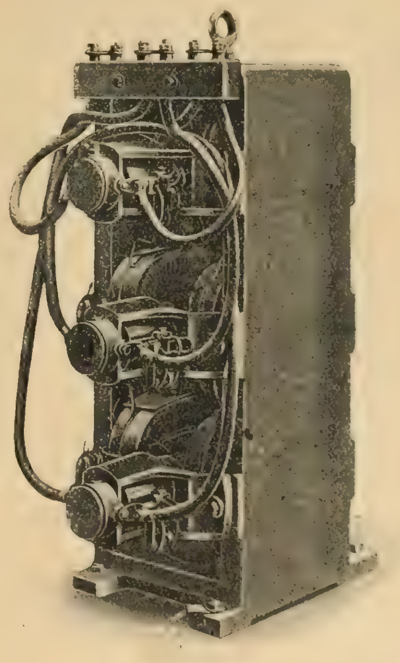


Fig. 1.—Kapp Vibrator.

these vibrators, and after devoting a considerable amount of time to their study, recently received an order for, and successfully completed the manufacture of, their first vibrator (other than a purely experimental machine). This vibrator has since been put into regular commercial service and, being the first of its kind, has excited great interest.

The vibrator is working in conjunction with a 330-B.H.P. induction motor built by Messrs. Siemens Brothers Dynamo Works, Ltd., and is installed at the Chemical Works, Late H. and E. Albert, South Bank, Near Middlesbrough. The motor is a 12-pole machine operated from the system of Cleveland and Durham Electric Power, Ltd., who supply energy at a pressure of 2,750 volts and a frequency of 40 cycles per second.

The vibrator is a phase advancer, or exciter, for use with induction motors or generators respectively, and consists of a magnet frame carrying three sets of 2-pole field-magnets, in which revolve three armatures of the usual direct current type. The three armatures are connected in mesh to the slip-rings of the induction motor as shown in the accompanying diagram, fig. 2, which also shows all the necessary connections (although in some cases it may be desirable to provide an inter-locking arrangement to prevent the motor from being started with the vibrator in circuit, that is to say, practically on short-circuit).

The field-windings are excited with direct current. The low-frequency rotor currents in the armatures cause the latter to rotate first in one direction and then in the opposite direction with the frequency of slip. This rotation induces in each armature a voltage which is opposed to the E.M.F. of self-induction of the motor, and is greater than the latter by an amount sufficient to supply through the resistance of the rotor windings the necessary current to produce the magnetic field of the motor. With normal excitation of the vibrator no magnetising current flows in the stator windings, and consequently the motor operates with a power factor of unity. If the exciting current be increased, the greater voltage then induced by the rotation of the armatures will produce in the rotor windings a magnetising current greater than that necessary to produce the magnetic field of the motor, and consequently a leading current will result in the stator windings.

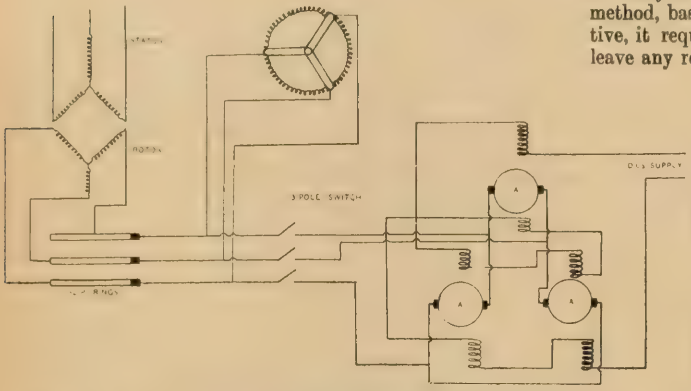


Fig. 2.—Diagram of Connections of Kapp Vibrator.
After closing the three-pole switch, the starter is placed in the "off" position.

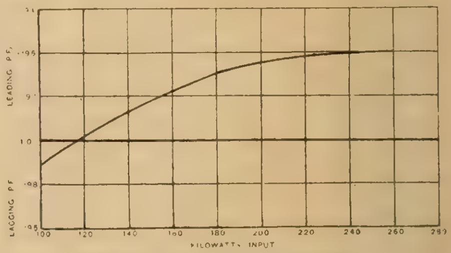


Fig. 3.—Power-Factor Curve.

Fig. 1 shows the vibrator under description, which it will be noticed, is a small and compact machine. The armatures are only 10 cm. in diameter, and at full load with a slip of 2.45 per cent. rotate about 3½ revs. in each direction. Since the frequency of supply is 40 cycles per second they change their direction of rotation every half second.

The results of the tests made are plotted in the accompanying curve, which shows that at half load the power factor was 0.99 leading and at full load 0.96 leading. The corresponding power factors without the vibrator were 0.76 lagging and 0.87 lagging respectively. The machine was guaranteed to give unity power factor from half load to full load, and when the field current was adjusted for the latter value the excitation loss in the fields of the vibrator was only 50 watts.

The vibrator will work equally well with an induction machine running either as a motor or a generator without change of connections, so that when used with machines driving winding engines or locomotives complete compensation would be obtained under all conditions. A valuable feature of the vibrator is that in the event of any mishap (such as, for instance, the failure of the field) it may be left in circuit even although failing to fulfil its function as a phase advancer, without affecting the running of the motor with which it is installed.

The use of the vibrator improves the operating qualities of a motor not only by correcting the power factor, but also by considerably increasing its overload capacity and maximum torque. Under favourable conditions the efficiency of the motor will be improved. The overload capacity will be increased because not only the stator currents, but also the rotor currents, of the motor will be reduced when the motor is operating above the load corresponding to its maximum power factor.

The vibrator described above was installed to the order of Cleveland and Durham Electric Power, Ltd., and was built at the works of Messrs. Sandycroft, Ltd., near Chester. By the courtesy of the Chemical Works, Late H. & E. Albert, it was inspected on March 20th last by Dr. Kapp and a large number of engineers connected with the Newcastle and Tees-side Local Sections of the Institution of Electrical Engineers.

RADIO-TELEGRAPHIC RECORDER.

By Dr. ALFRED GRADENWITZ.

The receiving process used in connection with early experiments in wireless telegraphy called for the use of a Morse recorder. Recent processes utilise several kinds of detector in conjunction with a telephone receiver. While this method, based on acoustic principles, is much more sensitive, it requires remarkable skill, and, moreover, does not leave any record. Endeavours have therefore been made repeatedly to combine this method with the use of a graphic recorder, but the apparatus so far suggested in this connection have been too delicate to lend themselves to anything like a general use.

At a recent meeting (January 12th, 1914) of the French Academy of Sciences, Prof. Bigourdan demonstrated a recording apparatus devised by M. Tauleigne, in conjunction with the well-known manufacturers, F. Ducretet and E Roger, which affords the advantages of being simple in construction, robust, and easy to regulate and operate. It allows all signals of sufficient intensity for acoustic reception at 20 cm. from the telephone receiver to be readily recorded.

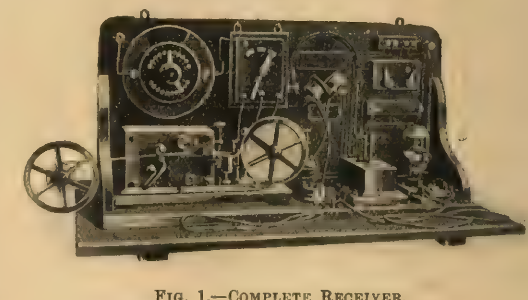


Fig. 1.—Complete Receiver.

The apparatus is protected by letters patent, and comprises the three following parts :—

1. A special electrolytic detector allowing the depth of immersion of a platinum wire electrode to be regulated.

2. A polarised magnetic relay.
3. A variable-speed Morse recorder.

These parts are supplemented by a tuning coil and various accessories.

The positive electrode of the detector E (figs. 1 and 3) is constituted by a platinum wire, dipping into the liquid to a depth regulated by means of the upper button B (fig. 1). The negative electrode is constituted by a carbon. This arrangement allows a battery P_1 of two Leclanché cells to be used as source of current, the electrolyte being a mixture of 10 parts of pure sulphuric acid with 90 parts of water.

Fig. 2 is an outside view of the relay, and allows all regulating organs to be seen. The movable lever J carries a light contact spring designed to be bent on turning the screw K; the lever swings freely between the two stop screws G (insulating contact) and K (platinum contact), on its being removed ever so little out of its position of equilibrium. It will, on the other hand, strike one screw or the other, when this is at the end of its path. Should this for some reason or other be impossible, the effective length of the antagonistic spring Q will have to be altered.

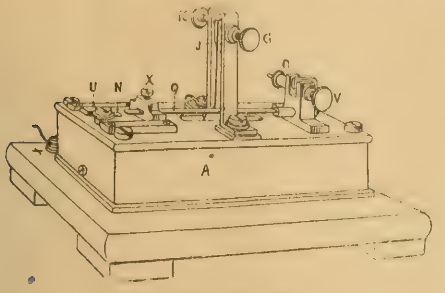


Fig. 2.—Polarised Relay.

This relay is inserted into the circuit of the detector E, so that the positive pole of the battery P_1 is connected up to the positive terminal of the relay A.

Under the action of the current, the lever J will leave the insulating contact of the screw G, on which it only presses very lightly in the state of rest, and will make contact with the screw K. The length of stroke is controlled by the two screws G and K, and the position of equilibrium corresponding to the maximum sensitiveness is obtained by turning the head of the screw V. This screw acts on a lever arm twisting the spring Q; a spring situated in the socket O returns the lever to its former position, on turning the screw in an opposite direction. The telephone receiver R_1 has been provided, to guard against too intense an action on the detector.

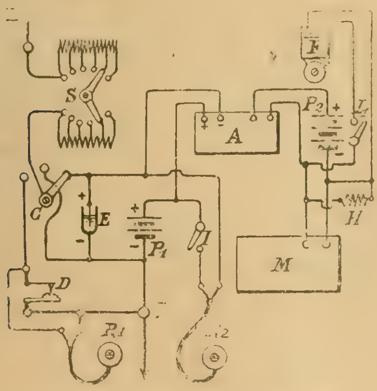


Fig. 3.—Diagram of Connections.

The Morse recorder has been specially designed with a view to allowing the rate of unwinding of the paper tape to be regulated in accordance with the rate of transmission of wireless signals. The most suitable arrangement consists of connecting the apparatus up in series, the self-induction coil S and the detector E being inserted in the circuit constituted by the antenna and the earth-plate.

This recorder has been used in receiving the Eiffel Tower signals up to a distance of 400 to 500 k.m., with antennæ of moderate dimensions. M. Tauleigne has, however, designed an apparatus which, when connected up to the antenna and the receiver, allows Morse records to be taken at practically any distance from the transmitting station.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Mercury Vapour Lamps.

With reference to the correspondence appearing in your columns under the heading "The Lighting of the I.E.E. Lecture Theatre," we feel that we cannot allow Mr. Frank Broadbent's letter, appearing in the current issue, to pass without comment.

Mr. Broadbent makes some remarks regarding the partially decorative application of mercury vapour lamps in the I.E.E. theatre, and we feel that your correspondent wrote more in relation to this particular installation than to mercury vapour lamps in general. The remarks are very apt to be taken as applying generally, and are entirely misleading. We should be very glad to meet Mr. Broadbent and to demonstrate to him that mercury vapour lamps are a strong commercial proposition, and have very many undoubted applications. While we are glad to acknowledge the influence of the Electrical Review, we must claim that some, at least, of the success of the mercury vapour proposition is due to the merit of the system.

The Westinghouse Cooper Hewitt Co., Ltd.
Mark Foulds, *Manager*.

London, N., *March 31st*, 1914.

Creosoting Wooden Poles.

I should be glad if any reader would give me an idea of a simple apparatus for creosoting poles carrying electric wires, to preserve them from dry or wet rot in the tropics.

The poles vary in length from 25 to 70 ft. Cast-iron piping is available in any size or length for a bath. Superheated steam and electricity are also at hand. As creosote is expensive here, would coal tar serve? Is there any chemical that I could use in the bath that would disagree with the stomach of white ants? Solignum is available but expensive in large quantities. Iron poles are also too costly, but concrete poles seem a good idea. Could any reader refer me to any literature on the latter subject?

Any hints will oblige.

Ta Tao.

China.

[The following articles, &c., on the preservation of poles have appeared in our pages in recent years:—January 13th, 1911, p. 79; September 8th, 1911, p. 386; December 22nd, 1911, p. 1012; February 2nd, 1912, p. 193; February 9th, 1912, p. 203; June 28th, 1912, p. 1059; August 30th, 1912, p. 335; November 1st, 1912, p. 709; August 22nd, 1913, pp. 306 and 320; September 19th, 1913, p. 444; January 16th, 1914, p. 85.—Eds. Elec. Rev.]

A New Aluminium Alloy.—A new alloy of exceptional lightness, considerable mechanical strength, and freedom from electrolytic action, is stated to be gaining popularity in British engineering circles. It is named "Ivanium." This alloy, obviously one of aluminium with one or more metals occupying positions relatively near aluminium in their electrochemical properties, is only 2½ per cent. heavier than pure aluminium. It is stated to have the property of retaining its hardness after being subjected to heat, and of being non-magnetic. When polished, the surface remains bright indefinitely. Castings made in ivanium are stated to be equal in finish to the finest gun-metal. The alloy does not clog a file, and it can be screwed, tapped, milled, and soldered with ease. Joints soldered together are stated to be as strong as the original metal. The melting point is low, about 300° C., and the alloy is claimed to be a useful deoxident.—*Standard.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

E.A.C. Heavy Duty Inching Starter.

We recently inspected a new patent starter which has been developed by the Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, S.W.: in this device the usual no-volt coil and spring return have been eliminated, their functions being performed by other means. This change enables the angular movement of the starting lever—and, therefore, the number of contacts employed—and the pressure on the contact brush or shoe to be increased. It is impossible to start the motor without first inserting all the resistance, and it is impossible to leave any of the resistance in circuit when the motor is running.

From the drawing, fig. 2, it will be seen that there is a frame or cradle pivoted on the starting lever, and held to the left by a spring. On pushing the handle to the right a contact is made at G, but this is ineffective unless the lever is standing over the contact A, that is, in the starting position. This condition being fulfilled, the first motion of the handle closes the circuit of the solenoids which actuate the circuit breakers D D, causing these to close, simultaneously inserting resistances into their circuits by opening contacts at F F through the action of the fingers E E. Thus the current in the solenoids is reduced to a small value sufficient only to keep the breakers closed. The starting lever can now be moved to the right, cutting out the resistance by steps; but if the pressure on the handle is relaxed for an instant, the contact G is broken and the circuit-breakers immediately open. If, on the other hand, the resistance is cut out too rapidly, the excessive current actuates the overload release H, interrupting the solenoid current at J and opening the circuit breakers, so long as the contact brush attached to G is over the sector B and the handle is pushed to the right, the circuit-breakers are held in but cannot be pulled in. On arriving at the full-on position, however, with all the resistance cut out, G is over C, and in this position the opening or closing of G no longer affects the circuit-breakers, which are held in independently of the circuit through G.

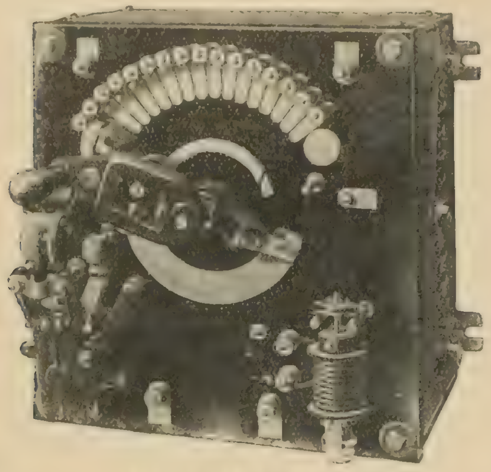


Fig. 1.—A New E.A.C. Starter.

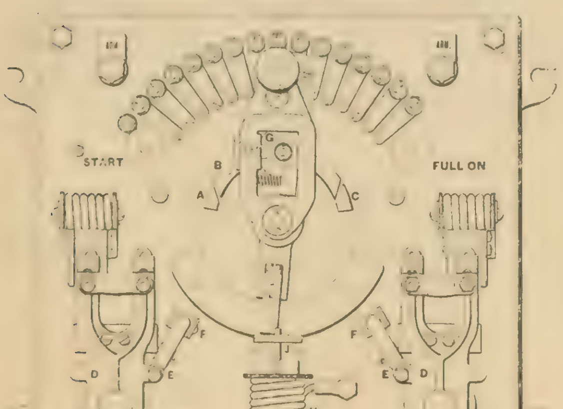


Fig. 2.—Connections, E.A.C. Starter.

The circuit-breakers when closed are at *all* times controlled by the overload release H, and it is claimed that the device is "fool-proof," for it is impossible to make a mistake with it. The circuit is never broken on the resistance contacts, but only by the circuit-breakers, which have renewable carbon breaks and a magnetic blow-out; the carbon sparking rollers shown on each segment therefore have practically nothing to do. It will be observed that as the slightest movement of the loose handle to the left releases the circuit-breakers, it is impossible to move the starter arm backwards with current on. For driving printing machines, therefore, the starter is particularly suitable, as the severe trials of "inching" are felt only by the circuit-breakers. The starter is of substantial construction and good workmanship and appears to fulfil every requirement of a good starter very efficiently. Fig. 1 shows the device as made up with one circuit-breaker.

Thermal Auto-Starter for D.C. and A.C. Motors.

The desiderata of a self-acting motor starter are that it should act satisfactorily whatever the load on the motor started, that it should be equally suitable for use in D.C. and A.C. circuits, and that standard patterns should be easily adaptable to any size or type of motor. Innumerable solenoid-actuated auto-starters have been patented, but these are applicable only to D.C. motors. They involve the use of relays, and the complexity of their construction increases as their action is made more automatic. The expansion of a hot wire may be used to move the starting switch lever, but this involves serious waste of energy in the hot-wire shunt circuit, and a constant rate of starting independent of the motor current. That form of starter which utilises the sudden increase in electric resistance of iron at a certain critical temperature by employing magnified Nernst lamp ballast resistances is useful for small machines, but the apparatus is costly and easily broken. By the use of bi-metallic contact strips, the rate of starting can be made to vary with the load on the motor, and simple, strong and effective construction and reliable action can be secured. Referring to the accompanying figure, when the main switch S is closed, current flows to the motor through all the resistance sections W, in series with which are bi-metal strips Z. Due to the heating effect of the current and unequal expansion of its component strips, Z buckles, makes contact with B and thus short circuits the first section W_1 of the starting resistance. The remaining sections are successively short circuited in similar manner. Each compound strip is constructed so that it makes contact at an appropriate current (or all may be rated for the same current and placed at different distances from the stationary block). The steady current being rather greater than that which brings Z into contact with B, firm contact pressure is secured and contact is further improved by the addition of copper wire brushes. The area of each contact strip determines the rate of starting under given load conditions. On open circuit, the springs return rapidly to their "off" position, and there is no reasonable limit to the frequency of using the starter. Any starter can readily be converted to automatic action on this principle by adding to the existing equipment a small board carrying the necessary bimetallic strip and contact block. The springs should be protected by a cover to prevent irregular action due to varying air currents. No sparking occurs at the contacts and there are no wearing or (in the ordinary sense of the word) moving parts. Starters of this type have been built for currents up to 100 amperes, and as small power accessories, they may be worth notice and trial.—*Elek. Zeitschrift.*

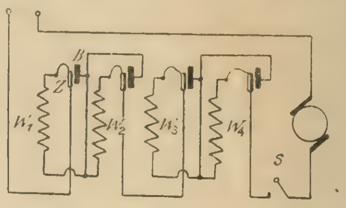


Fig. 3.—Diagram of Connections, Thermal Auto-Starter.

[Obviously the heavier the load at starting, and therefore the starting current, the more quickly are the resistances cut out, and this is a serious drawback—Eds. Elec. Rev.]

A Highly Sensitive Thermo-Electric Pressure-Gauge.

In a paper recently presented to the French Academy of Sciences, M. Guéritot, of Nancy University, draws attention to the fact that thermo-electric junctions allow the slightest motion of air in a tube connecting two reservoirs to be ascertained, provided a small part of the air be heated beforehand. Since the air is set in motion with the slightest pressure difference between the two reservoirs, a highly sensitive pressure-gauge can be designed on this principle. The tube connecting the reservoirs is bent in the centre, and is so arranged that the knee is the highest point of the tube. The air in the interior of the tube near the knee is heated by means of a conductor traversed by an electric current, and the hot air remains at the top of the bend. The two junctions of a thermo-electric couple connected up to a galvanometer are arranged in the axis of the tube, to the right and left respectively of the heated portion. As long as the air in the interior of the tube is at rest, the two junctions are surrounded by cold air at the same temperature, and the galvanometer records no current. As soon, however, as the air is set in motion, it carries the heated gas along one of the junctions, thus producing a thermo-electric current, which is recorded by the galvanometer. Experience has shown this gauge to give most reliable readings. The galvanometer, after each deflection, returns accurately to zero, its deflection changing direction as the gas flow is reversed. Moreover, the galvanometer readings are proportional to the volume of gas set in motion. The apparatus allows an air current corresponding to the motion of $\frac{1}{10}$ mm.^{3} to be ascertained.

The sensitiveness of the gauge can be further increased by providing several junctions, and it is possible also to obtain a graphical record by using a registering galvanometer. The inventor has made the following experiments :

The gauge having been connected on one hand with a reservoir containing air, and, on the other hand, with a tube open to the atmosphere, it will record any variation in air pressure, through the motion of the air entering or leaving the reservoir with any such variation. The apparatus thus allows a minimal variation in pressure (as low as one-millionth of a millimetre of mercury) to be made visible.

Since the apparatus is devoid of inertia, in connection with a Pitot tube it enables sudden variations in wind velocity to be watched, and any fluctuations hidden by the variations of other apparatus to be observed.

The gauge, on account of its remarkable sensitiveness, allows in conjunction with a Riess thermometer, the energy of extremely slight electrical discharges to be measured. It, *e.g.*, gauges the energy absorbed from a Hertz resonator in the Riess thermometer.

LEGAL.

KIDDERMINSTER TRAMWAYS CASE.—CROSS CLAIM FOR DAMAGES.

(*Continued from page* 570.)

Mr. Arthur Charlton, continuing, said it was brought to his notice in July last that the defendants were proposing to make the tunnel.

Mr. Eustace Hills : On July 7th had the Town Council refused permission to lay the cable under your tramway ?—That is so, I think.

Mr. Young said that he would tender evidence that they had leave.

Witness, continuing, said that it was part of his duty to inspect the tramways, and on September 2nd he received information that the defendants were commencing to tunnel under it. He went to the spot with some of his men, and notwithstanding their protest, tunneling was continued, and completed on the early morning of September 3rd.

Did it in any way affect the tramway ?—Yes. I considered that the work was improperly done.

Asked about the dimensions of the tunnel, witness said it was about 3 ft. in diameter on one side of the tramway, and 2 ft. 6 in. on the other side, tapering in the middle down to about 2 ft. It was cut through sand without any timbering or roofing. It was just a plain tunnel, cut out with shovels and short picks. The tunnel was unsafe, as the support of the tramway being taken away the concrete would not carry the heavy traffic passing over the top. When the tunnel was finished the subsoil was replaced, and an attempt was made to ram it in from the side, which was impossible. They could not ram up to the roof in that way. The tunnel was 8 ft. long. The proper way to lay a cable under a tramway was first of all to lay a pipe and then draw the cable through it. In the event of a cable breaking down when laid in that way, it could be drawn out for repairs. But in this case to get at the cable for repairs would cause a serious interference with, and a danger to, the tramway. The cable was placed in a wooden box, which was filled in with boiling bitumen. After the tunnel was constructed, it was found that a portion of the line over and near it had "dished," and it became necessary to renew the foundation and make good the faulty spot in the tramline. By the advice of the solicitor he was proceeding to cut away the cable, but when he had got three-quarters through he was stopped by the police. He had intended, had he not been stopped, to remove the cable.

Mr. Eustace Hills : Was that a proper step to take in making good the tramway ?

Witness : I think so

The Judge : I do not. The cable had nothing to do with the tunnel.

Mr. Hugo Young, for defendants : Our case is that the cutting of this cable was simply to prevent our using it.

During further examination of the witness as to the various items of the claim a mass of documents was put in, which drew from the Judge the comment that there seemed to be sufficient paper in the case to have filled up the tunnel.

In cross-examination, Witness said that Mr. Lycett was the managing director of the company, and was also the managing director of the Kidderminster District Electric Lighting and Traction Co., Ltd. That company supplied the electric lighting for Kidderminster. Both those companies were offshoots of the British Electric Traction Co. The Sheerness Co. with which he was now connected, was also one of the associated companies. He was aware that Messrs. Woodward were supplying themselves with electric light from one of their works.

Mr. Hugo Young : Do you know that the cause of all this trouble is that Messrs. Woodward had a plant for supplying themselves with electric light ?

Witness : I do not know that that was the cause of the trouble. They were generating at one of their works and wanted to connect with another so that they might have a supply for themselves.

In further cross-examination, the witness said that he, as manager of the Electric Lighting Co., wrote to the defendants protesting against their action.

Mr. Hugo Young : Was not the point in your mind that if you could you would stop them supplying themselves with electricity ?

Witness said that that was not the point in his mind. On July 29th an application was made for an interim injunction, and it was then represented that the cable could not be properly laid without digging down from the surface.

Mr. Hugo Young said that the injunction was granted in very careful terms not prohibiting the defendants from laying the cable, but ordering that they should not so lay it as to interfere with the tramways.

Cross-examination continued : A notice from the defendants was received on September 2nd stating what they were going to do. On receiving that notice, he gave his foreman instructions to take on a few extra navvies, but he did not tell him to bring a gang of roughs. As a matter of fact, 41 men were brought up, and they were supplied with refreshments, the object being to prevent the cable being laid. According to his instruction, he was going to take the cable out, and for that purpose he cut it.

His Lordship : Did you want to remove the cable to prevent these people using the current between their two works ?

Witness : No. I was endeavouring to remove the cable according to orders.

His Lordship : Do you suggest that the cable could do any harm to the tramways ?

Witness : Not for the time being ; but it might do so in the event of anything happening to the cable in the future.

By Mr. Young : An injunction was obtained to prevent the Tramway Co. from interfering with the defendants' cable. Witness added that when the defendants' cable was cut, representatives of Messrs. Woodward, Grosvenor & Co. were not present.

"Don't you think it would have been fairer to have notified them of your intention ?" asked counsel.

Witness said he saw no reason why they should be present.

Mr. Justice Rowlatt : I can tell you a very good reason ; it might have avoided a conflict of evidence in this case.

Mr. Young : I put it to you, that this alleged injury to your tramway is make-believe. Do you swear there was any serious injury to your tramway between September 2nd and 16th ?

Mr. Charlton : I do ; the concrete foundation over the tunnel had gone in.

So as seriously to interfere with the tramway ?—Yes.

Did the cars continue to run until you took up the rails ?—They did.

And was there, in your judgment, any danger in allowing them so to run ?—That was the reason we took the rails up ; the rails were springing.

Mr. Harold North, chief assistant engineer to the Tramway Co., gave evidence that the soil was all sand, and if disturbed, it would not stand pressure. Eight or nine days after the tunnel was cut, he noticed the tramway setts had sunk about 2½ or 3 in.

Cross-examined : His attention was not called to this part of the tramway before the tunnel was cut.

Robert Clarke, permanent-way engineer to the Kidderminster Tramways Co., gave evidence as to the nature of the soil under the tramline and the work done by the defendants in relation to driving the tunnel. He said that after the work he noticed that there was vibration in the sets.

Under cross-examination, witness said there was observable sinking of the setts before the tunnel was cut, but not to the extent of 2 or 3 in. He thought the hole should have been timbered.

Other evidence of a similar character was given, and the hearing was again adjourned.

On the case being resumed on Thursday, further evidence was called for the plaintiffs to show that the tunnels had caused fractures and cracking in the concrete bed of the tramline, which necessitated renewals. The subsoil beneath the concrete through which the tunnel had been driven was of a loose character, being soft gravel and sand.

Bertie French, installation foreman employed by the plaintiff company, stated that on examining the tramline at Worcester Cross on September 8th, he found that the setts were opening and sinking, a condition of things which was not due to ordinary wear, but to some undermining of the foundation. He assisted in opening up the ground where the defendants' cable had been laid, and when he got into the trench he assisted in cutting the cable until he was stopped by the police.

Mr. Justice Rowlatt : When that cable was covered up would it have been a danger to the tramway ?—Not provided it had not gone wrong.

His Lordship : Why did you dig down to it ?—To put concrete in.

His Lordship : But you did not want to put concrete as deep as that ?—My instructions were to put in 6 ft. of concrete.

HIS LORDSHIP: Was not your object to get down there to cut the cable?—Not to my knowledge.

Several labourers who had worked in repairing the line and digging out the trench gave evidence as to the nature of the subsoil through which the defendants' tunnels were cut.

MR. EDWARD FITZMAURICE, permanent-way engineer for the British Electrical Federation, also gave evidence as to the nature of the soil, and expressed an opinion that the tunnel through which the cable was taken was not a suitable form of tunnel, having regard to the fact that it was beneath the tramway.

The hearing was continued on Friday and Saturday, when Mr. Hugo Young opened the case for the defendants, and called evidence.

On Monday judgment was given for the defendants in the first action by the Tramway Co. against Woodward, Grosvenor & Co., and for the plaintiffs in Woodward, Grosvenor & Co., against the Tramway Co.; damages £100.

(*To be concluded.*)

WAR OFFICE *v.* KIRKLAND & CAPPER, AND J. H. T. WOODD.

(*Continued from page* 569.)

CONTINUING his evidence regarding the lead-covered wire, MR. PATCHELL said that in one instance the wire seemed to have been bent till it had burst, and it was badly knocked about in other places. It had been handled a good many times, but it looked as if the lead was eaten away at one point; it had been "pitted," most likely, by electrolysis through leakage. If carried round rough walling and sharp corners, this lead-covered wire would be cut; the insulation on the wire itself was not good enough to be watertight without the lead covering, and if there was any damp it got through the lead covering to the wire, and the insulation broke down. If the lamps were not changed, and there was no leak on the circuit, the employment of a fuse wire of unduly low resistance did not matter a bit. He did not see how the alleged failure to keep the distribution boards clean could account for the mischief, if the distribution boards had been properly finished and connected up. It was apparently quite a chance that the faults developed where they did, and he had very little doubt that if the installation had been continued with, other faults in it would have developed. If the system was the same throughout, and done at the same time with the same workmen, he thought they were justified in abandoning the whole of the work of that type.

Cross-examined by MR. WALTER, K.C., WITNESS said that large quantities of lead-covered wire were used; he had used lead-covered wire himself, and had had no trouble with it. Its use was provided for in the I.E.E. regulations. Ordinary lead-covered wire was, generally speaking, of a lower grade of insulation, and the insulation more or less depended on the lead covering being kept intact.

There is nothing wrong with lead in plaster provided the work is properly done?—It need not necessarily break down if the work is properly done.

Witness said he did not know of cases of bare wire being laid in plaster. He had seen in very old work cases of insulated wire without lead covering.

Electrically plaster is an insulator?—Yes, of a low quality; it is hygroscopic, that is the difficulty.

Do you know that the Westminster Electric Co. test between poles and not only between the wires and the earth?—I do not.

If in fact the Westminster Electric Co. tested between poles, shorts would be indicated on that test?—If all the switches were put on, certainly.

If those tests took place and the company were perfectly satisfied on those, that would show that at that time there were no shorts between the mains and no shorts to earth?—Certainly.

A test with the megger would show if there was a leakage?—Yes, but a leakage is not shorting.

The hearing was adjourned after the conclusion of the evidence until next term, owing to the illness of Mr. Justice Lawrence.

(*To be continued.*)

ELECTRIC SIGN CASE SETTLED.

A SCHEME for the erection of an electric sky sign was, on April 2nd, the subject of an action before Mr. Justice Darling in the King's Bench Division, in which Wm. Henry Drucquer, a tobacconist, of Elgin Avenue, Maida Vale, and Frederick Edward Coe, of Mount Vernon, Hampstead, sued Jacob Weak, of Berlin, for alleged breach of agreement to provide money for the erection of an electric sky-sign by A. B. Carter & Co., Ltd., in which the parties were jointly interested.

Mr. V. P. Valletta and Mr. H. A. Levinson were for the plaintiffs, and Clavell Salter, K.C., Mr. Cecil Walsh, K.C., and Mr. Perhals Phillips were for the defendant.

MR. VALLETTA said that the agreement sued upon was one made verbally in June, 1911, and the plaintiffs and the defendant, it was said, were to contribute one-third shares of a fund for the purpose of financing A. B. Carter & Co., Ltd., in the matter, each of the parties being directors of the company.

In his defence, MR. WEAK, in the first place, denied the making of the contract as alleged, and alternately gave reasons why, in his view, he was entitled to repudiate it.

After COUNSEL had opened his case, his LORDSHIP saw Mr. Valletta and Mr. Clavell Salter in his private room, and a settlement was arrived at.

It was announced that the settlement put an end to all matters in dispute between the parties without any admission of liability.

LONG EATON GAS CO. *v.* LONG EATON DISTRICT COUNCIL.

ON Friday last, in the Chancery Division, there was opened before Mr. Justice Sargant the action of the Attorney-General at the relation of the Gas Co., which was brought to decide whether the Council were justified in making a differentiation of charges between consumers of their electric supply. The hearing was continued on Monday, and the case stood adjourned to the following day.

ALLIS-CHALMERS CO. *v.* THE FIDELITY AND DEPOSIT CO. OF MARYLAND.

IN the Court of Appeal, on April 3rd, Lord Sumner, Lord Justice Kennedy and Mr. Justice Lawrence gave judgment in this case, on the appeal of the defendant company against a judgment of Lord (then Mr.) Justice Phillimore. The matter was reported in our issue of March 20th.

Mr. Sanderson, K.C., and Mr. McCardie appeared for the applicant company, and Mr. Sankey, K.C., and Mr. Bernard Lailey for the respondent company.

LORD SUMNER, in the course of a lengthy judgment, said the questions were, when was there a concluded contract, and if there was one before April 18th, when did the risk under it commence. As to whether the terms of the contract had been agreed and a bargain completed before April 18th, the commencement of the term of insurance was fixed in the plaintiffs' own proposal. They applied for the insurance to commence from the "issuance" of the bond. Assuming that "issuance" was referred to merely for the purpose of fixing the date to be inserted in the policy—and other modes of fixing it might have been adopted, for example, the date of the policy itself, or the first of the following month, or any other date—still, whatever "issuance" meant, that fixed the date as the commencement of the insurance, and if any other date were inserted, the policy stated something never agreed and in a material respect expressed a contract that never was made. It was this policy alone that was sued upon, and rectification was not asked for. "Issuance," they were told, was a word originating in the United States of America, where both parties had their head offices. It was a new word to his Lordship, and the Court must do the best they could with it. He took it to mean a somewhat imposing kind of issue. The printed proposal form on which the word was used was prepared by the defendants. The actual word "issuance" was inserted by the plaintiffs in writing. The printed form spoke in one place of the bond being executed; in another, of it being issued, and issued to the assured. In ordinary speech the two words indicated different things, and "issuance" corresponded to the latter. If the policy when executed had been left on the table, or given to a clerk to make up for the post, or taken by a messenger to Paris, the last thing that one would have said of this executed policy—an agreement signed by one party only—would have been that it had been issued. It could never have ceased to have been in the defendants' sole control, and they might have recalled, destroyed or altered it at any time. It was no more when sent to the Paris branch by post. He could not think there was any issue or issuance of the policy until at least it was ready for delivery to the opposite party, and actual notice of that readiness had been given to him, or probability, until there was actual delivery. The date mentioned in the policy for the commencement of the risk was the date of the execution of the policy, November 8th, 1912, and the date of its termination unless renewed, November 7th, 1913. But intimation that the policy had been executed and was at the assured's disposal took place at the earliest on March 9th, and unless Lochenies had authority to receive such information on the plaintiffs' behalf, which his Lordship doubted, there was no intimation to the plaintiffs at all till March 18th. That being so the policy stated a term, viz., the commencement of the risk which it was essential to get agreed, and stated it in a way that contradicted instead of conforming to the plaintiffs' proposal. Regarded as a counter offer by the defendants, this term was never agreed by the plaintiffs before the month of April, 1912, and the loss was not covered by the insurance. If the transaction was regarded as a bargain under which the risk was only to begin when the policy was delivered to the plaintiffs, again the loss was not covered by the insurance. In either case the result was the same. At the date of the defalcations by Lochenies the plaintiffs were not covered. The critical matter was whether the term "issuance" was satisfied by the act done by the defendants on March 8th, so as to warrant the insertion of that date in the policy and make the risk commence then, and in his opinion it was not. Accordingly the appeal succeeded.

LORD JUSTICE KENNEDY concurred.

MR. JUSTICE LAWRENCE dissented. It was said that "issuance" must be said to be actual delivery, or at least the passing of the policy out of the power of the insurer, but he could not give the word such a meaning. The defendants read "issuance" as the date of the execution of the bond, and they inserted not only in the bond itself, but in their books, the same date, namely, March 8th, 1912, as the date that the risk commenced, and March 7th, 1913, as the date when it terminated. In his opinion, there was no other way of construing "issuance" in a business sense. He thought the appeal should be dismissed.

By a majority of the Court, the appeal was allowed, and judgment entered for the defendants, with costs.

CHARING CROSS, WEST END & CITY ELECTRICITY SUPPLY CO., LTD. *v.* LONDON HYDRAULIC CO., LTD.

THE appeal of the defendant company against a judgment of Mr. Justice Scrutton, already reported in these pages, was heard in the Court of Appeal this week. The appeal was dismissed with costs.

PARLIAMENTARY.

London United Tramways Bill.

The Bill promoted by the London United Tramways Co. came before the Select Committee of the House of Commons, presided over by Mr. Walter Guinness, on March 31st and April 1st and 2nd. The Bill provides for agreements between the company and other bodies for the working of tramways and light railways, provision for through bookings, the carrying of a greater number of passengers on tramcars, the running of trailer cars, &c.

Mr. Balfour Browne, K.C., appeared for the promoters, and explained that the opposition was in respect of the powers sought to enable the company to enter into agreements with the various local authorities, and to enable each local authority, if it thought fit, to postpone, for a period not exceeding 42 years, the date at which it had a right to purchase the tramways in its area. One clause provided that as regarded Surbiton, Isleworth, Teddington, Hampton Wick and Twickenham, who were concerned in the Hampton loop section, neither could enter into an agreement without the consent of the others.

Mr. J. Devonshire, managing director of the company, gave evidence in support of the Bill, and said that its main object was to enable bargains to be made with the local authorities, under which, in return for an extension of the time of purchase, road widening and improvements might be desirable.

In cross-examination, by Mr. Fitzgerald for the Middlesex County Council, witness denied that the object was to get an extension of period to enable the company to deal with its financial burdens.

Mr. Fitzgerald contended that if the power was granted it would enable a number of local authorities to override the general Tramway Act, and the action of one authority might prejudically affect the interests of others.

The Committee struck out the portion of the Bill dealing with power to make bargains with the local authorities.

Evidence was then heard for a clause giving the company power to use trailer cars, and Mr. A. L. C. Fell, manager of the London County Council Tramways, expressed the view that congestion of traffic was decreased by the use of trailers.

The Metropolitan Police authorities opposed the application on the ground that it would result in further congestion.

The Chairman said the Committee had open minds on the question, but they were not prepared to give the company power to run trailers in contravention of any existing agreement with a local authority.

Mr. Macassey said that the tramways of the company ran through the districts of 23 local authorities, but there were only agreements of the nature referred to with Wimbledon and Kingston.

The Committee eventually passed the clause subject to conditions. These were that the question of running trailer cars at Ealing should be left to the Board of Trade; that trailers should not be used in the neighbourhood of the depôts at Surbiton; and that the Board of Trade should consult the local authorties of Teddington and Twickenham with regard to the running of trailers in those districts.

The Bill, as amended, was ordered to be reported for third reading.

Houghton Gas and Electricity Bill.—The Standing Orders Committee has agreed to suspend the Standing Orders to allow of the promoters inserting an additional provision.

Second Reading.—In the House of Commons, on April 1st, the L.C.C. (Tramways and Improvements) Bill was read a second time.

BUSINESS NOTES.

Consular Notes.—CHILE.—In a recent report the British Consul at Valdivia states that the business in machinery, for the obvious reason that it necessitates a large lock-up of capital, is in the hands of local branches of large Valparaiso and Concepcion firms. Manufacturers who address the Valdivia Consulate with a view to securing local representation for the sale of their machinery, are in most cases merely wasting time; they should address Valparaiso firms, or their British or Continental shipping agents, with the object of securing representatives for the sale of their machinery throughout the whole of the country. As regards catalogues, they must bear in mind that the provinces of Valdivia and Llanquihue are largely populated by Germans and the descendants of German settlers; if they have no Spanish literature to dispose of, they should send German, or even French (there are a number of wealthy and influential Basque merchants established in the neighbourhood), resorting to English as the last extremity, for among the Chilian-Germans English is little known. The German goods are preferred, and that the many local German merchants should have inculcated the natives themselves with a liking for their wares, is only natural; this may be better understood when it is stated that for shipping purposes, whatever be the line of goods required, a knowledge of the German language is as serviceable as a knowledge of Spanish. Of the three largest firms established in Valdivia, however, two are British and one American (all three have important London connections), and these three firms have a large *clientèle* composed in the main part of German merchants (wholesale and retail) and German farmers.

AFGHANISTAN.—In a recent comprehensive report on the trade of Afghanistan, a Special Commissioner of the United States Government states that interesting evidence as to the awakening of the closed country of Afghanistan to modern progressive ideals of civilisation is to be found in important construction works now being carried out under circumstances of great difficulty, especially those connected with costly and difficult transport of needed machinery and other material. The most interesting development of this sort is a project now under way for transmitting electrical energy at 14,000 volts from a waterfall about 120 ft. high to Kabul, the capital, situated about 10 miles away. This development is in charge of an American engineer, Mr. A. C. Jewett, formerly an employé of the General Electric Co., Schenectady, N.Y., who was more recently chief engineer for the important hydro-electric development in the State of Kashmir, India.

This hydroelectric scheme will cost between £100,000 and £125,000 when completed, of which about £60,000 will be spent for machinery and materials. The water-power obtained will be used for distributing cheap electrical energy to the gun factory, shoe factory, projected woollen mill, and other industries at Kabul, under the control of the Government of His Majesty the Amir; also for electric lighting of the royal palace, other residences, and Government offices and streets. The machinery and material, including switches, generators, steel towers and copper-covered steel wires, are being imported chiefly from the United States. The contract for this work is held by the Bombay firm of F. and C. Osler, Ltd. (also of Broad Street, Birmingham, England). The development should be of particular benefit to the industries of Kabul, which are now greatly handicapped by the excessive cost of fuel. There are no coal mines in the country and wood is also very scarce; for factories at Kabul wood has to be carried for many miles on the backs of camels. The difficulty of transporting the needed machinery and ironwork through the Khyber Pass and over the almost impassable road, a large part of the way to Kabul, is greatly delaying the project, which may require several years more to complete, although work was begun over a year ago. The attempt to use motor lorries imported for this purposes has failed, owing to the bad condition of the road to Kabul, and it is only by use of elephants that the heavy and bulky articles required can now reach Kabul. Local labour, under the direction of the American engineer and two well-qualified assistants, is being used on this work.

POLAND.—The British Consul in Poland reports that trade between that country and the United Kingdom appears to be increasing, if reliance can be placed on the numerous new lines of business which appear to be connecting the two countries. The attempts which have been made during the last few years to open direct connections without the intervention of the German middlemen appear to be succeeding to a certain extent, and there is much evidence to show that a sentiment favourable to such a condition of affairs is gaining ground, both locally and in the United Kingdom. A possible means of assisting these aspirations may be found in altering the system of collecting acceptances and drafts, which, at present, requires the medium of one of the German banks, involving the payment of two or three bank commissions, and a similar number of losses by exchange from sterling into marks, from marks into roubles and *vice versâ*. So long as such acceptances are drawn in Russian currency, the Imperial State Bank in Warsaw, whose commission is very small, is willing to make the collection and remit by cheque on London in sterling. This method has the advantage of circumventing various expedients adopted by unscrupulous persons for delaying or not meeting their obligations, as in the event of the acceptances not being met at once, their credit is cut off and cannot be re-established for some years. It is not necessary for British firms to keep any deposit for this purpose at the State Bank, but this bank will not discount any such bills unless the British firm has a branch in the Russian Empire and keeps a current account of proportionate sums in the bank itself.

TURKEY.—The British Consul at Smyrna reports that telephones have been put up between the police stations of that town and all the surrounding suburbs; further, a few firms have installed telephones between their head and other offices. The suburb of Boudjah has had public lighting by electricity arranged in the village, through a British firm. The municipalities of Odemish, Baindir and Kirkagatch have also had telephones put up in their towns by the same British firm. The Smyrna-Gueuztepe (Belgian) Tramway Co. is shortly to electrify its lines and light by electricity the route followed. Concessions have also been granted for an electric tramway from Smyrna to Nymphio and round the back of the town to Smyrna and for the electrification of the Quay Co.'s tramways. The concession holders are, it is understood, all ready to consider offers of firms that wish to participate in the exploitation of these projects. All those applying for concessions must appoint a reliable local agent to watch matters if they mean their application to be taken seriously.

Elsewhere in his report the Consul says that the year 1912-13 saw several exploits of the Black Band, that has for so many years operated from Smyrna and Constantinople, and has found victims in every country with which it has done business. Its methods are well known, but the caution given in previous reports needs to be repeated. The various tricks of this swindling confraternity may be tabulated as follows:—

1. Dealing honestly with one or two well-known firms and giving them as references.
2. Giving as references various bogus commercial inquiry offices

3. Giving each other as references and adopting false names, false addresses, &c.

4. Forging bills of lading, for goods ordered in Turkey when payment or part payment on receipting of bill of lading has been agreed to.

5. Sending stones, dirt or other rubbish instead of goods.

6. When importing goods from the United Kingdom, making a part payment on giving the order and then after receiving and selling the goods and being pressed for the remainder of the payment, forcing the foreign firm's lawyer to accept 20 per cent. rather than lose the whole amount by putting the swindler into bankruptcy, a proceeding which always results in finding that all the man's possessions have been long ago transferred to other names.

The British Chamber of Commerce of Smyrna has published the names of certain prominent members of the Black Band, and it seems largely due to its efforts that the Black Band has somewhat neglected the United Kingdom recently.

NORWAY.—The American Consul at Stavanger reports that the market for electrical supplies in the Stavanger Consular district is worthy of close investigation before a firm attempts to enter the field, because the laws respecting installation of electrical equipment restrict the use of many specialities. The American Edison base standard type of sockets is used. The municipal electric light plant, under the supervision of Driftsbestyrer Nannestad, is required by city ordinances to approve the electrical supplies before they may be installed. Mr. Nannestad has expressed to the American Consulate his willingness to examine any samples of American electrical specialties sent him, and will in return be pleased to report to interested firms whether such submitted supplies meet with the city's approval. If they do not he will endeavour to point out wherein they are objectionable. English may be used in any such correspondence. This same city bureau, besides supervising the installation of electric apparatus, retails supplies to the trade and is naturally interested in making its purchases wherever it can do so to best advantage. The keen competition in supplying the local market must be kept in mind, especially on account of the activities of German and Swedish firms. Practically no electrical supplies in use locally are manufactured in Norway. The foreign firms supplying this market have their interests looked after by personal representatives—either travelling salesmen calling on the trade with samples or branch offices with a stock of goods. One company also has offices in Christiania, Bergen, and Trondhjem. Some of the goods are supplied through agencies located in Christiania, but even where such a sales arrangement exists, representatives are usually sent into this territory. The buildings in this district are mostly of ordinary frame construction. Although a more fireproof type of structure, either of brick or cement, is now favoured, the wiring is carried in iron conduits. In all the newer buildings, the wiring is concealed within the walls or ceilings. There are no steel-frame construction business blocks, and not a dozen buildings in the city have more than two full stories. Electric power is furnished cheaply throughout the district, due to the many available waterfalls. For this reason electric lighting is within reach of the poor, and this market is a good one for all kinds of electrical supplies. Stavanger is equipped with alternating current furnished day and night. The lighting circuits are at 130 volts and power up to 230 volts, 50 cycles per second.

Canada.—The *Canadian Electrical News* states that the Northern Electric Co., Ltd., recently incorporated with a capital of $10,000 000, will absorb the Northern Electric and Manufacturing Co., Ltd., and the Imperial Wire and Cable Co., Ltd., Montreal. "Both of the latter companies have been in working alliance, and they will now be merged under the new name, the present names of the two concerns being dropped when the new company comes into working order."

British Trade with New Zealand.—Mr. W. G. Wickham, His Majesty's Trade Commissioner in New Zealand, attended at the offices of the London Chamber of Commerce, 97, Cannon Street, E.C., last Monday and Tuesday, April 6th and 7th, for the purpose of conferring with firms interested in trade with New Zealand. Mr. Wickham is anxious to obtain the views of firms as to any matters of interest he may usefully investigate, and to afford all possible information as to trade in New Zealand.

Catalogues and Lists.—The Cable Accessories Co., Ltd., Tividale, Tipton.—Leaflet No. 35 contains illustrations and prices of a number of lantern fittings for half-watt lamps for street, station and shop lighting; No. 32 shows ironclad double-pole switch and fuses for street lighting fittings.

The Solenoid Regulator Co., Highgate Square, Camp Hill, Birmingham.—New price list of field rheostats wound with non-corrosive wire on porcelain tubes. Sketches and dimensions are given.

Messrs. Pitters Ventilating and Engineering Co., Ltd., 20, Bishopsgate, London, E.C.—Catalogue Section E (8 pages) giving illustrated particulars and tabulated prices of their silent-running "Multiblade" fans for desk, bracket, pendant, ceiling and other service. Automatic shutters and fan starters and regulators are also shown.

Messrs. Mather & Platt, Ltd., Manchester.—Twelve-page booklet describing their electrolyser for the production of sodium hypochlorite for bleaching and other purposes.

Messrs. Scholey & Co. Ltd., 151, Queen Victoria Street, London, E.C.—Supplementary price list of electric fans, desk, oscillating, ceiling and port-hole types for the coming season.

Mr. E. C. Amos, 22, Martin's Lane, Cannon Street, London, E.C. (A. Borsig, Berlin).—18-page pamphlet, also loose illustrated leaflets, giving a full description of the "Crystal" system of automatic water supply by means of "Crystal" electrically-driven centrifugal pumps. Copies will be sent on application.

Fiberloid Co., Ltd., 92, Carver Street, Sheffield.—Small 16-page pamphlet giving particulars and prices of their fiberloid (celluloid), horniloid and vulcanised fibre for electrical purposes.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Four new publications have been issued as follows:—Angold Bulletin 6A, fully describing the "Angold" Magazine Flame Arc Lamps; C. 1791, giving particulars of the various types of "Demon-Grip" continuity fittings; L. 1805 concerning the "Witton" 4½-volt Dry Battery, and L. 1782 describing the "Geeko" Companion Set.

Book Notices.—We have received a copy of the new issue of the "Newcastle and Gateshead Chamber of Commerce Year Book and Commercial Review (1914)," which has been published for the Chamber by Messrs. Sells, Ltd., London, at 2s. 6d. It contains maps of Newcastle-on-Tyne and Wallsend, a plan of the River Tyne, with interesting views of the river, &c. The collieries, industries, works, &c., of the district are very fully described, and there are a number of illustrated articles relating to particular firms, their works and manufactures. There is also a classified Merchandise and Trades List.

"Electric Car Maintenance." By Walter Jackson. Price 12s. 6d. net. "Elementary Magnetism and Electricity." By C. M. Jansky. Price 6s. 3d. net. London: Hill Publishing Co., Ltd.

"Report of the University College (University of London) Committee, 1913-1914." London: The University.

"Annales des Postes, Télégraphes et Téléphones." March. Paris: A. Dumas. Price 10 fr.

"La Lumière Electrique et ses Différentes Applications au Théâtre." By V. Trudelle. Paris: Dunod & Pinat. Price 10 fr.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol XXXI. March. Brussels: E. Bruylant. Price 1 fr. 75.

The *Scientific Review* is a new "non-technical, popularly-written review of all that is newest in Science and Technology throughout the world." For its objects we have the fullest sympathy; its contents range from wireless telegraphy to sewage treatment, and a great variety of subjects is dealt with more or less fully. But in spite of the advance of science into every domain of modern life, it is manifest rather by its products and results than by its methods to the layman, who as a rule cares little about the means by which his comfort is enhanced, and is easily bored by an explanation of the how and why. Our new contemporary, therefore, will have an uphill fight, in which we wish it every success.

Private Arrangements.—Marbro, Ltd., electrical accessories manufacturers, 22, Belsham Street, Morning Lane, Hackney, N.E.—The creditors interested herein were recently called together when the Receiver for the debenture-holders reported that he had also been appointed to act as liquidator of the company. He presented a statement of affairs which showed liabilities to cash creditors of £1,067 while there was £940 due to the trade. In addition there were preferential claims for £60, first debentures for £1,000, and second debentures for £250. The assets were estimated to realise £2,676, and consisted of stock in trade, £600; machinery, &c., £1,500; tools, £76; furniture and fixtures, £100; and sundry debtors, £400. It was stated that if the company was wound up compulsorily, the assets would probably not realise anything like the amount at which they were set down. An offer had been received to purchase the business for £1,000, and in addition an undertaking would be given to pay the trade creditors in full by four equal instalments, the first to become payable on April 1st. In the event of the offer being accepted, the second debenture-holders would defer their claims, and the cash creditors would do the same. After a short discussion, the offer made was unanimously accepted.

Trade Announcements.—The Atlas Electrical Co., Ltd., have removed to larger premises at 58, High Street, Charing Cross Road, W.C., where they will carry large stocks of "Atlas" metal-filament lamps and electrical accessories of every description.

Messrs. F. K. Osterman & Co., of 5, Bond Street, Vauxhall, London, S.W., are just opening an extended electrical department, with showrooms, carrying stocks of electrical machinery and accessories. Installation and dynamo and repair work are features of the business.

The Hart Accumulator Co., Ltd., announce that Mr. T. H. Valentine, of 38, Dame Street, Dublin, does not now represent them as their agent in Ireland.

Mr. Geo. Cooper, electrician and contractor, late of White Hart Street, has purchased the entire stock of Mr. John Wooley, and has removed to his premises at 32, Clumber Street, Mansfield.

Messrs. John Dugdill & Co., of Failsworth, have opened large show and salerooms for their patent movable fittings at 41A, Mosley Street, Manchester (opposite the Chamber of Commerce). They invite firms to send them catalogues (with discounts) of allied goods, not movable fittings.

The Electrical Supplies Co. have removed from Cheapside to larger premises at 53, Victoria Street, Westminster, S.W.

Bankruptcy Proceedings.—C. Blake (Bilston Electrical Co.), electrical engineer, Bilston.—Last day for receiving proofs for dividend, April 22nd. Trustee: Mr. S. W. Page, 30, Lichfield Street, Wolverhampton.

Dissolutions and Liquidations.—The Electromobile Co., Ltd.—This company is winding-up voluntarily, with Mr. Stewart Cole, of Sardinia House, Kingsway, W.C., as liquidator. A meeting of creditors is called for April 16th at the Connaught Rooms, Great Queen Street, W.C.

Limbrey, Martin & Co., electrical engineers and contractors, 38, Gondar Gardens, West Hampstead, N.W. Messrs. F. E. Limbrey and A. R. Martin have dissolved partnership as from December 31st, 1913. Mr. Limbrey will attend to debts, and carry on the business under the style of Limbrey & Co., at the same address.

LIGHTING and POWER NOTES.

Bacup.—Street Lighting.—The T.C. has decided to electrically light the whole of the Rochdale Road route within the borough. It was also resolved to supply electricity for power and lighting purposes to Messrs. John Hargreaves, Ltd. Tenders are to be obtained for the overhead equipment for the supply of electricity to street lamps, to be suspended from the tramway wires.

Bawtry and Barmborough.—Street Lighting.—The Doncaster R.D.C. has decided to apply to the L.G.B. for powers to carry out a street lighting scheme in the district with electricity obtained from the new colliery company. Messrs. Best & Turner, of Bradford, are to be asked to provide an E.L. scheme for Bawtry and Austerfield, and district.

Bootle.—Street Lighting.—The T.C. has decided to light Aintree Road by electricity at an estimated cost of £377.

Bradford.—The Electricity Committee has sealed an agreement with the Yorks. E.P. Co., with reference to a supply of electricity in bulk to Messrs. Waterhouse, of Norwood Green.

Chorleywood.—The U.D.C. has sealed an agreement with the Colne Valley E.S. Co., relating to a supply of electricity for the district, and which empowers the Council to purchase the undertaking within 21 years, or at the expiration of any subsequent seven years.

Continental Notes.—Italy.—La Società Italiana per il Carburo di Calcio last year produced 33 tons of calcium carbide at its works at Papigno and Narni. The company, in addition to its manufacturing business, also supplied approximately 32 million kw.-hours from its hydro-electric stations to the Gas Co. at Rome, and has contracted to supply the Società Volsina d'Elettricita with power to the extent of 2,500 kw. as from the commencement of 1915, increasing to 10,000 kw. in 1922.

Norway.—The municipality of Gloppen, in Western Norway, has recently acquired the water rights of the Breim River, which is estimated to give some 9,000 h.p. It is intended to develop a small power for local use, and the remainder when large consumers require it.

Switzerland.—A syndicate, including the Rhätischen Bahnen, the Kanton Graubunden, the Motor-A.G., Baden, and the Eisenbahnbank, Basle, has been formed to utilise the water-power of the upper Albula, the Julia and the Landwasser at Mühlen. An advantageous concession has been arranged with the Communes of Mühlen and Roffna, and the consent of the Grisons Canton is about to be given. It is expected that the municipality of Zurich will interest itself in the scheme. It is proposed to erect a dam collecting 2,300 million cb. ft. of water. A large hydro-electric station will be built, and the lower lying country will be safeguarded from damage by flood.—*E.T.Z.*

Cranbrook (Kent).—Overhead Wires.—The R.D.C. has referred the application of Messrs. J. B. Saunders & Co., of Westminster, for permission to utilise overhead wires for an electricity supply for Cranbrook and Hawkhurst, to the respective Parish Councils.

Dumbarton.—Electricity Works Fire.—According to the *Belfast Evening Telegraph*, the Dumbarton T.C.'s electricity works was damaged by fire on April 1st; the damage is estimated at £1,200.

Eastbourne. — Proposed Mains Extensions. — The E.L. Committee has recommended the T.C. to adopt the borough electrical engineer's report, proposing an expenditure of about £4,656 on alterations to the distributing system.

Flockton.—L.G.B. Inquiry.—An inquiry has been held by Mr. H. R. Hooper into the application of the U.D.C. to borrow £480 for the purpose of public lighting; the Council is proposing to adopt a scheme of the Yorks E.P. Co., and is also considering a scheme for private lighting.

Frant.—Proposed E.L.—The Tunbridge Wells T.C. has asked the borough electrical engineer to report on a request by Messrs. Saunders & Co., for terms for a bulk supply of electricity to Frant.

Leeds.—Electricity Works Extension.—The City Council on Wednesday, last week, gave its approval to the £200,000 scheme for the extension of the electricity works.

Leyton.—There is a surplus of £1,188 on the electricity undertaking for the year ended March 31st last, as compared with an estimated deficit of £368. The surplus for the year ending March 31st, 1915, is estimated at £565.

London.—Marylebone.—With regard to the alleged failure of the Electrical Power Storage Co. to properly carry out its maintenance contract in respect of the Rathbone Place storage battery, the Electrical Supply Committee states that the company is not disposed to carry out the necessary works, alleging that the bad state of the battery is due to the Council's improper usage. The Committee has decided to submit the matter to arbitration.

L.C.C.—The report of Mr. C. H. Merz, bearing on the future of the supply of electricity in London, has been received by the Council and is to be placed on sale.

Lurgan.—B. of T. Inquiry.—Mr. G. B. Deane held an inquiry last week into the application of the U.D.C. for authority to expend £12,000 on an E.L. scheme. The Lurgan Gas Light and Chemical Co., and the Ratepayers' E.L. Committee opposed the scheme.

Mansfield Woodhouse.—Street Lighting. — The U.D.C. has decided to light Morven Avenue with nine double 50-c.p. electric lamps, the current to be supplied by the Mansfield Corporation.

Middleton.—Proposed Loan.—The T.C. has been recommended to apply for a loan of £6,000 for extensions at the electricity works, to accommodate transformer plant in connection with a supply of electricity from Manchester for distribution in the borough.

New Zealand.—The Dunedin Corporation proposes raising a loan of £150,000 in connection with the extension of its electricity undertaking, and for the provision of an auxiliary plant; this, however, has been anticipated to the extent of about £112,000, so that only about £38,000 remains to be spent.—*Board of Trade Journal.*

Oulton Broad.—Prov. Order.—The Electricity Co. having asked the B. of T. to dispense with the consent of the U.D.C. to a prov. order for electric supply, a meeting has been arranged between the Council and the company, and the Council has decided to ask for a clause giving it power to acquire the undertaking at any time after 15 years from the granting of the order, and, if desirable, to effect a compromise with regard to the period named.

Redcar.—Proposed E.L.—The U.D.C. has appointed Messrs. A. W. Valon & Son to advise it generally on the question of E.L.

Rochester.—Organ Blowing.—Work has been commenced on the substitution of electric power for the hydraulic power used for the organ in Rochester Cathedral; the old plant obstructed three arches in the crypt, which will now be cleared, the electric motor being placed in an adjoining arch.

Saddleworth (near Oldham).—Proposed E.L.—A meeting of the U.D.C. and large mill owners has appointed a Committee to formulate an electricity scheme for the district.

Tenby.—Proposed E.L.—The T.C. has decided to apply to the B. of T. for a prov. order for E.L. in the borough.

Treeton.—Street Lighting.—The P.C. has accepted the terms of the Rothervale Colliery Co. for a supply of electricity for new public lamps in the village at 2d. per unit.

Turton (Lancs.)—Cottage Lighting.—A canvass is being made to see what support can be got for a scheme for the lighting of small cottages by electricity at a fixed charge of 7s. per quarter, with no restriction as to consumption.

Warrington.—Loan Sanction.—L.G.B. sanction has been received for the borrowing of £14,531 for extensions of plant and buildings at the electricity works.

Wick.—The T.C. has granted wayleaves to Messrs. Edmundson's Electricity Corporation for an electric lighting undertaking in the town.

York.—Workhouse Lighting.—In consequence of the saving effected by the use of electricity in some departments of the workhouse, the B. of G. intends, when the opportunity arises, to install E.L. throughout the building.

TRAMWAY and RAILWAY NOTES.

Australia.—The financial statement of the Adelaide S.A., Municipal Tramways Trust for the half-year ended January 31st last, shows total revenue receipts amounting to £163,720; working expenses, £101,477; and a balance to credit of this account of £62,243. The full statutory charges for the half-year amounted to £61,153, and the balance of net revenue was £62,629, leaving a surplus for the half-year of £1,476. The reserve for renewals now amounts to £58,039, and for insurance to £6,004; the sinking fund account amounts to £86,346. The gross revenue was £8,277 more than in the preceding half-year. We are indebted to Mr. W. G. T. Goodman, the chief engineer, for these particulars.

Aberdeen.—MAGNETIC BRAKES.—On the recommendation of the tramways manager, the Corporation is to purchase [illegible] brakes for eight of its tramcars from the B.T.H. Co., at a cost of £[illegible].

Bradford.—YEAR'S WORKING.—The total receipts of the Corporation tramways for the past year amounted to £308,138, against £289,616 in the previous year. The passengers carried numbered 67,[illegible],839, an increase of 5,615,863, the car-miles run were 6,[illegible]878, an increase of 281,317, and the receipts per car-mile were 11·82d., against 11·63d.

Continental Notes.—NORWAY.—A company has been formed with £17,500 capital to build an electric railway ("Ekebergbanen") to Ljan. The line will be 3½ miles in length, and will work in traffic connection with one of the two tramway companies now operating in Christiania. The constructional cost is estimated at £47,500, the car-miles at 280,000 per annum, the receipts at £12,500 per annum, and the profit, after allowing interest and depreciation, at £5,000 per annum.

Crompton.—The Tramways Committee has decided to interview the Oldham Tramways Committee on the question of the extension of the Oldham system, and the obtaining of powers to connect the tramways between Shaw and Newhey.

Gateshead-on-Tyne.—The T.C. is to withdraw its opposition to the N.E. Railway Co.'s Bill for the running of railless electric trolley cars over the high-level bridge, subject to protective clauses relating to road maintenance being inserted.

Glasgow.—ALL-NIGHT SERVICE.—The Tramways Committee has decided to begin a service of all-night cars on 16 of its routes in the autumn.

Halifax.—YEAR'S WORKING.—The income of the Corporation tramways for the year ended March 31st, 1914, was £109,666. The expenditure was £95,416, leaving a profit £14,250. The passengers carried numbered 20,276,077, and the car-mileage was 2,242,086 miles.

Leeds.—ANNUAL ACCOUNTS.—The total receipts of the T.C. tramways department for the year ended March 31st, 1914, were £427,261, an increase of £15,930 over the previous year. Ninety-four million passengers were carried during the year, and the car-mileage was 9,204,331 miles. The receipts per car-mile averaged 11·145d.

Liverpool.—NEW TYPE CARS.—The Tramways Committee has adopted a new type of tramcar which is ultimately to supersede the present type of rolling stock. The new type was designed by Mr. C. W. Mallins, the general manager, and is an improvement on the present stock in comfort and appearance. The double entrance and exit system is retained, and accommodation is provided for 80 people. The passages between the seats both on top and inside are wider, and the lighting and ventilation are on an improved plan.

Newcastle-on-Tyne.—RATE RELIEF AND NEW CARS.—At a recent meeting of the City Council, called to consider the municipal rates, Councillor Adams criticised the action of the Tramways Committee in granting £18,000 in relief of the rates, and, at the same time, seeking powers to borrow £12,240 for the purchase of new cars. Ald. Rodgers said the proposal to acquire new cars was an outcome of the extensions that had taken place, or were likely to take place in the future, if they got their cars running to Benton; they were not replacing old cars, and the expenditure, as in laying the lines would be capital expenditure, and, fairly, ought to be defrayed out of borrowed money. In the last seven years they had rebuilt 51 cars out of revenue and reserve, and had built 15 absolutely new cars, but they could not go on building out of their revenue. Mr. D. Adams said, despite the statements made by Ald. Rodgers, he was still going to move that the report of the Tramways Committee be sent back for further consideration. Ald. Rodgers said it was folly to think that the present-day ratepayers should be taxed in order that the ratepayers of 15 or 20 years hence should be given a free tramway service. That would be what they would be doing if they were to build new stock out of revenne. The amendment was rejected, and the report was carried.

New Zealand.—The Dunedin Corporation proposes to purchase three electric omnibuses for use in connection with the tramway system, to double a portion of the present tramway line, and to construct additional cars.—*B. of T. Journal.*

Rochdale.—YEAR'S WORKING.—During the year ended March 31st, the receipts on the Corporation tramways, including the Heywood system, amounted to £83,176, an increase of £2,830 over the preceding year. The passengers carried numbered 14,581,777, an increase of 844,625, and the mileage run was 1,788,030, an increase of 39,063.

South Shields.—YEAR'S WORKING.—During the year just ended, the number of passengers carried was 1½ millions in excess of the previous year, the receipts increased by £1,000, and the car-mileage by 83,000. As the result of adopting 1d. [illegible] tickets, 12,000 tickets a week were sold, as compared with [illegible] 1½d. return tickets per week formerly; in the same way, by dropping the price of four-journey tickets from 3d. to 2d., the number per week increased from 280 to 1,600. Application is to be made for a provisional order to extend the tramways to the borough boundary at Harton and to the top of Mile End Road.

Wallasey.—TRAMWAY EXTENSIONS.—The Tramways Committee has recommended that provision be made in the proposed Bill for the construction of a tramway from New Brighton Pier, along the promenade to Harrison Drive, and to the existing tramway at Grove Road, and for a service of motor-omnibuses.

Wigan.—YEAR'S WORKING.—The income of the T.C. tramways department for the year just ended was £78,000, as against £71,289 for the previous year. The car-mileage was 1,500,846, an increase of 51,658.

Wimbledon.—The T.C. Law Committee has decided to withdraw its opposition to the L.U.T. Bill, 1914, provided that the tramway along part of St. George's Road is abandoned, and that trailer cars shall not be run within the borough, except at certain times, without the Council's consent.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The public has made little use of the coastal stations, which are costing for maintenance at the rate of something like £800 a year each, and collecting a revenue of scarcely £80, on the average. The P.M.G., therefore, has reduced the charges from 10d. to 6d. a word, to increase the traffic.

Berlin-Milan Telephone.—The telephone service between Berlin and Milan was opened on Wednesday last week. On Tuesday this week, it was extended to Rome and eight other towns.

Imperial Wireless System.—On Thursday last week, the last public sitting of the H. of L. Committee on Lord Murray's transactions, was held, and the accusing counsel delivered their closing addresses.

Semi-automatic Telephony.—It is stated that the semi-automatic telephone exchange at Dresden is the largest of its kind in the world, being capable of affording provision for up to 100,000 subscribers; the number of connections at present is 16,000. The Dresden exchange was commenced shortly after the opening in 1912 of a semi-automatic exchange at Posen; two further exchanges on the semi-automatic system are being erected at Liegnitz and Leipsic respectively.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—April 15th. Installation of electrically controlled clocks in the new station for the Joint Station Committee. Specifications (10s. 6d.) from Mr. J. A. Parker, 80, Guild Street.

Australia.—May 12th. P.M.G.'s Department. Standard batteries for all States; Schedule No. 1,010. See "Official Notices" April 3rd.

VICTORIAN RAILWAYS.—May 13th. One hundred enclosed arc lamps. Deposit £5. Mr. E. B. Jones, acting secretary.

May 20th. Victorian Railways Commissioners. One three-phase slip-ring electric motor and accessories. Deposit £1. Local representation. A specification can be seen at the B. of T. Commercial Intelligence Department in London.

MELBOURNE.—April 27th. Overhead travelling cranes for sub-stations and lifting tackle for power stations, for Melbourne Suburban Railways. See "Official Notices" April 3rd.

Ballymena.—April 11th. B. of G. E.L. installation at workhouse and supply of steam engine, 20-KW. dynamo and steam pumps. Specification from Mr. F. D. Brown, Engineer, 93, Ann Street, Belfast.

Belgium.—May 6th. The municipal authorities of St. Nicholas (Province of Liége) are inviting tenders for the concession for the public and private electric lighting of the town.

Bootle.—April 22nd. Corporation. Supply of two 500-600-KW. rotary converters, transformers and switchgear for the electricity department. Forms of tender from the Borough Electrical Engineer, Electric Light Station, Pine Grove.

Bosnia.—DOBOJ.—April 20th. Municipal electric light installation for Doboj and Usora, comprising supply and erection of driving machinery, electrical equipment of the generating station, supply and erection of pumps and motors, complete distribution network for Doboj and Usora. Particulars from the Stadtgemunde, Doboj, Bosnia.

Bradford.—Corporation. Fifty tramcar bodies.

Bristol.—April 15th. Arc lamp carbons and incandescent electric lamps for a year for the Docks Committee. Mr. W. W. Squire, Engineer, Cumberland Basin.

Devonport.—April 27th. Corporation Gas Department. Electrically-driven jib crane and coal hoppers. Specification, &c. (£1 1s.), from Mr. I. Carr, Widnes

Doncaster.—April 17th. Corporation. 1,200 tons of steel rails, also fishplates and soleplates, for Tramways Department. Specification (10s.) from the Borough Engineer, 3, Priory Place.

Dublin.—April 17th. Corporation. Twelve months' supply of arc lamp carbons. See "Official Notices" April 3rd.

Edinburgh.—April 20th. Corporation. Extension switchboard, for McDonald Road station. See "Official Notices" April 3rd.

Farnworth.—April 18th. U.D.C. Switchgear and cables. Mr. H. J. Hutchinson, Engineer, Electricity Works.

Germany.—May 1st. The municipal authorities of Farmsen, near Hamburg, are inviting tenders for the supply of 8,200 metres of electric cables.

Leeds.—May 11th. Corporation. Steam turbine, three-phase alternator and exciter, 12,000-KW., 1,000 to 1,500 R.P.M., and condensing plant. See "Official Notices" April 3rd.

E.L. installation, West Leeds Working Men's Club. The Secretary.

Leyton.—The Borough Surveyor has been instructed to invite quotations for the wiring of the Isolation Hospital.

Limerick.—April 17th. Corporation. Electrical accessories, service boxes, cables, &c. See "Official Notices" April 3rd.

London.—L.C.C. April 22nd. Installation, 218 wiring points, 283 lights, at Wilson Street Elementary School, Islington, N. See "Official Notices" April 3rd.

FULHAM.—April 29th. B.C. Coal for the electricity department for 12 months. Borough Electrical Engineer.

Manchester.—April 21st. Corporation. Power-driven rail-bending machine. Specifications, &c., Mr. J. M. McElroy, General Manager.

New Zealand.—May 11th. Hydro-electric and sub-station plant for Tauranga. Specification, &c., from Messrs. H. W. Climie & Son, engineers, Tauranga. Deposit £2.

WELLINGTON.—April 15th. Public Service Stores Tender Board. 14 miles of H.D. bare aluminium cable, also binding wire, aluminium connectors and terminals, porcelain insulators, dry cells, wall telephones, &c. Particulars can be seen at the Commercial Intelligence Department of the Board of Trade, London.—*B. of T. Journal.*

Norway.—April 11th. Norwegian State Railways. Galvanised iron wire, insulated copper wire, dry batteries and insulators. Local representation. Particulars can be seen at the Board of Trade Commercial Intelligence Department in London.

Norwich.—April 14th. Corporation. Coal (12,000 tons) for 12 months for the electricity works. City Electrical Engineer.

Nottingham.—April 16th. Twelve months' supply of stores for Corporation electricity department. See "Official Notices" April 3rd.

Rathkeale (Co. Limerick).—April 18th. Gas engines and suction plant, dynamos, storage battery, switchboard, overhead lines and street lamps, for Rathkeale Electric Lighting and Power Co. See "Official Notices" March 27th.

Rochdale.—April 15th. Corporation. Boiler feed pumps and crane. See "Official Notices" March 27th.

Shipley.—April 16th. 1,500 yards of double tramway, for the U.D.C. Specifications, &c., from Mr. W. H. Dawson, Engineer and Surveyor, Council Offices.

Spain.—April 20th. The municipal authorities of Orgaz (Province of Toledo) are inviting tenders for the concession for the electric lighting of the town during a period of 13 years.

The Spanish Ministry of War in Madrid has just invited tenders for the supply of the current required for the electric lighting of the Military Barracks at Ceuta.

Torquay.—April 20th. Corporation. Two water-tube boilers, fuel economiser, steam pipes, valves, &c. See "Official Notices" April 3rd.

Tunbridge Wells.—April 30th. Corporation. 4,000 tons of small coal for use with Underfeed stokers. Borough Electrical Engineer.

April 22nd.—Corporation. 300-KW. steam prime-mover, alternator and exciter, condenser with air and circulating pumps. See "Official Notices" April 3rd.

Tyrol.—HALL.—May 2nd. Installation complete of a single-phase mine railway in the State salt mines; also supply of a single-phase alternating current locomotive and 15 iron mine trucks and a revolving tipper. Particulars of the K. k. Salinenverwaltung, Hall, Tyrol.

Walthamstow.—April 24th. U.D.C. One water-tube boiler and pipework, overhead bunkers and conveying plant, cast-iron circulating water pipes, for the Electricity Department. See "Official Notices" April 3rd.

Warrington.—April 14th. One year's supply of motors and transformers, for the Borough Electricity Dept. See "Official Notices" March 27th.

April 16th.—Corporation Gas Department. Switchboard, distribution board and wiring. Mr. W. S. Haddock, General Manager, Gas Offices.

Wigan.—April 18th. Corporation. Electrical accessories, service boxes, cables, &c. See "Official Notes" March 27th.

April 18th.—Corporation. Tramcar accessories, brake blocks, overhead line material, &c. See "Official Notices" April 3rd.

April 20th.—Corporation. H.T. feeder cable, transformer and switchgear. See "Official Notices" March 27th.

CLOSED.

Batley.—The Electricity Committee has accepted the tender of the Brush Electrical Engineering Co., for the construction of the pipework, &c., required in connection with the Ljungström turbo-alternator set.

Belgium.—Three concerns submitted tenders last week to the Société Nationale des Chemins de Fer Vicinaux, of Brussels, for the overhead equipment of the extension of the Namur-Citadella-Namur Station light electric railway, the lowest offer being that of the Société A.E.G.-Union Electrique. The tenders ranged from £852 to £1,220.

Blackburn.—The T.C. has accepted tenders of Messrs. Walter Scott, Ltd. (Leeds), for the supply of steel tram rails, and the Electric Construction Co., Ltd. (Wolverhampton), for the supply of a three-wire booster for the electricity works, and for electric motors, for 12 months.

Bolton. — The Corporation contracts for motor starters and direct-current meters below 10 amperes capacity, for the year ending March, 1915, have been placed with the Electrical Apparatus Co., Ltd. Ten top-covers for cars have been ordered from the United Electric Car Co., Ltd.

Bradford.—The Electricity Committee has accepted the offer of Messrs. Ferranti, Ltd., for the supply of E.H.T. switchgear required at Valley Road Works for £685, and that of the British Westinghouse Co. for certain L.T. switchgear for £193, and four 4,000-ampere automatic circuit breakers for £332.

The Committee has also accepted the tender of the Davenport Engineering Co. for the construction of two cooling towers for £4,994, and that of Messrs. Musgrave & Co., Ltd., for the erection of three induced-draught fans, at the Valley Road works for £1,250.

Burton-on-Trent. — The Electricity Committee has accepted the tender of the British Westinghouse, at £4,793, for a turbine and £370 for a switchboard; also that of Messrs. Aiton and Co. for pipework, at £203.

Gloucester.—The T.C. has accepted the tender of Messrs. Cammell, Laird & Co., Ltd., for car wheel tires; and that of the Vacuum Oil Co, Ltd., for light car oil.

L. and N.W. Railway.—Messrs. Balcke & Co., Ltd., have obtained from the London and North-Western Railway Co., a contract for cooling plant for their new power station at Stonebridge Park. It consists of eight natural draught chimney cooling towers of the firm's standard design, having a total capacity of 2,000,000 gallons of water per hour. We are informed that this is the largest cooling tower contract ever placed in this country.

Leyton.—The U.D.C. has accepted the following tenders for repairing the electric light installation at the undermentioned schools during the ensuing 12 months :—

Headland & Headland: Sybourn Street, Norlington Road, Newport Road Canterbury Road, Farmer Road, and St. Joseph's schools.

E. H. Grimshaw & Sons: Davies Lane, Harrow Green and Kirkdale Roa schools.

H. H. Taylor: Cobbold Road and Goodall Road schools.

London.—Islington.—The Lighting Committee has accepted the tender of Messrs. Witting & Partners for two cooling towers. with pipework and valves, the estimate for which was £2,225. The foundation and building work, estimated at £1,250, is to be carried out by the electricity department.

Shoreditch.—The Electricity Committee reports the receipt of the following tenders for the supply and erection of E.H.T. and L.T. switchgear for the electricity works :—

Crompton & Co.		£2,580
Reyrolle & Co., Ltd.		3,055
Johnson & Phillips, Ltd.		2,906
Spagnoletti, Ltd.		2,832
Edison & Swan U.E.L. Co., Ltd.		2,448
Switchgear & Cowans, Ltd.		3,565
B.T.H. Co.		2,761
British Westinghouse E. & M. Co., Ltd.	(recommended)	2,350
Siemens Bros. Dynamo Works, Ltd.		1,947
Bertram Thomas		1,949
Ferguson, Pailin & Co.		2,557

Manchester.—The following tenders have been accepted by the Corporation :—

For Electricity Committee :—

Supplies of cable —B.I. and Helsby Cables, Ltd. ; Electrical Engineering and Equipment Co., Ltd. ; Johnson & Phillips, and the Western Electric Co., Ltd.

Tramways Committee :—

Tramway rail bonds.—B.I. and Helsby Cables, Ltd.
Trolley wire.—F. Smith & Co., Ltd.
Brackets and tubes for tramway poles.—J. Spencer, Ltd.

For requirements in the tramways department during the year ending March 31st, 1915, the Tramways Committee has accepted the following Tenders :—

Motor and controller spare parts, &c.—British Thomson-Houston Co., Ltd., Rugby.
Brass water caps (B.T.H. equipments).—Gabriel & Co.
Finger brackets, hinge brackets, &c. (B.T.H. equipments), two-way connectors, &c., bell presses, sundry lighting material, &c.—S. Gratrix, junr. & Bro., Ltd.
Fibre strips, &c. (B.T.H. equipments).—Sutcliffe (Crumpsall), Ltd.
Circuit breaker handles (B.T.H. equipments).—D. C. Bate.
Motor and controller spare parts, &c., controllers (complete).—Dick, Kerr and Co., Ltd.
Motor and controller spare parts, traction lightning arresters, 32 car sets magnetic brake equipment, &c.—British Westinghouse Co., Ltd.
Resistances (grid type) —Electro-Mechanical Brake Co., Ltd.
Grids for resistances.—Henry Wallwork & Co., Ltd.
Commutator segments, armature and field coils.—P. R. Jackson & Co., Ltd.
Motor brush-holders, &c.—Kay & Co.
Controller fingers, &c., canopy trolley bases.—Estler Brothers.
Trolley poles.—Brecknell, Munro & Rogers, Ltd.
Incandescent lamps, switches, bells, telephones, &c.—General Electric Co., Ltd.
Incandescent lamps (traction).—Drake & Gorham, Ltd.
Cells, rubber strip, mackintoshes for drivers, &c.—C. Macintosh & Co., Ltd.
Conduit tubing.—Perfecta Seamless Steel Tube, &c., Co.
Amber mica segments, &c.—Meirowsky & Co.
Asbestos, fibre, &c., insulation tape, &c.—L. Andrew & Co.
Celluloid.—British Xylonite Co., Ltd.
Impregnating insulation varnish.—Pinchin, Johnson & Co., Ltd.
Insulating compound.—R. W. Blackwell & Co.
Carbon brushes for traction motors, crucibles, fireclay material, &c.—Morgan Crucible Co., Ltd.
Arc lamp carbons, sundries.—Baxendale & Co., Ltd.
Overhead equipment insulating material, pole switches.—A. Wiseman, Ltd.
Trolley heads.—Equipment and Engineering Co.
Trolley wheel bushes and spindles.—Fleming, Birkby & Goodall, Ltd.
Electrical signal spare parts.—Tramway Supplies, Ltd.
Automatic sanding devices.—M. Cummins.
Tubular sanding devices.—J. Taylor.
Peacock brakes.—Peacock Brake Co.
Automatic lifeguards.—Hudson & Bowring, Ltd.
Folding sideguards.—Philipson & Co.
Power and lighting cables and bell wire.—Connolly Bros., Ltd.
Brass wire, &c., twist drills, and various materials.—Till & Whitehead, Ltd , Manchester.
Steel wire.—F. Smith & Co. (wire manufacturers), Ltd.
Iron and steel wire and cable.—Johnson & Newphew, Ltd.
Lubricating oils, grease, &c.—Isaac Bentley & Co., Ltd.
Varnishes (portion), lapcine.—Robert Ingham, Clark & Co., Ltd.
Enamel.—Blundell, Spence & Co., Ltd.
Fireclay material for pitch boilers, earthenware pipes.—Hall & Rogers.
India-rubber goloshes, gloves, &c.—D. Moseley & Sons, Ltd.
India-rubber tubes for sand gears, &c.—F. Reddaway & Co., Ltd.
Special blocks and wheels for grinding steel rails, emery wheels.—Carborundum Co., Ltd.
Ball races for trolley standards.—W. J. Ritchie & Co., Ltd.
Truck and other springs.—West Bromwich Spring Co., Ltd.
Anti-friction white metal.—Tandem Smelting Co., Ltd.
Tinplates, lead, zinc, spelter, &c.—Rd. Johnson, Clapham & Morris, Ltd.
Car axles and car wheel tires.—Cammell, Laird & Co., Ltd.
Car wheel centres.—Edgar Allen & Co., Ltd.
Gear and pinion wheels.—F. W. Rowlands & Co., Ltd.
Chilled iron brake block castings.—National Rail and Tramway Appliances Co., Ltd., and Interchangeable Brake Block Co., Ltd.
Tramcar meters.—Chamberlain & Hookham, Ltd.
Thermit welding, &c.—Thermit, Ltd., London.

The Corporation tramways department has decided again to use tantalum traction lamps for the ensuing 12 months.

The General Electric Co., Ltd., have received an order from the Corporation for 12-ampere Angold magazine lamps for the lighting of Oxford Street and Peter Street.

Rotherham.—The E.L. Committee has accepted the tender of the British Westinghouse Co. for a turbo-alternator, at £7,925, and one of the British Thomson-Houston Co. for a rotary converter, at £2,755.

South Africa.—Messrs. Hubert Davies & Co., Johannesburg, are the successful tenderers for the new Heilbron electric lighting plant.—*British and South African Export Gazette.*

We understand that the British General Electric Co., Ltd., of Johannesburg, have recently secured the contract for the whole of the plant and equipment for the municipal lighting scheme of Ermelo, in the Transvaal.

Sutton (Surrey).—The U.D.C. has accepted the tender of Messrs. Stuart & Moore, of Ealing, for electric fire alarms, at £349, payable by two annual instalments, and £17 10s. per annum for seven years for maintenance.

Swindon and Highworth.—The B. of G. has accepted the tender of Messrs. J. Lott & Sons, Swindon, for electric cable, flexible and "Phlatta" switches.

Tunbridge Wells.—The Corporation has accepted tenders for the following :—

Piston rings for one 500-kw. Ferranti set.—Allen & Simmonds, Ltd.
Switchgear.—British Thomson-Houston Co.
New atmospheric exhaust pipe and valve.—Babcock & Wilcox, Ltd.
One 7,500-gal. feed pump.—J. P. Hall & Sons, Ltd.
Oil filter in connection with the feed pump.—Glasgow Patents Co., Ltd.
Mechanical stokers to boilers Nos. 3, 4 and 5.—Underfeed Stoker Co., Ltd.

Wimbledon.—The E.L. Committee has accepted the following tenders for annual supplies :—

Extra high-pressure, high-pressure and other cables.—Union Cable Co., Ltd.
Two-core V.I.R. cables.—Western Electric Co., Ltd.
V.I.R. cables, asbestos-braided and cotton-braided cables, workshop and other flexibles.—W. Geipel & Co.
Compounds.—Dussek Bitumen Co.
Tapes, &c.—Siemens Bros. & Co., Ltd.
Service boxes, dividing boxes, &c —W. Lucy & Co., Ltd.
Sealing ends.—B.I. and Helsby Cables Co., Ltd.
House fuse boxes.—Sykes & Sugden, Ltd.
Frames and Covers.—Callender's Cable Co., Ltd.
Meters.—Ferranti, Ltd.
Accessories.—General Electric Co., Ltd.
Flame arc carbons.—Henrion Carbons.
Destructor tools.—James Harvey.
Lubricating oils.—A. Duckham & Co., Ltd.
Petrol.—Anglo-American Oil Co., Ltd.

Watford.—The E.L. Committee proposes to renew the contract with Henley's Telegraph Works Co., for the supply of cables for a further period of 12 months.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Newcastle Section).—Monday, April 13th. At 7.30 p.m. At Armstrong College. Address on "Electric Furnaces," by Mr. V. Stobie.

Institution of Engineers and Shipbuilders in Scotland.—Saturday, April 18th. At 7.30 p.m. At Rankine Hall, 39, Elmbank Crescent, Glasgow. Smoking Concert.

Junior Institution of Engineers.—Friday, April 17th. At 8 p.m. At 39, Victoria Street. Paper on "A Few Typical Carburetters, by Mr. R. S. Fox.

Saturday, April 18th. Visit to the Australia House, Kingsway.

NOTES.

Competition for Motor-car Starters.—The Hungarian Automobile Club is arranging a competition for automatic motor-car starters ; there will be two classes, one for electrical devices and one for all others. No starter can be entered for the trials unless it is mounted on a car of at least 8-H.P. rating ; moreover, no starter is eligible unless it and the car are certified as having come successfully through the Club's severe reliability trials in the Carpathians. Immediately after this year's trials the devices will be examined and judged.

Electrical Ship Propulsion.—News has come to hand that the electrically-propelled United States Government ship *Jupiter* has carried out most successful official trials, on which she maintained a mean sea speed of 15·1 knots for a period specified by the Government of 48 hours, which is ·4 knot above her builders' trial speed : the power developed was 6,940 H.P., with the three-phase twin-screw induction motors running at a mean speed of 115·7 R.P.M. It is reported that the Engineering Department officers of the U.S. Navy are highly pleased with her trial performance, and it has been proved that for her displacement tonnage and speed, she is the most economical ship afloat. In order to clear away any possible excuse for not generally using this type of electrical ship propulsion, and also with a view of getting further data for guidance in the design of future electrically-driven battleships, the American Government have issued orders that as soon as possible she is to leave Mare Island Navy Yard, California, and to proceed over a voyage of no less than 13,000 sea miles, *i.e.*, down the west side of America, nearly to Cape Horn, through the Straits of Magellan, and up the east side to Hampton Roads.

This test is one which is not without risk (even with ordinary vessels) as there are practically no facilities for repairs should anything of a serious nature go wrong with the steam turbine or steering gear, to which all ships travelling in these wild and tempestuous positions, where Atlantic meets Pacific Ocean, are liable. The American engineers, who have carried out most extensive tests, have, however, every confidence in the *Jupiter*, and are now about to put her through what may safely be called the most severe trial for any vessel afloat.

Institution and Lecture Notes.—London Association of Foremen Engineers.—The anniversary banquet of this Association is to be held at Cannon Street Hotel, E.C., on Saturday, May 2nd.

The Institution of Mechanical Engineers will hold its summer meeting in Paris, from July 6th to 10th.

The Iron and Steel Institute has issued a programme of papers and proceedings for the annual meeting, to be held in London, on May 7th and 8th.

Greenock Electrical Society.—The annual meeting took place on the 2nd inst. The secretary, Mr. A. Hurry, read the report of the year's progress; the election of officers for the coming year followed, and the proceedings then took the form of a smoking concert.

A Long Drop.—In a recent issue of a magazine interested in the coal and iron trade there was a note to the effect that an electric hand lamp (Osram), which dropped down the shaft of a colliery 760 ft. deep, was smashed, as far as the case and the accumulator were concerned, but that the metal-filament bulb was found to be intact, and was, in fact, used straight away in conjunction with another accumulator.

Educational Note.—The Council of the Society of Engineers (Incorporated) has passed a resolution that the "abolition of the external degrees in engineering proposed by the Royal Commission on University Education in London would be a grave injustice to many engineering students"; the Council is strongly opposed to the recommendation being carried into effect.

Paraffin Wax for filling Joint Boxes.—At a meeting of the West of Scotland Branch of the Association of Mining Electrical Engineers at Glasgow, replying to the discussion on a paper read by Mr. J. P. C. Kivlen on "The Choice of Mining Electrical Plant," the author said that Mr. Wilson, in the course of his contribution to the discussion, made some sweeping assertions in regard to the use of paraffin wax. While he had only mentioned in his paper that he used it, without in any way advocating its general use, he was now prepared to adduce facts and figures which would be found interesting to those who knew little or nothing of this excellent insulator. Paraffin wax was a pure hydrocarbon, and was the ideal that they all looked for in a transformer or switch-case oil, suitable for the highest voltages. Its insulating properties were much higher than those of any of the bituminous or resinous compounds, and its specific resistance was over twice that of the best rubber. Its useful temperature range was equal to that of vulcanised bitumen, and, strange as it might seem, under ordinary working conditions it was practically fireproof. Mr. Wilson had stated in his criticism that wax was hygroscopic, but he (Mr. Kivlen) was prepared on the authority of a well-known oil chemist, whose life had been spent in the study and production of mineral oils and wax, to assert that such was not the case. In proof of this, he might say that it had been used for many years in the making of condensers. If it had any tendency to retain moisture, it would be useless for this purpose, as the condensers would be incapable of sustaining a charge. It was also used when accurate capacity tests were being made on submarine cables to counteract the effects of atmospheric humidity. There were two reasons why paraffin wax had not come to the front for box filling. The first was entirely obvious to those interested in the sale of compounds, and the second was because it was more expensive. It might not be the ideal thing to use for vulcanised bitumen cables, but it filled all the conditions equally well with box compound. It was clean to use and could be used over again if a box was opened for examination. Finally, he would not suggest the use of wax with paper-insulated cables.

Bioscope Theatre Supply.—The supply of electricity to kinematograph theatres is a matter of considerable importance to station managers; the load is well worth having, and the supply authority is in the fortunate position of having, as a rule, no rival—for the bioscope operator cannot do without electricity.

But there is, nevertheless, an alternative—the private generating plant, which has been brought up to so convenient, efficient and economical a degree of excellence that, where there is space for its accommodation, it seriously threatens the supremacy of the public supply. The only other obstacle, apart from the space question, is the matter of capital cost; but it is reported from Brighton, where the picture theatres complain of the high and unfair charges of the Corporation, that a large firm has offered to provide the machines and accumulators, free of charge, subject to a payment of 2½d. per unit for a period of three years—at the end of which time the picture manager will become owner of the plant without any further payment! The same firm offers to continue to run the plant, after the change of ownership, charging only ¾d. per unit.

We cannot vouch for the truth of this report, but if it is true, and if this arrangement can be carried out on a commercial basis, it seems quite clear that, in the first place, the suppliers who charge 2½d. or more per unit are reaping a fabulous profit; and in the second, that the time is at hand, or has now arrived, when they will either have to be just to their customers, or find themselves supplanted. To persist in classing the load, whether supplied through a motor-generator or not, as a "lighting" one is a mere ostrich-like policy; it is not on all fours with any other load, being indeed part of the professional equipment of the bioscopist, and it is not fair to class it as ordinary lighting. It is to be hoped that station managers will not allow the business to slip out of their hands.

Swiss Electrical Industries.—Some interesting particulars regarding the growth of the Swiss electrochemical and metallurgical industries in 1912 are furnished by a report of the Federal Customs Department. The manufacture of carbide of calcium, including that transformed into cyanamide, amounted in the year to 40,000 tons. Its selling price through the action of the International Syndicate, remained normal, and active steps were taken to enlarge the openings for its consumption. In particular its employment has been extended in connection with autogenous soldering and in the manufacture of cyanamide. Some extension of its use has also taken place for portable lighting requirements, and in certain new applications of acetylene in the manufacture of chemical products. The world's consumption of carbide is estimated at 300,000 tons. The manufacture of carborundum has likewise undergone extension, and the Swiss production is estimated at 3,100 tons. The manufacture of another abrasive substance has also been started in Valais, called "abrasite," the output of which is between 1,000 and 1,500 tons a year. It is an artificial carborundum with an alumina base. The advance in price of aluminium, foretold in the previous year, was realised, and the Syndicate of Manufacturers again fixed the price at 2 fr. The output of the Aluminium-Industrie Aktien-Gesellschaft, of Neuhausen, was considerably increased by the operations of its works at Chippis, which was started in 1911. The consumption of aluminium has steadily advanced, and new applications for it are constantly being found. For example, it has been found possible to make an aluminium paper, which has obtained a great vogue as wrapping for chocolate. For the manufacture of this aluminium paper, 42 $m.^2$ of which are made from 1 kg. of metal, some 1,200 tons were employed during the year, and it is very probable that this quantity will be largely exceeded in coming years. The export figures of articles coming under Class XIg of the Customs tariff, comprising pure aluminium, as ingots, bars, sheet, pipe, aluminium alloy wire, industrial and other manufactured articles, more than doubled those of the previous year. It reached the figure of 85,710 metric quintals, of a value of 13,892,541 fr.; whereas the corresponding figures in 1911 were 38,032 metric quintals and 6,752,035 fr. Of iron alloys, ferro-silicon, which is now being made in three localities in Switzerland—at Martigny, Viège (Lonza) and Bodio—appears to have revived, and the Swiss outturn should exceed that of the previous year; it amounted to between 7,000 and 8,000 tons. The total consumption of ferro-silicon may be estimated at between 35,000 and 40,000 tons. Ferro-chrome continues to be manufactured, as also ferro-silicon, at Martigny (Météor) and at Bodio, also ferro-tungsten at Chèvres; the output of the last-named alloy is estimated at about 300 tons; this is an increase on that of the preceding year.

The London Electrical Dispute.—The strike of electrical wiremen continues in London. From the statements appearing in the newspapers from day to day it is not possible to gather which, if either, side is winning. The Trade Union claims that many firms have agreed to its demands, but Mr. Tate says that not one member of the London Electrical Masters' Association has so agreed. It is stated that a letter was sent by the Masters to the Union inviting the officials of the latter to meet the Association, with authority to agree to Rule 1, which prohibits exception being taken to the employment of non-Union men. The E.T.U. organiser says that the Union has everywhere steadfastly refused to accept a disability clause, and it cannot accept it in London because it is affiliated to the Building Industries Federation, which is continuing its struggle on this very point. "For us to accept it would probably seriously prejudice their position." The inconvenience to members of the Masters' Association is said to be very slight. The secretary's estimate the other day was that not more than 250 men were on strike. A financial daily says that on the 6th inst. 500 were out, and that "50 master electricians, including some of the best firms in London," had given way and agreed to the men's demands. There appear to have been conferences between the Electrical Trade Union and the Newspaper Owners' Association respecting the pay and conditions of Union electricians employed in newspaper offices, and there has been a slight trouble at Marylebone, now satisfactorily settled, consequent upon an employé of the Corporation electric supply department being sent to a job described as "black." The men at the Office of Works are out.

The Siemens Smoking Concert.—On Monday the directors and staffs of Messrs. Siemens Bros. & Co., Ltd., and Messrs. Siemens Bros. Dynamo Works, Ltd., held a smoking concert in the King's Hall of the Holborn Restaurant. Mr. Alexander Siemens presided, and the hall was comfortably filled with the members of the staffs and their numerous guests. The programme, the cover of which was embellished with a special design, suggestive of the cordial relations prevailing between the various branches of the Siemens companies throughout the United Kingdom, was an exceptionally good one, and credit is due to Mr. George Lakeman, under whose direction it was performed; it included such names as Miss Violet Essex, Miss Ruby Wilson, Messrs. Joseph Cheetham, Joseph Bull, Dutch Daly and other eminent artistes, whose efforts were cordially appreciated by the audience. Mr. Harry Gooding's Imperial Orchestra played selections during the reception and interval. Altogether the organisers are to be congratulated upon a function marked with every feature of success and enjoyment.

Electrified Horses.—According to the *Daily Express*, Mr. C. J. Palmer, a London electrical specialist, proposes to apply electrical treatment to stimulate the growth of racehorses.

Photography an Electrical Action.—At the meeting of the Royal Photographic Society on March 17th, Mr. H. Stanley Allen D.Sc., delivered a lecture on the electronic theory of the latent image on the photographic plate. In his opinion, the fundamental change in a plate on exposure to light was a physical one. A chemical alteration in the nature of actual decomposition might follow it, but there must be first a movement or commotion within the molecule of the emulsion. This physical change, he thought, ought to be considered from the point of view of the two great modern advances in theoretical physics, the electromagnetic theory of light on the one hand, and, on the other, the theory that negative electricity consisted of discrete particles or electrical atoms known as electrons. The result of putting these two theories in conjunction, was to suggest that light could only act up on matter by setting in vibration an electron or some electrified body of atomic dimensions. If the vibrations were extremely rapid, as in the case of ultra-violet light, they would act on the electrons; and if slower, as in the case of the red end of the spectrum, they would act on atoms or groups of atoms. What was known as the photo-electric effect was the liberation of electrons from ordinary matter when light, especially of short wave-length, fell upon it. He showed by experiment how a polished metal plate easily lost a negative charge of electricity when illuminated by ultra-violet light, although it retained a positive charge. Dr. Allen regarded it as quite likely that ordinary photographic action was the result of ionisation, or the splitting up of the atom or molecule into parts which were oppositely electrified. The result of waves of light falling upon a photographic film was to liberate electrons from the haloid grain in that film, the electrons moving with a velocity which depended upon the stimulus applied, being most pronounced under ultra-violet impingement. Passing away from the grain, these electrons became attached to the neighbouring molecules of the gel, and the developer, acting on this ionised arrangement, produced the developed image. The phenomenon known as photographic reversal, Dr. Allen explained by supposing that the emission of electrons under a great stimulus of light was so considerable as to cause a heavy positive charge on the parent grain, and a heavy negative charge on the accumulation of electrons around it, leading up to such a point as to bring about spontaneous neutralisation, the grain of haloid reverting to its original condition. This view of reversal was challenged in the course of the subsequent discussion, but Dr. Allen maintained that the analogy of the Leyden jar was a good one. If one took a Leyden jar, connected it to a Wimshurst machine, and went on charging up, a stage would be reached at which the equilibrium broke down. In the same manner, on continuing to expose a photographic film to light, the electrical field would be such that a stage would be reached at which neutralisation took place spontaneously.

Electric Lighting of Motor-'Buses.—It is generally admitted that the National steam 'buses are amongst the best lighted of the motor vehicles in service in London at the present time. In the course of a recent paper Mr. Thomas Clarkson gave some particulars of the electric lighting equipment now installed, which comprises a dynamo directly coupled to a small steam engine, this replacing the battery-dynamo lighting system, which was used for several years. A steam pressure of about 70 lb. per sq. in. is found ample; the engine and dynamo run at 950 R.P.M., and the dynamo has an output of 14 amperes at 12 volts. Metallic filament lamps are used. This equipment is the most satisfactory of any tried by the author, who stated that it is cheaper both to install and to maintain, and there is a saving of about 100 lb. in weight as compared with the battery-dynamo system. The effect of fluctuations in boiler pressure (which are inevitable in consequence of the variable demands for power, especially in congested traffic) is avoided by fitting a reducing valve to the lighting engine.

Electricity Supply Authorities and their Employés.—Mr. H. H. Harper, city electrical engineer of Melbourne, writes under date February 27th:—"In your issue of January 9th, page 41, reference is made to efforts which are being made by two associated electric power and supply companies in North Metropolitan districts to secure the insertion in their Bill of clauses prohibiting strikes of their employés. I enclose herewith copy of Sections in the Victorian Employers' and Employés' Act dealing with this question, which may be of interest to you." We print the Sections below:—

EMPLOYERS' AND EMPLOYES' ACT, NO. 1,219, DATED DECEMBER, 1891.

Sec. 3.—"Employé" shall not include a domestic servant, but save as aforesaid shall mean any person who, being a labourer, shepherd, stockman, servant in husbandry, journeyman, artificer, handicraftsman, miner or otherwise engaged in manual labour, whether under the age of 21 years or above that age, has entered into or works under a contract with an employer, whether the contract be made before or after the passing of this Act, be express or implied, oral or in writing, and be a contract of service, or a contract personally to execute any work or labour.

Sec. 17.—Where a person employed by a municipal authority or by any company or contractor upon whom is imposed by Act of Parliament the duty, or who have otherwise assumed the duty of removing, dealing with or treating the sewage of any city, town, borough or shire, or of supplying any city, town, borough or shire, or any part thereof with gas or electric light or any other species of light or water, wilfully and maliciously breaks a contract with that authority, or company or contractor, knowing or having reasonable cause to believe that the probable consequences of his so doing, either alone or in combination with others, will be to deprive the inhabitants of that city, town, borough or shire wholly or to a great extent of their supply of gas or electric light or other species of light, or water, or to interfere with the sewage thereof, he shall on conviction thereof by a Court of Petty Sessions or on indictment or presentment as hereinafter mentioned, be liable either to pay a penalty not exceeding £20, or to be imprisoned for a term not exceeding three months, with or without hard labour.

Every such municipal authority, company, or contractor, as is mentioned in this section shall cause to be posted up at the gasworks, electric lighting works, waterworks, or other works, as the case may be, belonging to such authority, or company, or contractor, a printed copy of this section in some conspicuous place where the same may be conveniently read by the persons employed, and as often as such copy becomes defaced, obliterated, or destroyed, shall cause it to be renewed with all reasonable despatch. If any municipal authority, company, or contractor, make default in complying with the provisions of this section in relation to such notice as aforesaid, they or he shall incur on summary conviction by a court of petty sessions, a penalty not exceeding £5 for every day during which such default continues, and every person who unlawfully injures, defaces, or covers up any notice so posted up as aforesaid in pursuance of this part of this Act, shall be liable, on summary conviction, to a penalty not exceeding 40s.

The Storage of Celluloid.—Three public authorities have introduced Bills into Parliament affecting the storage of celluloid and articles into which celluloid enters—London County Council (General Powers) Bill, City of London (Various Powers) Bill, and Glasgow Corporation (Celluloid) Bill. An appeal for funds has been issued, together with a memorandum by Mr. James D. Kiley (chairman of the Fancy Goods Section of the London Chamber of Commerce) in connection with opposition which it is intended to offer.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Recommendations to come before the Warrington Town Council are that the salary of MR. F. V. L. MATHIAS, chief electrical engineer and tramway engineer, shall be increased from £425 to £450, with two annual increments of £25 each; and that the salary of MR. JOHN TELFER, tramways manager, shall be increased from £250 to £276.

MR. GEO. BROADHURST, assistant electrical engineer at Worthing, has resigned, he having been appointed electrical engineer to the Basingstoke Corporation.

The Swansea Electricity Committee received 64 applications for the position of charge engineer, and gave the chairman, vice-chairman, and chief engineer, power to make the appointment.

Tramway Officials.—MR. ALBERT E. WRAY, assistant manager of the South Metropolitan Tramways Co., was, on leaving to take up a new appointment, presented with a clock and an illuminated address. The proceedings were held in the depôt at Mitcham Road, Croydon, and Mr. A. V. Mason, the manager of the company, made the presentation. Mr. Wray has been with the company since 1909. He has now been appointed manager and engineer of the Gravesend and Northfleet Tramways Co. and the North Kent Motor-Omnibus generating services.

General.—The Highways Committee of the L.C.C. recommends that SIR ALEXANDER KENNEDY be appointed consulting engineer to advise and report as to the arrangements from the point of steam consumption in connection with the extension of the Greenwich electricity station and generally on the station extensions, and to advise the chief officer of tramways generally on questions connected with such extensions and to afford the Council whatever consultative assistance may be required. Messrs. Kennedy and Donkin are to be appointed engineers for specifying and superintending such new plant or work as the Council may place in their hands at a retaining fee of £500 to cover all references, reports and consultations in connection with the tramways undertaking; 5 per cent. commission on all certificates for plant up to £50,000 a year and 4 per cent. on expenditure over this amount; a commission of 3 per cent. only to be paid on the new constructive work in connection with the second stage of the extension at the Greenwich station.

MR. N. G. BARRACLOUGH, electrical engineer to the Workington Iron and Steel Co., Ltd., Workington, is going to Canada and the Eastern States of America, in May, for a short vacation, and he intends visiting large electrical works and iron and steel works where electrical power is extensively used.

We understand that MR. G. R. DRUMMOND, M.I.E.E., M.I.M.E., after nine years of continuous service as electrical and mechanical engineer to the Bikanir Government, India, severed his connection with that State early in March, 1913, and, after a short stay in Jodhpur, for which State he was consulting engineer, sailed for Australia with his wife and family for a holiday and for seeing the various electrical undertakings in the several States. Mr. Drummond returned to India in November, 1913, to resume his duties, and proceeded to Lahore to reconstruct the Lahore Electric Supply Co.'s undertaking. In January, 1914, the Jodhpur Durbar decided to accept the electrical power scheme put forward, and offered the post of electrical and mechanical engineer to their State to Mr. Drummond, which offer was accepted, and in March, 1914, Mr. Drummond took up this appointment, and commenced work on the scheme. All the plant is on order from England, and it is hoped to commence the supply towards the latter part of 1914.

Mr. H. D. Johnston, late of the Canadian British Insulated Co., Ltd., Montreal, has joined the staff of the Eugene Phillips Electrical Works.

Dr. R. Pohl, M.I.E.E., of Bradford, has been appointed by the Bradford Technical Education Sub-Committee as External Examiner in Electrical Engineering for the final examinations for the Technical College diplomas and for the Technological Exhibitions for the present year.

A marriage was to take place on Wednesday, April 8th, between Mr. William H. Gatley, A.M.I.E.E., electrical engineer and contractor, Todmorden, and Miss Grace Crabtree, eldest daughter of Mr. Barker Crabtree, cotton manufacturer, Cross Lee, Todmorden, Yorks.

Mr. Bentham, electrical engineer of the Thryberg Hall and Warren Vale Collieries, Kilnhurst, who has occupied his position for the past 30 years, has been presented with a gold lever watch by the officials and workmen employed at the collieries. The presentation took place at the Church Hall, Kilnhurst, at a concert, presided over by Mr. H. S. Witty, the manager of the collieries. During the evening Mrs. Bentham was presented with a pendant.

Mr. F. Heppenstall, A.M.I.E.E., has resigned the position of manager of the switchgear and transformer department of Messrs. Johnson & Phillips, Ltd., Charlton, S.E., to take up an appointment with the General Electric Co., Ltd., 67, Queen Victoria Street, E.C., where he will devote his particular attention to matters in connection with wires and cables.

Mr. A. E. C. Burgess has joined Mr. A. C. F. Webb, of Sydney, as partner. The name of the firm is A. C. F. Webb & Burgess, and their address, 1,105, Culwulla Chambers, Castlereagh Street, Sydney. Mr. Burgess is visiting England with the object of seeing the latest developments, and his address will be, until July, c/o London Bank of Australia, 71, Old Broad Street, London, E.C.

Obituary.—We much regret to record the death of Mr. H. Hewson Brown, the well-known character impersonator. He was a member of the Electro-Harmonic Society, and should have appeared in a sketch "Impressions from Life," at its last smoking concert, but, as the musical director announced, he was then suffering from pneumonia, although two days before he was apparently in his usual health. He died on the following Tuesday, March 24th, at the early age of 33, and our estimable contemporary, the *Referee*, states that his widow and three young children are left quite unprovided for. A fund for their benefit has been opened, and donations should be sent to Mr. Harry Hall, 207, Oxford Street, W. A Bohemian Concert in aid of the fund will be given at King's Hall, Holborn Restaurant, on May 5th, and tickets, price 2s. and 1s., can be obtained from Mr. Hall. Mr. H. Hewson Brown was, we understand, formerly with the Sun Electrical Co., and later he was a director and manager of the Hewson Manufacturing Co., Ltd., electric sign makers, of Wardour Street, W., giving up his connection with that firm only in February last. This sad end to a promising career is one that we think may appeal to the Electrical Trades Benevolent Institution, and members of the Electro-Harmonic Society may also wish to show their appreciation of Mr. Brown's annual appearances by supporting the fund above mentioned.

NEW COMPANIES REGISTERED.

Henry Pooley & Son, Ltd. (134,898).—Registered March 27th, by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C. Capital, £150,000 in £1 shares. Objects: To take over the business, assets and liabilities of a company with a similar title, in liquidation, to adopt an agreement with the said old company, A. J. Giles and W. and T. Avery, Ltd., and to carry on the business of manufacturers of and dealers in weights, measures, scales, balances, weigh-bridges and weighing and other machines and appliances of all kinds for or used in connection with weighing, measuring or estimating length, area, capacity, number or quantity of articles, materials, substances, force or energy, including automatic machines and appliances, electricians, mechanical, electric and general engineers and contractors, founders, machinists, &c. The signatories (with one share each) are:—W. Chamberlain, Pendock Grove, Cobham, manufacturer; G. C. Vyle, Soho Foundry, Birmingham, manufacturer. Private company. The first directors (to number not less than two or more than 11) are C. H. Bartlett, A. H. Gibson, Sir James F. Flannery, Bt. (chairman), L. Jacobs, C. E. Martineau, H. Pooley, J. S. Pooley, W. W. Wiggin and G. C. Vyle. Messrs. W. and T. Avery, Ltd., may, while holding three-fourths of the paid-up share capital, appoint directors. Solicitors: Pinsent & Co., 6, Bennetts Hill, Birmingham.

Argentine Electricity Co., Ltd. (134,883)—This company was registered on March 27th, with a capital of £45,000 in £1 shares, to generate, produce, distribute and deal with electricity for lighting, heating, telegraphy, telephony, or otherwise. The subscribers (with one share each) are:—F. J. Moss, 59, Whippendell Road, Watford, clerk; J. C. Fennings, 94, Endsleigh Gardens, Ilford, clerk; R. W. Ames, 93, Green Street, Bethnal Green, N.E., clerk; R. Walker, Mill Park Lodge, Hornchurch, solicitor; J. H. Collins, 131, Elthorne Avenue, Hanwell, W., clerk; H. W. Newton, 37, Queen Victoria Street, E.C., solicitor; E. Boys, 37, Queen Victoria Street, E.C., clerk. Minimum cash subscription, £1,000. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification (except first directors), £100; remuneration as fixed by the company. Registered office, Capel House, 62, New Broad Street, E.C.

Marbro, Ltd. ([illegible]).—This company was registered on March [illegible], with a capital of £[illegible] in £1 shares [illegible] to carry on the business of manufacturers of and dealers in, electrical goods, apparatus and accessories [illegible]. The subscribers (with one share each) are:—A. H. [illegible], [illegible] Road, [illegible], S.E., [illegible]; [illegible] Grady, 10, [illegible] Street, [illegible]. Private company. The number of directors is not to be more than [illegible]; the first are not named. Remuneration, [illegible] per [illegible] and [illegible] per cent. of the surplus profits in excess of [illegible] per cent. upon the [illegible] pref., and 10 per cent. on the ord. Registered office, 22, [illegible] Street, Morning Lane, Hackney, N.E.

Tucuman Tramways, Light and Power Co., Ltd. ([illegible])—Registered March 26th by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C. Capital, £611,000 in £1 shares. Objects: To generate, distribute, supply and employ electricity, whether for light, heat, power or other purpose, to acquire and carry out contracts, concessions or grants for the construction, maintenance, repair, operation or control of railways, tramways and other roads or ways, of electric lighting and other works, to contract for the lighting of any public or private places by electricity or otherwise, &c., and to adopt an agreement with the Cordoba Central Railway Co., Ltd. The signatories (with one share each) are:—G. W. Houghton, 3, St. Helens Place, E.C., company director; A. M. Smith, 3, St. Helens Place, E.C., company director; A. H. A. Knox Little, 9, Rue Louis le Grand, Paris, civil engineer; R. A. Roberts, 283, Lewisham High Road, S.E., incorporated accountant; G. Tyrel, 3, St. Helens Place, E.C., solicitor; H. F. Plant, 3, Park Road, Forest Hill, S.E., clerk; W. E. Rosser, 191, Sebert Road, Forest Gate, Essex, clerk. Minimum cash subscription seven shares. The first directors (to be not less than three or more than seven) are to be appointed by the signatories. One of such first directors shall be a person nominated by the sellers, under an agreement of February 28th, 1914, referred to in the agreement above mentioned. Qualification, £100; remuneration, £700 per annum, divisible. The directors' borrowing powers are restricted to twice the amount of the issued capital for the time being. No notice of situation of registered office has been filed.

Mander Utility Co., Ltd. (134,811).—This company was registered on March 21th, with a capital of £6,300 in 6,000 8 per cent. cumulative preference shares of £1 each, and 6,000 ordinary shares of 1s. each, to carry on the business of manufacturers and agents and factors for the sale of electrical apparatus and appliances, telephones, telephone and bell wire, flex electric bells, dry cell batteries, motor-car lamps and novelties, &c., and to adopt an agreement with J. W. Mander. The subscribers are:—J. W. Mander, 30, Greenhill Road, Harrow-on-the-Hill, manufacturers' agent, 100 cum. pref. shares; H. Pawlik, 103, Edith Road, West Kensington, manufacturers' agent, 100 cum. pref. shares; E. E. Haynes, Compton House, Hounslow, secretary, 1 cum. pref. share; A. M. Junkermann, 108, Edith Road, West Kensington, manager, 1 cum. pref. share; E. N. Fellowes, 29, Warwick Square, S.W., solicitor, 50 cum. pref. shares; C. H. Marks, 49, Calthorpe Street, W.C., clerk, 1 cum. pref. share; H. W. Palmer, 17, Villiers Road, Bushey, Herts., cashier, 1 cum. pref. share. Minimum cash subscription, 20 per cent. of the shares offered to the public. The number of directors is not to be less than two or more than five; the first are J. W. Mander, H. Pawlik, E. N. Fellowes, C. Drummond-Wolfe and S. G. Fraser; P. S. Tompkins is first secretary; qualification, 100 shares; remuneration (except managing directors or manager), £50 per annum (chairman £100). Registered office, 1, Great Winchester Street, E.C.

Cleartone Antiseptic Telephone Drum, Ltd. (134,862).—This company was registered on March 26th, with a capital of £1,000 in £1 shares, to carry on the business indicated by the title and that of manufacturers of and dealers in paper appliances, &c., and to adopt an agreement with R. C. Belt, R. F. Popham and H. Davidson. The subscribers (with one share each) are:—H. Davidson, 13, Chepstow Mansions, Chepstow Place, W.C., company director; R. F. Popham, 16, Kensington Gardens Square, W., gentleman. Private company. The number of directors is not to be less than two or more than five; the first are R. C. Belt, H. Davidson and R. F. Popham. Registered office, 59-61, New Oxford Street, W.C.

H. F. Foster & Co., Ltd. (134,981).—This company was registered on March 27th, with a capital of £7,000 in £1 shares, to carry on the business of specialists in the lighting of motor-cars, railway carriages and vehicles, manufacturers of, and dealers in, dynamos, electric plant, machinery and fittings, &c. The subscribers are:—A. H. Benson, 62, Ludgate Hill, E.C., company director, 2,000 shares; A. W. S. Pocklington, 47, York Street, Westminster, S.W., 100 shares. Private company. The number of directors is not to be less than two or more than five; the first are A. H. Benson, Ankerwycke, Wraysbury, Bucks.; A. W. S. Pocklington, Ballard's Garden, Ewell, Surrey; and H. F. Foster, Stanley House, West Street, Epsom; qualification, £200; remuneration of A. W. S. Pocklington, as managing director, £500 per annum; of others, as fixed by the company. Registered office, Ashley Works, South Street, Epsom.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

City of Buenos Ayres Tramways Co. (1904), Ltd. (82,214).—Capital, £1,240,000 in £5 shares. Return dated March 2nd, 1914. All shares taken up. £1,240,000 paid. Mortgages and charges: £174,000.

Newcastle and District Electric Lighting Co., Ltd. (28,022).—Capital, £300,000 in £10 shares. Return dated March 18th, 1914. All shares taken up. £10 per share called up. £297,500 paid, leaving £2,500 in arrears. Mortgages and charges: £293,840.

Lamp Manufacturing Co., Ltd. (76,151)—Capital, £10,000 in £1 shares; return dated February 3rd, 1914, 5,400 shares taken up; £5,400 paid. Mortgages and charges: £2,500 debs.

Morley Electrical Engineering Co., Ltd.—Capital, £5,000 in £1 shares; return dated February 16th, 1914; 1,524 shares taken up; £504 paid; £1,020 considered as paid. Mortgages and charges, £3,000.

Autolectric Transmission, Ltd.—Debenture dated March 13th, 1914, to secure £[illegible], charged on the company's undertaking and property, present and future, including uncalled capital. Holder: O. A. Knight, 37, York Road, Hove, Brighton.

Broom & Wade, Ltd.—Particulars of £3,930 second debentures, created March 4th, 1914, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital and freehold hereditaments at Lindsay Avenue, West Wycombe, Bucks., subject to prior mortgages for £1,500 and £1,000. Trustees: J. C. Peache and G. B. Lawrence.

C. F. Casella & Co., Ltd.—Mortgage dated March 14th, 1914, to secure £[illegible], charged on 16, Gurney Street, Walworth, with yard, stables, cartsheds and workshops. Holder: Miss V. Abraham, [illegible], County Derry, Ireland.

Church Stretton Electric Supply Co., Ltd.—A memorandum of satisfaction in full (*a*) on March 4th, 1914, of charges bearing various dates from March 17th, 1909, to July 24th, 1912, securing in the aggregate £[illegible], and (*b*) on February 18th, 1914, of trust deed dated March 19th, [illegible], securing £5,000, has been filed.

CITY NOTES.

Urban Electric Supply Co., Ltd.

The annual meeting was held on April 1st at Salisbury House, London Wall, E.C., Mr. H. B. Grotrian presiding, in the absence of the chairman of the company, Mr. P. D. Tuckett, who had had to leave for the United States on business.

The Chairman in proposing the adoption of the report (see Elec. Rev., page 547), remarked that before leaving this country Mr. Tuckett asked him (Mr. Grotrian) to tell the shareholders that he left without anxiety as far as the company was concerned, as he considered that its affairs were in a satisfactory condition. Dealing with the accounts and taking the profit and loss account first there was an increase of £7,435 in the item of profits earned at various works, being an increase of 13 per cent. which was the same rate of increase as obtained last year, so they would see that the company showed steady progress. Coal had again, unfortunately, cost them more—an increase of £1,587 on top of an increase of £4,427 last year, due entirely to the higher price of coal. The amount carried down to net profit was £61,684, as against £54,265 a year ago. On the debit side of the profit and loss account, interest to contractors showed an increase of £1,557, and interest on debenture stock an increase of £1,139. The amount set aside for redemption of debenture stock was increased by £781, making a total increase in charges of £3,177, leaving, with £996 brought forward, a net disposable balance of £23,021. They proposed to apply that balance as follows: reserve for depreciation, £12,000; dividend of 4 per cent. for the year on the preference shares, £10,000; leaving a balance of £1,021 to be carried forward. The 1 per cent. balance of dividend on the preference shares would be paid by funded dividend certificate as last year. If the company made the same progress in the present year as it had in the past year they would, of course, be able next year to pay the full dividend on the preference shares in cash. The capital expenditure in the year was £76,260, an increase over last year of £21,576. This was largely accounted for by the Cornwall Power Co.'s increased expenditure of £18,583 compared with last year. Debenture stock issued during the year amounted to £34,918, from which had to be deducted £6,093 purchased for redemption under the terms of the sinking fund. Two items which appeared in last year's balance sheet, namely, preliminary expenses, £2,081, and discount and stamp duty on debenture stock issued, £28,881, were no longer shown, as, together with discount on debenture stock issued during the year, £5,221, they had been written off against capital reserve fund, and he thought they would agree that that was an improvement to the balance sheet, those items being assets of an undesirable nature. To redemption reserve they had added this year £6,039 against last year's £5,875, and they now recommended that a further £12,000 be set aside for reserve for depreciation, making a total reserve of £62,339, which he hoped they would consider satisfactory. Proceeding to deal with the results shown by the various companies in which the company was interested the chairman said that the lamp connections had again been large, showing an addition of the equivalent of 82,824 33-watt lamps, of which addition 36 per cent. was for lighting and 64 for power. A good feature of this connection was that a larger proportion was for lighting than last year. The additions made in the year increased the previous total connections for lighting by 8 per cent. and for power by 17 per cent. The output in units for the past year showed an increase of 5,344,495, from 16.690.488 to 22.034.983, Cornwall, as last year, being principally responsible for the increase. Regarding the profits realised in individual undertakings good results had been shown at Twickenham and Stamford, while Newton Abbot, Caterham and Berwick had also made fair progress. Hawick showed a small increase, and would have done better but for the depression in the textile trade. The small reduction shown at Weybridge was accounted for by the decrease in profit on their wiring business; but, there the effect of the metal filament lamp was being specially felt, whilst at Dartmouth the decrease was due to a similar cause, the consumption by the Naval College being again largely reduced. The other towns—Godalming, Grantham and Glossop—had all suffered from the effects of dearer coal, which largely accounted for the want of progress. The Cornwall Electric Power Co. again showed a greatly increased profit—£11,775, which was £5,490 more than last year. The profit this year was 7 per cent. on the capital spent, which he thought they would consider a satisfactory result for a power company only in its third year of working. The difficulty in Cornwall last year was not so much in obtaining increased profitable business as in being able to obtain from the makers the large units of machinery and plant requisite to cope with that increased business. That difficulty had been overcome and they now had installed at Hayle 9,000-kw. of plant, which was ample for present requirements. The business was, however, growing rapidly and contracts had been arranged which would largely increase the demand upon the station. Of course, all this involved somewhat heavy capital expenditure, but the directors had the matter under consideration and there should be no difficulty in raising funds for the Cornwall undertaking so long as such profitable results could be shown. On the whole, they might take it that the business was making steady progress. There was a prospect of the cost of coal being reduced, and should this be realised a substantial improvement might be looked for in all their stations.

Mr. Edmund Charrington seconded the motion.

In reply to questions the Chairman said the board had gone into the question of capital expenditure and they estimated that they would have to spend about £35,000 on that account this year. They did not take any business on now unless they could see a very substantial return on it, and if they had such business offered them it would be foolish of them not to take it. Therefore they could not altogether stop capital outlay. The amount of the redemption under the sinking fund was one per cent. cumulative, which this year would amount to about £7,000. The debentures for the purpose were purchased in the open market. Regarding their coal, they always impressed upon the engineers at their various stations the necessity of maintaining at least a six weeks' supply.

The report was adopted.

Chilian Electric Tramway and Light Co., Ltd.

An extraordinary general meeting of the shareholders of the above company was held on April 2nd at the office, London Wall Buildings, E.C., Mr. L. Breitmeyer presiding.

The Chairman said the object of the meeting was to consider a resolution for increasing the borrowing powers of the directors. The present borrowing powers were limited to the extent of the company's capital, which was £1,150,000, and as considerable additional capital expenditure had been incurred and more might be necessary, they thought it necessary to ask for additional powers to meet any contingency that might arise. He therefore moved that the directors be authorised to borrow, raise or secure further moneys but so that the amount for the time being owing in respects of moneys borrowed, raised or secured, shall not exceed £2,000,000.

Mr. Hector de Backer seconded the resolution, which was carried without discussion.

Tynemouth and District Electric Traction Co., Ltd.

The annual meeting was held on Friday last at Electrical Federation Offices, Kingsway, Mr. H. S. Day, presiding.

In proposing the adoption of the report (see Elec. Rev., page 589), the Chairman said that the past year had shown an improvement upon 1912 which had enabled them to somewhat strengthen their reserves, to pay an additional one per cent. dividend and to carry forward a slightly increased amount as compared with the previous year. It was satisfactory to know that the receipts to date were up to expectations and if only they had a good summer their prospects were very encouraging.

Mr. Geo. J. Somerville seconded the motion and the report was adopted without discussion.

The French Osram Co.—It is proposed to increase the share capital of the Société Anonyme La Lampe Osram by the issue of £140,000 in ordinary shares and £120,000 in preference shares, the latter to be paid to the extent of 25 per cent. The additional capital is required for the purpose of extending the scope of the company and the acquisition of the Paris firm of Rich. Heller, who manufacture electrical specialities, and who will receive £20,000 in ordinary shares of the French Osram company as the purchase price.

Continental.—Germany.—The Deutsche Kabelwerk Gesellschaft, of Lichtenberg, Berlin, reports a net profit of £34,685 for the last financial year, as compared with only £31,017 in 1912. Of this sum £4,449 is being devoted to a special reserve, £4,527 to bonuses, £21,000 distributed in the form of an 8 per cent. dividend to the shareholders, leaving £4,709 to be carried forward.

Great Northern Telegraph Co., Ltd., of Denmark.—At the general meeting which will be held at Copenhagen on April 25th, the board will propose to pay a total dividend and bonus of 20 per cent. for the year 1913, including the 5 per cent. already paid, and to transfer the usual amounts to the reserve and pension funds.

County of London Electric Supply Co., Ltd.—The subscription list in respect of the new issue of 10,000 preference and 6,000 ordinary shares was closed on the 31st ult., and the issue was largely over-subscribed. The allotment letters and letters of regret were posted on Saturday, 4th inst

La Plata Electric Tramways Co., Ltd.—The directors recommend a balance dividend on the preference shares of £6,000, covering the period from March 1st to August 31st, 1912, placing £1,000 to reserve, and carrying £330 forward.

Callender's Share and Investment Trust, Ltd.—It is announced in the Press that an interim dividend at the rate of 5 per cent. per annum is to be paid for the six months ended February 28th.

Bell's United Asbestos Co., Ltd.—The total distribution on the ordinary shares for 1913 is 12½ per cent., £5,000 is placed to general reserve fund, and £12,693 is carried forward.

Lima Light, Power and Tramways Co.—A dividend of 1 per cent. for the final quarter of the year is declared.

Lymington (Hants.) Electric Light and Power Co., Ltd.

At the annual meeting the Chairman (Mr. Keppel Pulteney) said he was glad that their record was much of the same satisfactory character as hitherto. The number of consumers had increased. The output of units generated showed a substantial increase, the sale of current having gone up by £145. The chief item of expense was coal and other fuel (£422), which showed the large increase of £90, but there had been a larger output. The Chairman complimented Mr. Holman (the resident engineer) and Mr. Jones (the secretary) on their working of the company. In concluding, the Chairman alluded to the large amount to be carried forward, explaining that with an increased business the directors might think it advisable to provide an additional engine and dynamo.

Prospectuses.—*General Electric Co., Ltd.*—The subscription list opened on Monday, and was to close on Tuesday, in an issue at par of 30.000 6 per cent. cumulative preference shares of £10 each, and 10,000 ordinary shares of £10 each. The objects of the issue are stated as follows :—

"(*a*) The erection of a building in Kingsway to accommodate the whole of the company's office and warehouse staff in London, for which purpose a site containing 25,000 superficial ft. has been acquired. The building, with its proper equipment, is expected to cost about £150,000.

"(*b*) The extension of the Witton Engineering Works, Birmingham.

"(*c*) The subscripton of £100,000 in shares (being a moiety of the capital) of Pirelli-General Cable Works, Ltd., which has been formed to erect and carry on works at Southampton for the manufacture of cables for power, lighting, and other purposes.

"(*d*) The extension of the company's trade at home and abroad, and in particular through the medium of its subsidiary and associated companies.

"The continued growth of the business has made ever-increasing demands on the premises of the company for the housing of the necessarily larger number of employés, and for stocking the greater variety of goods which have to be stored for meeting the requirements of customers. The centralisation of the London business under one roof, coupled with the economy in rent, the concentration of the staff, and the greater facilities for the display of goods and the execution of orders, will more than justify the proposed expenditure, which will itself prove a very profitable investment."

The amount required to pay the dividend on the preference capital, including the present offer, is £42,000 per annum, and the auditors' statement shows that the above dividend is covered nearly two and a-half times over without taking into account the profits to be derived from the proceeds of the present issue. Our readers are already fully informed concerning the very prosperous condition of this company whose progressive record was shown in the following climbing up of net profits for the five years from 1909-1913 :—£47,342, £62,813, £79,384, £92,297 and £103,434.

Portland Railway Light and Power Co.—The list was to close on Wednesday in an offer of $1,064,000 first and refunding mortgage 5 per cent. sinking fund gold bonds (convertible issue) at 93 per cent.

Canadian General Electric Co.—According to the *Financial News*, the directors report that for 1913 a profit of $2,029,898 was earned, and, after deducting $470,934 for depreciation and $222,655 for interest, the net balance is $1,336,309. Deducting from this dividends on preference and common stock at rate of 7 per cent. per annum, and a bonus of 1 per cent. on the common, amounting in all to $776,634, there remains surplus earnings of $559,675, of which $328,134 has been added to reserve fund, and $231,541 to the balance of $682,391 at credit of profit and loss. The reserve now amounts to $2,700,000, the balance at credit of profit and loss to $913,932, making a total surplus of $3,613,932, equal to 36·13 per cent. of the share capital. There has also been accumulated a reserve for depreciation now amounting to $1,537,605. During the year the directors acquired all the property, &c., of Allis-Chalmers-Bullock, Ltd., of Montreal, and the property and assets of the Stratford Mill Building Co.

Indian Electric Supply and Traction Co., Ltd.—The directors report (according to the *Financier*) that the surplus on the year's working to December 31st, in Cawnpore, was £10,145, against £8,458 in 1912. London expenditure was £1,335, against £746 in 1912, and, after providing for debenture interest, £3,600, there remains a net profit of £5,226, plus £1,834 brought forward. The directors have placed £3,000 to reserve, and they recommend a dividend of 4 per cent. for the year, which will absorb £3,120, carrying forward £939. A chimney, an economiser, and a condenser were built and installed during the autumn, and have been got to work since the new year opened, the benefits of which are now being felt.

Middleton Electric Traction Co., Ltd.—The annual meeting was held in London on May 1st. Lord Vaux of Harrowden, the chairman, said that they had carried 172,018 more passengers, run 5,000 more miles, and earned £1,211 more in traffic receipts than in 1912. There was reason to believe that the improvement would continue.

Sao Paulo Tramway, Light and Power Co., Ltd.—The directors have declared a dividend of 2½ per cent., payable May 1st.

British Westinghouse Electric and Manufacturing Co., Ltd.

Mr. J. Annan Bryce, M.P. (chairman), presided on Monday at Hamilton House, E.C., over the fourteenth annual meeting of the above company.

The Chairman, in moving the adoption of the report (Elec. Rev., page 588), said they would have heard with sorrow the news of the death of Mr. Westinghouse, who, though he had been ailing for some time, retained a keen interest in the development of all the businesses of which he had been the founder. He was a man of very remarkable powers, which enabled him to become a pioneer in many fields of engineering. Since the last annual meeting, as they knew, the shareholders had been called together to approve a scheme for the reduction of the capital. They approved that scheme, and, in due course, it was sanctioned by the Court. The accounts now before them were based on the reduction made by that scheme, and, as they would see, the capital values of their shares were now respectively £2 per preference share, and £2 per ordinary share, while the assets upon the other side of the account had been correspondingly reduced. In the process of carrying out this scheme, the balance to the credit of profit and loss account, £66,895, as per last balance-sheet, had been absorbed, so that the profit and loss account this year started without anything brought forward. With regard to the accounts, he would first deal with the balance-sheet. On the debit side he had already referred to the first two items. The next item, prior lien debentures, showed a reduction on last year's account of £6,700 representing the debentures purchased on the market, and others drawn by ballot to meet the requirements of the trust deed for the year. The item 4 per cent. mortgage debenture stock, £1,241,353, remained as before. The item sundry creditors and credit balances, £262,499, was somewhat in excess of last year, as was natural in view of the increase in the business. Reserve for employers' liability remained as before. On the credit side, the first three items—purchase money of patents, works, machinery plant, &c.—now stood at the figures to which they were adjusted by the reduction of capital, except that the latter had been increased by the necessary expenditure during the year under review and again reduced by the amount of depreciation for the year. Stock and material on hand, £737,566, showed an increase of about £96,000 over last year, which was accounted for by the increased business. Completed work on contracts, £251,000, showed only a small increase of about £1,700. This was very satisfactory as showing that the improvement in the rate of collections had kept pace with the increase in the volume of business. Sundry debtors, less reserve, £207,107, were about £30,000 less than last year, which further illustrated the improved rate of collections. Shares and debentures in other companies were £172,610. This item showed a considerable reduction on the previous year's figures, owing to values having been written down on the reduction of capital, leaving the two chief investments, which were shares in the Clyde Valley Electrical Power Co. and the Traction and Power Securities Co., at amounts which, in the directors' opinion, represented their value. Both these securities continued to improve, and there was reason to hope that before long the former would be in a position to enter upon a dividend-paying stage, while the latter had recently declared a small dividend at the rate of 4·6d. per share, or about 2·8 per cent. Bills receivable and cash showed a considerable increase over last year, largely due to the continued improvement in the rate of collections. With regard to the profit and loss account, the net profits compared as follows with those of the previous five years : 1913, £106,494 ; 1912, £41,074 ; 1911, £20,708 ; 1910, £12,437 ; 1909, loss, £798 ; 1908, loss, £7,446. They would see that there had been steady and continuous progress for the last six years. After providing for the usual charges for debenture interest, redemption of prior lien debentures and other fixed charges, there was a net profit for the year of £106,494 to be dealt with. Out of this the directors had placed £50,000 to general reserve, leaving a balance of £56,494, out of which they recommended the payment of a dividend at the rate of 5 per cent. on the £1,000,000 of preference shares, and the carrying forward of £6,494 to the next year's accounts. He was sure they would agree that it was a sound policy to take the opportunity of good years to establish a reserve against the vicissitudes of trade. It was desirable in their business to have a good surplus in order to enable them to take advantage of any lucrative contracts that might offer, but which, in some cases, might necessitate their being out of pocket for long periods. The company, in common with other kindred concerns, had had a favourable year, better than they had reason to hope when he addressed them at the last annual meeting, though there were indications at that time of an appreciable improvement over the year 1912. Orders had come in well, and, he was glad to say, at somewhat better prices. Perhaps the most important order secured by them, of which, no doubt, many of them were aware, from references in the Press, was that from the London and South-Western Railway Co. for train equipments in connection with the electrification of their suburban traffic. Compared with those of 1912, the orders received for apparatus of their own manufacture showed an increase of 40 per cent. Whether the current year would prove to be as favourable as last it was too soon to hazard an opinion, but the first three months did not show any appreciable falling off. There were, however, indications of a slackening in trade generally. The directors were taking advantage of every opportunity to increase the business of the company both at home and abroad. Very friendly relations existed between the company and the Westinghouse Continental companies, and an increase in their business owing to those connections might be anticipated.

Mr. E. A. Goulding seconded the motion.

Mr. F. Tomkinson asked whether the directors intended to use the £50,000 placed to reserve as a fund for equalising dividends.

The Chairman said he did not know that they had in view any special use for the fund, but of course the board did not enter on the payment of a dividend without seeing their way to continue paying it.

Mr. H. W. Birks, as one who, he said, had made himself disagreeable in past years, heartily congratulated the board on the improved position, and also on the fact that the company had settled the dispute with the Underground Railway Co. in a friendly way. He suggested that shareholders would be glad to learn how that matter had been settled.

The Chairman said the company for years had an account against the Underground Co. for about £87,000 for plant supplied, with which they gave a guarantee as to coal consumption. The plant exceeded the coal consumption guaranteed, and the Underground Co. made counterclaims. The matter came before the Hon. Alfred Lyttleton for arbitration, and he gave an interim judgment which raised legal questions. These question were submitted to the Divisional Court, who decided against them, and they went to the Appeal Court, who also decided against them. On going to the House of Lords, however, the decision was in their favour. Then the matter was referred back to the arbitrator for assessment, and, unfortunately, he died. The two companies then came to the conclusion to settle the matter by bargaining between themselves, and this was done. By carrying the case to the House of Lords they saved some £70,000 or £80,000. As a result of the final settlement they lost £52,000, and they thought they came off very well. The contracts were accepted and guarantees given at a time when undoubtedly the experience gained did not justify such guarantees being given. In those early days the business was done without a profit, but now no business was done without profit.

The report was then adopted.

STOCKS AND SHARES.

Saturday Afternoon.

Why unfortunates connected with a technical weekly should be obliged to spend their Saturday afternoon before Easter in ministering to the wants of probably unappreciative readers, instead of taking the air in one of London's secluded spots—Hyde Park, for instance—the wit of the financial paragraphist declines to comprehend. However, there it so we may as well dip our pen into the ink of the martyr and ahead with it.

The Stock Exchange markets have resumed an appearance of strength and confidence. itics, as the all-absorbing factor, have given way to the sweet re nableness of cheap money. Consols have gone a-soaring; money is unlendable at 1½ per cent.; the Bank Rate is expected to come down after Easter, and all the investment markets sing for joy.

Even the menace held out to the Home Railway industry, in consequence of the strike in South Yorkshire, has availed merely to check the tide of bullishness in that department. All sections of the market have hardened. Particular attention has been paid to high-yielding stocks of the steam variety; but the Undergrounds lagged a little behind the rest by reason of the fact that there is still something of a stale bull account left in Metropolitans and Districts. Since we wrote, however, there are moderate improvements in both of these, while Underground Electric Incomes have also strengthened, though the £10 shares are ⅛ down. Prices of the London Traction descriptions are well maintained, but there is no movement calling for special notice. The new Metropolitan Consolidated stock, with deferred dividend—given in payment of Great Northern and City Railway shares—is quoted at 27—30, and the company's 3½ per cent. Preference, ranking for dividend from July 1st, 1916, is called 65—75.

Electricity Supply shares are better. The feature of the week has been the over-subscription—and by a substantial amount—of the new County of London Ordinary and Preference shares. This came as rather a surprise to the market, which had been expecting that the issues would be just covered, if that, by the proprietors, seeing that the differences between the quotations of the old and the new were not greatly in favour of the latter. Upon its becoming known that the issue had been over-subscribed, a premium of 7s. 6d. was established on both the new Ordinary and the new Preference. The allotments we understand, were made yesterday (Friday) afternoon.

The existing County of London Ordinary ares have advanced to 12⅛, and the Preference to 11⅞, while rise have also occurred in the Ordinary and Preference shares of the aring Cross Company. City Lights are ⅛ higher. Speculation in [illegible] has fallen off in marked fashion; of its revival, however, and that before very long, there cannot be much doubt, having regard to the speculative possibilities which lie in the hope that the Corporation may elect to come to terms with the company, instead of allowing the concern to drift into the hands of the County Council.

Brazilian stocks and shares of all kinds are swayed by the movements of the rate of exchange cabled daily—sometimes twice a day—from Rio. Down to 15¾d. the other day, it has since recovered to nearly 1s. 4d., and its rapid gyrations drag the prices of Brazilian securities after it in fashion somewhat bewildering. Brazilian Tractions fell to 83, recovered to 85½ and then settled down to 84½. The bonds of the Tramways Companies—Rio and Sao Paulo—have held their substantial improvements. The Government of Brazil is expected to steer through its present difficulties without having recourse to funding its interest payments, or making some other temporary composition with its creditors. Hence, stocks and shares in companies Brazilian have followed the example of the Government bonds, and are showing a much better disposition generally. Para Railway Ordinary constitute the inevitable exception, being ⅛ lower.

Mexican matters, too, are thought to be progressing favourably towards some kind of an early settlement. President Wilson and General Huerta appear now to have more consideration for peace than they have displayed throughout the course of the past six months, and the result is reflected clearly enough in most Mexican securities. Those of the utility companies are steady, showing little alteration of importance on the week. But the tone is more confident, and the pressure to sell has been sensibly relaxed. Mexico Trams are 1½ to the good.

La Plata Trams are unaffected by the directors' decision to pay the dividend on the 6 per cent. Preference shares for the half-year to September, 1912.

Marconis are once more in the limelight. The price fell to 3⅜, as we noticed in our last article, on the assumption that the American Marconi Company would not be able to repeat even its tiny dividend performance of a year ago. Americans dropped to 16s. at one time, Canadians to 8s. 3d. There seems to be some doubt, however, as to the certainty that the American Marconi Company will pass its dividend; and a smart recovery, to 3½ buyers, occurred in the price of the parent shares, which had the effect of toning up the quotations for the subsidiaries. The rise started with a good deal of quiet option buying on behalf of Continental operators; and rumour ran round to the effect that the company itself is doing exceedingly well.

The Great Northern Telegraph Company has declared the usual final dividend of 15 per cent., making 20 per cent. for the year, and the price of the shares is unchanged at 33. Telegraph Constructions at 37 are again 10s. lower, raising the yield to 6 guineas per cent. on the money. British Insulated are also dull, another 5s. fall reducing the price to 9½. The Automatic Telephone Company's report indicates steady progress. British Westinghouse were sold by people who had bought on anticipation of a good report; when this materialised they took their profits. The 4 per cent. Debenture stock is, however, the only issue to show a change in the nominal quotation. Willans & Robinson Debenture stock has weakened a point. The electrical "strike" has been almost disregarded.

There was a pleasant little dinner the other night, when first-hand information, almost as pleasant, was given concerning some of the leading light and power companies of Canada and the United States. The strides which these are making are comparable in importance only to the fresh fields for extension that lie around the first-class undertakings of the Montreal and Shawinigan description.

Within the last day or two papers have been seen in the market having references to the new issue of Preference shares by the South London Electric Supply Corporation, and the prospectus is out of the substantial amounts of Ordinary and Preference capital offered by the General Electric Company. Brief details have been given here previously of these emissions. New issues are being accorded so flattering a welcome just now, that fresh additions to the list are likely to be made daily before the holidays, and the cheapness of money, which has much to do with the new issue successes, is almost certain to continue for some time to come.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Mar. 25	2,891	+ 176	12	8,486	+ 164	..	..
Blackpool-Fleetw'd	,, 28	1,225	869	12	3,118	— 799	8	..
Bristol	,, 27	[illegible]	[illegible]	13	90,342	+ 3,781	30·5	..
Brit. Elec. Trac. Co.	,, 27	[illegible]	2,766	.	..	..	429·8	1·25
Chatham and Dist.	,, 26	[illegible]	139	12	9,761	42[illegible]	14·98	..
Cork	,, 26	1,809	- [illegible]	12	5,386	— 16	9·89	..
Dublin	,, 27	21,456	[illegible]	13	64,206	— 2,782	54·25	..
Hastings	,, 26	[illegible]	[illegible]	12	8,496	— [illegible]	19·8	..
Lancashire United	,, 25	6,169	+ 132	12	18,407	+ 1,806	42	8
Llandudno-Col. Bay	,, 27	[illegible]	— 813	17	2,591	— 309	6·5	..
London United ..	,, 27	22,209	—1,226	13	66,480	— 560	..	..
Tyneside	,, 25	1,953	— 350	12	5,685	— 225	11	..
Anglo-Argentine ..	,, 25	30,126	+ 1,716	12	685,255	+ 22,109	..	..
Auckland	,, 18	[illegible]	+ 8,766	26	182,422	+ [illegible]	25·42	1·31
Calcutta	,, 28	[illegible]	+ 811	..	..	+ [illegible]	..	..
Kalgoorlie, W.A. ..	Feb.	[illegible]	..	8	4,509	..	20·5	..
*Madras	Mar. 1	1,929	— 187	8	11,215	+ 1,921	15·25	..
Montevideo ..	March	[illegible]	— 510	[illegible]	[illegible]	+ 856	..	..
Cen. London Rly.	Mar. 28	21,243	+ [illegible]	13	67,773	— 1,575	6·78	·4
City & S. Lon. Rly.	,, 28	11,304	[illegible]		[illegible]	— [illegible]	7·26	..
Dublin Lucan Rly.	,, 27	[illegible]	[illegible]	12	[illegible]	— 104	7	..
L'pool Overh'd Rly.	,, [illegible]	[illegible]	+ [illegible]	13	21,266	+ [illegible]	6·6	..
London Elec. Ry. Co.	,, 28	[illegible]	+ [illegible]	13	[illegible]	2,510	31·25	..
Mersey Railway .	,, 28	8,784	+ 16	13	[illegible]	+ 111	4·5	.
Metropolitan Rly.	,, 29	[illegible]	+ [illegible]	13	[illegible]	- 20,53[illegible]	29·25	8·5
Met. District Rly.	,, 28	53,417	+ 1,527	13	172,450	+ 1,535	25	..

* Two weeks.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	69 — 74	+1	6 1 7
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	15½ — 17½	..	..
Do. Do. Deferred ..	100	..	..	6½ — 8½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	3	..	56 — 59	..	5 1 8
Do. 5 % Perp. Deb. ..	100	5	5	98 — 95 xd	..	5 1 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	79 — 82	..	5 9 9
Central London Railway, Ord. ..	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 5
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5% Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	92 — 95	—1	5 5 0
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	65 — 70 xd	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 3
Lancashire United, 5 % Deb. ..	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord. ..	1	..	..	7/32 — 9/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅝ — ¾	..	6 13 4
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	79 — 84	..	5 7 2

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	+1	4 7 0
London United Trams, 4 % Deb.	100	4	4	60 — 64	..	6 5 0
Metropolitan Railway Consol. ..	100	1⅝	1⅝	42¼ — 43¼	+ ½	3 15 2
Do. Surplus Lands	100	2¾	2¾	63 — 65	..	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	..	4 5 4
Metropolitan District Ord. ..	100	Nil	..	28¾ — 29½	+ ¼	Nil
Do. 6 % Deb.	100	6	6	138 — 141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	84 — 87	..	5 3 6
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 9
Do. 5 % Deb.	100	5	5	85½ — 88½ xd	..	5 13 0
Potteries, Ord.	1	3½	..	⅜ — ½	..	..
Do. 5 % Pref.	1	5	5	19/32 — 21/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	2⅞ — 3⅛	— ⅛	Nil
Do. "A"	1/-	..	..	⅜ — 7/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 — 114	..	5 5 3
Do. 4½ % Bonds	100	4½	4½	99 — 101	..	4 9 0
Do. 6 % Income	100	6	6	90 — 91	+ ½	6 11 10
Yorkshire (West Riding), Ord. ..	5	Nil	..	5/16 — 9/16	..	Nil
Do. 6 % Pref.	5	3	4	4 — 4½	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	83 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅝ — 4⅞	— 1/16	5 12 10
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 9/16	..	6 0 7
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 — 106	..	4 14 3
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 — 100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	83½ — 85½	+1½	7 0 2
Brisbane Trams Invt., Ord. ..	5	8	8	7½ — 8	..	5 0 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 — 101	..	4 9 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	117 — 121	+1	6 12 4
Do. Pref. Ord.	100	6	6	105 — 109	+1	5 10 1
Do. 5 % Pref.	100	5	5	101 — 104	..	4 16 2
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	93½ — 95½	—1	4 9 1
Calcutta Trams, Ord.	5	7½	5†	6¼ — 6¾	..	5 11 1
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	N	..	0 — 1/16	..	Nil
Do. 5% A Deb...	100	5	5	85 — 90	..	5 11 1
Do. 6% B Deb...	100	3	..	10 — 20	..	Nil

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
La Plata Elec. Trams, Ord. ..	1	..	..	⅛ — ¼	..	..
Do. Pref...	1	4⅜d.	6	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1¼ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1⅛ — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅞ — 5¼ xd	..	5 14 3
„ Elec. Tr. (1904), Deb. ..	100	5	5	101 — 103	..	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ — 100½	..	4 19 6
Mexico Trams Com	$100	7	7	74 — 77	+1½	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	79 — 83	..	6 0 6
Do. 6 % Bonds	100	6	6	78 — 83	..	7 4 7
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	3⅞ — 4⅜	— ⅛	11 8 6
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	90 — 93	..	5 7 5
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97 — 99	..	5 1 0
Do. 5 % Mort. Bonds	100	5	5	89 — 91 xd	..	5 10 0
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	98 — 101	..	4 19 0
Singapore Trams, 5 % Deb. ..	100	5	5	88 — 92	+2	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	94 — 97	..	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
Bournemouth & Poole, Ord. ..	10	6	7	9¾ — 10¾ xd	..	6 10 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref... ..	10	6	6	10¼ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 97	..	4 12 9
Brompton & Kensington, Ord. ..	5	10	10†	8¾ — 9¼	— ⅛	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	— ⅛	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91½ — 94½	..	4 4 8
Charing Cross, West End & City	5	5	6	4⅞ — 5⅜	+ ⅛	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	+ ⅛	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	+ ⅛	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4½ — 5 xd	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10	17 — 18	+ ½	5 11 1
Do. 6 % Cum. Pref.	10	6	6	12¾ — 13¾	..	4 7 3
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 7 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 — 103	..	4 8 1
County of London, Ord.	10	6	7	11⅞ — 12⅜	+ ⅛	5 13 2
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	+ ⅛	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	102½ — 105½	..	4 5 9
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 — 103	..	4 7 5
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4¼ — 4¾ xd	..	6 6 4
Do. 5 % Cum. Pref.	5	5	5	4¼ — 4¾ xd	..	5 5 3
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 8	..	5 12
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅝ — 1¾	..	5 2 7
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	92 — 95	..	4 4 1
Metropolitan	5	4½	4½	3⅝ — 3⅞	..	5 16 3
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford..	5	7	7	5 13/16 — 6 5/16	..	5 11 0
St. James' and Pall Mall, Ord. ..	5	10	12	9¼ — 9¾	..	6 3 1
Do. 7 % Pref	5	7	7	6⅞ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2¾ — 3⅜ xd	..	6 10 4
Do. 5 % First Mort. Deb. ..	100	5	5	98 — 101	..	4 19 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 1/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock ..	100	4½	4½	94½ — 97½ xd	..	4 12 4
Urban, Ord.	£3	Nil	..	⅜ — ⅝	..	..
Do. 5 % Cum Pref.	5	3‡	4	2¾ — 3¼	— ⅛	6 3 1
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88 xd	..	5 12 3
Westminster, Ord...	5	10	10	8½ — 9	..	5 11 1
Do. 4½ % Cum Pref.	5	4½	4½	5 1/16 — 5 5/16	..	4 4 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 3s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5 — 5½	..	5 14 3
Calcutta, Ord.	5	8¼	6†	7⅝ — 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5 — 5¼	— ⅛	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	5 8 0
Canadian Gen. El. Com.	$100	7	8	111 —115 xd	..	6 16 9
Do. 7 % Pref.	$100	7	7	119 —124 xd	..	5 9 5
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 — ⅝	..	7 13 0
Do. 5 % Deb.	100	5	5	87 — 90 xd	..	5 11 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87 — 89	..	6 14 10
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½—95½	+ ½	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	6†	13/32 — 17/32	..	10 11 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103½—106½	..	4 14 0
Mexican El. Lt., 5 % 1st M. Bds.	.	5	5	65 — 70	..	7 2 10
Mexican Lt. & Power, Common	$100	4	4†	44 — 47	..	..
Do. 7 % Cum. Pref.	$100	7	7	78 — 82	..	8 10 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	78 — 83	..	6 0 6
Do. 5 % 2nd Mort. Bonds	100	5	5	65 — 69	..	7 4 11

NAME.	Stock or Share.	Dividends for		Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	54 — 59	..	..
Montreal, Lt., H. and Power	$100	9	10†	230 —235	..	4 5 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	245 —255	..	3 18 5
Do. 6 % Non-Cum. Pref.	Do.	6	6	103 —108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102 xd	..	4 8 3
Shawinigan Water, Capital	$100	5½	6†	138 —142	..	4 4 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	101 —103	..	4 7 8
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 97	..	4 12 9
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Victoria Falls Power, Pref.	1	6	6	23/32 — 25/32	..	7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	102 —104	+1	5 15 5

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	23/32 — 27/32	..	8 5 0
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	6 17 2
Babcock & Wilcox	1	16	14†	3⅛ — 3¼	..	4 18 6
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 8 6
British Aluminium, Ord.	1	..	..	1 1/16 — 1 3/16	..	..
Do. 6 % Cum. Pref.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Prior Liens Debs.	100	5	5	96 — 99	..	5 1 0
Do. Deb. Stk.	100	5	5	88 — 93	..	5 7 6
B.I. & Helsby Cables	5	10	13	9½ — 9¾	— ¼	6 13 4
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	101 —104	..	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	2	Nil	5	1 15/32 — 1 19/32	..	6 5 0
Do. Deb.	100	4	4	73 — 75	—1	5 6 8
Do. 6 % Prior Lien	100	6	6	100 —103 xd	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	39 — 43	..	10 9 6
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	5†	11¾ — 12¼	..	6 0 0
Do. Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	22½	2½ — 2¾	..	..
Do. Deb.	100	4½	4½	104 —107	..	4 4 1

NAME.	Stock or Share.	Dividends for		Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	⅜ — ⅝	..	..
Do. Pref.	1	6	6	11/16 — 13/16 xd	..	7 7 8
Edison & Swan, A, £2 paid	5	Nil	..	1/16 — 3/16	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	62 — 67 xd	..	7 9 1
Electric Construction	1	5	..	17/32 — 21/32	..	7 12 6
Do. Pref.	1	7	7	15/16 — 1 1/16	..	6 11 7
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10¼ — 10½	..	5 14 8
Do. Deb.	100	4	4	84 — 88 xd	..	4 11 0
Henley's, Ord.	5	15	20	13½ — 14½	..	6 17 11
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 9 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	7½	10½ — 11½	..	6 10 5
Do. Pref.	10	5	5	8¾ — 9½	..	5 5 9
Telegraph Construction	12	20	20	36 — 38	— ½	6 6 7
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	64 — 68	—1	5 17 8
Do. B 4 % Cum. Pref.	100	..	..	50 — 55	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾ — 6¼	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	122 —125 xd	..	6 8 0
Do. Collat. Trust	$1000	4	4	91 — 94	..	4 5 3
Anglo-American Telegraph	Stock	3	3	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	109 —110	+ ¼	5 9 4
Do. Def.	Do.	30/-	30/-	23½ — 24	..	6 5 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7⅜ — 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80½ — 82½	..	4 17 0
Cuba Telegraph	10	6	6†	8¾ — 9¾	..	6 8 1
Do. 10 % Pref.	10	10	10	15¾ — 16¾	..	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3¾ — 4 xd	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7½ — 8 xd	..	6 5 0
Direct United States Cable	10	4	4†	6⅝ — 7⅛	..	5 12 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	132 —135	..	5 3 8
Do. 3½ % Pref. Stock	Do.	3½	3½	77½ — 79½	— ½	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	10	7	7	12⅜ — 12⅞	..	5 8 9
Do. 4 % Deb.	Stock	4	4	94½ — 96½	..	4 3 0
Globe Telegraph and Trust	10	6	6†	11¼ — 11¾ xd	..	5 2 1
Do. 6 % Pref.	10	6	6	12½ — 13	+ ⅛	4 12 4
Great Northern Telegraph	10	20	20	32 — 34	..	5 17 8
Indo-European Telegraph	25	13	5†	58 — 60	..	5 8 4
Mackay Companies Common	$100	5	5	85 — 88	..	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7

NAME.	Stock or Share.	Dividends for		Closing Quotations April 3rd.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph	1	20	20	3½ — 3⅝	+ 3/16	5 10 4
Do. 7 % Cum. Partic. Pref.	1	17	..	2 13/16 — 3 1/16	+ ⅛	5 10 4
Monte Video Telephone, Ord.	1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 14 3
New York Telep., 4½% Gen. Bnds.	100	4½	4½	100 —101	+ ¼	4 9 0
Oriental Telep. and Elec.	1	10	8†	2⅛ — 2⅜	..	4 4 3
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	8 — 9	..	11 2 2
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96½ — 98½	..	4 11 5
United River Plate Telephone	5	8	6†	6⅜ — 6⅞	..	6 16 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 9 0
West Coast of America	2½	2½	..	1 3/16 — 1 7/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	1¼	2⅜ — 2⅝	..	4 15 3
Do. 6 % Cum. 1st Pref.	10	6	6	9⅝ — 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref.	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	10	7	7	13¼ — 13¾ xd	..	5 1 11
Do. 4 % Debs.	Stock	4	4	95½ — 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 — 99	..	4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Copper.—The very interesting statistics relating to the annual output of copper for various countries, scheduled by Messrs. H. R. Merton & Co., are now to hand. From these it is evident that the output, or, at any rate, the apparent output, for 1913, was less by 19,735 tons than the output for 1912. The quantity is not large, and may be due to closer estimating, as one would not be inclined to suppose that the peak of the world's production has been already reached. The largest producer, the United States, comes out 5,785 tons less than the previous year, with 548,578 tons, or 56 per cent. of the total output. The next largest producer, Japan, has added 6,500 tons to last year's output, and has 72,000 tons to its credit. Mexico shows a heavy decrease—20,475 tons, on last year's output, 51,980 tons. Australia has dropped 440 tons, showing 46,580 tons for 1913. Chile shows an increase of 2,000 tons odd, and has 39,385 tons as its figure. Canada, with hardly any falling off, shows 34,365, thus beating Russia at 33,240, which, however, is a slight increase over last year. Peru shows 25,310, than which it has done considerably better in former years. Africa is coming on with 22,510 tons.

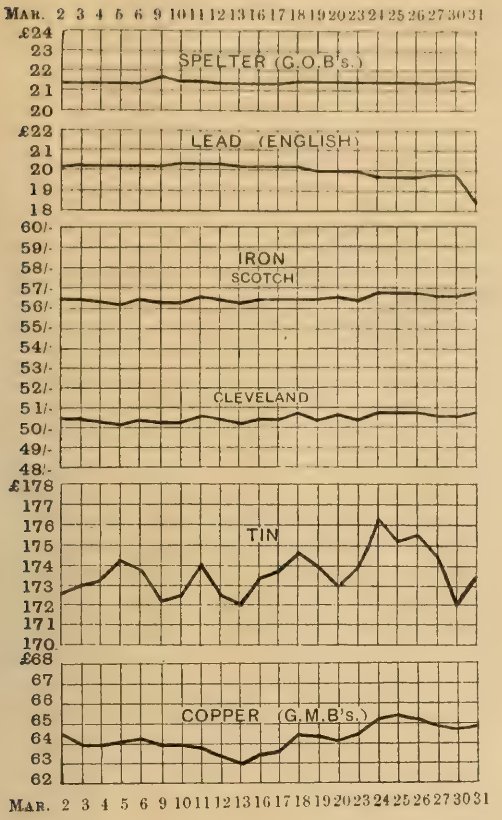
Of the European producers Spain and Portugal, with 53,835 tons, show a falling off of 5,095 tons on the quantity for the previous year.

Germany does 24,910 tons, very slightly under last year's, and Servia 6,275 tons, not its best output. England has 300 tons (estimated).

Of the above Australia and Japan have perhaps the most encouraging figures, the first having doubled its output in 13 years, and the second in seven years. Norway has one of the most steadily increasing outputs, now reaching 11,610 tons.

METAL MARKET.

Fluctuations in March.



The Electric Vehicle Committee.—At the last meeting of the Electric Vehicle Committee, on March 20th, it was decided to recommend to supply authorities and companies that for "off-peak" charging the maximum price should not exceed 1d. per unit on the supply authority's declared system and pressure. As to the price to be charged for electric energy during "peak load" hours, the Committee feel that very little charging should be necessary at such times, especially for commercial vehicles. Consequently they do not consider it desirable to make any recommendations as to a tariff, leaving it to each supply authority or company to fix its own rate for such hours. The committee suggest the wisdom of giving special encouragement for charging vehicles during the hours between 11 p.m. and 6 a.m., and they consider that the supply might be remuneratively given at a price of ½d. per unit. It is also recommended that a scale of discounts be arranged to meet the case of large consumers, and that an additional discount of 20 per cent. off the above rates be given for all energy purchased by a consumer for re-sale and metered on the latter's own premises. The Committee recommend that the minimum charge for battery charging ought not to exceed 2s. It is proposed that this amount should only include the housing of the car upon the charging premises during such time as charging is proceeding, it being open to the supply authority or company to make a further charge should the owner of the vehicle desire to house it on the premises after the charging operation has been completed. A letter is being sent to supply authorities and companies embodying these recommendations. As to the standard charging plug, the Committee have reconsidered the matter of earthing, and, in view of the fact that under certain conditions the charging of the battery might be done direct off a high-pressure supply service through a resistance, they have thought it desirable to earth the framework of the chassis through the plug and receptacle by means of a third earthing conductor embodied in the main flexible charging cable. The Committee recommend that arrangements be made for this earthing in all cases. The Technical Sub-Committee are busy dealing with details appertaining to the plug, such as terminals, areas of contact, &c. They are also considering the question of size of battery cells and battery trays, charging voltages, &c.

REVIEWS.

Conversion Factors, Tables and Data for the Testing of Steel Conductor Rails. Middlesbrough. Riddale & Co. Price 6s.

This is a collection, in pamphlet form, of five sheets of notes and tables prepared with the object of simplifying the conversion from one to another of the various expressions for the resistance of steel conductor rails for electric traction purposes. The resistance is usually expressed in relation to the resistance of any equivalent copper rail, equal either in weight or in section, or it may be expressed in ohms per yard per pound, or per square inch section of rail. The conversion factors and the notes here given are of considerable use, but, for those accustomed to the use of a slide rule, the tables are superfluous, as are also the alternative methods of calculating. It is little less than a disgrace to the profession that several expressions for such an important quantity should be in general use, and the sooner the Engineering Standards Committee publish the result of their conference on the matter the better. It is to be hoped that the cumbrous and confusing "times copper" figure will be superseded by the logical and direct expression of resistance in ohms per yard per square inch rail section; or, failing this, ohms per yard, per lb., or ohms per yard of 100lb. rail.—J. B. S.

Small Power Wireless Installations. By M. Child. 1913. London: Percival Marshall & Co. Price 1s. net.

This volume represents a revised edition of a valuable serial article which recently appeared in the "Model Engineer." A number of books have now been written to cater for the needs of amateur wireless telegraphists, but none we believe, gives a better treatment than this of the subject as required by these readers. The author explains the construction of the essential apparatus connected with a modern radio-equipment, discusses the elementary theory of these apparatus and presents the data necessary to enable the average reader to calculate wave lengths, capacities, inductances, and coupling percentages, etc. It is assumed that the reader is familiar with, or at least understands, the nature and general function of such apparatus as induction coils, condensers, telephones, buzzers, ammeters, and Morse keys, etc. Too many books of this class have failed through endeavouring to cover these matters as well as wireless telegraphy and its application, all within a hundred pages or so. If the reader is not familiar with such elementary matters, he should study them in separate books. A single small treatise on wireless telegraphy, to be useful must, like the present volume, assume reasonable fundamental knowledge, *i.e.*, cater specifically for the man who wishes to extend some electrical knowledge or hobby to include wireless telegraphy.

After a brief indication of the general nature of wireless telegraphy, the author plunges at once into a general description of the aerial and earth wires, and the source of energy to be used. The long-spark fallacy is exposed, the desiderata of a transformer are specified, and the function and construction of condensers are explained. Chapter II deals at length with the purpose and construction of variable (sector) condensers and of inductances. We frequently wonder why, in the formula:—Frequency = Velocity of Propagation ÷ Wave Length, the velocity is not expressed as 300,000 km. per second, and the wave length in metres, yielding the frequency in kilocycles (kcy.).

Spark gaps form the chief subject matter of Chapter III; the author recommends cup and point electrodes, and illustrates the design and connections of a useful 1-kw. set. The advantages of the rotary spark gap, in respect of preventing arching, are explained clearly. The principles of tuning and resonance are detailed in Chap. IV, a description of the actual apparatus required being postponed till Chap. IX is reached; the stress laid on this important subject is fully justified. The action and methods of coupling naturally follow for treatment in Chap. V, and here, again, the author is to be complimented on a clear exposition of matters which frequently perplex the amateur. In Chap. VI, the author deals with detectors and telephones, and presents a useful table showing the relative sensitiveness, reliability and durability of various detectors. The construction, adjustment and working of specific types of detectors (electrolytic, carborundum, silicon and others) are dealt with in Chap. VII, and in the next chapter the author discusses the theory, construction and action of the magnetic detector. The dimensions of inductances and condensers required for tuning purposes are discussed in Chap IX, and typical tuners are described suitable for use with various kinds of detectors. In the next chapter the author describes and illustrates the construction of a simple wave meter with lamp indicator, responding to only one wave length (say 300 m.), for amateurs' purposes. Chapters on buzzers and change-over devices and on aerials and earthing conclude this little work, which certainly represents a very successful attempt to meet the needs of the majority of amateur operators.

The Motor Cyclist's Handbook. By "Phœnix" (Chas. L. Lake.) Third Edition, Revised and Enlarged. London:, Percival Marshall & Co. Price 2s. net.

Generally speaking, it may be safely asserted that when a work of a more or less technical character runs to three editions in the short period of eighteen months, such work has met "a long-felt want." This is the case with "The Motor Cyclist's Handbook," the object of which is to provide the ever-increasing army of motor cyclists with a practical manual on the construction and management of their machines. There was a time when all motorists were extremely enthusiastic about their knowledge of motor mechanics and their ability to cope with any derangements experienced when out driving, which, in the early days, were of a very frequent nature. Now that the motor car has become part and parcel of modern life, the motor enthusiast, although he still exists, only forms a fractional part of the motoring public, the majority of whom are not interested in mechanical details, they leaving such matters to their paid servants. Hence, so far as cars are concerned, practical manuals are not in such great demand as was the case some few years ago. With motor cycles, however, the position is different, and, indeed, there is every likelihood that it will remain so for a long time to come, for whether the motor cycle is used for pleasure or business, the rider is compelled to act as his own chauffeur, and must make himself capable of coping with any unexpected breakdown, which, although to a much lesser degree than formerly, has still, at times, to be contended with. It is probably due to this that the demand for Mr. Lake's book is being so well maintained.

The author, very properly, starts with the engine, the book opening with a capital chapter devoted to the four-stroke engine, followed by one dealing with the two-cycle motor—in the development of which, from an automobile point of view, the motor-cycling world is doing useful work—and one with twin and four-cylinder engines. The next chaper deals with the constructional details of petrol motors, and is followed by notes on compression, the carburettor and ignition. It is to the last-named chapter that we, naturally, look with special interest. In this connection we find that while the technical details of the high-tension magneto, now almost exclusively used to provide the vital spark on petrol automobiles of all kinds, are fairly fully dealt with, no advice is given, under the heading "Care of Ignition Appliances," as to the attention that must be given to the magneto. At first we thought it had been entirely omitted, but further perusal elicited the fact that some hints with regard to keeping magnetos in good order are tucked away, a hundred pages further on, under the heading "Ignition Faults." It might be advisable in a subsequent edition to bring these more prominently under the reader's notice by modifying the arrangement so that a separate heading, "The Care of the Magneto," could be included. Another subject, too, that is somewhat scantily dealt with is that of electric lighting for motor cycles, and as this form of illumination is growing in popularity, no doubt the author will give it greater space in his next edition.

Transmission and gearing are naturally subjects that require lengthy treatment, so that it is not surprising to find nearly sixty pages devoted to them, while what may be termed the descriptive part of the book is concluded by chapters on Springing and General Design. Mr. Lake then deals with the management of motor cycles, and gives a number of chapters in which advice is offered on such matters as overhauling and tuning-up the engine, selection of a machine, driving hints, etc. Finally, there are chapters on the modern cyclecar, and on motor cycling accessories and equipment.

In a movement which is developing so rapidly as that of motor cycling, it is, of course, almost impossible for any book to be thoroughly up-to-date, but, even with this reservation, Mr. Lake's work can be strongly recommended as a good investment on the part of all motor cyclists who are desirous of knowing the why and wherefore of the many different items that go to form a modern motor cycle.
—C. J. W.

American Telegraph Practice. By Donald McNicol. London: Hill Publishing Co., Ltd. 1913. Price 17s. net.

This book claims to be a complete technical course in modern telegraphy, including simultaneous telegraphy and telephony.

After a short theoretical introduction, necessary to understand the principles upon which the art is based, a very full and detailed description is given of American telegraph methods, as far as apparatus and systems are concerned. The whole ground is covered from simplex sounder circuits to modern printing systems.

The portion of the book devoted to telegraph construction is, however, very small, being mainly confined to specifications of wire and cables.

Although, of course, for most telegraph men in this country the book will not be of much immediate utility, owing to the difference between the methods in vogue on either side of the Atlantic, yet it is good to learn what others are doing, and from this point of view the book can be recommended to all interested in the subject. Those of our readers who are brought into actual contact with American telegraph affairs will find the book of great utility.

It is throughout written very clearly. We have only noticed one point which could with advantage be modified in future editions. In discussing lightning effects, the author says that, among other manifestations, lightning may occur "as an alternating current of high frequency, having large capacity and high self-induction"! Of course, it is clear what he means, but the statement, as it stands, is vague, to say the least.

The book is well printed on good paper, and the diagrams and illustrations are very clear.

Telephone Cables. By J. C. Slippy. Pittsburg: From the Author. 1913. Price $2.50.

This small book may best be described as an American Telephone Cable Engineer's pocket-book. The ground covered includes specifications, plans and records, the running of cables, both overhead and underground, loading, maintenance and testing, and the costs of cables and cable work. The book concludes with an appendix containing tables of various data useful to the cable engineer.

The book contains a large amount of useful information in a small space, is well illustrated, and to anyone connected with American telephone cable work should prove valuable.

Factory Lighting. By C. E. Clewell. 1913. London: Hill Publishing Co. Price 8s. 4d. net.

Mr. Clewell's book on factory lighting is apparently written mainly for owners and managers of factories, but it is doubtful whether they would be able to dispense with the services of competent technical advisers, even after a careful study of his suggestions. Probably the slight doubt as to whether the book is intended primarily for the non-technical or the technical man is due to differences between American practice and English in regard to the employment of consulting engineers.

There is no doubt, however, that the book will be of considerable value to anyone interested in its subject. Mr. Clewell puts very clearly and forcibly the cash value of a good light, and his remarks on this point and on the desirability of keeping the lighting installation in thorough order should be taken to heart by every factory owner. It is only of recent years that there has been any appreciation of the fact that money spent on good lighting is a paying investment. Even to-day the majority of factory installations are carried out on the principle of getting just enough light to work by, irrespective of its proper application to the special conditions of the factory.

Anyone who has had experience of the trouble involved in persuading an owner to spend a penny more than the bare minimum required to get his factory wired will appreciate this.

The data Mr. Clewell has collected with regard to the improved output of a factory which results from good lighting, and especially his method of putting the value of good light in terms easily appreciated by the non-technical man, will help the advising engineer very considerably in his desire to have the lighting installation properly carried out, and properly looked after once it is done.

Mr. Clewell also has much useful information to impart with regard to the illumination that is desirable for various types of building, and gives many comparisons between old inefficient systems of lighting and more satisfactory systems that have been developed in their place. These will repay careful study by anyone interested in the subject, and this means everyone concerned in lighting work, for his examples include offices, drawing offices, factories of various kinds, power houses, etc., as well as the consideration of the special lighting desirable for machine tools, etc.

Whilst giving much information on all these subjects, Mr. Clewell fully appreciates the necessity of treating each case on its merits, and that it is useless to assume that the arrangement of lamps satisfactory in one factory will be equally satisfactory in another. Differences in the reflecting values of the walls and ceilings, for example, are obviously of vital importance. It is the existence of these variable factors that causes the doubt whether the book will be of much direct value to the factory owner without expert advice. Its value to him will rather be indirect by its advocacy of the general principle of the value of a good lighting system.

There is a very interesting chapter on the subject of "Lighting Maintenance and Records," but whilst there can be little doubt as to the value of proper maintenance, it is doubtful whether the rather elaborate proposals for recording the details of the lighting installation which Mr. Clewell suggests will be worth the considerable cost they would probably involve. It would have been interesting had Mr. Clewell been able to include some figures of the actual cost of keeping these records for specific installations of various types. In the same chapter occur some very striking figures showing the loss of light due to failure to clean globes and shades. One such test showed a drop of nearly 50 per cent. in the effective candle-power after only three weeks non-cleaning. The curves apparently are for lamps fitted with Holophane shades, which raises a question whether the deterioration would have been as considerable had a smooth shade of opal, Superlux, or some similar glass, or even metal, been used in place of the corrugated Holophane shade.

There are many other points of similar value brought out by Mr. Clewell, and the book is certainly worth close study by the lighting engineer. It should be added, that whilst the examples given are almost exclusively based on electric light, yet, as Mr. Clewell explains, the principle involved is the same whatever means of obtaining light be adopted, and for this reason the book should appeal to all classes of lighting engineers, and not only to the electrical engineers.

Aviation: An Introduction to the Elements of Flight. By Algernon E. Berriman. London: Methuen & Co., Ltd. Price 10s. 6d. net.

As has been the case with motor cars, motor cycles, and the other developments of the late 'nineties and the early years of the new century, the literature in connection with the subject of aviation and aeroplanes is rapidly growing in extent. Of the latest addition to such works—the one under notice—very little criticism can be offered, for its author is a gentleman peculiarly fitted to deal with the subject. Both as an engineer and as a journalist, he has had special facilities to make himself thoroughly conversant with all aspects of the subject of aviation, for until recently he was the technical editor of our contemporary, "Flight," and thus had greater opportunities than fall to the lot of most people.

The arrangement of the book does not follow the usual plan, for the historical part, which is generally given first, is relegated to the third section, so that, on reaching it the reader should be in a better position to appreciate the work of the pioneers. The first section deals with the fundamental principles of heavier-than-air flight, supplying the student with a knowledge of the technicalities of the science which is necessary in order to secure a proper grasp of the problems associated with flying that have been solved and those that still await solution. The second part is more particularly devoted to a consideration of the practical results that have been achieved, and refers in detail to the work of certain well-known pioneers such as Lilienthal and the Wright brothers. As has already been mentioned, the third section is largely historical, and gives an excellent recital of the progress that has been made since the days when the flight of birds first began to inspire men to emulation of their flying powers. The fourth division of the book is devoted to a series of appendices which, while having no exact or proper place in the body of the work, have been included to furnish the reader with a range of matter relating to such things as terminology, aeronautical clubs and institutions, bibliography, flying records, formulæ, etc.

We are somewhat in doubt as to the necessity or use of some of the tables and other data that are given in this section, a glance at which may possibly cause some would-be purchasers of the book to consider it too highly technical for them. Moreover, were we invited to make suggestions, we should recommend a little fuller treatment of the chapter on "The Petrol Engine." It is largely, if not entirely, due to the improvements that have taken place in internal-combustion engines in recent years that aviation has become an actuality in place of the possibility of which so many long dreamed. In fact, it may almost be said that the theory of heavier-than-air flight had been well established for some years, and that it had come to a point when only the advent of a reliable prime mover could give the science a further impetus. It is therefore somewhat surprising that the author should dismiss this section in a chapter which, extending to only five pages, is more devoted to the question of petrol and other fuels than it is to the subject indicated by its title. The chapter relating to "Accidents," too, would seem to be somewhat disjointed, for it is not clear whether the quoted opinions and recommendations of the Royal Aero Club relate to one or a series of accidents, and, in any case, it would, we think, have been better to have briefly outlined the particular accident or accidents so as to afford the reader a clearer idea of what the Committee's opinions relate to.

On the whole, however, the author has succeeded in producing an instructive work, and one that should appeal to all who are taking more than a superficial interest in aviation. The text is well illustrated, and a useful index is provided.—C. J. W.

Village Electrical Installations. By W. T. Wardale. London: Whittaker & Co. Price 2s. net.

Probably no engineer whose travels have taken him into country districts in many parts of the Continent has failed to notice the extent to which electricity is used for all kinds of purposes, and to compare these conditions unfavourably with those that exist in this country. Abroad, no doubt, they have the advantages bestowed by water power and by the absence of the expensive systems of mains so often imposed on a supply company here by district councils and others, but, nevertheless, much of our failure to use electricity more extensively is due to our lack of energy in taking advantage of such opportunities as do exist. Mr. Wardale's book may help to overcome this defect.

There is little doubt that by giving careful consideration to the local conditions many small installations such as those he describes could be successfully worked, and could return larger dividends than he suggests. It is to be feared that if this were not the case it would not be easy to raise the capital unless the shareholders regarded the advantage of electricity as in itself a partial dividend. He speaks of no return the first year; four per cent. the second, and five per cent. subsequently, but this could hardly be regarded as a very attractive business investment.

Mr. Wardale's book is, perhaps, rather elementary for a technical man who may have in view the formation of a company to work a small village electricity supply, but many of his points will be worth careful consideration. This applies particularly to the statement that such schemes can rarely stand alone. They need to be tacked on to some other business so as to reduce capital cost for the site and buildings and running costs by enabling a man to spend only part time on the supply station work. It is not always easy to arrange for this, but if it can be done the advantage is great. It is to be hoped that the possibilities of electricity supply in villages will receive more consideration than they have in the past, as they should open up a large field for electrical material of all kinds.

Shipping Exhibition.—We have received a copy of the Official Bulletin and Prospectus of this exhibition, which takes place at Olympia next September. It contains a list of exhibitors and photographs of some of the intended exhibits.

THE LIABILITY OF ELECTRICAL CONTRACTORS AND SUPPLY AUTHORITIES FOR ACCIDENTS.

[FROM OUR LEGAL CONTRIBUTOR.]

From time to time cases occur in which responsibility for accidents is sought to be placed upon electrical contractors and supply authorities responsible for installations. If, in the case of a contractor, it is manifest that the accident has arisen owing to the carelessness of those who work or operate the plant after it is taken over, the claim is easily disposed of; but more difficult questions arise if it is alleged that a defect in construction or design has been the cause of disaster. With regard to the supply authorities, whether they are local authorities or companies different considerations apply. The trouble which is so often occasioned by accidents through alleged short-circuiting, not unnaturally leads to consideration of the legal position. What is the legal liability of the electrical contractor who has installed the plant? If it can be shown that a disaster has happened owing to defective insulation, can the blame be attached to those who put in the plant?

Assume, for instance, that cables have been laid in a place where they are necessarily exposed to injury, as in a coal mine. Given all the conditions as to danger of short-circuiting being brought about owing to cables being worn and frayed by the traffic and work of the mine, it is for the electrical engineer, who has charge of the job, to see that risk is reduced to a minimum. At the same time it is clear that, having regard to the great risk of breakages below ground, no firm would guarantee that a short-circuit would be a thing impossible. What we desire to see is where the liability of the electrical contractor ends under the conditions which usually obtain.

Let us examine, in the first place, the Form of Model General Conditions for Electricity Works Contracts which have been approved by the Institution of Electrical Engineers with a view to seeing whether, if those conditions form the basis of the contract, any liability rests with the contractors after the conclusion of the work. Clause 31 of these conditions provides that:—

"The contractor shall properly cover up and protect such of the work as may be liable to sustain injury by exposure. He shall also take every necessary, proper, timely and useful precaution against accident or injury to the plant, and shall be and remain answerable and liable for all losses, damages or injury which, during the progress of the work, and until it be taken over, may arise or be occasioned by the acts or omissions of the contractor or his servants, but not for any subsequent consequential loss or damage, nor for any breakage or injury, wholly or partially caused by, or arising from, the acts or purchasers of others, or due to circumstances over which the contractor has no control . ."

The clause also provides that, until the plant has been taken over, the contractor shall indemnify the purchaser from all claims under the Workmen's Compensation Act, 1906.

It will be seen that howsoever this clause protects the owner until the completion of the works, it affords him no protection after that time. The period of liability is further defined by Clause 45, which relates to "Maintenance." It is there provided that:—

"Until the final certificate shall have been issued, the contractor shall be responsible for any defects that may develop under normal and proper use, arising from bad materials, design, or workmanship in the works. When called upon, in writing, by the engineer to remedy such defects, the contractor shall do so with due diligence, and unless such defects be remedied by the contractor within a reasonable time, the contractor shall be responsible for all losses and damages sustained by the purchasers through such defects."

Consideration of these two clauses shows that, if the common form of contract be adopted, the liability of the contractor practically comes to an end when he finishes a job; and even during that period he is not to be liable for the consequences of any accident for which he is not responsible. A fall of roof, for instance, which caused the break of a cable and a short circuit, would impose no liability upon him. No electrical firm could be induced to sign a contract which made them insurers of the work for all time.

We are unable to quote any cases which deal directly with the liability of electrical contractors who have been bound by clauses similar to those above set forth. Nor has the question of liability been considered in any cases which bear very directly on the point under discussion. This absence of authority is, to a large extent, accounted for by the fact that any disputes which do arise are heard behind the closed doors of an arbitration court.

One point, however, is clear, namely, that in employing a firm of electrical engineers to scheme out an installation, the owners or lessees of a mine must necessarily leave something to the judgment of those who are familiar with the vagaries of electricity; and people cannot be held liable for the consequences of a mere error in judgment. In one case (Fulham Borough Council v. National Electric Co., 1906, 70 J.P., 55) a contract for the installation of electric light in a building to be used for the purposes of baths and wash-houses provides (*inter alia*) "that the whole of the work is to be carried out in accordance with the existing rules as framed by the Phœnix Fire Office." No. 5 of these rules provides that: "Where a system of metal tubes is employed, the metal tubes should be earthed, except in those cases where earthing would not be desirable." A system of metal tubes was employed for the work, and in consequence of such tubes not being earthed, a bather received an electric shock which caused his death. The local authority, which owned the baths, paid damages in respect of the death, and sought an indemnity from the contractors. In the proceedings against the contractors, the arbitrator found that earthing the tubes would not have been desirable so far as the risk of fire was concerned, but would in fact have been desirable so far as risk of accident to bathers was concerned. It was held that there had been no breach of contract, and that therefore the wiring contractors were not liable. The lesson taught by this case is that, in drawing up a contract, the first consideration should be the safety of the men working in the mine. Electrical contractors might well be put upon such terms that safety of life and limb would be considered before cheapness of construction.

It remains to consider whether there is any limit to the liability of the mine-owner for the consequences of an explosion which has been caused by a short-circuit. With regard to the pitmen themselves, their right to prefer claims under the Workmen's Compensation Act is absolutely clear. The accident would arise out of, and in the course of, the employment. Again, it might easily be said that the accident was caused by a "defect in the ways, works, machinery, or plant," for which the employers would be liable under the Employers' Liability Act. It is to be observed, however, that there is a section in the Workmen's Compensation Act by virtue of which the employer, having paid compensation to the men, might seek an indemnity against the electrical contractor. For instance, if the accident took place in circumstances creating a legal liability in the contractor to pay damages to the miner, the miner's employer might have to pay compensation in the first instance, but the electrical contractor could be made to indemnify him.

Thus, suppose that during the execution of the works, the installation was negligently left in such a condition that when the current was switched on a short-circuit occurred, and a miner was injured; he could claim damages from the electrical contractor. This liability is based upon the well-known case of Heaven v. Pender, 11 Q.B.D. 503, where it was laid down that: "Whenever one person is by circumstances placed in such a position with regard to another, that everyone of ordinary sense who did think would at once recognise that if he did not use ordinary care and skill in his own conduct with regard to those circumstances, he would cause danger of injury to the other person, or property of the other, a duty arises to use ordinary care and skill to avoid such danger." Application of this principle will relieve the owner during the time the contractors are executing the work; but, as we have seen, it would afford no protection after his liability to maintain came to an end.

The conclusion, then, to which one is driven by the consideration of so much of the law of England as is applicable to the facts, is that the electrical contractor is in no sense an insurer. His liability practically ceases when he leaves the job.

In the case of a local authority or company supplying electricity, different considerations apply.

In the case of an accident caused by their employment of electricity, they may be liable even in the absence of negligence, notwithstanding the general principle that those carrying on statutory undertakings are not usually liable unless negligence be proved (Midwood v. Manchester Corporation (1905) 2 K.B. 597).

For instance, a case which was heard in 1910 by Mr. Justice Grantham indicated the serious liabilities imposed upon electrical companies who allow live wires to remain in disused premises. The facts may be very briefly stated.

It appears that the plaintiff was a builder and contractor, and was, in April, 1909, engaged in rebuilding a house, 32, Devonshire Place. In the course of his work he cut with a chisel into a piece of lead piping in a cellar, which was, according to his evidence, hanging down from the ceiling and which he took to be a gas or water pipe. It was, in fact, a pipe containing a live electric light wire, which had been left by the defendants when they had disconnected the consumer's installation some time previously. The result was a severe shock and burning owing to the fusing of the chisel and cable, and it was alleged that the plaintiff was completely incapacitated for over six months, and permanent injury had been caused. The defendants maintained that the cable had been properly disconnected by withdrawing the fuses of the cut-outs and removing the leads connecting the cut-outs with the installation, the cut-outs being left properly sealed up and insulated, and the pipe attached by wall-hooks to the wall. They claimed that the pipe was their own property, with which the plaintiff had no business to tamper; but it was maintained for the plaintiff that, having received orders to disconnect the service, the defendants had no right to keep a live wire on the premises. The defendants alleged negligence on the plaintiff's part, as the presence of the cable and sealed cut-outs should have given him warning of possible danger, but the plaintiff said that he did not see the sealed cut-outs, as they were hidden under some rubbish. It appeared that the plaintiff's foreman had told the defendant's engineer, before the disconnection took place, that, though the house was coming down, the cellar was not going to be touched, and that it was in consequence of this that the live wire was left on the premises. After hearing the case, the jury found a verdict for the plaintiff, and assessed the damages at £450 for loss of business, £75 for pain and suffering, and £56 for special damages.

This apparently amounts to a decision that if a supply authority have received orders to disconnect any premises they may not leave any live wires on the premises; or that if they do so, they do so at their own risk.

The principle that persons supplying electricity shall always be made liable applies generally in the colonies and dependencies. We recall a case of two years ago in which heavy damages were recovered in Newcastle, Australia. The action was brought to recover the sum of £2,000 as compensation for severe injuries sustained by plaintiff through coming into contact with live electric wires. He averred that the accident was caused by the careless and negligent method in which the council had erected and maintained the wires in question. The first count of the plaintiff's declaration charged defendant with being guilty of a public nuisance, and the second alleged that the council was negligent in the way stated. It appeared that the council put up certain live wires, along which it conducted electric currents, and it was said that the way in which that was done constituted a public danger and nuisance. Then, the council was grossly negligent in the way in which it maintained the installation. The accident out of which the action arose occurred on a balcony. The balcony was covered by a corrugated-iron roof; one wire was carried about two feet above this roof, and the other five feet above it. The wires were then stretched across the street to the opposite building, and this method of installation had apparently been in existence for some years, though the system had since been altered in such a way that nobody was likely to be injured by the electric current. On the 19th of January of last year, plaintiff had been instructed to make some repairs to the roof of the balcony. He was quite ignorant that the wires were "live," but he endeavoured to avoid contact with them. One of his men was working about the centre of the balcony, and plaintiff stooped down to give him instructions. Upon straightening himself up immediately afterwards, he received an electric shock and became unconscious. A message was at once sent to the electrical depôt, and the current being cut off, plaintiff was released. He was not dead, and was conveyed to the hospital, where he remained for five months. It was alleged that the Council had no right to place these wires in a position where they might come into contact with anyone, and by doing so it was guilty of creating what in law was a nuisance. The council could have placed the wires at such a height as to be out of the way of anyone working underneath them, and they should have been insulated so as to minimise the danger of installation. Apparently the wires had been originally insulated, but had been allowed to get into such a state of disrepair as to become dangerous. In the event the jury awarded the plaintiff £1,275.

WORDS TO THE WISE—AND OTHERS.

By "COMMERCIAL."

Most business people to-day will admit that the fashion of the times in regard to methods in business has been set to no small extent by our cousins in the United States. American "hustle" has become a by-word in the world's work, and the Americans have the most up-to-date methods in every department of commercial activity. Their machines, no less than their systems, are the products of the finest brains which they can command, and there is little doubt that the Americans produce the desired results. As always happens, one finds the extreme, not altogether desirable, which comes with exaggerated "hustling"; the extreme which defeats itself and lays open to ridicule those who go to such extreme. And we in Europe have, in a measure, become inoculated with modern ideas of "getting there," and in books and newspapers we have been told that there was a danger of our becoming "back numbers." (The Americanisms will perhaps under the circumstances be pardoned.)

As a result of this competition, in part, and by reason also of other influences nearer home, no matter what business one belongs to nowadays, the methods of manufacturers, office routine, and the business of advertisement, are all, or nearly all, brought right into line. Labour-saving devices are rampant, from automatic stamp machines to moving staircases, and we pride ourselves that this is indeed a strenuous age. Writers often call it "Modern stress," or something similar. Those who are faddists or extremists in this matter, label their office walls with such devices as, "Time is Money," or "Do it now," or "This is my busy day." They distribute small tracts to their employés, containing short sermons of the "Get on, or Get out" variety, and impress upon the recipients the importance of acting upon the advice contained in the said pamphlets. Doubtless the new methods are a vast improvement in many cases upon the ancient ones, and business increases and dividends grow. Workers of all ranks ought to be more efficient to-day than ever, other things being equal. Incidentally we ought really to be able to work shorter hours, but this is not done in many cases. Improved and more general education, coupled with modern systems, has naturally had a great influence in the business world, and nobody can fail to profit by these influences if they use the present opportunities wisely.

At the same time, in ordinary everyday experience with any business firm, one cannot help seeing little indications of the fact that some fall behind, even when they are most earnestly endeavouring to keep in front. Others are far behind the standards of usefulness to which modern education is supposed to bring them. We hear of a daily newspaper offering prizes for the best applications for a certain vacant situation in this or that business house. The offer is prompted solely by the fact that employers allege that they receive very few really adequately expressed and properly written applications. The employers complain of a lack of the sense of proportion in the candidates, as to the importance of things which matter, and those which do not. If these statements are true, and there is little doubt that they are, workers should not be surprised at the prevailing level of wages, and certainly they are not using all their advantages wisely.

Again, one receives an order from a large electrical firm, accompanied by an inquiry as to when the customer may expect the goods. Now presumably the price was as low as others, or the order would not have come. The goods are promised by a certain date—a fair and reasonable time. Then the buyer threatens to cancel if the delivery is not improved. "Very well," he is told, "cancel it, we cannot do better." He does not cancel, however, because he must have the stuff, and could hardly get it cheaper or quicker elsewhere. The action of threatening to cancel may be smart, but it is not business-like always to use such bluff.

Another order is placed to deliver in fourteen days, as promised. The day following, the buyer inquires if the goods can catch a boat in three days. Such an inquiry is absurd, and a waste of time and money. As if one would say fourteen days for that which can be done in three or four days! Yet these are people who are in business.

An American firm we are told can build a motor car in half an hour. We should not expect them to stock only sufficient sparking plugs to last just a few days, yet there are English factories which depend upon hand to mouth methods for supplies of equally important accessories.

Another illustration from the opposite side. A dynamo factory orders raw material, and receives a promise of delivery. This delivery is not kept, and subsequently two further promises are made and broken in the same manner. The goods remain undelivered after three promises, and the only reason for the delay is lack of system. It is worse than useless to promise a job, file away the letter copy, and forget all about it, until the buyer complains. To repeat this cycle of operations twice afterwards is beyond all sense or reason. It is done regularly, none the less.

Buyers would do well to state on their orders, in addition to the exact description of the goods, price, etc., the time by which they are required, in those cases where a definite date is in view. Especially does this apply to short delivery dates, since if no time is mentioned, the order takes its turn in company with others. Should a short date be named it is necessary to push the job through, therefore it saves trouble to name the date.

In the same way it is not fair to rush people for goods which are not to be used for some considerable time. Apart from the question of the capital which may be locked up in such material, while awaiting delivery instructions, the manufacturer often finds it difficult to keep to time, with such orders as are really urgent.

A more serious and, it is to be feared, more general, defect in workers than any of the foregoing, is the prevalence of the liability to error. We hear people say that men who make no mistakes, never make anything, but some there are who never make much else but mistakes. No one is infallible, and the opportunity for errors is great; but one thing must be lacking from an otherwise capable person, when he makes these mistakes regularly. That is concentration: and if that quality took the place now allotted by many to mere hustling, we should have greater freedom from error. All the above matters may appear on the surface as trifling, yet they make a considerable difference when they occur frequently. A little forethought obviates, on occasion, much unnecessary trouble.

TRADE STATISTICS OF SPAIN.

The figures given below show the imports of electrical and similar goods into Spain during the year 1912, according to the official statistics recently issued. It will be observed that there is a predominance of German trade in practically every branch. The figures for 1911 are given for purposes of comparison, and notes of increases and decreases have been added:—

Dynamos, electric motors, induction coils, resistances, transformers, etc., up to 400 kg. weight.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	3,173,000	3,692,000	+ 519,000
,, France ...	453,000	638,000	+ 185,000
,, Great Britain ...	324,000	568,000	+ 244,000
,, Switzerland ...	177,000	106,000	− 71,000
,, Other countries	174,000	453,000	+ 279,000
Total ...	4,301,000	5,457,000	+1,156,000

Ditto, weighing from 401 to 2,500 kg.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	2,278,000	3,054,000	+ 776,000
,, France ...	240,000	299,000	+ 59,000
,, Great Britain ...	333,000	430,000	+ 97,000
,, Switzerland ...	187,000	281,000	+ 94,000
,, Other countries	145,000	552,000*	+ 407,000
Total ...	3,183,000	4,616,000	+1,433,000

* U.S.A., 397,000.

Ditto, weighing from 2,501 to 5,000 kg.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	515,000	496,000	− 19,000
,, Switzerland	231,000	237,000	+ 6,000
,, Other countries	62,000	374,000†	+ 312,000
Total	808,000	1,107,000	+ 299,000

† Great Britain, 198,000.

Ditto, weighing more than 5,000 kg.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	3,065,000	4,026,000	+ 961,000
,, France ..	142,000	125,000	− 17,000
,, Great Britain ...	194,000	165,000	− 29,000
,, Switzerland	542,000	373,000	− 169,000
,, Other countries	17,000	320,000	+ 303,000
Total ..	3,960,000	5,073,000	+1,113,000

Accumulators and electric batteries.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	113,000	104,000	− 9,000
,, France ...	46,000	79,000	+ 33,000
,, Great Britain ...	8,000	7,000	− 1,000
,, Other countries	20,000	30,000	+ 10,000
Total ...	187,000	220,000	+ 33,000

Cables and wires for electricity, with or without insulating material, of 1 cm. dia. or more.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	1,381,000	1,151,000	− 230,000
,, Great Britain ...	18,000	645,000	+ 627,000
,, Other countries	74,000	249,000	+ 175,000
Total ...	1,473,000	2,045,000	+ 572,000

Ditto, less than 1 cm. in dia.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	135,000	122,000	− 13,000
,, France ...	78,000	74,000	− 4,000
,, Great Britain ...	20,000	384,000	+ 364,000
,, Other countries	16,000	14,000	− 2,000
Total ...	249,000	594,000	+ 345,000

Telegraph and telephone apparatus, electric meters and parts.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	1,106,000	1,122,000	+ 16,000
,, Belgium ...	123,000	77,000	− 46,000
,, France ...	259,000	324,000	+ 65,000
,, Great Britain ...	166,000	204,000	+ 38,000
,, Sweden ...	97,000	119,000	+ 22,000
,, Other countries	37,000	120,000	+ 83,000
Total ...	1,788,000	1,966,000	+ 178,000

Arc lamps.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	150,000	157,000	+ 7,000
,, France ...	30,000	25,000	− 5,000
,, Great Britain ...	18,000	10,000	− 8,000
,, Other countries	11,000	10,000	− 1,000
Total ...	209,000	202,000	− 7,000

Carbons for arc lamps.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	103,000	94,000	− 9,000
,, France ...	22,000	22,000	—
,, Great Britain ...	5,000	3,000	− 2,000
,, Other countries	3,000	4,000	+ 1,000
Total ...	133,000	123,000	− 10,000

Electrodes.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	35,000	19,000	− 16,000
,, Italy ...	34,000	55,000	+ 21,000
,, Other countries	14,000	16,000	+ 2,000
Total ...	83,000	90,000	+ 7,000

Incandescent electric lamps mounted.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	3,348,000	4,733,000	+1,385,000
,, France ...	152,000	158,000	+ 6,000
,, Great Britain ...	60,000	334,000	+ 274,000
,, Ohter countries	173,000	566,000*	+ 393,000
Total ...	3,733,000	5,791,000	+2,058,000

* Austria, 466,000

Ditto, unmounted.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	8,000	—	− 8,000
,, France ...	1,000	—	− 1,000
,, Other countries	1,000	—	− 1,000
Total ...	10,000	—	− 10,000

Hydraulic motors.—

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	1,192,000	1,135,000	− 57,000
,, France ...	134,000	127,000	− 7,000
,, Great Britain ...	92,000	7,000	− 85,000
,, Switzerland ...	110,000	278,000	+ 168,000
,, Other countries	13,000	16,000	+ 3,000
Total ...	1,541,000	1,563,000	−+ 22,000

	1911. Pesetas.	1912. Pesetas.	Inc. or dec. Pesetas.
Steam and gas engines, fixed.—			
From Germany	1,018,000	1,300,000	+ 282,000
,, Great Britain ...	857,000	762,000	− 95,000
,, France	184,000	288,000	+ 104,000
,, Belgium	175,000	226,000	+ 51,000
,, Other countries	105,000	180,000	+ 75,000
Total ...	2,339,000	2,756,000	+ 417,000
Cylindrical steam boilers.—			
From Germany ...	483,000	329,000	− 154,000
,, Great Britain ...	696,000	500,000	− 196,000
,, France ...	189,000	63,000	− 126,000
,, Belgium ...	122,000	71,000	− 51,000
,, Other countries	14,000	25,000	+ 11,000
Total ...	1,504,000	988,000	− 516,000
Multitubular boilers.—			
From Great Britain...	2,062,000	2,944,000	+ 882,000
,, Germany ...	629,000	652,000	+ 23,000
,, Belgium ...	181,000	165,000	− 16,000
,, France ...	285,000	633,000	+ 348,000
,, Other countries	26,000	168,000	+ 142,000
Total ...	3,183,000	4,562,000	+1,379,000

Note.—25 pesetas = £1.

ELECTRICAL TRADE IN INDIA.

Developments in Simla.

The American Government have issued a report by a Special Commissioner, who has recently been touring in India on the possibilities of trade in electrical appliances in Simla. In the course of this report the Commissioner states that in proportion to its population Simla, the summer capital of India and the brilliant social centre of Southern Asia, situated at over 7,000 ft. elevation in the Himalaya Mountains, promises to become the most important market in India for electrical appliances. Since August 1st, 1913, when a water power installation of about 500 kw. became available for public purposes, in addition to private installations already existing at the Viceregal Lodge and the official residences of the Lieutenant-Governor of the Punjab, the Commander-in-Chief of the India Army and the United Service Club, the demand for electrical energy for house lighting and power in Simla has to such an extent exceeded what was anticipated, that the municipal committee has already had to consider whether the existing plant should be increased in the immediate future. When all the more urgent demands are supplied, probably this year the existing plant will not suffice for any of the further demands which will almost inevitably be made as the use of electric lighting spreads to private houses.

Under the schedule of rates which has been announced by the Simla municipality, electricity will be cheaper in Simla than in any other part of India; in fact, it is anticipated that it would be cheaper in Simla to use electricity than kerosene oil. Owing to the many different purposes for which electricity will be required, and the many different types of consumers, it has been considered advisable by the municipality to adopt several alternative tariffs, each of which is best suited for certain types of consumers. One is a statutory flat-rate system which will be employed by consumers who wish to have their supplies metered, and amounts to 2d. per unit for motive power only, and a rate of 1d. per unit, subject to a discount of 25 per cent. during November, December, January and February, for heating and cooking only, and 4d. per unit for all other purposes, together with a charge of 1s. 4d. per month for meter hire. Another rate is for small lighting consumers requiring not more than five lamps, who will use electricity for lighting purposes only, and consists of a charge of 1s. per 30-watt lamp installed, or equivalent per month. Another rate is for domestic and residential consumers who wish to use electricity for general purposes, such as electric irons, kettles, lighting and heating. This amounts to 33s. 6d. per kw. per month for all purposes for domestic use up to 2½ kw. only, except during November, December, January and February, when the limit is raised to 5 kw. These rates are subject to 50 per cent. discount during the four months named. The reduced prices and increased limits for use of electric current in winter are due to the population of Simla being reduced during this season to about one-half of what it is during the summer months.

In a pamphlet which the Simla municipality has recently issued, it is mentioned that electrical energy can now be used for so many varying purposes that it is anticipated that it will eventually displace many of the existing methods at present in vogue in Simla for heating, water-boiling, ironing, cooking, motive power, &c.

The pamphlet enters very fully into the household uses of electricity and the apparatus therefor—vacuum cleaners, electric angethis (which completely replace the ordinary Indian charcoal angethi, but have many advantages over the charcoal angethis, enabling them to be used in addition for purposes for which the charcoal angethi is distinctly dangerous, owing to the noxious fumes given off), electric irons, fans, hand-drills, water boilers, &c.

For construction of wiring systems on consumers' premises, the Simla municipality has approved of certain contractors and electrical engineers who may make their own arrangements with customers. These firms, therefore, will doubtless handle all the Simla business in connection with electric supply extensions. They expect also to do a very large business in the sale of electrical appliances. In conversation with the manager of one of these firms, it was suggested that all kinds of electrical appliances and novelties, especially in connection with heating, would doubtless find a good market in Simla. Owing to the high elevation of the city and its proximity to the Himalayas, the climate even in the summer, may require, at least in the evenings, the use of heating appliances. It will not be until the spring that all the extensions will be completed, so that most residences can be provided with electric current, but even now there is large inquiry concerning electrical appliances.

It is anticipated that it will cost less to heat a Simla house with electricity than with either wood, coal, or kerosene oil. For smaller houses, in order to lessen fire risks, the voltage will be brought down by transformers from 220 to 110 volts, so that replacements for heating of 220 and 110 volts will be required. The municipality will supply alternating current in all cases at a frequency of 50 cycles per second and at the following pressures:—Single-phase low pressure, 220 volts; three-phase low pressure, 380 volts between phases; three-phase high pressure, 2,200 volts between phases. Except in special cases, demands for connections up to 2½ kw. will be supplied from one phase only. Above 2½ kw. consuming devices must be divided into two or more approximately balanced circuits and will be supplied from more than one phase.

It was mentioned that among the native population the electric appliances known as angethis would be in specially great demand for heating and simple cooking; these should be equipped with quartz element disks in the middle, which could be turned in a stand up and down. The stands ought not to be over 6 in. high, for the reason that the natives do not sit on chairs, but squat on the floor, so that higher than a few inches would be inconvenient for resting the feet. Three kinds of lamps are now on the market at Simla—Osrams, Mazdas and Wotans.

The Simla hydro-electric scheme, which makes possible the large use of electrical appliance at this summer capital of the Indian Empire, and which was completed, except for house extensions and connections, on August 1st, 1913, has been carried out for the dual purpose of supplying electric light and energy, and of furnishing energy for pumping water to augment the present supply.

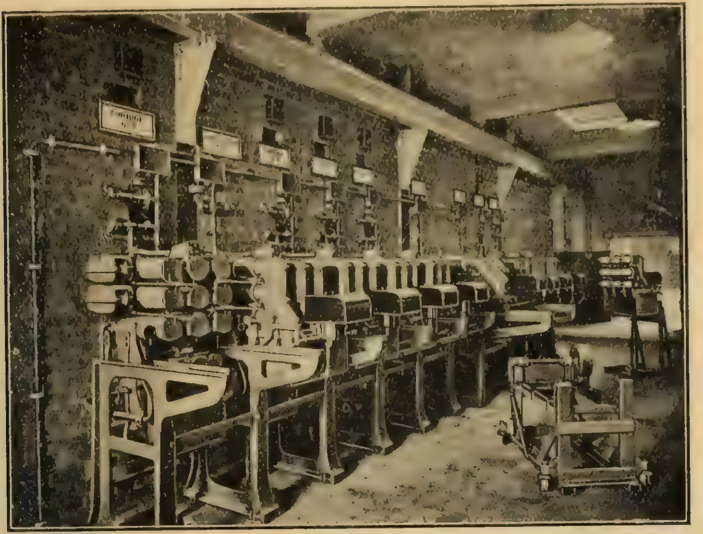
The requisite power is being obtained by taking water from the Nauti, a tributary stream of the River Sutlej, and by leading this water down an open concrete flume to the turbines and generators. In order to divert the water of Nauti into the flume, a weir has been constructed across the stream, with its crest 2 ft above the general bed level of the stream. The weir is constructed of galvanised iron wire crates, averaging about 5 × 5 × 5 ft. each, which are filled with bowlders, and are placed in a trench across the stream about 15 ft. below bed level.

On the bowlder crates the weir proper has been made of concrete, faced with cut stone in cement, and over this weir all floods will pass while diverting the ordinary low water flow into the flume head. As extraordinarily dangerous ground was met in the hillside immediately below the intake chamber, it was here found necessary to tunnel straight through this into the hillside and come out some 800 ft. downstream, clear of floods and bad ground. The concrete flume proper here commences. This flume is 4 ft. × 2 ft., and it winds along the hillside at a slope of 1 in 1,000 for about 1 mile, where it pierces through a promontory by a tunnel 7 ft. × 6 ft. cut out of the solid rock. This tunnel gave great trouble during construction, owing to the lack of skilled labour and the difficulty in getting down suitable drilling plant to the inaccessible spot where it is situated.

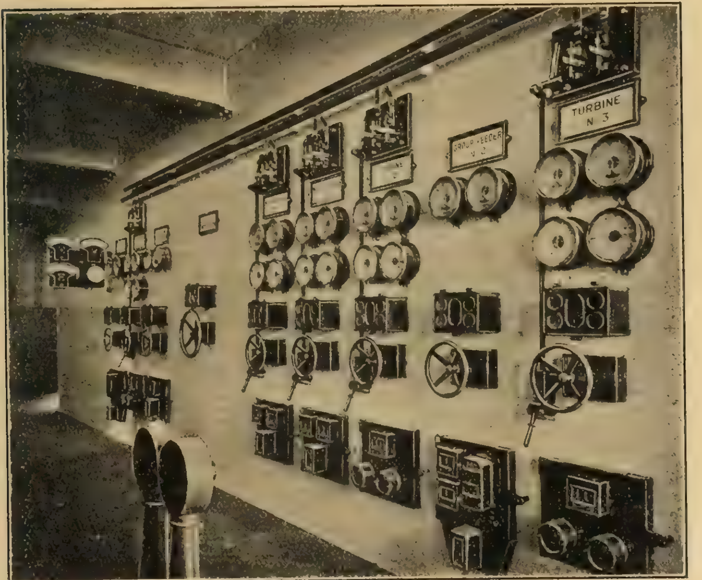
After emerging from this tunnel the flow continues in the open flume for about another mile to a large reservoir to hold an eight hours' full working supply of 6,250,000 gallons, which has been constructed on a suitable spur. The flume where it crosses a small creek called the Jaori, passes through a reinforced concrete box girder of 30 ft. clear span resting on dry stone masonry abutments, and it is also covered over in places where it has been considered that the hillside above was dangerous and likely to slip. Three settling tanks, provided with suitable parabolic scour outlets, have been constructed at intervals along the flume line to intercept all silt which might be brought down with the water, and in the large storage reservoir arrangements are provided for scouring out the silt. Also at certain selected spots where the hillside permits, overflows have been provided which would come into action if the flume were damaged and blocked in any way.

From the flume-proper terminus at the storage reservoir the water is led to the head of the penstock pipes through a reinforced concrete pipe, 40 in. in diameter, which is buried in a track about 1,000 ft. long. At the end of this pipe the headstock chamber is constructed, and out of this the six steel penstock pipes, 16 in. in diameter, lead down to the power-house, which is 545 ft. below.

The power house is designed in two complete halves, and also so arranged as to permit an extension being added to it when required, but at present only three out of six machines have been installed. Each half of the power station will contain three Pelton wheels, coupled direct to a three-phase alternator of 250-kw. capacity, at a speed of 500 R.P.M., a voltage of 2,200 volts between phases, and a frequency of 50 cycles per second. These alternators are excited by two direct-coupled exciters, mounted on the ends of the shafts of the two centre machines for starting operations, and also from a separate motor-driven exciter set. Power is conveyed from each alternator to the power house switchboard through three-phase rubber cables, and from the bus-bars power will be taken through oil-switch panels to a set of three 250-KW. single-phase, step-up, oil-cooled transformers, which will be situated in a separate transformer room, where the voltage will be stepped to 15,000 volts.



. Reyrolle Switchgear at Wolverhampton Electricity Works.



Control Wall, Reyrolle Switchgear, Wolverhampton.

The smaller town of Chair, a few miles away, also receives electric power from this system. The transmission line to Simla is about 9 miles long, and the one to Chair is about 12 miles long, while a third line is also being laid from Simla to Chair, 7½ miles long. This system of transmission lines, forming a triangle, has the merit of being able to send current round any two of them should any one of the three be broken. The Chaba-Simla and the Simla-Chair lines are supported on wooden structures, with short spans, while the Chaba-Chair line is supported on steel structures, with spans averaging 1,000 ft., with a maximum of 3,500 ft. All the lines are composed of three copper wires spaced 4 ft. apart in a triangle, and are protected at points where trouble from lightning is anticipated by superimposed steel earth wires. The structures also carry telephone wires, which run to all points where needed. The poles for street lighting will be fitted with one or two tungsten filament lamps, controlled at suitable spots by hand or automatic time switches. These lamps will be of 60 to 80 C.P.

A RECENT ARMOURED SWITCHBOARD.

Modern armoured switchgear has many advantages when installed in power stations for controlling generating plant, the principal of these being the safety afforded by the complete enclosure of all conductors and the economy effected in buildings and floor space.

The accompanying views, figs. 1 and 2 show a recent example of this apparatus incorporating the above features and supplied to the specification of Mr. S. T. Allen, Chief Engineer and General Manager to the Wolverhampton Corporation Electricity Department, by Messrs. Reyrolle and Co., Ltd., of Hebburn-on-Tyne. In this instance the switchgear is situated behind a wall upon which is mounted the necessary control gear, instruments, etc. The switches are provided with a mechanical remote-control, operated through the wall by means of a handwheel.

The gear at present includes panels for controlling three 1,500/3,000-KW. turbine generators (6,600 volts, 50 cycles); two motor-generators; a La Cour converter; and two group feeders.

Two additional panels are about to be added to control a 5,000-KW. turbine generator and a motor-generator.

Duplicate bus-bars are provided, interconnected by a 1,200-ampere non-automatic oil-break switch. Any switch may be readily connected with either bus-bar by inserting plug contacts of the self-aligning circular pin type, into their respective sockets on the switch.

Carriage-type switches are employed with a suitable interlock which, upon the withdrawal of a switch, ensures that the circuit is broken under oil and not on the main or isolating contacts, thus eliminating the possibility of external arcing.

The handlegear closing mechanism is mounted on the switch top-plate casting, and is coupled to the handwheel on the front of the wall by means of a spindle through cut gearing. "Free handle" is obtained in all positions, and the switches may be operated when racked out, for inspection purposes.

In order to successfully deal with the abnormal conditions obtaining on short circuits, very heavy oil tanks are provided and relief valves are fitted to the top plates or covers, the latter being of well ribbed cast steel. For the tanks steel boiler plate is employed with welded joints, the supporting bolts being closely spaced and of ample section; the tanks are lined with wood with partitions between phases. Relief is thus afforded to any internal pressure in the tanks, while a very rapid break at the contacts, under a large head of oil, as far as possible eliminates sustained arcing.

The bus-bars are supported by porcelain insulators in suitably shaped cast-iron enclosures, the latter being filled with high quality insulating compound after assembly.

The cables enter trifurcating boxes below the gear, the boxes being bolted to a chamber which contains the necessary current transformers and sockets for the potential transformer high-tension fuses. The latter transformer is mounted in a case supported in front of openings through which the fuses pass and these are inserted with an insulated handle. The fuse when in position is well protected mechanically by a stout poreclain insulator which completely encloses it and at the same time avoids any exposed connections.

All apparatus is built to jig in order to secure complete interchangeability.

The "control" wall is covered with white tiles and carries all the instruments and apparatus necessary for efficient working.

The generators are excited from common bus-bars, to meet the special requirements of the station, and these bars are mounted on the front of the wall near the ceiling, with the D.P. field switches immediately below. The latter are operated through links by handles beside the main switch handles, with which they are interlocked, thus rendering it impossible to open a field switch with the main switch closed or to close a main switch without first closing the field switch.

Above the main-switch handle is a box with illuminated coloured windows indicating whether the main switch is "OFF" or "ON" or whether connected to "TOP" or "BOTTOM" bus-bars. The lamps are controlled by suitable switches on the handlegear and the bus-bar label indicator. In the centre chamber of the box are housed the voltmeter and synchronising plug sockets.

A large swing frame hinged to the wall at the extreme end of the board carries the various voltmeters and synchronscopes. The space below the main-switch handle is occupied with a hinged frame upon which the relays (overload and reverse current) time limit, and potential fuse boxes are mounted, thus rendering these items very accessible for inspection testing, etc.

All wiring to the instruments and other fittings on the wall is run through 1¼-in. brass tubing with inspection joints, thus completing the system of armouring; at the same time all wires are easily reached, and for distinction they are of different colours.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

7,257. "System of duplex wireless or multiplex wireless telegraphy or telephony." S. D. Williams. March 23rd.

7,266. "Electrical burglar alarms." A. Zeiden. March 23rd. (Convention date, March 25th, 1913, Germany.) (Complete.)

7,274. "Electrostatic separators for sorting out the constitutent parts of commodities according to their permeability." A. Bibolini and P. Riboni. March 23rd.

7,298. "Electric lamp sockets." R. B. Benjamin. March 23rd. (Convention date, April 11th, 1913, United States.) (Complete.)

7,311. "Tubular support for electric luminous signs." G. Weissman. March 23rd. (Convention date, March 31st, 1913, France.) (Complete.)

7,318. "Indicators and order telegraphs." A. H. Pollen and H. Isherwood. March 23rd.

7,327. "Apparatus for supervising telephone exchanges working on a semi-automatic system." Siemens & Halske Akt.-Ges. March 23rd. (Convention date, March 25th, 1913, Germany.) (Complete.)

7,331. "Telephone Systems." E. A. Graham. March 23rd. (Complete.)

7,336. "Electro-magnetic means for vibrating piano-strings and the like." A. H. Maitre and V. H. G. Martin. March 23rd. (Complete.)

7,342. "Electric motors." E. G. Kennard. March 23rd.

7,416. "Electrical heaters." G. Cooper. March 24th.

7,437. "Apparatus for winding lappings, wire, or the like, upon ring-shaped coils or other bodies of similar shape." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) March 24th. (Complete.)

7,440. "Apparatus for controlling electric or other lighting systems by means of the action of a selenium or other light sensitive cell." C. J. Turner. March 24th.

7,451. "Automatic regulation of electric arcs." E. Girardeau. March 24th. (Convention date, April 1st, 1913, Belgium.) (Complete.)

7,454. "Unspillable valve for portable batteries with liquid electrolyte. G. Pearson and L. Fielder. March 24th.

7,455. "Spring terminal for electric batteries." G. Pearson and L. Fielder. March 24th.

7,462. "Method of and apparatus for indicating or signalling the rise of water level." Vertriebsges. Magnet-Elektrischer Apparate m.b.H. March 24th. (Convention date, May 9th, 1913, Germany.) (Complete.)

7,465. "System of selective electrical distribution." C. F. Kettering and W. A. Chryst. March 24th. (Divided Appln. on 7,545/13.) March 31st. (Convention date, November 20th, 1912, United States.) (Complete.)

7,469. "Reinforced-concrete telegraph or telephone pole." J. Jancso. March 24th.

7,496. "Electric lamps." E. V. Gratze. March 25th.

7,513. "Telephone switches." T. Green. March 25th.

7,542. "Electric Generators for lighting mechanically-propelled vehicles." H. C. H. Smyth. March 25th.

7,544. "Casings for electric cables or pipes conveying illuminating gas or other fluid." H. C. Scharrer and V. G. Frommos. March 25th.

7,548. "Means for and methods of reducing the frequency of an electric current by means of static transformers." A. M. Taylor. March 25th.

7,560. "Process for manufacture of hard compositions of matter from aldehydes and their derivatives and phenols with tars, turpentine oil, and related bodies and other substances." K. Tarassoff. March 25th.

7,562. "Electric Switch." Gustav von Hutschler and A. Ordon. March 25th. (Complete.)

7,566. "Electric driving mechanism for talking machines." F. Kramer. March 25th. (Convention date, April 18th, 1913, Germany.) (Complete.)

7,579. "Electrolytic recovery of zinc from solutions of zinc sulphate." E. J. Hunt and W. T. Gidden. March 25th.

7,586. "Switches for tramways and the like." A. Wilkinson. March 25th. (Complete.)

7,589. "Dynamo-electric generators." J. Stone & Co., Ltd., and A. H. Darker. March 25th.

7,590. "Dynamo-electric machines." J. Stone & Co., Ltd., and A. H. Darker. March 25th.

7,591. "Metal-filament lighting-devices." A-B-C-Schreitlampen G.m.b.H. March 25th. (Convention date, November 20th, 1913, Germany.) (Complete.)

7,618. "Holders of incandescent electric lamps." H. Edwards and J. Phillips Jun. March 26th.

7,677. "Electric resistances." J. Collinson. March 26th.

7,682. "Incandescent electric lamps." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitats-Ges., Germany.) March 26th.

7,684. "Methods of synchronising rotary and cascade converters." Siemens-Schuckertwerke G.m.b.H. March 26th. (Convention date, April 16th, 1913, Germany.) (Complete.)

7,685. "Electric switches." R. Bosch (Firm of). March 26th. (Convention date, February 21st, 1914, Germany.) (Complete.)

7,686. "Connecting devices for the leads from portable secondary batteries." R. Bosch (Firm of). March 26th. (Convention date, June 7th, 1913, Germany.) (Complete.)

7,692. "Contact-breaker device for electromagnetic vibrating members." A. H. Maitre and V. H. G. Martin. March 26th. (Complete.)

7,694. "Self-exciting high-frequency machine." T. E. Lurick. March 26th. (Complete.)

7,696. "Incandescent electric lamps." F. C. Cook. March 26th.

7,699. "Hydrodynamic speed indicators for ships." A. R. Spillemaeker. March 26th. (Complete.)

7,701. "Portable transmitters for wireless telegraphy." L. B. Miller. March 26th.

7,715. "Method of preparing highly magnetic iron and allied metals." F. H. Loring. March 27th.

7,717. "Fool-proof and safety automatic cell-charging switch and holder for recharging accumulators and the like." T. M. Lingard. March 27th.

7,731. "Electrical selective systems." H. G. White and I. H. Parsons. March 27th.

7,746. "Combined dynamo electric generator and electric motor." W. Fox. March 27th.

7,760. "Memorandum boards for use in connection with telephones and the manufacture thereof." J. F. Sessler von Herzinger. March 27th. (Complete.)

7,761. "Method and apparatus for the internal irradiation of the human body by means of rays emanating from a Rontgen-tube or other source. E. Pohl. March 27th. (Convention date, March 29th, 1913, Germany.) (Complete.)

7,766. "Electrical conductors." M. Hochstaedter. March 27th. (Convention date, March 27th, 1913, United States.) (Complete.)

7,772. "Telephones, phonographs and such like apparatus." A. S. Bowley. March 27th.

7,774. "Apparatus for suspending arc lamps and other articles." A. E. Spencer. March 27th.

7,779. "Commutators for dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd. C. P. Bramley and T. A. Wisdom. March 27th. (Complete.)

7,783. "Dynamo-machines." H. Leitner. March 27th.

7,788. "Device for obtaining Rontgen ray exposures." G. Bucky. March 27th. (Addition to 2,815/14. Convention date, April 7th, 1913, Germany.) (Complete.)

7,792. "Arc-light carbons." H. Ayrton. March 27th.

7,815. "Electric lamp fittings." J. B. Alexander. March 27th.

7,819. "Plug-and-socket contacts for electric circuits." B. Hopps and Lodge Sparking Plug Co., Ltd. March 27th.

7,821. "Device for subaqueous electrical driving of machines using or generating hydraulic pressure." Signal G.m.b.H. March 27th. (Convention date, March 29th, 1913, Germany.) (Complete.)

7,842. "Electrical heaters." H. S. Martin. March 28th.

7,851. "Electrically-operated cranes and like machinery." F. Holme & Co., Ltd. & E. Holme. March 28th.

7,854. "Electric-light fittings specially applicable to fittings adapted for indirect illumination." Simplex Conduits, Ltd., and L. Maxwell Waterhouse. March 28th.

7,859. "Machines for turning articles made of clay, such as insulators for telegraph purposes, pottery-ware, and the like. W. Podmore. March 28th.

7,868. "Apparatus for diminishing the air friction in electric machines having flywheels." Siemens-Schuckertwerke G.m.b.H. March 28th. (Convention date, March 29th, 1913, Germany.) (Complete.)

7,882. "Electric insulation of rail joints for rail or track circuits on railways or tramways." B. R. Wills and J. C. Sykes. March 28th.

7,884. "Electrical insulation for rail or track circuits for railways or tramways." B. R. Wills and J. C. Sykes. March 28th. (Divided Application on 19,603/13, August 29th.)

7,885. "Electrical insulation." B. R. Wills and J. C. Sykes. March 28th.

7,890. "Use of interrupted current as method of effecting an initial quivering in the vibration of bodies by electricity, more especially the strings of musical instruments such as the piano." A. H. Maitre and V. H. G. Martin. March 28th. (Complete.)

7,900. "Controlling switches for electric circuits." V. E. Joyce and Spagnoletti, Ltd. March 28th.

7,907. "System of operating electric control mechanisms for printing telegraphs and the like." Western Electric Co., Ltd. (Western Electric Co., United States). March 28th. (Complete.)

7,921. "Process of lighting by means of synchronised intermittent electric arc." A. Blondel. March 28th. (Convention date, April 1st, 1913, Belgium.) (Complete.)

7,922. "Microphones especially suitable for use in radio-telephony." A. F. Sykes. March 28th.

7,925. "Electro-deposition of metals." S. O. Cowper-Coles. March 28th.

7,926. "X-ray generators." U. Magini. March 28th. (Complete.)

7,932. "Conversion or transformation of electric current." A. Scherbius. March 28th. (Addition to 24,306/13. Convention date, March 29th, 1913, Germany.) (Complete.)

7,938. "Electric installations, particularly applicable to electric lighting." R. Despessailles. March 28th. (Convention date, March 29th, 1913, Belgium.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

22, 375. Electrical Resistances. C. E. Hay and H. W. Sullivan. October 2nd. (March 18th, 1913.)

1913.

3,344. Circuit Arrangements for Junction Lines at Automatic and Semi-Automatic Exchanges. Siemens & Halske Akt. Ges. February 8th. (February 10th, 1912.)

3,431. Circuit Arrangements for Automatic or Semi-Automatic Telephone Systems in which there are Several Lines to a Station or Group of Stations. February 10th. Siemens & Halske Akt. Ges. (February 9th, 1912.)

5,734. Electric Recording Devices. British Thomson-Houston Co. (Allgemeine Elektricitats Ges.) March 7th.

5,745. Brush Particularly for use as Sparking-Plug Cleaner. E. Swinney. March 8th.

5,926. Dynamo-Electric Machines. F. Newton and Newton Bros. March 10th.

6,136. Methods of Starting the Arcs of Electric Furnaces. E. K. Scott. March 12th.

6,169. Timing Device for use in connection with Electric Switches and for Other Purposes. N. Bendixen and F. C. I. Gondrup. March 12th.

6,186. Electric Train Signalling and Controlling Systems. A. J. Allard. March 12th.

6,369. Telephone Exchange Systems. P. H. Kennedy and J. W. Turner. March 14th. (Cognate Application 8,188/13.)

6,602. Electric Battery Lamps. W. E. Bladon. March 17th.

9,986. Selective System of Telephony. R. C. M. Hastings. April 28th.

12,060. Telephone Systems. Siemens & Halske Akt. Ges. May 23rd. (May 25th, 1912.)

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ESTIMATED AND OBSERVED VALUES OF ILLUMINATION.

YET another contribution to this much-debated subject is made by Mr. W. C. Clinton in a paper read recently before the Illuminating Engineering Society. Knowing the polar curve of candle-power distribution of a luminous source, sufficiently small to be regarded as a point, there is no difficulty in calculating the horizontal illumination which it produces directly at a certain spot. Nor is there any difficulty in determining the total horizontal illumination received directly at a given point from a number of such sources. When, however, allowance has to be made for light received by diffuse reflection from walls and ceiling, the problem becomes extremely complicated, since the effect of wall and ceiling surfaces in this connection is determined by their colour and texture, the dimensions of the room (as compared with the area enclosed by the light sources) and the polar curve of the luminous source or sources. The higher the percentage of horizontal illumination, the greater the importance of wall reflection.

In indirect and semi-indirect lighting schemes, ceiling reflection is of fundamental importance. Owing to additional illumination received by reflection from walls and ceiling, the point by point method of calculation generally gives lower values of horizontal illumination than those observed—the difference diminishing as the effect of walls and ceiling is reduced, either by their colouring or their remoteness. Dr. Bloch's "flux of light" method gives rapidly the mean horizontal illumination produced in any particular case, but does not provide the analysis of light distribution afforded by the more laborious point by point method. Another alternative is to calculate from the polar curve (by Dr. Kennelly's graphical method) the total flux liberated from the source up to any angle from the vertical and then to compare the mean horizontal illumination observed with that which would be produced did the whole flux arrive on the plane of reference. The ratio of these two values gives a "utilisation factor" for the installation.

By considering a number of typical installations, Mr. Clinton arrives at the conclusion that "light for illumination purposes is capable of estimation and measurement on an engineering basis." In cases where electric lamps are used, the discrepancy between his calculated and observed illuminations at various stations seldom exceeds a few per cent. Where larger discrepancies exist they are traceable to the source not giving the distribution and flux indicated by its polar curve. A case in point is that of a workshop lighted by gas mantles; owing to some of the latter being defective, the observed illumination on some benches amounted only to one-quarter of that predicted by calculation.

Without disparaging in the least the work performed and results obtained by Mr. Clinton, we cannot help feeling that too much time and energy is being expended on ways and means of calculating illumination. Wide variations exist in the reflecting properties of materials outwardly similar. The effects of windows, cornices and friezes are variable and difficult to determine, particularly in rooms of irregular shape.

Wide experience appears to us indispensable in securing any satisfaction from illumination calculations, and in many cases the application of this experience in another direction would permit the desired results to be attained without elaborate and tedious calculation. Where many assumptions of conditions and coefficients are involved, tabulated data, experience and common sense are likely to give at least as good results as calculations apparently more precise, and certainly more complex in application. In many cases factors and circumstances are involved which cannot possibly be reduced to mathematical treatment, and experience undoubtedly shows that results eminently satisfactory as judged by general illuminating principles and by photometric measurements are not always pleasing to the eye.

Such installations frequently lack the charm of less rigorously "correct" schemes, while offering no real compensating advantage. Considering the many indeterminate factors involved, and the ease with which electric lighting schemes can be tested tentatively by eye and photometer in any particular case, we believe that attempts to reduce illuminating engineering to an exact science may easily be carried too far. In even the most utilitarian applications æsthetic effect is an important factor and one which can never be made purely numerical.

On Exhibitions. In recent years, manufacturers in different sections of the engineering industry have occasionally offered organised resistance to the efforts of the private promoter of exhibitions. They objected not only to private individuals battening at the expense of an industry, but to the holding of unnecessary exhibitions at which they felt compelled to show because of the presence of competing firms. Of course there is not unanimity among manufacturers in this respect, for different classes of goods dictate different policies. Large machinery manufacturers are naturally less anxious to make displays involving large expense than are makers of smaller classes of apparatus and goods, which at almost any time may be trusted to make a profitable appeal to the popular mind when effectively shown. But we are not concerned at the moment so much with the question of general exhibition policy, as with the action of the organised machine tool makers in regard to the Shipping, Engineering, and Machinery Exhibition, which takes place six months hence at Olympia. According to correspondence received from the Exhibition managers, the Machine Tool Association has as a body refused its support to this Exhibition, and if any of its members show "will endeavour to penalise them for doing so." The B.E.A.M.A. is understood to have left its members who manufacture specialities used in the building of ships, free to do as they please regarding this particular exhibition. It is for the machine tool makers to decide for themselves what they will do, as makers of colliery machinery have done on previous occasions; if there is a good exhibition and they are not represented, they as well as the promoters may be the losers. The present indications, we are informed, are that machine tools will be the only section of engineering industry not represented. This will be regrettable. It seems to us that useful discussion might take place on the policy of Manufacturers' Associations which decide that they will not organise exhibitions at other than prolonged stated intervals, and yet will limit the activities of their members in regard to other displays.

Reactance *ad lib.* Following at a very short interval after Mr. Hollis's paper, Messrs. Faye-Hansen and Peck's contribution to the *Proceedings* of the Institution of Electrical Engineers, which we abstracted in our last issue, further emphasises the advantages of reactance coils installed in generating stations under the conditions which now obtain. We note that the authors agree in the main with the views which we put forward in our issue of March 13th as to the proper functions of reactance, and especially as to the position where it will do the most good with the least disadvantage—namely, between successive sections of the bus-bars. The failure of one generator, one feeder, or one section of the bus-bars may thus be localised, whereas without the use of reactance the whole of the immense store of kinetic energy represented by a number of large generators running at high speed might be suddenly released with disastrous consequences.

There is, however, a risk of running to excess in this as in most other matters, and in view of the extraordinary outbreak of what we may call reactance fever which appears to be taking place in this country, we feel it advisable to suggest that full consideration be given to every aspect of the question in each case before plunging into a perfect orgy of reactance coils such as that represented by the figure from the paper reproduced on p. 610 of our last issue. Here there are no fewer than 19 large triple reactance coils in a station of 100,000 kw., and if all the feeders were shown there would be some 25 coils in all! Surely this is carrying the thing beyond reasonable limits. The fact that we have managed without reactance coils, except in a very few stations, up to the present suggests that a moderate adoption of this class of safeguard is all that is justified by the needs of the case. The remarks of Mr. A. M. Taylor at the meeting of the Birmingham Local Section of the I.E.E., quoted elsewhere in this issue, and the figure showing what is contemplated for the new power station of that city, appear to be more in keeping with the requirements. We may direct attention also to the views of a contributor on the subject, which we print in this issue.

Copper. Since last writing, the position of the copper market has sustained some strengthening. The change for the better came from improved conditions in the United States in so far as the share markets were concerned, the stronger tone seen in that direction encouraging sentiment all round, and leading to a little —a very little—revival of speculative interest in certain commodities. It is too soon to look for any permanent revival of interest in this direction, for there is a long road to be traversed before things industrial pick up to even a reasonable extent in the United States, but there is a hope that with cheap money and better financial conditions, together with a restoration of a rather more confident sentiment, things will soon get started in an upward direction. The check experienced in trade has been pretty general, but it is proving most difficult to remove in the United States and Germany, both of which countries are even yet in a very bad way, and, indeed, so far as the position at large is to be gauged by conditions in the iron and steel sections, there is no turn for the better in sight. It is for this turn that most people are looking.

It is remarkable that with things generally as poor as they have been for so long, Europe should have proved her capacity to absorb copper at the rate witnessed this year without any inconvenience. That the shipments from America have exceeded all previous experiences goes without saying. For the 12 months ended March 31st North America shipped 409,838 tons, compared with 323,563 in 1912/1913, and 324,865 tons in the corresponding period of the former 12 months. During the first quarter of 1914 the arrivals in Europe from the United States totalled over 110,000 tons, against 88,000 tons in 1913, and 100,000 tons in 1912. The export movement from North America to Europe was, too, quite exceptional in the first three months of 1912, being at the average rate of 33,000 tons a month, while the year's average was only 28,500 tons, whereas the average for the 12 months ended March 31st was over 34,000 tons monthly. This shows the extent to which the European importations of copper have been proceeding, and in view of common knowledge as to the falling off in trade which has been experienced, and which still persists, it is not at all surprising that there should have sprung up a crop of rumours to the effect that copper is being secretly stored in some of the Continental ports.

The export movement from North America to Europe has been on a huge scale all through March, and continues, but it is a remarkable thing that the demand from this side of the Atlantic for copper should be of such an all absorbing nature as to lick up not only all the large excess available after United States home trade demands have been satisfied, but to encroach upon the stocks. It is no wonder, under the circumstances, that there should have grown up suspicions as to the *bona fides* of the export current from America, but the closest scrutiny has not been successful in revealing anything amiss with the statistical situation.

HYDRO-ELECTRIC INSTALLATIONS FOR WORKING THE MINES OF THE TEKKAH MINING CO. (PERAK, MALAY STATES).

[BY OUR BERLIN CORRESPONDENT.]

PRESENT conditions in working the tin mines of the Malay States are such as to require the use of motive power in a great number of cases. This applies primarily to mines situated in the lowlands. Not all hydraulic mines have water under a natural head at their disposal. When there is no river available in the neighbourhood of the mine, the latter is preferably worked as a dry mine, the material loosened (by hand) being conveyed upwards, and washed with the water always present in sufficient quantities at the ground level. Such mines are always exposed to a risk of being flooded, and cannot do without some form of motive power (for driving the pumps in hydraulic mines and operating the lifting gear and trucks in dry mines), if they are to be worked on really economical lines. Those few mines which are situated on the hills are not to the same degree dependent on the use of motive power.

POWER HOUSE AND PIPE LINE.

The Chinese were the first to open up the tin-bearing deposits of Malacca. They used some peculiar machines designed on the chain-pump principle and driven by the coolies themselves. When the Europeans introduced the steam engine all the mines adopted for their operation British locomotives and steam winches. However, this type of machinery, apart from its unsatisfactory efficiency, was soon found to be lacking in the mobility required for work so inconstant. Electrical operation, on the other hand, affords a number of advantages which are too well known to need enlarging on, and as the country abounds in brooks and rivers, the installation of hydro-electric plants is in a great many cases the most economic solution of the problem.

Considerations such as these, in 1910, induced the French Tin Mining Co., of Tekkah, founded with a view to the working of the tin mines situated at Tekkah, near Ipoh (Perak), in the Malay States, to have an extensive hydro-electric plant erected. The installation is briefly described below.

The river Guroh, a tributary to the Kampar, supplies the water required for the plant, under a head of about 200 metres above the Tekkah lowlands. This head is subdivided into two parts, each of about 100 metres, one of which is utilised for generating electrical energy in the power station, whilst the other supplies the pressure water required for operating the mines. The electrical energy is supplied to the Tekkah sub-station by a 9,000-volt overhead line, and is there transformed to 440 volts. The current is thence distributed to the various mines, where it is used for driving the pump motors and for lighting (at 240 volts).

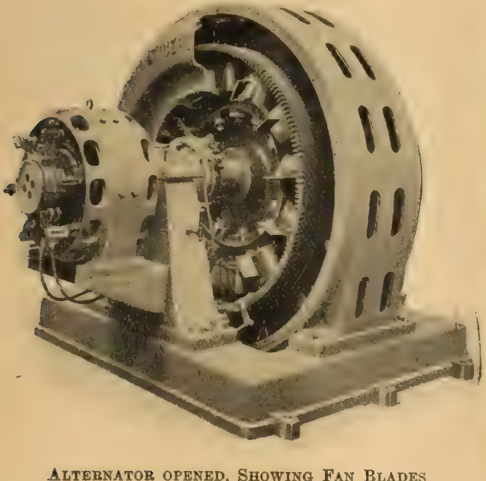
Two dams were constructed, which collect the water of the Guroh and a small tributary, leading it at the rate of 0·5 cb. m. per second into the admission conduit. This was designed partly as an open channel, and partly as a sheet-metal pipe, where the configuration of the ground required the installation of a closed conduit. It is about 3,500 metres in total length, and at three places traverses a heavy gradient.

The Ulu Guroh power house is situated at about 8 km. from the village of Gopeng, in a very narrow, densely-wooded valley.

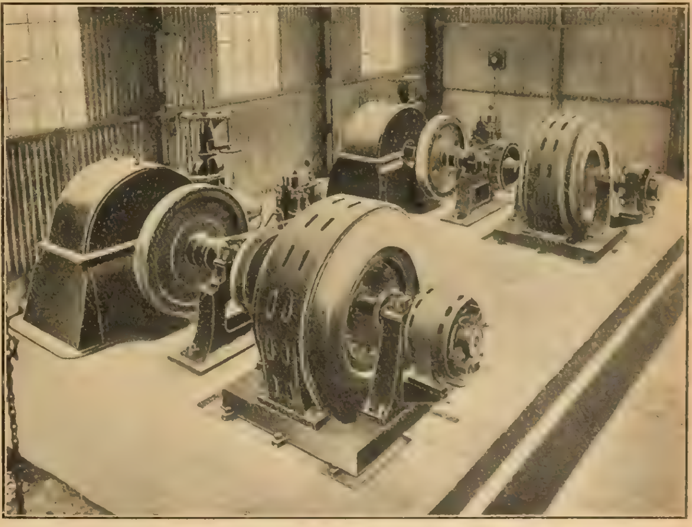
The pressure conduit is 300 metres in length, and corresponds to a water column 98 m. in height. It is made up of riveted steel pipes 700 mm. in diameter, the flanges of which are carried by masonry pillars. The material used for the pressure conduit was obtained in the country.

The power house is a two-roomed iron building, lined and roofed with corrugated iron. The larger room contains the turbines and generators, and the smaller one the switchboards and transformers. A substantial concrete foundation, containing channels for electric lines and the turbine discharge, carries the solidly anchored iron frame of the whole building.

A valve 700 mm. in clear diameter, relieved by a special by-pass, was fitted into the distribution pipe. This is operated in the power house through the intermediary of gearing. Two other valves each 400 mm. in clear width are provided for the two turbines. A gauge in the power house permanently indicates the value of the available head of water.

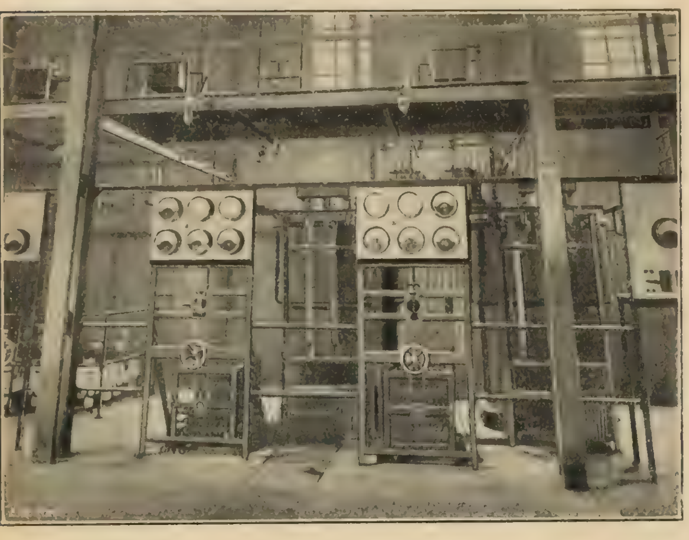


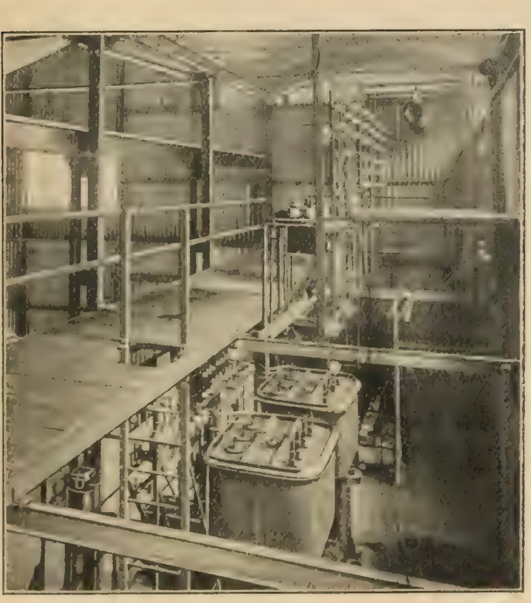
ALTERNATOR OPENED, SHOWING FAN BLADES



INTERIOR OF POWER HOUSE.

The power house contains two 500-H.P. turbine sets, working at the speed of 400 R.P.M. The turbines are designed on the Pelton system, with a single bucket wheel and two nozzles, each consuming 500 litres of water per second, under an effective head of 100 m. The Pelton type was chosen mainly in order to keep the amount of water consumed constant at all loads, thus not interfering with the working of the mining machinery operated by pressure water from the other half of the head. The turbine nozzles are always kept open, regulation being effected by means of two slides in the admission conduit, which are adjusted simultaneously by hand or by means of an automatic arrangement controlling the amount of water supplied to the wheel.


Switchgear in Power Station.


Back View of Switchgear in Power Station.

The automatic regulators, designed on Messrs. Escher, Wyss & Co.'s patented system, comprise a centrifugal governor, an oil pump and oil tank and a compressed oil servo-motor acting directly on the driving lever of the slides above mentioned. Hand regulation is effected by means of a hand-wheel. The admission conduit to each turbine is provided with a gauge, and there is another gauge on the regulator recording the oil pressure, and a speed-indicator. The regulator, oil pump and speed-indicator are driven by belts from the turbine itself. At the normal rate of working the automatic regulators only allow quite inappreciable speed variations, the maximum deviation in the case of a sudden change from full load to zero being 10 per cent., and the speed difference between full load and zero 3 per cent.

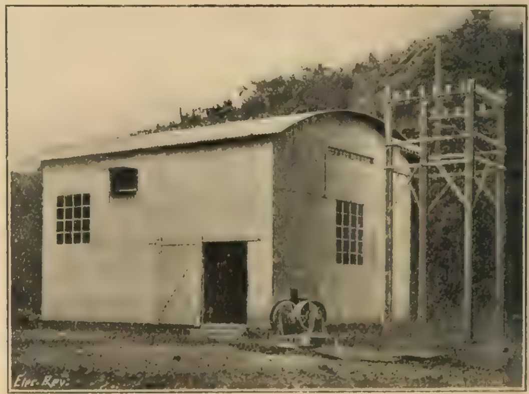
The turbine shaft carries a fly-wheel, and is connected to the generator shaft by an elastic Zodel-Voith coupling.

The hydraulic part of the power plant was supplied and installed by Messrs. Escher, Wyss & Co., of Zurich.

Motor-Starter.

The two three-phase generators are of the Maschinenfabrik Oerlikon's standard type, being designed on the following data :—Output, each, 410 K.V.A. (cos $\phi = \cdot 83$); pressure, 400-450 volts; frequency, 40 cycles; speed, 400 R.P.M.

These generators have stationary armatures and rotating magnet wheels and are direct coupled to their exciters. The armature windings are designed as grid windings, consisting of simple copper rods (two rods per slot) placed in open slots, which can be readily exchanged. The magnet coils are interchangeable, and are made up of copper tape wound on edge; they are pressed tightly together by means of cast-steel frames joined by bolts. These frames carry ventilating vanes, which ensure a thorough cooling of the windings and poles. In view of the peculiar climatic conditions and the humidity of the air, special care was bestowed on making the insulation as durable as possible. The shaft is carried in two bearings bolted to a base plate embedded in concrete and provided with automatic ring lubrication.



Sub-station at Tekkah.

From each of the two generators there are insulated cables and massive copper conductors leading to each of the corresponding transformers (of 410 K.V.A. and 450 volts primary pressure at 40 cycles). These are arranged in primary and secondary star connection, and are provided with oil and water cooling. The ratio of transformation is 1 : 20 with no load, the line pressure thus being 9,000 volts.

These transformers are designed on the standard core type with three vertical cores. The low-tension coils are situated close to the cores and comprise 30 windings per core, which are arranged in 10 sections, each of three copper tape windings, insulated from one another by substantial paste-board. Each section is separately wrapped with cotton tape. The high and low-tension coils are separated from one another by insulating cylinders. The high-tension coil comprises 600 windings, each of two parallel wires, arranged in 10 sections.

Cooling is effected by placing the whole transformer in an oil tank made of substantial boiler plate, which is in its lower part riveted to a cast-iron frame fitted with rollers, so as to facilitate transport. The case is widened out in its upper part, containing a seamless iron coil of pipe for water cooling, so that the active portion of the transformer can be readily removed without touching the cooling pipe. Cooling water is derived either from a brook in the neighbourhood of the power house or from the main conduit.

The switchboards are designed on the Maschinenfabrik Oerlikon's standard system without any lining. The diagram of connections was designed with a view to ensuring special simplicity and straightforwardness, so that even unskilled labourers such as are available in the Colonies might be able to attend to the plant without any risk of disturbance to the service. The high-tension conductors are made up of 6-mm. bare copper wires, and the conductors leading to the measuring instruments of plainly visible insulated wire fixed on insulators.

There are four marble meter panels, viz.:—One for each of the two generators, one for the lighting of the power house, and one for the testing voltmeter. The generator panels each contain three ammeters, one voltmeter and one wattmeter for the main current, as well as one ammeter for the exciter current.

In the secondary side of each transformer there has been inserted a main oil switch, actuated through levers from the switchboard. Below the marble slabs there are hand-wheels for operating the main current regulators. From the high-tension switches there are bare copper conductors leading to the high-tension bus-bars, whence the distribution lines are branched off. Though only one outgoing line has been so far installed, apparatus for two lines has been provided with a view to a subsequent extension. In the power house there has been inserted into the outgoing line a three-pole oil switch without automatic release, which is operated from a platform situated 4 metres above the floor. At the starting point of the line there is on the first pole outside the station a three-pole horn switch, allowing the line to be entirely switched off the power house. The testing voltmeter is, through a switch and a measuring transformer, connected up to the bus-bars.

The generators are connected up in parallel, with the aid of synchronising lamps, provision being made for their working separately, as well as in parallel, on to the conductor system. An auto-transformer stepping down the pressure to 220 volts has been provided for the lighting of the power house; this feeds 12 50-C.P. lamps.

The switchgear is completed by various safeguards, which are of considerable importance on account of the heavy atmospheric discharges occurring so frequently in that country. The high and low-tension circuits are, *e.g.*, protected by horn lightning arresters and water jet earthing devices. Generally there is only one of these sets of apparatus in operation, the other serving as stand-by.

The power transmission line is about 11·5 km. in total length. The line follows the valley of the river Guroh, and subsequently that of the Kampar, and after crossing a small hill, descends into the Gopeng lowlands.

The poles carrying the conductors are of very hard wood, obtained from the surrounding forests. They are of square section (15 × 15 cm.) and are erected at a normal distance of 45 metres apart. The maximum distance between two poles (80 metres) is at the crossing of a small valley near the river Kampar. The poles are sunk into the ground to a depth of 1·5 metres, and rest on a stone bed, ensuring a rapid drainage of water. They rise to a height of 6 metres above the ground. The conductors are hard-drawn copper wires 6 mm. in diameter, resulting in a maximum line loss of 5 per cent. at full load. A pillar switch has been provided on a frame at the Tekkah end of the line.

The insulators fixed to the poles, on galvanised iron brackets, have been designed as bell insulators, comprising three bells placed above one another; they have been tested at a pressure of 55,000 volts. One metre below the high pressure wires there is the telephone line connecting Tekkah with Ulu, and with the place where the lower water channel terminates in the pressure conduit of the mines; this has been designed as a double line of bronze wires 2·5 mm. in diameter.

The Tekkah sub-station contains two transformers of the same type as those of the power house, having a transformation ratio of 1 : 20, that is to say, a secondary pressure of 440 volts. The secondary winding is connected to the bus-bars, whence the motor lines are led off. In order to provide for an extension of the plant to be made later on, the switchboard has been designed for four outgoing lines, though only two motors have been so far installed. The low-tension switchboard comprises four panels for the outgoing lines, each with a switchboard and an ammeter, and in addition, a panel for the common voltmeter.

At the sub-station there have further been installed lightning arresters and excess voltage cut-outs on the same arrangement as at the power house, as well as a small transformer of 30 K.V.A. and 440/220 volts supplying the lighting current for the mines and dwellings.

The two three-phase lines feeding the motors are 600 and 700 metres in length respectively, and are made up of bare copper cables comprising 19 wires 2 mm. in diameter. One of these lines feeds a motor of 100-120 H.P. working at 800 R.P.M., which through belt transmission drives an air compressor supplying the compressed air for a "Mammoth" pump. This pump has been supplied by Messrs. A. Borsig, of Berlin-Tegel, and serves to raise water and the tin-bearing earth from the mine into an ore-washing tank. The other line leads into the second mine and feeds a motor of the same design and size as the former, driving through belt transmission a centrifugal pump supplied by Messrs. Dumont, of Paris.

Each motor has its own marble slab switchboard, carrying the circuit-breaker, ammeter and fuses. Oil starters are used in starting the motors.

The mines are at present lighted by six 15-ampere arc lamps connected through transformers to the motor line, in addition to about 20 incandescent lamps of 16-50 C.P. About 100 metal-filament incandescent lamps of 16-100 C.P. have been installed for lighting the dwellings.

The telephone plant, ensuring communication between the power house on the one hand and the sub-stations and mines on the other, comprises three wall telephones and two portable telephones. Bronze wire 2·5 mm. in diameter has been used throughout.

The whole of the electrical material, apart from that for lighting the mines and dwellings, was supplied by the Maschinenfabrik Oerlikon, who, on account of their previous installations in the Malay States and other tropical countries, had extended experience in the designing of electric plants under specially unfavourable climatic conditions. A contemplated extension of the Ulu Guroh-Tekkah plant will raise the total output to 1,230 KW.

The water discharged from the turbines enters a channel 6 km. in length, whence it arrives at the pressure conduit leading as far as the mines. This conduit is about 7 km. in length, and its diameter decreases gradually from 900 to 600 mm., providing an available water pressure of 6 kg. per sq. cm. at the place of operation. This water is used for the operation of monitors having discharge openings 5 to 7·5 cm. in diameter, the direction and position of which can be adjusted at will by means of a simple lever. The issuing water jet serves to loosen the tin-bearing earth, which, as above mentioned, is, along with the water, raised by pumps.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Appointment of an Assistant Electrical Engineer.

Men who fear to approach their chief are evidently not wanted in Worthing, and therefore "Chief Assistant" has a well-founded grievance against those responsible for the advertisement. It is, however, a pity that strained feeling should arise when an assistant attempts to better himself. A chief ought to welcome the confidence of his employés who seek his assistance in their endeavours to get on.

Sometimes the assistant is to blame for making too frequent appeals for rises, concessions, testimonials, &c., which indicate restlessness, and possibly discontent, and the latter is an abomination to any chief. Zeal and ambition must be tempered with discretion on the part of the assistant, otherwise even the best chief may turn and rend him.

As to signing the offensive document, I plead guilty of having done so. In so doing I relied upon my assistant's integrity for one or two items not personally verifiable, believing this to be all that could be expected.

Chief.

Cottage Lighting.

Charge for lamps at the rate of 6d. each as security; if the average renewals do not exceed one per annum, the amount paid to be refunded to the tenant on leaving. This would serve as security for payment of current accounts, and reduce renewals cost.

Mr. Fennell's scheme for free wiring should only apply to existing property; in the case of new property, offer to put in the installation at an inclusive charge of, say, 5s. per point while in course of erection, fittings and lamps to remain the Corporation's property.

It might be possible to give the consumer a rebate at the end of each year, when the units consumed are below a fixed number, thus encouraging economy and keeping an eye on the next-door neighbour. The landlord or his agent would surely collect accounts and guarantee payment; in many cases it is the custom for the agent to guarantee weekly payments for rent, and collect at 7 per cent. to 10 per cent.

The landlord, if he acted as collector, would probably include electric light in his rent, as the 7 per cent. on revenue from the use of electric light would be clear profit to him, and give him an interest in securing new consumers.

Arthur C. Greig.

London, N.

Electricians and Pipe-fitting.

Having read your leader in the REVIEW of the 3rd inst. *re* the dispute between the E.C.A. and the electricians of London, I note with some astonishment your suggestion that "pipe-fitting" is an unskilled part of the electrical installation. If this is so, how is it that we who have served our apprenticeship to a firm of contractors ever had anything to do with it? While an apprentice myself I was always led to understand that the erection of conduit was part and parcel of the trade, and required quite as much skill as the actual wiring. After working in the trade for seven years, I am still of the same opinion, which makes me think that the writer of the article never did any "pipe-fitting."

Wireman.

[The point of the article in the part referred to was that the masters were to a certain extent justified in calling the merely mechanical part of pipe-fitting lower-grade work than the running and connecting of wires; it was not suggested that it was entirely unskilled work, and the proposed rate of pay, which is intermediate between unskilled and highly skilled, proves this.—EDS. ELEC. REV.]

Lighting of the I.E.E. Theatre.

We have read with interest the discussion on the various forms of lighting, and think that the fact that there is an inverted arc lamp, the effect of which is really shadowless, on the market, may be worth the notice of those concerned.

The old open-type inverted arc lamp is no doubt fairly efficient as regards the light given from the lamp, but its effect on the ceiling and surroundings is very much marred by the harsh shadows which are cast by the various fittings at the top of the lamp.

Mr. Justus Eck's remarks as to the advantage of having to trim the lamps are well founded, but open-type lamps are at a considerable disadvantage, in that their burning hours are so short, and they, therefore, require attention much more often than mere cleaning would demand. This is the reason for the introduction of the inverted-enclosed lamp, in which the burning hours are six times those of the open-type lamp and are sufficiently long to enable the lamp to be used, in most instances, for a whole week without attention.

Pure indirect or semi-indirect lighting when correctly obtained is quite satisfactory, and the lamp mentioned above solves the problem.

Interested.

Creosoting Wooden Poles.

The following information may be of value to "Ta Tao":—

The writer has erected in Western Australia wooden poles carrying heavy mains, and after long experience and repeated test and trial, the following was found to be the only satisfactory method of treating them.

White gum poles 24 ft. long, 10 in. bottom butt, 4 in. top, were used. I was fortunate in being able to secure some lengths of old 12-in. cast-iron pipes, and cut them into 4-ft. lengths; with these I "shod" the bottom butt of the poles to a length of 3 ft. 6 in., leaving a clear 6 in. of pipe at the base, which I filled with concrete. The pipe extending 3 ft. 6 in. up the pole, and being 12 in. in diameter, left a space into which I drove wooden wedges round the sides. I then poured about a pint of paraffin oil into the space between the pole and the pipe, and after allowing sufficient time for this to dry, I filled up with cement.

I might say that this is the only method of treating wooden poles against white ant, dry rot and wood insect engendered in the poles.

G. L. Duthoit.

Loftus-in-Cleveland.
April 10th, 1914.

Protection or Tyranny?

With reference to the recent correspondence in your columns on the above fascinating subject, we have been much interested in the letters of "Junius" and also of Mr. F. W. Purse. The former is gratified that the chairman of the Council of the B.E.A.M.A. has honoured him with his attention, and attributes this to his pen-name.

We do not, however, think that he has any real cause for gratification, and his insinuation, in this instance, that the B.E.A.M.A. is playing the same game of spoof as the House of Commons is somewhat misplaced.

We have been members of the B.E.A.M.A. since its incorporation, and were members of the National Electrical Manufacturers' Association before that, and it may interest "Junius" to know that not merely have we never heard of such a rule existing, but we have never heard it discussed; in fact, if it exists anywhere, it has nothing whatever to do with the B.E.A.M.A.

Who are the grades of workers who are dissatisfied with the working of the B.E.A.M.A.? Some of the members themselves may be, but this hardly affects "Junius," and he is presumably not referring to the possible divergence between the larger and smaller firms of the Association. If he be, we should suggest he considers the composition and the controlling interests of the larger firms.

As far as Mr. Purse's complaints are concerned, we have been in the electrical industry for many years, and have no doubt that Mr. Purse was really joking when he suggested that the poor British manufacturer was tyrannising over the municipal buyer. The B.E.A.M.A. are only trying to lay down fair and reasonable conditions because of the grossly unfair conditions issued by many public officials. Some clauses, such as the municipal engineer being his own arbitrator, and paying for goods 12 months after he put them to use (not after he bought them), are examples of their fair-mindedness. It is doubtless the same class of public official who, when a manufacturer calls upon him with, as far as he may know, an epoch-making device, of which the engineer is entirely ignorant, sends out a message "not wanting any to-day," as if the milk cart were on its rounds. As a further example of tyranny we would suggest that Mr. Purse peruse the correspondence in your issue of April 3rd, on "Appointment of an Assistant Electrical Engineer."

What Mr. Purse apparently fails to realise is that it is only combinations of very large firms that can force the buyer into subjection to the seller. His remedy is to buy from the smaller firms wherever he can, but in no case ought Mr. Purse to be allowed to buy from German manufacturers, who exercise a far worse tyranny in their own country and employ cheap labour.

Some day the British workman will wake up and rend the buyer of foreign manufactured goods.

Facts.

"Situations Vacant" Advertisements.

I would suggest that much time and trouble could be saved by both advertisers and those replying to advertisements if an indication were always given as to the locality of any berth vacant when advertised under a Box No.

I do not mean that it should be detailed, but just a word or two, such as Manchester district, in or near London, South-Western county, &c.; perhaps, also, a hint as to whether Corporation, private supply company or manufacturers' works—where the same is not clear from the context of the advertisement—could be included without the use of more than an extra four words.

This would obviate answers being received from those who have no intention of going to certain districts (or, say, leaving London), and so save the time of advertisers should any such application be entertained by them, and would also be of great service to possible applicants.

G. M.

London, S.W.

The Modern Motor.

As an experienced man I was much interested in the article on "The Modern Motor" in last week's issue of the Review, written by Mr. E. F. Butler. Having had the care and control of large installations, both direct and alternating, up to 20,000 volts, three-phase, perhaps my opinion on modern motors and generators may be useful to many readers. I quite agree with Mr. Butler on those points dealing with the general inaccessibility of the parts of "modern motors," but, at the same time, flatly refuse to believe they are superior in performance (*i.e.*, doing work). To quote a few out of many old makes of 10 or 15 years ago, let me mention those made by the General Electric, America; Thomas Parker, of Wolverhampton; Mather and Platt, Manchester; the Union Electric Co., England; Crocker-Wheeler, Newark, America.

I can assure Mr. Butler that the old motors made by these people 10 or 15 years ago are, in several cases to my knowledge, running as well to-day as ever they did. It is a rare sight to see one of these old armatures out for repairs; notice the beautiful long commutator, with its thick segments. I have had the pleasure of taking out many of these old armatures and comparing them with the present-day rubbish, with the winding section cut down as low as ever it dare go. Not only is there a reduction in good metal, but the present-day armature has not the sound workmanship about it which is so noticeable on comparison with the 15-year old stamp. Motors are not built now for rough work, or for taking adrift easily either. It took me five hours to draw the brass sleeve off a 36-H.P. motor which had seized, even with the oil-well quite full of oil; another 5-H.P., with a white-metal sleeve, seized under similar conditions, and it had to be broken away. It appears to me that these present-day bearings are turned up to dead size whilst quite cold, but, with a load coming on suddenly, they are very apt to seize unless sufficient clearance is left for warm running. Of course, as regards brush gear, [illegible] is caused by a great distortion of the field causing heavy brush sparking; I may say that this is more the case with generators than with motors, and is often due to brush gear being monkeyed with and thrown into wrong position whilst under a heavy load. A fixed brush, in my opinion, is far superior to those of the wobbling, loose shoe type, which always get burnt either at the front or back through rocking on the commutator. The brush-holder should swing from the spindle by the aid of flexible copper strips as in the case of the Crocker-Wheeler type. The brush is gripped firmly in the shoe, and can be properly bedded down, and tension can be applied as the brush wears down in exact proportion. The present-day motor is too cramped altogether, in fact many of my motors cannot be got at to touch up the commutator unless the brush gear is taken right away; this means taking all one end away. The ring oiler bearing was a marvellous invention, and far superior to the drip-fed bearings on the older machines, which required close attention. The rings should be quite visible and accessible by the lifting of dust-proof lids from the outside of the spider castings. A small flash lamp is the proper thing to use to inspect the rings, to see if they are turning and picking up oil properly.

Henry Fowler.

Liverpool, *April* 13*th*, 1914.

LEGAL.

Kidderminster Tramways Case.—Cross Claim for Damages.

(*Concluded from page* 616.)

The hearing was continued on Friday, April 3rd.

Mr. Hugo Young, at the suggestion of his Lordship, in opening the case for the defendants, included in his address his opening of the case for the plaintiffs in the action of Woodward, Grosvenor and Co. against the Tramway Co. He said that the only point in the action was the simple issue whether the making of the tunnel had in any way affected the tramway track, and if so, what was the amount which it would cost the Tramway Co. to make good the damage. The defendants obtained the consent of everybody, including the Public Works Committee, to open the road. One thing was clear, and that was that it was not an honest complaint of injury to the tramway and a desire to recover for the damage done—to recover a few pounds for making good the track. It was manifest that the object of the plaintiffs had been—they being the electric lighting authority as well as the tramway owners—to keep the defendants from laying their cable so as to enable them to supply themselves with electric light, instead of taking the plaintiffs' supply, which was not suitable. Notice was given to them of the defendants' intention, and therefore there could be no complaint that they were not fully warned. On July 29th they applied for and obtained an injunction against the defendants to restrain them from interfering with the tramway. A curious thing about the injunction was that Mr. Lycett, the managing director of both companies, acted for the moment as a solicitor's clerk, coming down to serve the injunction personally upon the defendants, when he intimated to Mr. Woodward that he was going to try and prevent him from getting the light. When he could not persuade the defendant to abstain from laying the cable, he said something to this effect:—"You know we are a big company, and we are going to see this thing through." Heavy expenses had been incurred in trying to stop the defendants. The injunction was obtained, but when the summons was heard there was no order made beyond that they were not to interfere with the tramlines. The defendants did not want to interfere with the tramway, and an undertaking was given that they would not do so. The work was done upon the assumption that they might do it if it could be done without interfering with the tramway. Tracing the history of the case, counsel said that on September 16th the tramway people took steps with the object of destroying the cable, and further legal proceedings were taken by the defendants to restrain them. The whole thing was based upon the circumstance that on September 16th, when the company had occasion to repair their line, they found the crack in the concrete, upon which they set themselves to discover that the defendants had done some injury. He would be able to show by evidence that the concrete at this particular place was cracked as far back as 1912, a long time before the defendants ever went near it. A strong reason for saying that the tunnelling did not necessarily cause damage was to be found in the fact that a second cable which the defendants had laid had existed up to the present time without the slightest injury being discovered. It was common ground that there was a depression in the road when the defendants began to do their work but that was not caused in any way by them. The plaintiffs, however, were trying to make out that it only began as and from September 2nd, when the tunnelling work was started. He did not dispute that there was a crack, but he maintained that it had existed 12 months before. Although it was admitted that the cable was doing no harm at present, the Court was asked to order that it should be taken up. No Court could make such an order as that, because the land beneath the tramway was not the property of the company. Their claim. if they had any, would only be to have their line made good.

His Lordship said if it could be shown that the cable was likely to cause injury, he would have jurisdiction ; but it was manifest that the cable was as solid a substance as anything that could be put in to take its place. The fact seemed to be that the cable was sought to be removed in the interest of the Electric Lighting Co , and they had no right to do it.

Mr. Young then proceeded to state his case as the plaintiff in the second action. He said, assuming they had got the cable in improperly, and that some injury was caused to the tramway in consequence, the extent of the Tramway Co.'s rights was only to compensation in damages. Before discovering any injury at all, however, they came down armed with counsel's opinion and instructions to take out a piece of cable so as to destroy its effective use for electric lighting. The cable did not injure them in any way except as an electric lighting company. They came in the dead of night and hoped to cut the cable and fill in the hole without being seen. If they had succeeded, Messrs. Woodward would have been put to enormous inconvenience and expense, and damages were now claimed for injury caused by the cutting, and an injunction was asked for restraining the Tramway Co. from doing the same thing in future.

Evidence was given by Mr. G. W. Grosvenor, managing director of Woodward, Grosvenor & Co., Mr. C. J. Jeffreys, manager for Thomas Vale & Son, contractors, of Stourport, who carried out the tunnelling work, Mr. James, the borough surveyor of Kidderminster, and Mr. A. Ritchins, road foreman to the Corporation of Kidderminster.

The hearing was continued on April 4th, when several witnesses, Corporation officials, and contractor's workmen, were called to give evidence as to the character of the subsoil under the tramline, and the manner in which the tunnelling work was done, and what happened when Mr. Charlton attempted to cut the cable. Mr. Wm. Hy. Griffiths, electrical engineer and manager of the Birmingham branch of the A.E.G. Electrical Co., gave evidence as to the nature of the soil where the tunnel was cut.

Mr. Frank Ernest Jones, foreman of the engineering and mechanical department of Woodward, Grosvenor & Co., and Police-Inspector Geo. Smith, also gave evidence, and the case for Messrs. Woodward was closed.

Mr. Eustace Hills, addressing the Court upon the whole of the two cases, contended that the Tramway Co. having to make and maintain their line, no one could come and tunnel under the road in such a way as to let them down, and the Town Council, as a matter of fact and a matter of law, could not give anyone leave to open up the road within the tramway jurisdiction. He said that the material point was whether the tunnel caused injury to the concrete bed of the tramway, and he contended that it did interfere with the support, and so with the tramway itself. Mr. Eustace Hills continuing his speech on behalf of the Tramway Co., on Monday, April 6th, argued that Messrs. Woodward, Grosvenor and Co. had no actual possession upon which they could rely upon which to found their action. They had not abandoned their cable, but it became part of the soil when laid. If it could be said that they had constructive possession, it would not give them the right of action without title.

Mr. Justice Rowlatt : It was attached at either end to their works, and they were sending an electric current through it.

Mr. Eustace Hills submitted that one of the tests would be whether the cable could be removed without disturbing the rights of anyone else.

Mr. Hugo Young, in his reply, maintained that Messrs. Woodward & Grosvenor had a right to sue for the damage to their cable. They had never parted with their physical possession of the cable, and it was with the acquiescence of the owners of the soil that they laid it. The Courts had held that in cases of this kind there was not any "passing" of possession merely because the cable was put in the soil.

Mr. Justice Rowlatt, in giving judgment, said that the action had taken a long time to try, but that time was fully justified by the importance of the matters concerned. The first action was by the Tramway Co. for damages, and an injunction in respect of two tunnels under the tramline, and the only question was the effect which those tunnels had upon the tramway. It was not in dispute that the plaintiffs had the right to run their tramway upon the street without being interfered with by any excavation in the subsoil and the road, and the question was whether any damage had been caused by the defendants. In any event the damage was not serious. The line at the point in question had been condemned, and would have had to be renewed in the course of two or three years, and the damage caused by the defendants, if any, was to a very small amount. In his judgment, it would only amount to the interest in respect of anticipation of repairs. The damage would really be less than £10 ; but the question was whether the plaintiffs had made out the case that the line had been damaged by either the first or the second tunnel, and the attention of the plaintiffs had been directed to the fact that the tunnel was about to be made, and one would have thought that the plaintiffs who had been given rights over the public streets, would feel that it was their duty to see that the tramway was not interfered with. One would have thought that the matter would have been arranged between the parties, and any danger which it was thought might result would have been pointed out to the defendants. But, unfortunately, that was not the course pursued. It appeared that the electric tramways had directors who were also directors of the local Electric Lighting Co., and it was as clear as anything could be that those people resolved to use their tramway for the purpose of preventing Woodward & Grosvenor from supplying themselves with electricity, and coercing them into taking the current from the Electric Lighting Co. On July 29th the Tramway Co. obtained, *ex parte*, an injunction, and the extraordinary course was taken of Mr. Lycett, the chairman of the company, coming down and serving the injunction personally upon the defendants. Mr. Lycett then said that they wanted to supply the electricity themselves. Mr. Grosvenor told him that it was not the kind of current they wanted, and that they preferred to provide their own. It appeared that Mr. Lycett tried to intimidate Mr. Grosvenor into taking the electricity from him. The only respect in which the defendants' freedom of action was limited by the injunction was that they were not to injure the tramway. No suggestion was made for the protection of the tramway, but the plaintiffs thought fit to adopt measures which threatened a breach of the peace. They thought fit to hire 41 navvies and occupy the trench, so that the defendants could not carry out their work, and it was only by the intervention of the police that the intolerable interference was put an end to. It did not come very well from such people to complain that the work had not been done in the best possible manner. On September 16th, without giving notice to the defendants, the plaintiffs came in the night, and digging down to the tunnel which the defendants had made, they cut the cable. Whether they dug down to separate the connection by taking out the piece, or merely to cut it through, seemed to be immaterial. That it was their intention to destroy the connection he was satisfied. It was suggested that they did it because the cable was illegally laid. If it had been illegally laid, it had not caused any infringement of the rights of the plaintiffs. It was not illegal in the sense of it having been laid without consent having been obtained. It was then suggested that it was illegal because it was dangerous to the tramway ; but when it had been laid it formed a solid mass in the soil, and was as safe a foundation for the tramway to run over as if it had been solid stone. The real reason was to get down to the cable and sever it. The whole thing was utterly illegal. It was a malicious injury to property, and being done at night might have been followed by a penalty of penal servitude. But when the police stopped this malicious injury, they thought fit to overbear the police by saying that they (the police) were obstructing Mr. Charlton in his rights. In an affidavit put in for the plaintiffs, it was said that the police appeared to be acting under the direction of Messrs. Woodward & Grosvenor, but that was a monstrous position to take up, as the police were merely doing their duty. The object clearly was, the cable having been injured, to cover up the place and prevent Woodward & Grosvenor from discovering where the interruption in their current was. Here they had the tramways, for an indirect motive, trying to make out that the interest which they had in their tramways entitled them to interrupt the enterprise of Woodward & Grosvenor. They tried to get the Corporation to interfere, they tried to intimidate the defendants themselves, but all to no purpose, and they then committed a breach of the law and tried to overbear the police. They had been wrong in every point throughout, and he was satisfied that the tunnels did not give cause for complaint. The tramway people did worse than the defendants were charged with having done, because they removed the soil immediately beneath the concrete when they tried to get down to the cable to cut it. He came to the conclusion that there had been damage to the concrete before any of the things complained of happened, and that the depression in the line was due to that damage. The onus was upon the plaintiffs to show that damage had been done, and they had failed to do so. The plaintiffs' action must be dismissed as to the first tunnel, and as to the second tunnel he would grant no injunction whatever. As to the cross action in respect to the separation of the cable of Messrs. Woodward, Grovenor & Co. by the Tramway Co., there was no defence at all except the contention that the plaintiffs had no such interest in the cable as would entitle them to maintain and keep it. That point had given rise to an interesting legal discussion. The plaintiffs assumed rightly that they had the sanction of the owners of the soil to lay the cable which consisted of three strands of copper wire laid in a pipe to connect their dynamo on the one side with their works on the other side of the road, and it was put in the soil to keep it out of the way. It appeared to him that it would be very astonishing to hold that the property in that cable, as separate from the soil in nature, so distinct from it and so isolated from it, passed to the owners of the sub-soil. The question was whether the plaintiffs had sufficient interest in the cable to maintain an action against a mere wrong-doer, and he thought they had. The cable was laid in the soil, but it remained the property of the plaintiffs. The objection to the action, therefore, failed, and there was no other defence. The actual damage was £28, but the case was one which was attended by exemplary damages. All the trouble had been brought about by the course which the defendants had taken, and he gave judgment for the plaintiffs in the cross action for £100.

Judgment was therefore entered for Messrs. Woodward and Grosvenor in both actions.

Attorney-General at the Relation of the Long Eaton Gas Co. v. the Long Eaton District Council.

In the Chancery Division on Friday, April 3rd, there was opened before Mr. Justice Sargant this action, which was brought to decide whether the Council were justified in making a differentiation between consumers of their electric supply.

Mr. Mark Romer, K.C., and Mr Percy Wheeler were counsel for the plaintiffs, and the defendants were represented by Mr. Martelli, K.C., and Mr. Courthope Munroe.

Mr. Romer, in opening the case, said that the action was brought at the relation of the Gas Co., who had the right of supplying gas in the district, the defendants being the Urban District Council, who had powers for supplying electrical energy for light and power within their district. The plaintiffs claimed a declaration that a certain differentiation in the charges which the defendants were now making for the supply of power was a differentiation which contravened Secs. 19 and 20 of the Electric Lighting Act of 1882. Those were the sections which related to the giving of undue preference. The facts of the case were very short, and might be very shortly stated. The defendant Urban District Council obtained its statutory authority to supply electrical energy under the Local Council Electric Light Order of 1900. Long Eaton, the district supplied by this Council, though in the county of Derby, was close to—he understood only 8 miles from—Nottingham, and was right in the centre of the lace manufacturing district. There were within the district supplied by the defendant Council a large number of lace factories—factories where machine-made lace was manufactured. These factories might take both their power and light from the defendants, or they might do one or the other of these things by gas, or they might do both by gas. Down to the time of the differentiation of charge of which the plaintiffs complained in this action, the Urban District Council charged the same rate for power supplied to the factories which were also lighted by electric light as they charged for power to factories lighted by gas. Likewise, the same charge was made for electricity for lighting purposes to factories whose machinery was driven by electric power as was made for light to factories whose machinery was run by gas power. In September of 1911, however, the complaint of differentiation commenced with the issue of the following circular from the Long Eaton Urban District Council, dated September 25th, 1911, from the electricity supply works, Long Eaton. It ran :—

"Dear Sir,—I am directed by my Council to inform you that the following resolution has been adopted with reference to the price charged for electricity to power consumers, which will take effect as stated therein, viz. :—

"*Revision of Electricity Charges.*

"The Committee, having fully considered this matter, recommend that the present scale of charges remain in force where power and lighting are both taken exclusively from the Council electricity mains, but in cases where electricity supply is taken for power only, or for power and partial lighting, the lowest scale of charges where the number of units consumed during any quarter exceeds 4,000 shall be 1d. per unit, and otherwise according to the existing scale, such amended charge to commence on January 1st, 1912.

"I enclose herewith the scale of charges for electricity referred to in this matter.

"(Signed) **Frank Worrall,**
"*Engineer and Manager.*"

That scale of charges, continued Counsel, was for over 4,000 units and under 6,000 1d. per unit, and over 6,000 units ¾d. a unit. The result was that there was a differentiation made by this circular from January 1st, 1912, the effect of which was to put up the price to those who did not light entirely by electricity. Where a man lighted his factory by gas, or partly lighted it by gas, instead of ¾d. a unit for a supply of over 6,000 units a quarter, he would have to pay 1d. per unit. A differentiation, said Counsel, to the extent of a ¼d. per unit in favour of those who exclusively lighted their factories by electric light. His submission was that such a differentiation was forbidden by Secs. 19 and 20 of the Act of 1882. Undue preference as used in Sec. 20, must, he submitted, mean a preference that was undue with reference to what was insisted on in Sec. 19. That was to say, that if the undertakers purported to attempt to discriminate between consumers who under similar circumstances were entitled to a corresponding supply, then they were guilty of an undue preference. If under the existing scale of charges the discrimination was against persons who used the light only which was produced at the time of the maximum load, it would not be a controversial matter but rather a matter of common sense. Either the differentiation was because they wanted to obtain the custom for lighting from the people who were using the energy for power, or because they thought that in that way they would be able to obtain the customers of the gas company. It was a differentiation for the purpose of rival trading. If their object was to increase their new customers, they were not entitled to do it by discriminating against their old customers. They had already differentiated between houses and factories, and it was difficult, therefore, to understand any valid reason that would justify the change that had been made.

Counsel proceeded to deal at length with the authorities largely with reference to the carriage of goods, for the purpose of showing that where different rates had been allowed it had been shown that there was a difference in the cost of providing the carriage.

On Monday, April 6th, Mr. William Ernest Radford, who was called for the plaintiffs and examined by Mr. Romer said that he was a lace manufacturer at Long Eaton. He used electric power and originally desired to use gas for lighting. He had a lot of gas fittings, but in consequence of the Council's circular he took the electric light. His factory sometimes worked for the whole 24 hours, but the usual hours were from 4 a.m. until midnight. Sometimes his machines stood idle and he would then be using the electrical energy for light alone. There were frequent occasions when he was using the energy for light when he was not using it for power.

Cross-examined by Mr. Martelli, witness said that for the winding machinery he employed women and girls and their hours were limited by the Factory Acts. The hours the winding machinery would be working were from 7 a.m. to 7 p.m. The load on the other machinery would go on to midnight, the time when the electric light would be used; he used about one-tenth of the energy for lighting that he did for power.

Mr. George Stevenson, director of the Long Eaton Gas Co., said the shed factories usually were supplied with electric power. There were four types : those which took electricity for power and gas for light, those that took electricity for both power and light, those that took steam for power and gas for light, and those that took steam for power and electricity for light. The general principles of charging were the same in both the gas companies and the electricity companies. Generally speaking, light would not be required by the factories when they did not require power.

Mr. Harold B. Stretchley, lace manufacturer of Nottingham said that his factory at Long Eaton was erected in 1904. In consideration of his taking electricity for light, the Council cancelled their increased charge for power. There was a separate meter for the light and for the power. He would not be using the light when the power was not being taken. It would be very exceptional if he did. In 1912 he was enlarging his factory, and he asked the Council to give him the reduction from that time.

That concluded the plaintiffs' case, which was summoned up by Mr. Percy Wheeler.

In opening the case for the defence, Mr. Martilli said it had an importance beyond that to the present parties, for it was a common practice now for suppliers of electricity to charge one rate where the energy was taken for power only, and another where both power and light was taken. The analogy between this case and cases of railway rating, must not be carried too far. In the case of the railway rates the effect was to the price of the goods supplied, but then the Courts were considering the charge for the carriage of goods, and how it was considering the charge for supplying goods. As he understood it the questions which his Lordship had to decide were three. First of all under Sec. 19 did the customers for power get their supply under similar conditions to the customers for both power and light, for the words of the Section were that it was customers who were taking a supply under similar circumstances that were entitled to a corresponding supply. The first question, therefore, was were customers for light and power customers taking a supply under similar circumstances? The next question was did the former—that was that people who used the current for both power and light get a corresponding supply to those who used it for power only? The third question was whether there was any question of undue preference under Sec. 20? The defendants asked his Lordship to answer all those questions in the negative.

Mr. Justice Sargant : Is your contention that taking the two first questions, in order for the plaintiffs to succeed I shall have to answer both of them in the affirmative? One would not do?

Mr. Martelli said that was so. He proposed to deal with the case first of all on the assumption of there being no question of partial lighting.

Mr. Justice Sargant : If it is bad as to part it must be bad as to all the rest?

Mr. Martelli : That must be so with regard to the first question. He said it was important to remember that all these factories in Long Eaton were worked under normal conditions. They were practically worked 20 hours out of the 24.

Mr. Justice Sargant said that he thought that was the evidence given by the plaintiffs' witnesses.

Mr. Martelli said that one further point was that when they were not working up to their full normal time they would work in the daytime in preference to working at night. The evidence was that 20 per cent. of the winding machine work was done by women, and those women could only be employed in the factory for 12 hours, and those were the daylight hours. From 7 a.m. to 7 p.m. were practically the daylight hours, and at 7 p.m. a substantial part of the power was shut off, the defendants thought 25 per cent. at least. When, therefore, the energy was taken for power only, at 7 p.m. 25 per cent. of the generating plant would become idle, and would remain idle until 7 o'clock the next morning. The figures showed that the day load was seven-tenths of the total load, and it must be an advantage to compensate for the falling-off of the day load by getting users for lighting purposes at night. The maximum power load was always during the day. It must also be borne in mind that light was four times the price of power. Power was ¾d. per unit and light was 3d. per unit. Counsel did not suggest that the principle he was contending for would apply when something besides electricity was supplied. For instance, the Council could not make a difference in the price of electricity to a consumer because that consumer took coke from them, but he did submit that they were entitled to differentiate in their charges for electricity between what he might call a good and a bad customer.

Mr. J. F. C. Snell, examined by Mr. Munroe, said the load factor of the station was 26·01 for the year ending March, 1913. Load factor was an important point, because the load factor of the gen sumer determined the load factor at the station. The better the load factor the cheaper the undertakers could afford to sell because of the less cost to them. Another factor was what was known as the diversity factor of the load. A supply company had to provide plant for the maximum load. In the case of the defendant Council it was 950 KW., which was the amount installed, whereas 658 KW. was the maximum required, giving a margin of over 300 KW. odd. The increase of the electric light demand would tend to improve the diversity factor. For that reason a consumer taking a supply for power only, and one taking power plus light, could not be said to be taking a supply under similar circumstances. The load factor would not be the same. There might, however, be cases where the load factor of the person taking energy for power only would be better than that of one taking power plus light. As a rule, however, it would be the other way about. Apart from the special case, the load factor of the person taking power only and the person taking power plus light, would be different. The load factor of the person taking both would be the better. At Long Eaton the consumer of power plus light would have a slightly better load factor than consumers of power only. Speaking generally, in Long Eaton the person who took both power and light was the better consumer from the Council's point of view.

Counsel asked whether it was a commercially sound principle to give preference to the consumer of both?

The question was objected to, and counsel said he merely asked it in case it was suggested the preference was given merely to injure the gas company.

Mr. Romer said that was not suggested.

Mr. Frank Worrall, A.M.I.C.E., engineer of the Long Eaton District Council, said he had had charge of the electricity works of the Council since 1900, when the provisional order was obtained. Long Eaton was purely a manufacturing district; before electricity was introduced, the motive power for the factories was either steam or gas. They had had one case of a factory lighted partly by gas and partly by electricity, and in that case the consumer was given the benefit of the reduction. That was the only case of the kind they had had, and he thought it extremely unlikely they would have another. They charged less for power than they did for light, because they could use the machinery for power when it was not required for lighting purposes.

Mr. William Jenkins, vice-chairman of the District Council, and chairman of the electric light undertaking, gave reasons for making the differentiation.

That concluded the defendants' case, which was summed up by Mr. Courthope Munroe. He submitted that because one or two cases might work out the wrong way, the Council were not to be prevented from giving a preference which would hurt nobody and attract to their undertaking customers whose custom was beneficial. Only two persons would be hit by this scale of charges, and they would be hit because they had an abnormally good load.

Mr. Martelli, in the absence of Mr. Courthope Munroe, continued the summing-up of the case for the defence. His Lordship remarking that the case was one of such importance that he desired all the assistance he could get from counsel. Mr. Martelli said where the charge was made under two different scales—two different prices—Sec. 19 was not contravened because the purchaser could come under which scale he pleased. The person against whom there must not be discrimination was a person taking a supply under precisely the same circumstances as some other persons. How could it be suggested that the supply of power corresponded with a supply for both power and light?

Counsel said he desired to deal shortly with the authorities that had been referred to.

His Lordship said he did not desire to curtail counsel's argument in any way. He should be unable to give judgment during the present sitting as the case was one of such great importance that he must consider it. He could not help thinking that the matter must be thrashed out on much more elaborate evidence than he had heard from either side.

Mr. Martelli agreed.

Mr. Justice Sargant said that on the question of fact he supposed that the winding was a separate part of the business and was carried on in a separate part of the building, and therefore when the power stopped for winding machines light would also be stopped. The light in the winding department would not be required after the winding machinery had stopped?

Counsel agreed that that would be so.

Replying on the whole case, Mr. Romer said that he should assume that to the defendants the cost of energy was the same both for power and for light, for he thought the evidence proved that, or that the cost of the production of light was slightly higher than the cost of the production of power.

His Lordship said that he did not understand that any difference in price was now insisted on. He took it that defendants were relying upon this additional demand for light as producing a levelling up.

Mr. Romer said then he might start off with this fact which was not disputed—that light cost, if anything, more than power. Then defendants charged 3d. per unit for light and only ⅝d. a unit for power, and yet they were contending that they were endeavouring to obtain customers for light in order to cheapen the cost of production. The fallacy that lay at the bottom of their argument was that they could supply a man more cheaply with light and power than than they could supply one man merely with light and and another with power. He could understand that argument if the machinery was working only in the daytime, because then the machinery that supplied the light at night could be used for supplying the power in the daytime, but immediately you got overstepping the contention failed, because you must have machinery sufficient for supplying the maximum load. When a man who was taking power came and said now also supply me with light, he was no different, so far as the cost of his supply was concerned, to a man who came and said supply me with light, I am not taking power. His submission was that the proposed distinction must be *ultra vires*.

His Lordship reserved judgment until next sittings.

Charing Cross, West End & City Electricity Supply Co., Ltd., v. The London Hydraulic Co., Ltd.

In the Court of Appeal Lord Sumner, Lord Justice Kennedy and Mr. Justice Bray disposed of this case on the appeal of the defendant company from a judgment of Mr. Justice Scrutton. The question turned upon the reciprocal rights and obligations of companies having statutory powers to lay mains under the public streets. The plaintiff company supply electricity in the City of London, pursuant to the terms of a Provisional Order, and for the purposes of such supply they had laid electric mains in various streets. The defendant company, acting under statutory powers conferred upon them in 1884, had, in the same streets, laid certain hydraulic mains, which conveyed water at a pressure of 600 lb. to the sq. in. Their Act contained a provision stating that nothing should exempt them from, *inter alia*, actions for negligence or nuisance. Certain of the defendants' hydraulic mains burst and did damage to the plaintiffs' mains, for which the plaintiffs sought to recover. Their case was that the water either escaped from the mains through the defendants' negligence, or that, having escaped it became a nuisance. Defendants denied negligence, and said that in the absence of negligence they were not liable. Mr. Justice Scrutton held that the defendants, not being exempted from liability by their Act, and having brought their high-pressure water to the streets for their own profit, were bound to keep it there at their own risk, and were, therefore, liable for damage done by the bursting of their mains. Hence the present appeal.

Mr. Sankey, K.C., and Mr. F. Gover appeared for the appellants, and Mr. McCall, K.C., and Mr. C. B. Marriott for the respondents.

Lord Sumner, giving judgment, said that both companies carried on undertakings for profit, for the purposes of which they obtained certain statutory permissions and powers, and also protections under private Acts of Parliament. The damage in respect of which the action was brought was actually sustained by the plaintiff company's cables in four streets—namely, Water Lane, Upper Thames Street, Cannon Street and St. Swithin's Lane. They were all streets in which both the mains of the defendants and the cables of the plaintiffs had been laid. The finding of the Judge in the Court below was that the mains having remained in safety for a considerable time, there were in 1912 subsidences and shiftings of the soil, leaving the mains unsupported in places, and that the weight and pressure of pipes, and the water within, probably assisted by the vibration of the heavy traffic and a sharp frost at the time, caused the respective fractures. Negligence having been negatived by the learned Judge, the question was whether, in the circumstances, the plaintiffs had suffered injury or an invasion of their rights by a nuisance on the part of the defendants. He thought that he might answer that question briefly by saying, in the words used by the Master of the Rolls in Midwood and Co. *v.* Manchester Corporation, heard in 1905, that if this was not a nuisance, he did not know what would be one. The decision in that case was binding on this Court, and unless the two cases could be distinguished, no more was to be said. The Manchester Corporation were empowered to supply electrical energy in their district, and for that purpose to lay down mains, but it was a condition of their statutory powers that nothing therein contained should exonerate them from any indictment action, or other proceeding for nuisance in the event of any nuisance being caused by them. One of their mains fused, and the bitumen, in which the mains was laid, in consequence became volatilised into an inflammable gas, which accumulated for some time and then exploded, causing a fire by which goods on the premises of Midwood & Co. were damaged. It was held that apart from any question of negligence, the Corporation were liable to Messrs. Midwood as for a nuisance. In his (Lord Sumner's) opinion, the facts of that case were indistinguishable from the facts of the present case. Further, he thought that this case was covered by the judgment of the House of Lords in the case of Rylands *v.* Fletcher, from the facts of which it was also indistinguishable. It was argued that the doctrine of Rylands *v.* Fletcher, was only applicable as between owners of adjacent closes, and that the principle there laid down depended on the rights attaching to the ownership of land; whereas here, it was said, instead of two adjacent owners of land there were two neighbouring owners of chattels not strictly adjacent. It was also said that the parties here were in the position of co-users of a highway, and that on that ground also the doctrine of Rylands *v.* Fletcher did not apply. He did not think that these distinctions were well founded. In his opinion the doctrine of Rylands *v.* Fletcher was not limited to adjacent owners of land, but extended to such a case as the present. No doubt that case was a case between adjacent owners, but the judgments showed no intention of confining the principle to the case of adjacent freeholders. The defendants, too, had relied on the fact that they came to the *locus in quo* first, and that the plaintiffs came afterwards; and they contended that the plaintiffs were therefore bound to take the place as they found it, one of the things which they found there being the defendants' mains. No doubt there were cases in which it was said that a person who complained of a nuisance had himself gone to the nuisance. But the analogy between this case and those cases, was not made out unless it could be shown that it was the normal condition of mains like the defendants', that they should squirt out water from time to time. If the argument about taking a thing as one found it was to be applied, it ought to be assumed that these mains were sound. He therefore thought the contention of the defendants, based on the sequence of events, was illusory. It was not having water in the pipes, or subjecting the water to high pressure that constituted the legal wrong ; it was letting the water escape that was the legal wrong. He thought that Sec. 17 of the defendants' Act of 1884 must be read as meaning that nothing in that Act or their earlier Act of 1871 should exempt the company from liability for the nuisance caused by them. The appeal therefore failed.

Lord Justice Kennedy and Mr. Justice Bray concurred, and the appeal was accordingly dismissed, with costs.

Crompton & Co., Ltd.

(Scheme Sanctioned and Action Stayed.)

In the Chancery Division, Mr. Justice Warrington heard the petition of Crompton & Co., Ltd., electrical engineers, for the sanction of the Court to a scheme of reconstruction.

Mr. Younger, K.C., and Mr. H. E. Wright appeared for the company, and Mr. Clauson, K.C., and Mr. Carr for certain debenture-holders, who opposed the scheme.

Mr. Younger said this matter came before his Lordship once again in a different shape from that in which he dealt with it on the last occasion. The matter then came before his Lordship in the form of a motion in a debenture-holders' action, asking for the appointment of a Receiver and manager, on the ground that although the debentures said that a winding up was not to make the principal moneys payable, when it was a winding up with a view to reconstruction, they were, in fact, payable. His Lordship came to the conclusion on the construction of the debentures that whatever the parties meant they had not succeeded in giving effect to it, and he thought the case was one for the appointment of a Receiver. His Lordship, however, directed that the appointment was not to be made for six weeks, in order that an appeal might, if decided upon, be entered, and in order also that the scheme now before his Lordship should be considered. Both things had been done ; an appeal had been entered, but was not to be brought in if the scheme was to become effective, and the scheme had been prepared and passed by a majority of the creditors. The only opposition came from Mr. Clauson's clients, who were the plaintiffs in the action.

Mr. Clauson said he would suggest a modification of the scheme to meet his clients' views, and if that modification was accepted, they would not oppose the scheme further. They desired a term inserted in the scheme that as regarded any debenture-holder who had not voted in favour of the scheme, and who at some period expressed his desire to have his debentures paid off, the company should pay them off.

Mr. Younger : I cannot assent to that ; it is impossible.

Mr. Clauson said it was quite plain that if the debenture-holders insisted on their rights now, they should be paid off at par ; but he would be satisfied if that were done at some reasonable period.

His Lordship : I have to say whether the scheme should be sanctioned, notwithstanding the opposition.

Mr. Younger said in 1913, the company not having been very successful in recent years, a scheme of reconstruction was prepared and propounded for the purpose of bringing in fresh capital to the company through the medium of shareholders. By the scheme the company was to go into voluntary liquidation, with the view of its transfer to a new company, which would issue debentures for £100,000 in exchange for the present debentures. The rate of interest on the debentures was to be increased from 5 to 5½ per cent. The scheme made the new company bound in respect of the debentures as if it were the old company, and it gave the debenture-holders a charge on the whole undertaking of the new company, and gave them all the security they had, and an additional security as well.

Mr. Clauson : I accept that statement as accurate.

Mr. Younger said a meeting of the debenture-holders was held, when there were present 149 holding £74,000. In favour of the resolution there were 14 debenture-holders present in person holding £8,550, and 121 present by proxy holding £51,850, altogether 135 holding £60,400. Against the scheme there were two persons in person holding £2,500, and 12 persons by proxy holding £10,800, altogether 14 holding £13 300. So they had something in excess of the statutory demand. There was a sum of £50,000 brought into the company and the evidence showed that the effect had been to considerably increase the business of the company, and profits largely in excess of the old were now being made. Counsel concluded by asking his Lordship to sanction the scheme and said the opposition to it was a technical one.

Mr. Clauson said the only point before his Lordship was whether a term should not be put into the scheme that the debenture-holders who wished to be paid off should be paid off. He submitted that that was a proper provision to be put in the scheme, and if his Lordship assented to that he would hear nothing further from him.

His Lordship said the rate of interest on the debentures was to be raised from 5 to 5½ per cent., and the position of the debenture-holders in the new company and its assets was substantially the same, subject to this, that fresh capital to the amount of £50,000 was raised by the new company. Some proportion of that had gone to pay debts and liabilities of the old company, but how much that was he did not exactly know, or by how much the debenture-holders' security had been increased if at all by the raising of that capital. The voting on the scheme resulted in a majority in favour, exceeding the statutory majority by about £6,000. In these circumstances ought he to sanction the scheme? It was said that he ought not to sanction it without inserting a provision that the plaintiffs in the debenture-holders' action should not be affected by it. What was proposed was a compromise in the strictest sense of the term, because the plaintiffs had an action against the old company for the realisation of their debentures and the company had presented an appeal against the order he pronounced the other day for the appointment of a Receiver. There was something of a compromise there. But if it were not a compromise it was an arrangement between the company and its creditors. In regard to the meetings the statutory provisions had been complied with and he had to satisfy himself that the arrangement was such that a man of business would reasonably approve. How was it possible for him to say that it was not? It seemed to him that although the arrangement was practically an arrangement which did take away somewhat from the strict rights of the creditors, it was his duty to sanction it. He therefore sanctioned the scheme.

Mr. Younger said they would now take an order staying all proceedings in Mr. Blair's action (the debenture-holders' action), paying his costs in that action and on this petition, and discharging the Receiver.

His Lordship made the order accordingly.

Osram Lamp Works, Ltd., v. The Gabriel Lamp Co. and George Davis.

In the Court of Appeal, before the Master of the Rolls, Lord Justice Buckley and Mr. Justice Channell, on April 7th, this case was heard upon the appeal of the plaintiffs from the order of Mr. Justice Eve in the Chancery Division.

The case came before the learned judge on a summons for further and better answers to two interrogatories. The matter was reported in our issue of March 6th, page 426.

At the conclusion of the arguments their Lordships allowed the appeal, holding that the plaintiffs were entitled to have the interrogatories in question answered.

War Office v. Kirkland & Capper and J. H. T. Woodd.

(Continued from page 616.)

Continuing the cross-examination of Mr. Patchell, Mr. Walter, K.C., said :—Supposing that a fuse blows, and you put in another fuse of the same size and find that blows again. What should you say to a system which we shall hear of later, of putting in a fuse stronger and stronger till something held ?—It is not a wise method.

That indicates the fault by burning it out ?—It might do, without injuring the wire in any other place.

In the course of further cross-examination, Witness said that the work was done under the 1903 rules ; the rules were altered very slightly in 1907, and considerably altered in 1911.

We have reached a standard of perfection nowadays ?—They are levelled up with a view of eliminating bad work such as we see on the table here.

At this stage the Solicitor-General referred to the question of damages, and said it seemed to him it would be impossible for the Judge to go into this matter and discuss the damages until they ascertained what was the measure of liability, if liability existed.

The Judge said this seemed to be very reasonable.

Mr. Walter said his submission would be that everything that was done here was expressly authorised by the War Office specification.

The Judge : So I understand. The possibility of your being wrong must be taken into consideration, and if you are wrong, then the question arises as to the amount of damage. I have an opinion that you two gentlemen would be much better advised to refer any question of damage to some electrical engineer in whom you both have confidence.

Counsel for all three parties agreed to this course.

Mr. Patchell, further cross-examined by Mr. Walter, said that earthing of the casing of conductors was not only to guard against electrolysis, but for safety as well.

You do not earth the conductors ?—Yes : the middle wire of a three-wire system is also earthed. This was a three-wire system supplied by the Westminster Electric Co., with 400 volts across the outers. By the Board of Trade regulation they had to earth the neutral point in the station. He did not agree that practical experience always showed that any electrolysis that was going to develop generally developed in the first six months.

The Solicitor-General : With regard to those two bad circuits that you examined, was there anything in the wire or in the insulation that you saw consistent with there having been a fault in the flex and an excessive current passed through the conductors through an overstrong fuse ?—No, I do not think so.

Further cross-examined by Mr. Walter, Witness agreed that there was something on the copper of these two particular circuits that was not present in the other circuits. The inside of the rubber in both cases was not "tacky," but it was slightly sticky on the inside in one case. It was not so sticky as he would expect if it had been overheated. The lead of the pieces cut out was in good order.

Subsequently the Solicitor-General called evidence to prove that Messrs. Bolding's men were constantly on the premises within the year after May 13th, 1907.

Mr Solomon Elliott, a headmaster at the college since it was opened, said he recollected electricians being there within the 12 months working at the lights. There were two men; they had nothing to do with the Royal Engineers or the staff of the college.

Mr Frederick D. Brewer, waiter at the college, also gave similar evidence.

The Solicitor-General said that this was the plaintiffs' case, and he handed in the answers to interrogatories that he had received.

Opening the case for the defendant Mr. Woodd, Mr. Shearman, K.C., said he would submit that there was no case at all against Mr. Woodd, and that, in view of the contractual relations between the parties, there was no evidence of neglect by Mr. Woodd as an architect, and negligence was the only case that was suggested here against Mr. Woodd. The action was originally launched by the War Office against Messrs. Kirkland & Capper, the engineers, and they added Mr. Woodd as a defendant as soon as they found that he would not give evidence against the engineers. Dealing with the precise terms of the War Office contract with Mr. Woodd, Mr. Shearman emphasised the point that the electrical work was to be placed in the hands of "responsible experts." It was said in the amended statement of claim that Kirkland and Capper were employed by the War Office through the defendant Woodd. The agreement between the parties, broadly, was this: that Mr. Woodd was to be responsible as architect for the building, and Messrs. Kirkland & Capper were engineers responsible for the engineering work. It was not Mr. Woodd's duty at all to supervise the electrical engineering work. He was an eminent architect whose speciality was work for hospitals. He had done a great deal of work for Guy's Hospital, and this lead-covered system buried in plaster had been installed there; he was told that there were 30 miles of wire there, and the system was fully satisfactory. Messrs. Kirkland & Capper were paid a commission of 5 per cent. to include their certifying—the contract between the War Office and Messrs. Bolding said that the persons to certify should be Kirkland & Capper. Mr. Woodd was doing the architect's work under this £100,000 contract on the 5 per cent. basis, and he was not to be paid any percentage on the electric light. If there was anything wrong here at all it was due to lack of careful workmanship: upon the documents no charge of professional negligence against Mr. Woodd could be maintained. He would satisfy the Court that the system *per se* was not in itself a negligent system; it required very careful laying, and evidence would be called to show that the system had been carried out elsewhere with perfect success. The only obligation Mr. Woodd owed was not to be negligent as architect. He had no responsibility as regarded the choice of the electric lighting system.

Mr. Walter, K.C., in opening the defence of Messrs. Kirkland and Capper, formally submitted that there was no case against his clients of professional negligence. Messrs. Kirkland & Capper were an extremely well-known firm of consulting electrical engineers. Mr. Kirkland had been in practice on his own account for some 25 years. His partner, Prof. Capper, who joined him in 1898, was Professor of Engineering at King's College. The duties of a consulting engineer were to prepare the specifications and drawings necessary for the carrying out of the contract, to prepare tenders, to advise his employers as to such tenders, to instruct the contractors whose tender had been accepted generally as to how the work was to be carried out, and to instruct the clerk of the works who would be personally present during the whole time as to the carrying-out of those works. He would require the contractors to submit to him for testing and examination any of the materials that they proposed to use, and he would periodically, while the work was in progress, visit the works and see that his instructions were generally being carried out. It was next part of his duty to adjust between the contractor and the clerk of the works any disputes that arose as to the materials, or as to the nature of the work, as to which the clerk of works was making a complaint, and it was his duty to make such tests as he regarded as necessary to see that his instructions had been carried out, and finally it was his duty to certify that the work had been carried out to his instructions and to his satisfaction. It was not the duty of a consulting engineer to live on the works, he was employed for consultation and not for superintendence; it was not his business to see the materials delivered on the site, it was not his duty to watch the execution of every piece of work, or to see that every workman was doing his work properly—all those duties devolved on the clerk of the works, and here there was an able clerk of the works who was fully instructed by Mr. Kirkland as to those portions of the work with which Mr. Kirkland was concerned, and which he would have to see properly carried out. He had not been called in the case, and he was the clerk of the works employed by the War Office, who signed every certificate in the case. The Court would hear that the most extreme care was taken to see that all this work was properly done.

Mr. Walter went on to say that there was no agreement with Kirkland & Capper: they were employed as consulting engineers on the basis of 5 per cent., and no other basis, and there was no written contract. The acts of negligence alleged were:—(1) Using lead-covered conductors buried in plaster without conduits. (2) buried in plaster without protection; (3) conductors that were carried over "rough walling and sharp corners, whereby the lead covering became cracked and broken." No evidence had been given as to that or to suggest that anything had happened in regard to that. In the alternative it was said:—"If the lead covering did not become cracked from the said cause, the defendants negligently allowed the contractors to put the conductors in with the lead covering already cracked and broken." That was no part of a consulting engineer's duty; that was for the clerk of the works. It was said in the further alternative that the defendants, in permitting the departure from the specification, negligently omitted to order the same as a deviation from the terms of the specification, so as to secure the plaintiff a deduction from the amount payable under the contract. That was based on the assumption that a system was ordered that was cheaper, whereas the Judge would hear it was dearer, and it was only after considerable influence had been brought to bear that the contractors were got to forgo their claim to be paid for the more expensive work than that which they specified for. It was also said that defendants "negligently allowed the laying by the contractors of the lead-covered conductors in an irregular manner without keeping or communicating to the defendants any correct record of the places where the same were laid," that was, plans. The contract did not provide for these plans, they were never prepared and were never asked for. The drawings asked for were supplied. As to the acts of alleged negligence, counsel submitted that there was not a shred of evidence to justify any of the claims, that this was an action that ought never to have been brought and that it was started without any technical advice from any competent person. Counsel proceeded to review at great length the history of the case, from the verbal employment of his clients to advise the War Office as consulting electrical engineers, and dealt in detail with the various duties that fell upon them. It was said that lead-covered conductors might be used in any situation provided the conductors were accessible, and might be run through walls or partitions or plaster for short lengths, for instance, "behind cornices or mouldings." That was to say, if they wanted to bring a circuit in at the door they could run it the whole way round the room under the plaster. Counsel contended that the use of lead-covered conductors was authorised wherever conduit could be used, and it was necessary for the engineer to take care that the wiring was so divided up by means of junction boxes or connection boxes that they could locate any fault that there was in the circuit. That was the whole object of accessibility. Mr. Walter proceeded to deal in detail with the schedules, to show that no defect had arisen from the system adopted here of lead in plaster. He contended that the other side were trying to mix up the duties of the clerk of the works and of the consulting engineer, and produced diaries to prove the constant attendances of Mr. Kirkland and his intimate supervision. As each section of the wire was laid, it was tested before the plaster was put up; after all the plaster was in, every separate section was tested to see that it was right at the time after it had been plastered. After the whole installation was put in, it was tested by Mr. Kirkland personally throughout the whole building, and every single thing was perfect. Then came the electric light company, and that company did not put in anything till they had themselves tested to see that the wires were in a condition to connect with their mains, that was to say that there were no earths and no short circuits. They tested not only from the earth to the mains but between the mains, and everything was found perfect. Then the mains were connected, and the system went on. That lighting was taken over in May, 1907, and there was a resident electrician in charge, who had not been called in the case. The year 1907-8 was the year of maintenance, during which the contractor had to make good anything that happened. There were new things put in by the contractors on the instructions of the War Office, as to which no communication of any kind was made to Mr. Kirkland. Mr. Walter passed to an exhaustive critical examination of the complaints, and explained at length the three-wire system. He said he would show that the system adopted was perfect. The defects were between the boxes and the lighting points, that was where the users of the system could do harm. Every fuse in the building was over-fused. His experts would say that in this case the whole trouble had been that for a period of two or three years up to 1909, when Mr. Kirk examined it, there had been no proper care taken of this installation at all. The defects were clearly defects at lighting points and nowhere else. Counsel went on to allege that the system had been abused, and the whole installation had been treated in "a monstrous way"; in one instance bell wire had been put in by the War Office. He would call past presidents of the Institution of Electrical Engineers, who would say that the system here was perfect, and it was nothing but gross misuse that had caused these defects—defects that were perfectly trifling, and could have been put right, if they had been looked after as soon as they occurred, without the smallest difficulty. After charging his clients with negligence, the War Office had put in a fresh installation of their own, with a new specification in the contract: they had discarded their own specification.

The Judge: You need not detail that at length. At present I am not satisfied that even supposing you were negligent, you were negligent to such an extent, or in such a way as would justify them in scrapping the whole system and putting in a new system of their own and charging you with the cost of it. But that is quite another thing from saying that there is no liability for any negligence.

Mr. Walter: Of course. If there is any negligence we are liable. I am going to show by the evidence that the most scrupulous care was taken, and that there was no negligence of any kind or description.

Mr. John Henry Townsend Woodd, the defendant, was then called. He said he was a Fellow of the Royal Institute of British Architects, and he had practised as an architect for about 30 years. He was architect to Guy's Hospital, and had had a wide experience in architecture for hospitals, laboratories, and buildings of that kind, as well as general experience. In February, 1903, Colonel Lake, of the War Office, asked him to call and put before him the preparation of a design for the Medical Staff College at

Millbank. Eventually he suggested Mr. Kirkland as an electrical supervising expert, as Mr. Kirkland was working with him at Guy's Hospital, where they had employed lead-covered wire similar to that at Millbank in a large nursing home and chemical laboratories. He would advocate the burying of the wires in every good building, as projections were unsightly. The system of burying lead-covered wire in plaster had been perfectly satisfactory at Guy's Hospital. In the last three years they had put in about 13 miles of it, *i.e.*, of conductors. With regard to the War Office contract, the sum relative to the architectural work was about £85,000, on which his commission was to be charged. The builders were Ashby & Horner, of Aldgate. They used Frazzi blocks both for the support of the floors and in a great many of the partitions between the rooms. The electric light tender was signed on January 2nd, 1906, and accepted by the War Office direct, and at that date a number of these Frazzi blocks were in position. These blocks were very light, very strong and partly sound-proof. On no consideration would he have allowed the blocks, when in position, to be chased. As to the electric light system, the buildings being well advanced, he and Mr. Kirkland had to consider what system would be the best to adopt to avoid chasing the Frazzi blocks, and in order to produce what he required, a flush surface, both in the laboratories and also in the college building. Many of the ceilings in the college buildings were rather elaborately ornamented, and he saw that it was impossible to have exposed wires on those, and they agreed, after due consideration, that it would be best to adopt the system of lead-covered wire buried in plaster that they had used successfully elsewhere. He did not know what the terms of the contract were between Messrs. Bolding and the War Office, or whether the system he was ordering was or was not a direction to vary the contract. Had he known that he could not do it in this way without varying the contract, he would have directed a variation. He thought no other system could have been adopted where the Frazzi blocks were in the ceiling, as the floors over the ceilings were solid concrete in almost every instance in both buildings. He thought it was not practicable to run behind the Frazzi blocks and drop wires through a hole bored in the Frazzi. There were 879 points altogether, of which 112 were in benches, where this system did not apply. That gave 767, of which 451 were in the college, and of these 335 went wholly or partially over Frazzi blocks; of those in the laboratories, 155 out of 316. He took no part in supervising the laying of the wires, and in his experience he had found no difficulty in their being laid properly by competent workmen. The clerk of the works in this case was the most excellent clerk of the works he had ever worked with. If he had the building to re-wire that day he would wire it in the same way. He took the view as against the view of the War Office that no blame attached to the consulting engineers, and as a result he had been made a defendant to the action.

In reply to cross-examination by the Solicitor-General, MR. WOODD said he had not had professionally under his charge at any time the installation of any electric light system. He believed that at Guy's Hospital they had tried to chase the Frazzi blocks when in position to get water pipes through, but it was seldom done successfully. A man would probably break one block out of every five in chasing. He considered that he omitted nothing that could be construed as professional negligence against him, and by his reading of the documents he thought it was fully open to him to use the system that he did.

Re-examined by MR. SHEARMAN, MR. WOODD said he had found that this was the first occasion on which in a large building they had used this particular Frazzi construction. As to the suggestion that tubing might have been run between the ceilings and the floors, all the floors were solid from the ceiling to the surface above, except in the roof, which was pierced. He did not give any emphatic direction that lead-covered wire should be used throughout; he only advised it as the best system, provided there was no objection in the mind of the engineers to adopting it.

MR. ARTHUR BLOMFIELD, a member of the firm of Sir Arthur Blomfield & Sons, Montague Place, Baker Street, W., architects, said he had heard that Mr. Woodd had declined to allow conductors to be run on the surface of the ceilings and partitions in connection with the laboratories and medical college, and, in his view, that was a reasonable and proper requirement. He thought that Mr. Woodd's decision not to allow the chasing of Frazzi blocks was a prudent and sensible decision to arrive at. He had seen the contract between the War Office and Mr. Woodd, and the power of variation. He had not seen the contract between the War Office and the contractor.

The JUDGE: Suppose the contract says that it should be in pipe wherever it is buried in plaster, and suppose you have not plaster that is thick enough to bury the pipe, would you consider it proper, as an architect, to vary the system in the contract under the variation clause?—I think, so far as I am concerned, I should not have done so without approaching my clients, but I do not think it was unprofessional to have taken that amount of discretion.

Answering MR. SHEARMAN, he believed there was no objection to the system of burying lead-covered conductors in plaster, but in these matters he would personally rely entirely on the advice and aid of an electrical engineer.

Cross-examined by the SOLICITOR-GENERAL: It was correct that in his experience in no case had the electrical engineer ever advised the laying of lead-covered conductors in plaster. The commonest system advised at the present day was the conduit system, the wires being laid in pipes.

The SOLICITOR-GENERAL: Assuming that the use of lead-covered conductors was either prohibited or strictly limited, do you think that a reasonably prudent architect, under Clause 8, would have ordered a departure from that system as a minor variation?—I am afraid I cannot regard it as reasonably prudent.

Re-examined by MR. SHEARMAN: Witness said he thought if an architect went down once a week to make inquiries of the clerk of the works it was very good. The clerk of the works as a rule was recommended by the architect and paid by the employer, but he was under the architect's orders.

MR. K. D. YOUNG, a Fellow of the Royal Institute of British Architects, said he had been in practice for 40 years and was concerned with hospital architecture. He said it was prudent for an architect to consent to an electrical system where the wires were buried, covered with lead, in a building where the only other available means was laying them upon the surface. He thought there was nothing in the system adopted that made it unreasonable for the architect to adopt.

Cross-examined by MR. GORDON HEWART: He considered that it was physically impossible to employ the conduit system at this college and laboratory, in the circumstances that had been explained. He agreed that conductors in barrel conduit were more accessible than lead-covered wires buried in plaster, and only knew of one case which he superintended, where lead-covered wires were buried in plaster. That was about 10 years ago.

MR. ERNEST JAMES BROWN, late president of the Institute of Builders, and chairman of the Frazzi Fireproof Construction Co., Ltd., said that Frazzi was a kind of terra cotta, and made of a particular alluvial deposit brought down by the River Po in Italy. He recollected his firm supplying Frazzi for the Royal Medical College at Millbank. The blocks could not be chased before put into position; they could be cut with a saw. They could be cut when in position, but much risk was incurred in doing it, as it would weaken the partition, weaken the joints, and in all probability, unless a man was very careful, he would cut right through the slab and smash the slab.

Cross-examined by MR. GORDON HEWART, he thought it was possible to cut the blocks in position; it could be done in a very small piece, but all through a building it would never be done, and no self-respecting architect would ever allow it to be done. The opinion he had given was the result of practical experience.

This closed the case for Mr. Woodd.

MR. THOMAS KIRKLAND was then called. He said he was a consulting engineer, and had been in practice since 1891 on his own account, and since 1898 in partnership with Prof. Capper. Witness was the consulting engineer to Guy's Hospital, to the Brompton Hospital for Consumption, and to a large number of other institutions. At Guy's he designed and supervised the whole of the electric generating system, with an installation to start with of nearly 6,000 lighting points. He first used lead wire buried in plaster at Guy's in 1900; it was adopted to meet a special requirement, where they had walls that would not allow of being chased to any depth, and they had to devise a system to meet the architect's requirements of having the walls perfectly smooth. In 1900 the length of the installation was about a mile or two, and that had been continually extended. Sometimes they had used casing and iron tubing. He thought there were about 30 miles of lead-covered wire buried in plaster at Guy's, and the system was perfectly satisfactory. In regard to the Millbank buildings, he was asked by Mr. Woodd if he would act as consulting electrical engineer for that installation, and he consented, and he received the War Office specification in June, 1904. He prepared the contract and conditions under which the work would require to be done, which he called the specification at the end of the contract. He made himself fully acquainted with the terms of the War Office electric light specification, and he arrived at the conclusion that the conditions laid down warranted him in using lead-covered conductors buried in plaster, as Clause 13 had this condition: "The conductors are in all cases to be accessible to authorised persons."

What provision in using lead-covered wire did you make to comply with that clause?—According to my view of accessibility, there are two requirements to be satisfied; the first is that you should be able to get at the ends of the wires to test if they are all right or not, the second is that you should be able without undue trouble or expense to replace any damaged wire. I satisfied the first condition by putting in what his Lordship defined the other day as manholes at either end, so that they could be got at; then I adopted the principle I had adopted from the first start of my use of this wire, that it is of no use imagining when you bury wire that you want to get it out. You do not want to get it out. What you want to do is to be able to replace any of those wires, and the method of replacement is by cutting off the ends of the wires at these manholes, and then making a fresh chase to the point which you want to remove and inserting a new wire.

(*To be continued.*)

TRAMWAY RATING APPEAL.

THE Court of Appeal has, by a majority, allowed the appeal by the Islington Assessment Committee from a decision of a Divisional Court making absolute a rule *nisi* which had been obtained at the instance of the L.C.C. for a mandamus addressed to the appellants calling upon them under Sec. 47 of the Valuation (Metropolis) Act, 1869, to appoint a valuer to make a provisional valuation list showing the reduction in the rateable value of the County Council electric tramways, situate in Islington, arising from the competition of motor-omnibuses. We shall refer to the matter in a later issue.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A Loading System for Metal Scrap.

An interesting system for loading metal scrap into boxes, recently brought out by Messrs. Steel, Peech & Tozer, Ltd., of Phœnix Special Steel Works, Sheffield, is illustrated in fig. 1, in side elevation. It will be seen that it consists in the use of an overhead travelling crane working in conjunction with a movable chute. The magnet of the crane is lowered into the scrap wagon, which stands on a line of rails at one side of the area over which the travelling crane operates. The magnet picks up a load of scrap, and the crane is then moved to bring the magnet over the scrap chute; the load is released, and the scrap is guided by the chute directly into the box or pan which has to be loaded. When the box is filled the magnet is lowered on the chute, and current is then switched on to the magnet, the crane is set in motion and the chute is moved over the next box or pan to be filled. No locomotive is required after the pans have been put into place, and the crane-driver is able to do the whole work of transference.

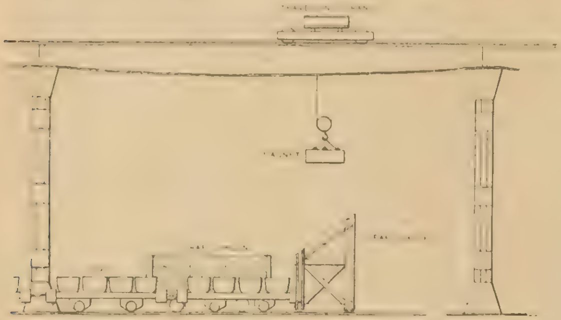


Fig. 1.—Method of Loading Scrap-Iron.

The magnet which is used for this class of work is a 52-in. or 72-in. size, according to the scrap to be lifted. By this method it is claimed that all the scrap handled is lifted by the magnets directly into the box, whereas in present methods of loading a good deal of the scrap lifted by the magnet, instead of going into the box, falls outside on the floor.

A Waistcoat-Pocket Wireless Detector.

The Ondophone, invented by a French engineer, M. H. Hurm, of Paris, is a wireless telegraph detector of strikingly small dimensions. The apparatus (fig. 2) only weighs 195 grammes, and is readily carried in a waistcoat pocket, though lending itself, on account of its great sensitiveness, to many applications in actual practice. The extremely sensitive detector proper is designed on M. R. F Pellin's patented system, which is based on the use of a galena crystal, without any liquid or fragile parts, such as glass, &c.; it is worked without any battery, and has the advantage of being subject to no wear and tear, the crystal contact being practically invariable. Another factor increasing the sensitiveness of the apparatus is the direct connection of the detector with the receiver, and the separate arrangement of the incoming wires, which reduces the mutual induction of the latter to a minimum. The substantial design and accurate adjustment of the ondophone are likewise valuable aids to its sensitiveness.

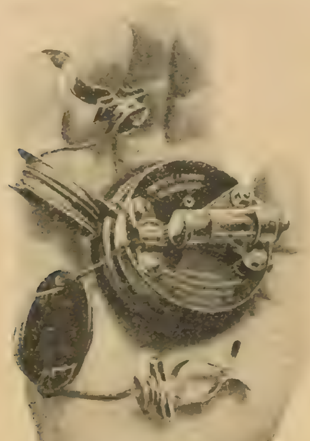


Fig. 2.—The Ondophone.

The ondophone can be connected up to the circuit at a moment's notice; the connecting wires are each 2 m. in length, thus allowing of a distance of 4 m. between the earth connection and the antenna. Each wire carries a bobbin, on which it may be wound up partly or entirely as the case may be.

Since the point of the seeker coincides with the most active part of the detector crystal, the most sensitive spots are found in a minimum of time; the signals can be heard almost anywhere on the surface of the crystal, and the only thing required is to search for the point where the reproduction reaches a maximum intensity. As soon as this point has been found, the seeker is fitted with a protective hood, preventing any accidental displacement.

Earthing can be effected by means of any (unpainted) water or gas pipe. If no such pipe be available, a piece of metal gauze or a metal plate of several square decimetres should be buried in moist ground, one of the terminals of the ondophone being connected with a metal wire soldered to the plate. Another method consists in allowing one of the terminals to lie on moist ground, contact being made by putting the foot or any heavy object on it. When there is no proper earthing available in the neighbourhood of the apparatus, *e.g.*, in a telephone cabin devoid of gas lighting, it sometimes suffices to put the terminal on one of the fingers. This enabled the Eiffel Tower signals to be heard distinctly at Sables d'Olonne, *i.e.*, at 450 metres distance, though the apparatus was insulated by the carpet and floor, the second terminal being connected up to a telephone line.

In order to ensure a connection with the Eiffel Tower within a radius of 200 km. round Paris, any slightly insulated small metal piece can be used as antenna. The greater the distance from the transmitting station the better should, of course, be the insulation and the larger the antenna connected with the ondophone. In the case of any considerable distances, an aerial wire proper cannot be dispensed with, the received intensity of the signals being the higher as the aerial wire is longer, higher and better insulated. The conductor of any telephone or telegraph apparatus constitutes an excellent aerial wire, by means of which the Eiffel Tower signals can be perceived throughout the whole of France and part of the border countries.

"Plexsim" Griddle Plates.

Amongst the several new items on the Plexsim system placed on the market by Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, attention may be drawn to a range of griddle plates. There is a ready demand for these, especially in the North; sizes are made suitable for the needs of both restaurants and domestic service. They are rectangular in shape, finished in black with a planed metal top; a useful size for the house is 16 in. long × 8 in. wide, loaded with 1,000 watts. Temperature regulation is provided for by the usual three-pin terminals; the plates are supported on insulating feet, and have a good general appearance. The largest size is 24 in. × 12 in., taking 2,500 watts at full load.

Fig. 3.—Simplex Electric Griddle Plate.

Benjamin Half-watt Lampholders and Reflectors.

We have received from the Benjamin Electric, Ltd., of 1a, Rosebery Avenue, E.C., particulars of their Goliath screw lampholders for half-watt lamps. These consist of a one-piece china holder with copper screw contact and centre contact of spring phosphor-bronze to ensure constant contact with the lamp cap. All other conducting parts are heavy electro-coppered brass stampings. Open

Fig. 4.

Fig. 5.

Benjamin Lampholder and Reflector.

terminals (fig. 4) are provided for situations where the holder is enclosed, and concealed terminals for exposed installations; either type may be provided with the Benjamin lamp grip, which is regarded as important for half-watt lamps of high candle-power.

The firm has also introduced an extensive and an intensive distribution type of steel reflector, fig. 5 in two sizes, for 300 and 500-watt lamps. These are of enamelled steel, fitted with the types of lampholder already mentioned, and giving ample ventilation and easy access to the terminals for wiring.

These reflectors are claimed to give efficient light distribution, and to shield the glare from the naked filament; they have been specially designed for factory and interior use.

Electro-Pneumatic Hammer.

Messrs. S. Wolf & Co., of 115, Southwark Street, S.E., have recently introduced a new electro-pneumatic hand hammer, which appears to possess advantages over the ordinary compressed-air hand hammer, in that being a self-contained unit it can be moved about to any required position and coupled to any available lighting or power circuit. It consists of a small motor-driven air compressor, using low air pressure, and a length of armoured hose connecting it to the hammer. The actual blows of the hammer are caused by the rapid alternate admission and withdrawal of air behind the piston which carries the hammer head, and the strength of these blows can be adjusted at will. As the pressure on the working side of the piston falls to atmospheric at the end of each stroke, the cycle of operations is bound to recommence automatically. The air pump is provided with an eyebolt for lifting purposes, and a light tripod or truck is provided to facilitate transport. The apparatus is built to standard throughout and is suitable for use in engineering works for cutting or riveting, and should be valuable for drilling in stone quarries. The motors are built for all standard voltages and for both continuous and alternating current.

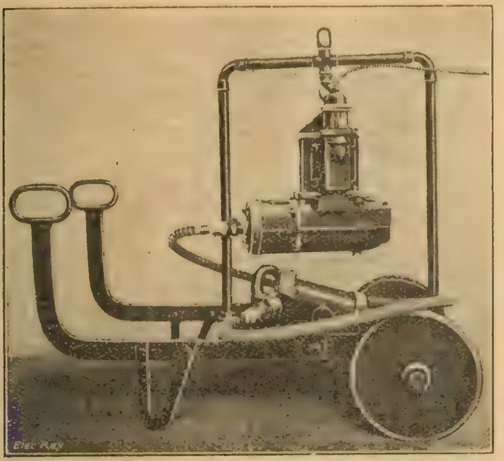


Fig. 6.—Electro-Pneumatic Hammer Outfit.

An Electric Car Telephone.

Those who use motor-cars will know the difficulty, particularly in those types of car construction where the driver sits outside the enclosed body, of communicating with the driver when the car is under way. In some cars a speaking-tube has been installed, but this is a more or less unsatisfactory device.

In order to remedy this deficiency, a very neat form of car telephone has recently been brought out by the American Electric Co., of Chicago. It consists of a special transmitter with a convenient handle and a loud-speaking receiver, with a projector for attaching on either the right or left-hand side of the car, near the chauffeur. The receiver is furnished with a curved trumpet, which is said to have the effect of magnifying the sound very considerably, with the result that an order transmitted in quite an ordinary voice inside the car is heard distinctly by the driver under all conditions. A 6 or 8-volt battery is used, and the current consumption is very small.

Electricity in Fiery Mines.—The chief subject discussed at the resumed Conference of the South Wales Miners' Federation on April 7th was the use of electricity in fiery mines. The matter arose out of statements at the Senghenydd disaster inquiry, and the danger of the emission of sparks from cables was emphasised by Mr. T. Richards, M.P., general secretary of the Federation. Reports from various lodges were considered. There was a preponderance of opinion that the use of electricity as a motive power should be prohibited, and a resolution was carried asking the Labour members in Parliament to endeavour to secure the prohibition of electricity for motive power in fiery mines.

BUSINESS NOTES.

Cables for the Buenos Ayres Western Railway.—The electrification of the Buenos Ayres Western Railway Suburban System is probably the largest railway electrification scheme yet undertaken, and a few particulars of the cables will be of interest. The contract for supplying and laying the whole of the cables in connection with the undertaking has been secured by W. T. Henley's Telegraph Works Co., Ltd., which firm, it will be remembered, also secured a similar contract in connection with the electrification of the suburban lines of the Central Argentine Railway, the cables for this latter undertaking being now in course of installation. The Buenos Ayres Western Railway system will be operated at a pressure of 800 volts direct current. Energy will be generated at 2,500 volts, 25 complete cycles per second, and transformed to 20,000 volts by means of three single phase step up transformers connected directly to the terminals of each generator. This will then be transmitted to five sub-stations, the feeders to two sub-stations being run in dnplicate. These sub-stations will be equipped with rotary converters for transforming the three-phase current to continuous current at the pressure of 800 volts, and from there connection will be made to the conductor rails. The principal cable item is one of approximately 116,000 m. of ·10 sq. in. three core, split conductor, paper-insulated, lead-covered, and steel-wire armoured cable, which is to be used for feeders at the working pressure of 20,000 volts. This cable will be tested after 24 hours' immersion in water up to 50,000 volts, and a sample piece cut from any drum selected by the consulting engineers, is to withstand a test pressure of 100,000 volts. It will be laid direct in the ground at a depth of 1 m., further protection from mechanical damage being afforded by 2-in. creosoted boards being placed over the cables. At cross culverts and level crossings the cables will be drawn through cast-iron pipes, and where they run across bridges they will be hung on racks and protected from the sun's rays by sheet-iron. All joints will be of the vacuum type in gun-metal sleeves, similar to those adopted for the Central Argentine Railway cable. The track cable consists of about 17,000 metres of single-core paper-insulated cable, part of which will be lead-covered and single-wire armoured, and part sheathed with vulcanised bitumen, taped, braided and laid solid in fibre troughing. This track cable will, of course, feed the conductor rails and connect across breaks in the rails at level crossings, junctions, &c. The contract also includes the supplying and laying of about 58,000 metres of dry core, lead-covered and wire-armoured telephone cable, and, of course, the necessary terminal boxes, pillars, telephone apparatus and accessories, of which a very large quantity will be wanted. We understand that this is the largest contract that has ever been placed for any power cable installation, and following as it does in the wake of the Central Argentine Railway contract secured by the same firm, which at the time it was placed was a record contract, enables Henley's to feel proud of themselves as suppliers of extra-high-tension electric cables. Moreover, the portion of the work that has been put in hand by the railway company represents a part only of the complete scheme, which is divided into two sections—Section A, of which the contract under notice consists, being the larger of the two. If the railway company eventually decide to carry out the complete scheme, the value of the contract will be very considerably enhanced. The work is to be completed in 16 months, and it will call for the services of a large number of engineers, jointers, &c. Messrs. Livesey, Son & Henderson and Messrs. Merz & McLellan are the consulting engineers for the complete scheme.

Catalogues and Lists.—British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.—New Mazda automobile lamp folder (No. 2,342 C) of eight pages with space left for printing in the names of firms who require numbers for distribution. Small illustrations and tabulated prices are given of headlight, sidelight, tail and dashlight, steering-pillar light lamps and festoon and tubular lamps for interior lighting. Dimensioned diagrams show the measurements of the lamps and bulbs.

Mr. E. H. Thew, 2-8, Dean Street, Newcastle-on-Tyne.—Specimens of ivorine and metal labels for machinery.

Messrs. David Rowell & Co., Ltd., 33, Old Queen Street, Westminster, S.W.—Catalogue D58 of 32 pages, giving illustrated descriptive matter relating to iron fencing, gates, iron buildings, stairs and bridges.

Messrs. Alfred Herbert, Ltd., Coventry.—The April number of the firm's *Monthly Review* of modern machine shop practice contains well-illustrated articles on a number of subjects, and a monthly stock list. Twenty-four-page illustrated list of capstan lathes, chucks and tools.

Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, London, W.—Publication No. 223, shows illustrations of their Equipose telephone arm used in various positions, and states prices of same.

Messrs. Oliver, Clark & Co., 41, Gerrard Street, Shaftesbury Avenue, London, W.—24-page catalogue showing a collection of electric lamp and candle shades in silk, parchment and paper, also the "Verilite" candles. Prices are quoted.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—16-page booklet, containing an illustrated description of their "Tangent" system of shaft signalling apparatus, which does not employ stepping or ratchet mechanism in its operation. It provides a check on the signal sent, and a mistake made by the sender is at once apparent to the engineman. The number of the signal shows at the first knock of bell, any signal sent, automatically extinguishes any previous one, and luminous indication of the levels, as well as of the signal itself, can be provided.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—The firm's Osram lamp department have issued a handy blotter pad or book, consisting entirely of blotting paper, alternate pages bearing an illustrated advertisement of Osram wire-drawn lamps. Anyone in the trade can have one of these blotters on application.

Messrs. L. Andrew & Co., Whitworth Street West, Manchester. —Price list of india-rubber, canvas, and asbestos goods.

Bankruptcy Proceedings.—Morris Zains, described as an electrical engineer and tobacconist, of 98 and 105, Wardour Street, and 26, Dean Street, Soho.—An application for an order of discharge was made on Tuesday last week to Mr. Registrar Linklater, at the London Bankruptcy Court.

Mr. Egerton S. Grey, Official Receiver, reported that the bankrupt failed in October, 1910, with liabilities of £304, and no assets. A Russian Jew by birth, he came to this country in 1890 with £20 in his pocket, and was for some years employed in the cigarette trade. In 1900 he purchased for £130 a tobacconist's business in Wardour Street, and, two years later, he started business in the same street as an electrical and incandescent fittings dealer. He attributed his insolvency to liability under a judgment for £88 and costs in an action brought by the petitioning creditor for the return of balance of moneys handed to him (bankrupt) upon his consenting to stand bail for the creditor when arrested on a charge of receiving stolen property. As offences, the Official Receiver reported (1) insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities; (2) imperfect book-keeping; (3) trading with knowledge of insolvency.

His Honour made an order for the discharge to be granted upon payment of £30 within one month, or, in the alternative, a further suspension of two years.

J. G. S. Cunnington & H. P. Allison (Laing, Wharton and Cunnington), electrical engineers and contractors, 7, Great Newport Street, W.C.—Trustee (Mr. A. Page, 28, King Street, E C.), released March 2nd.

Frederick Thomas Hewitt, of 28, Avenue Road, Bradford, formerly carrying on business in partnership as electrical engineer under the style of "Foyard & Hewitt," in Victoria Chambers, Bradford, and now a commercial traveller for the same firm, was examined at the Bradford Bankruptcy Court last week. He admitted liabilities of £130, with no assets except £13 12s. 6d. paid to the solicitor for filing his petition. He and his partner were formerly clerks in the employ of the Phœnix Dynamo Co., and when he left to go into business with Mr. Foyard, he had no capital. He left the partnership in December, 1910, because capital was needed, and he had none. For 18 months after that he sold electrical fittings on his own account, and after that he had acted as a traveller for his former partner at 30s. a week salary with travelling expenses. The examination was closed.

Tom Murray Woodcock, electrical engineer, 64, Holly Street, Sheffield, Yorks.—The first meeting of creditors herein was held on April 8th, at the Official Receiver's offices, Figtree Lane, Sheffield, when the liabilities were put at £209 and assets at £54, leaving a deficiency of £155. The failure was attributed to lack of capital, loss on contracts, and heavy business expenses. The Official Receiver remains trustee.

W. H. Pease, electrical engineer, Royal Hotel Shops, Scarborough, and 19-20, Baxter Gate, Doncaster. Receiving order made April 9th on debtor's own petition.

Trade Announcements.—To meet increasing business Messrs. F. Parkinson & Co. have erected new premises, comprising offices, works and stores, at Wells Works, Guiseley, Leeds, and henceforth all correspondence should be addressed there. Telephone numbers: Leeds Area "35 Guiseley"; Bradford Area "34 Guiseley." Telegrams: "Parkinson 35 Guiseley."

Messrs. J. F. Leach & Co., electrical engineers, 5, Market Street, Manchester, invite manufacturers to forward catalogues and lists.

Messrs. A. H. Faulkner & Co., electrical contractors, 8, Market Place, Manchester, have taken into partnership Mr. J. R. Chadbourne, late engineering sales representative in the Manchester district for Messrs. Richard Hornsby & Sons, Ltd. The business will in future be carried on at the same address under the name of Faulkner, Chadbourne & Co. Firms are invited to forward trade lists.

Messrs. Rose Bros., of London, are holding an exhibition of electrical novelties (pocket and police lamps, advertising novelties, massage, cinematograph and other apparatus) at the Victoria Hotel, Manchester, from April 20th to 24th.

Lead.—In their latest report, Messrs. James Forster and Co. state:—"The influence of the recent selling of American native lead still hangs over this market. Dealers are apprehensive of a renewal of same, and the comparative prices in New York and here are too close to be comfortable. The difference is certainly not sufficient to protect us if the position on the other side does not improve. Consumption continues very heavy, particularly in the electrical trades and, although arrivals for the three months ending March 31st are considerably heavier than for the like period in 1912 and 1913, there is still no surplus lead about."

Cranes at the County Hall.—We understand that the three motors installed on a locomotive crane, which runs along the river front of the County Hall, referred to in our issue of March 27th, were supplied by Messrs. Crompton & Co., Ltd., to the order of Messrs. Butters Bros., the makers of the crane.

Private Arrangements.—T. W. Vaughan & Co., Ltd., 22, Cross Street, Islington, London, N., electrical engineers, &c.—The creditors interested herein were called together last week at the Institute of Incorporated Accountants, Gresham Street, E.C., when a statement of affairs was presented, which had been prepared by Messrs. Greenhalgh, Sharp & Co., I.A., of 16, King Street, Cheapside, E.C. The statement of affairs disclosed liabilities of £3,484, of which £2,940 was due to unsecured creditors, and £551 to the debenture-holder. The assets were estimated to realise £2,841, less £133 for preferential claims, leaving net assets of £2,708. Those assets were not sufficient to meet the claims of the debenture-holder, and a deficiency was thus disclosed of £3,484. Mr. J. K. Garioch, the liquidator of the company, stated that Mr. W. Ros Sharp had been appointed to act as Receiver for the debenture-holders. The liquidator further stated that the company was incorporated on March 15th, 1911, with a nominal capital of £5,000 divided into 2,000 ordinary shares of £1 each, and 3,000 6 per cent. cumulative preference shares of £1 each. The vendors were Thomas William Vaughan and Walter Grey Smail, and the first directors of the company were Thomas William Vaughan and Mason Kidner. The vendors were allotted 1,000 ordinary shares each in consideration of goodwill and purchase of business. In May, 1912, Mr. F. C. Stark became a director of the company and purchased 1,000 ordinary shares and 490 preference shares, and on the same date took up 1,000 preference shares for cash. In July, 1912, it was found necessary to find further capital, and Mr. Stark guaranteed an overdraft of £500 at the bank, and again at the end of September the same conditions arose, and Mr. Stark guaranteed a further overdraft of £500. In April, 1913, further money was required, and Mr. Stark advanced further amounts aggregating £800. On June 6th the company created a charge on the whole of the assets in the form of a debenture for £3,500 in favour of Mr. F. C. Stark, to cover the amounts already advanced, and the balance of the amount of the debenture was subsequently paid to the company by Mr. Stark. During the year ended March, 1912, the sales were £8,580, with a gross profit of £1,694, and after allowing for all outgoings and depreciation there was a net loss of £557. In the following 12 months the sales were £14,151, the gross profit £2,478, and there was a net loss of £681. For the year to March 14th last the sales were £11,502, and there was a net loss of £2,566. Replying to questions, Mr. Garioch said that when the company was formed the goodwill was valued at £1,000 odd. In January of last year it was reported to the board that the company had entered into a contract with the London Opera House, which had resulted in a loss. In view, however, of the advertisement which the company had received through that work, it was decided to increase the goodwill by £1,800 odd. Dissatisfaction was expressed by the creditors present, and it was decided that the meeting should be adjourned. The following are creditors:—

Sloan Electrical Co.	£277	Albion Iron and Wirework Co.	£37
Siemens Bros. Dynamo Works	222	Rowson, Drew & Clydesdale	37
Brit. Westinghouse Electric Co.	154	Bullivant & Co.	29
Mellowes & Co., Ltd.	150	Cope, Allman & Co.	28
London Elec. Warehouse (?) Co.	141	Campbell, Macmaster & Co.	28
Igranic Electric Co.	129	Senier, T. W., & Co.	26
Cresswells, Ltd.	120	Hare, F. B., & Co.	24
Thames Bank Iron Co.	114	Russell, Jas., & Sons	24
Walsall Hardware Mfg. Co.	102	Krupka & Jacoby	23
Union Electric Co.	95	Gornal, W.	19
London Com. Elec. Stores	82	Wilkins, N. W., & Sons	21
National Radiator Co.	76	Winn, C., & Co.	21
Newton Chambers & Co.	69	Braby, F., & Co.	20
Baldwins, Ltd.	65	Hunt & Mitton	20
Brotherton Tubes and Conduits, Ltd.	62	Walker's Perfection Fire Co.	22
McCrea & Sons	58	British Uralite Co. (1908)	19
Spencer, J. E. H.	50	Wilson-Wolf Eng. Co.	18
Foster Engineering Co.	47	Hudson, W. A.	18
Bennett, E., & Son	47	McGaw & Co., Ltd.	18
Kemp, John, & Co.	39	Masham, J., & Sons	17
		Potter & Co.	16
		and 97 creditors for smaller sums.	

Broken Hill Mines.—At the annual meeting of the Broken Hill South Co. held at Melbourne in February, Mr. M. R. Greene, chairman, said that to economically work the southern section of the mine and to enable increased quantities of ore to be dealt with, the directors had decided to install an electrically operated plant at No. 2, No. 4 and No. 5 shafts. All ore at present came up No. 1 shaft. The southern ore would be brought up No. 4 shaft, where it would be necessary to erect storage, crushing and transit facilities to handle this material. The work was one of some magnitude, and would also necessitate a rearrangement of their tramways, &c. They would make their own sulphuric acid, and storage facilities were needed for this purpose.

Electric Lighting in India.—The problem of lighting in India has been solved in many places by employing self-contained electric generating sets manufactured by the Aster Engineering Co. (1913), Ltd., of Wembley. It is stated that there are over a hundred of these Aster sets, of varying capacities, in use in different parts of India. They are installed in the Government houses at Ranchi, Chittagong, and Bankipore, in a number of clubs, in various hospitals, in the bungalows of officials of the Assam-Bengal and Eastern Bengal State Railways, as well as in the palaces of a large number of native gentlemen.

Meter Contracts.—Messrs. Chamberlain & Hookham, Ltd., have received the following contracts for meters for the ensuing year:—West Hartlepool, Pembroke, Halifax, Barrow, Mansfield, Newport and Belfast.

Liquidation.—The Argentine Electrolytic Syndicate, Ltd.—This company is winding up voluntarily with Mr. R. E. Clarke, of 17, Albion Street, Hanley, as liquidator. A meeting of creditors is called for April 23rd.

Social Evenings.—The members of the staff of the British Westinghouse Electric and Manufacturing Co., Ltd., connected with the supply department, chief office and stores, at Long Millgate, Manchester, held a smoking concert on April 3rd, at the Douglas Hotel, Manchester. This very successful social and musical evening was held to commemorate the trading in the supply department for the year 1913. Mr. J. Gibson, manager of the department, was in the chair, and he congratulated the staff generally on making the supply department, which has only been in existence a few years, into a profit-making business. He said that the outlook for the present year was entirely favourable, and that if the staff worked in co-operation and harmoniously together as they had done in the past there was no doubt that in 12 months' time he would be able to report still better results. Social evenings of this kind tended to "Rub off the corners" and promote good feeling and comradeship throughout the staff. Amongst others who contributed to the evening's entertainment may be mentioned:—Messrs. A. Pougher, pianoforte solos; W. H. Brown, baritone; Messrs. Hill and McGrath, Japanese fiddle duets; T. Clough, elocutionist; H. McGrath, baritone; E. Hunt, comedian; D. Elliott, comedian; W. S. Hayes, tenor; G. Ellam, bass; O. C. Oakley, baritone; A. Brignal, comedian; C. Thornley, comedian; and J. F. Cagney, humourist. We understand that the event is practically certain to be repeated annually in future.

Messrs. Elliott Bros., of Century Works, Lewisham, and Westminster, held their annual social on Saturday, 4th inst., at the Blackheath Concert Hall, over 700 employés and friends being present. An excellent entertainment was provided for the first part by the "Magpie Pierrots," the evening concluding with the play, "The Private Secretary," which was admirably performed. Refreshments were served in the interval, during which the Century Works Orchestra provided a capital programme of music. The company present included Mr. W. O. Smith and Mr. G. K. B Elphinstone, the heads of the firm.

LIGHTING and POWER NOTES.

Australia.—The gross revenue of the Melbourne municipal electricity department for the year ended December 31st, 1913, was £150,355, as compared with £130,276 in the preceding year. The expenditure amounted to £74,075, and the profit to £20,824. The E.L. Committee is of opinion that the present overhead mains should be placed underground, and has set apart £3,000 for the extension of the underground system.

Aylesbury.—Year's Working.—The U.D.C. has adopted a report by the resident engineer on the working of the electricity undertaking during the first year, which shows an output of 231,660 units, revenue £2,131, and expenditure, at 1·03d. per unit, £994. The substitution of gas by electricity for public lighting will effect a saving of £307, and after meeting the interest and sinking fund on a capital outlay of £21,331, there is an estimated surplus of £91 available for contingencies above the 2½ per cent. already provided.

Belfast.—Proposed Battery.—The City electrical engineer has reported that in December next the normal load on the generating station will necessitate the use of all the continuous-current machinery for both traction and lighting simultaneously, with the exception of one of the large units. If this failed there would be no spare plant, and he advised the Electrical Committee that the tramway service might be curtailed in favour of the lighting, which was compulsory, or the capacity of the station might be increased by adding a storage battery. An approximate estimate for a 1,000-kw. battery with boosters and switchgear, was £10,800, and £1,000 for new buildings. The Committee strongly recommended the latter proposal to the Corporation, but it decided to refer the matter back to the Committee for a report on the capacity of the present generating station. The question of the repairs of the tramway track, said to cost about £16,000 per annum, was referred back to the same Committee.

Braintree.—E.L. Scheme.—A Committee of the U.D.C., which had been advised by Mr. H. P. Girling, of Maldon, has reported that the cost of the proposed E.L. scheme would be from £9,000 to £14,000, including provision for free wiring and a plant capable of supplying Bocking. The Council decided to have a detailed report prepared by Mr. Girling, who would canvass the district.

Canada.—Hydro-Electric Report.—The annual report of the Ontario Power Commissioners shows a capital expenditure to the end of 1913 of $5,915,000, advanced by the provincial treasury at the rate of 4 per cent. interest. The total revenue was $2,611,918, as against $1,617,674 in 1912, and the surplus $620,875, as against $240,506. Allowing $230,480 as a depreciation charge, the net profit was $390,395. The total plant value of the municipalities is $9,196,483, and 45 municipalities are connected to the system. The progress can be gathered from the fact that in 1912 there were 33,568 lighting and 1,399 power consumers, while in 1913 the numbers were 63,157 and 2,532 respectively. The gross surplus invested in plant extension amounts to $861,381, depreciation reserve to $410,327, and net surplus so far to $451,054.

Representatives of Messrs. Smith, Kerry & Chace, of Toronto are inspecting the Athabasca River at Grand Rapids, with a view to the erection of a hydro-electric plant, estimated to cost from five to ten million dollars. It is proposed to transmit the power developed to Edmonton, which is 175 miles away.

The Toronto Hydro-Electric Commission is investigating the Interurban Electric Co.'s undertaking within Toronto, with a view to the purchase of the same.

Colchester.—The electrical equipment at Severalls Asylum (of the Essex C.C.) will entail a total expenditure of £15,609, instead of £13,180 as previously estimated.

Dartford.—Bulk Supply Proposals.—Mr. John F. C. Snell has advised the Council to proceed with the proposal to supply electricity to Crayford, at an estimated cost of £15,000, and to supply power to the West Kent Power Co. for Messrs. Vickers' and Messrs. Richards' flour mills, at £4 5s. per k.w. plus 0·3d. per unit. The Council has decided to consider the report in Committee.

Dover.—Street Lighting.—The T.C. has decided to replace 257 gas lamps with 239 electric lamps, at a capital outlay of £1,600. The annual cost of the 257 gas lamps is £925, and E.L. will cost £846, an annual saving of £79.

At the Royal Hippodrome, which spends some £300 a year for electricity, it is intended to put down a private plant, and the borough electrical engineer is to advise the Council what will be a reasonable charge for a supply in the daytime, and also as a stand-by.

Dundalk.—Proposed Loan.—The U.D.C. has decided to apply for a loan of £20,000 in connection with the proposed electrical installation at the works of the Great Northern Railway Co. in that town.

Dundee.—Mr. J. W. Napier, engineer and manager of Alloa Gas and Electricity Departments, has reported on the proposed E.L. at Newport and Wormit to the effect that "the price of gas in Newport and Wormit is very reasonable, and unless there is reliable information before the T.C. that the electric light would be largely taken advantage of, the Council would not be justified in considering an E.L. scheme."

Ellon.—E.L. Scheme.—The T.C. has now decided in favour of an E.L. scheme. Guarantees for 1,300 lights have been secured, and the site of the present gas works is to be transferred to the undertaker for the erection of a power station.

Farnworth.—Bulk Supply.—The U.D.C. has sealed an agreement with the Lancs. E P. Co. for a further supply of electricity in bulk, and is to install additional plant, including a 500-kw. rotary converter, at its works.

Failsworth.—Street Lighting.—The question of lighting part of the main road by electricity has been referred to the Lighting Sub-Committee for further consideration.

Gravesend.—Loans; Street Lighting, &c.—The favourable tenders received for new plant have enabled the T.C. to reduce the loan applied for from £13,600 to £12,500.

The electrical engineer has been instructed to convert the lighting of Darnley Street and Cobham Street from gas to electricity.

Mr. P. M. Crosthwaite, on April 7th, held an inquiry into the Council's application for a loan of £12,500, and the only opposition was by one or two members of the Council and Sir Julian Hayes, on the ground that the expenditure was unnecessary.

Grimsby.—We have received from Mr. W. A. Vignoles, the borough electrical engineer, a copy of the third edition of his "Electricity Consumers' Guide." In addition to a good deal of general information bearing on supply arrangements, examples of the cost of wiring premises and annual cost of electricity are given; useful suggestions are also given in regard to wiring, lighting, heating, cooking, &c.

Hazel Grove.—Proposed E.L.—The U.D.C. has confirmed an agreement with Messrs. Lomax, Kendal & Co. to take a canvass to ascertain probable consumers of electricity.

Hereford.—Proposed Loan.—The T.C. is applying for a loan of £1,500 for electricity mains, services, &c.

Hoyland.—E.L. Scheme.—The U.D.C. has instructed Mr. Barker, electrical engineer of Barnsley, to prepare plans of proposed mains, and also an estimate of the cost of a generating station, with a view to the Council generating and supplying electricity within its area.

Langholm.—Proposed E.L.—The T.C. has remitted to a committee to report as to the introduction of electric light.

Lincoln.—Rate Relief.—The T.C. has decided to allocate £1,500 from the electricity and tramway profits to the relief of the rates.

London.—Lambeth.—Infirmary Lighting.—The Building Committee has reported that the South London Electric Supply Corporation has offered, in connection with the lighting of the children's infirmary lodge and isolation block at Norwood, to lay the mains, free of cost to the Guardians, and to supply electricity at 3d. per unit for lighting and 1d. per unit for power, for five years. The Committee was of opinion that this was a favourable opportunity to install electricity in these institutions, and to make a comparison between gas and electricity; and, furthermore, considered that electricity was cleaner and more healthy. The Committee recommended that the offer be accepted, and that tenders for the wiring and fittings in the institution be invited.

Although the board recently approved of an estimate of the South Metropolitan Gas Co. for the installation of gas fittings in the southern wing of the infirmary, the superintendent, in view of the discussion by the Committee, withheld the order for the time being. An offer of the Gas Co. to re-model the whole of the fittings in the infirmary for £35 was referred to the Committee for consideration.

Electricity Supply of London.—Owing to the hostility of the engineers of certain of the London electricity companies, it is the intention, says the *Financial News*, of the bankers supporting the London Electric Supply Bill to withdraw it for the present session of Parliament, the prospect of any agreement between the parties concerned being remote.

Messrs. Merz & McLellan's report to the L.C.C. on the subject of the future of London's electricity supply was issued on Wednesday last. Their conclusion is that, whatever form of control be adopted, a new undertaking should be established to carry out the necessary changes leading to the ultimate amalgamation of the existing undertakings, as far as possible without compulsory powers. They regard the concentration of generating plant on sites down the river as the correct policy, and advise that a high-pressure three-phase primary distribution system at 50 cycles per second be standardised for London as soon as possible. They consider that the policy of concentration, after disposing of the existing plant, would result in a net saving of about £170,000 a year; the initial capital outlay required would be six or seven millions sterling. The idea of retaining and extending even two or three of the best existing stations on the river banks is rejected as inadmissible, and that of generation at the coalfields is also dismissed from consideration at present. Further particulars will be given in our next issue.

The L.C.C. has been recommended by its Finance Committee to sanction the borrowing of £10,087, as to mains, £7,055; machinery, £1,292; services, £1,040; and meters, £125, by the Southwark B.C. for electricity purposes. Also the borrowing by the Woolwich B.C. of £15,000, as to buildings, £6,000; and machinery, £9,000; in connection with the extension of its electricity undertaking.

Lowestoft.—Loan Sanction.—The T.C. has received L.G.B. sanction to a loan of £950 for meters, repayable in five years.

Malvern.—The U.D.C. has resolved not to entertain the offer of a supply of electricity in bulk from Worcester Corporation. It also decided, at an estimated expenditure of £1,500, to install additional plant at the electricity works.

Mold.—E.L. Scheme.—Mr. Leigh, of Northwich, has submitted to the T.C. a report on the suggested E.L. installation for the town.

Newcastle (Co. Down).—Last week the chairman of the U.D.C. laid the foundation stone of a power station in connection with the E.L. scheme for the town. The Irish Towns E.L. and Power Co. is to provide 100 50-c.p. lamps, 30 25-c.p. lamps and three lamps of 300 c.p. each.

Normanton.—Proposed E.L.—The U.D.C. has been recommended to promote an E.L. order, and to appoint a sub-committee to make the necessary arrangements.

Passage West (Co. Cork).—E.L. Scheme.—It is understood that the scheme for the E.L. of Passage West, Glembrook and Monkstown will be worked in connection with the electrical plant at Passage Docks. The number of public lamps to be erected is 42. The Cork R.D.C has provisionally approved of the scheme, which will cost about £3,000.

Rathkeale (Co. Limerick).—E.L. Scheme.—Steps are being taken to provide an E.L. undertaking in the town, and promises to take a supply have been received.

Ruthin.—Prov. Order.—The B. of T. has granted a rov. order for the installation of electric light in the borough.

South Shields.—The Council has decided to carry out an extension to the sea front lighting, and is installing 10 Metroflam magazine arc lamps (75 hours' burning).

Saddleworth.—E.L. Proposal.—The first meeting of the newly-formed Electricity Committee has discussed the proposed electricity scheme. Several members thought there was no chance of a scheme of production succeeding, and the best thing would be to obtain a supply elsewhere.

The opinion was expressed that there would be a better chance of a lighting scheme succeeding if the Council could buy cheaply in bulk from Stalybridge or Oldham, or both. The meeting was adjourned in order that inquiries might be made from these places.

Springhead. — Proposed E.L. — The U.D.C. has appointed a deputation to inquire on what terms the Oldham Corporation will supply electricity to Springhead.

Sunbury.—Prov. Order.—The D.C. has consented to the granting of the proposed Feltham and District E.L. Order. At a B. of T. inquiry, the promoters intimated that as soon as an order was granted, a company would be formed.

Tasmania.—The gross revenue of the Launceston E.L. and Power Department for the year ended July 31st, 1913, was £21,666, and the working expenses amounted to £7,924. The net revenue amounted to £13,619, and the surplus to £5,676, as compared with £4,088 in the previous year.—*Australian Mining Standard.*

Torpoint.—Public Lighting.—The U.D.C. has sealed an agreement with the new E.L. Co. for electric lighting in the town.

Torquay.—Proposed Loan.—The T.C. has decided to apply for sanction to a loan of £16,000 for additional plant at the electricity works. Mr. Salt, the electrical engineer, reported that although the construction of an entirely new station would be better than the extension of the existing station, the cost would amount to £30,000 or £35,000, and that, whilst the advantages were problematical, there would be considerable risk of the undertaking being prejudicially affected financially, especially as a considerable sum would have to be provided out of revenue to replace machinery which, whilst not worth anything if not removed to another site, was still of considerable value where it was. Moreover, the site of the present station was better than any that could be suggested. The estimated cost of the additional plant recommended was £15,722.

Tynemouth.—Loan Sanction.—The T.C. has received sanction to the borrowing of £3,000 and £1,000, for mains and services respectively. The Electricity Committee has decided to charge all premises now supplied at theatre rates, 3½d. per unit up to £2 per week, and 2¾d. per unit for all additional current supplied each week, as from April 1st last, and to supply electric vehicles with current at 1d. per unit, provided the demand is taken off during the winter peak periods.

Walsall.—Proposed Mains Extensions.—The Electricity Committee has recommended the extension of the mains from Marlow Street to the Darwall Street sub-station, at an estimated cost of £1,015, and application is to be made to the L.G.B. for sanction to borrow £3,000 for mains extensions.

Wednesbury. — Free Wiring Discontinued. — The T.C. has decided to discontinue forthwith the free wiring of consumers' premises.

Worcester.—Owing to the increased demand for electricity in the centre of the city, the Electricity Committee finds it necessary either to lay an additional cable or to change back to the alternating system, in which case the H.T. feeders could be used for some time. Whichever system is adopted, another sub-station will be necessary at the Cross, as the present one is taxed to its full capacity. The Committee recommends that borrowing powers for £500 be applied for for this purpose and for adapting consumers' apparatus to suit the new conditions.

Worthing.—Half-Watt Lamps.—A sub-committee of the T.C. has been appointed to report as to the desirability of substituting half-watt metal-filament lamps for the present flame arc lamps for street lighting.

U.S.A.—Municipal Power Stations.—According to the *Canadian Engineer*, an official census of municipal electricity stations in the States shows that in 1912 there were 1,562, with a total income of $23,218,989; the plants totalled 559,328 H.P., and the output for 1912 was 537,526,730 KW.-hours. The arc lamps in service were estimated at 91,851, and other lamps at over seven million, while the motors connected equalled 164,291 H.P. The income derived by municipal stations for lighting streets and public buildings is estimated where no cash income is derived. Since 1907, 310 additional stations are shown, 301 being new, while the balance represents stations taken over for municipal working.

According to the *Electrical World*, the Boston City Council is to ratify a 10-year street-lighting contract with the Edison Electric Illuminating Co., in which 5,000 6·6-amp. magnetite arc lamps are involved, and the price per lamp will be reduced from $103 to $87·5 per annum. Hartford, Conn., has adopted 300-c.p. nitrogen-filled series tungsten lamps for ornamental street lighting service, placed on 141 double and 113 single standards.

Yeovil.—Prov. Order.—The B. of T. has granted the prov. order applied for by Messrs. Petters, Ltd., of the Nautilus Engineering Works, Yeovil.

TRAMWAY and RAILWAY NOTES.

Brazil.—The whole of the power required by the Brazilian Traction Co., at Rio de Janeiro, is now being supplied by the new hydro-electric plant. It is expected that the water-power installation at Sao Paulo will also be completed during the present month.

Brighton. — Railless Traction. — The T.C. has written to the Hove Council expressing the opinion that no useful purpose will be served by an experimental route on the Cedes-Stoll system being constructed in Hove on one of the through routes, as this system is quite unsuited for the routes in question, Brighton having notified Hove that the under-running system is the one which it has chosen. The Council, however, will agree not to apply for a B. of T. arbitrator for three months from the date of the report, namely, March 23rd, provided this action is not prejudicing its position by the delay. The "through" routes in both towns have to be constructed on a system to be agreed between the two Corporations, and failing agreement, the system is to be decided by a B. of T. arbitrator.

Bristol.—The Bristol Tramway and Carriage Co. has petitioned to be heard in Parliament against the Corporation Bill. The memorial, among other contentions, urges that the Corporation Bill, taking powers to work tramways that it has not been decided to acquire, is unprecedented. It is contended that the Bill is an attempt to go behind the law which requires Board of Trade sanction to Corporation purchase. The petition, moreover, points out that the Corporation can only claim to acquire part of the Bristol system, other portions of which are on different terms, and some never acquirable, because outside the city. Further, it is contended that the employés' interest in the pension fund of the company would be lost by transfer of part of the undertaking to the city.

Dublin.—B. of T. Report.—Lieut.-Col. von Donop, reporting on the accident which occurred at Merrion Square, on February 1st, by which a Dublin United car was derailed and overturned, numerous passengers being injured, one fatally, points out that the car was entering a curve, the facing points for which are worked by the Tierney-Malone electric point controller, and that this is the first serious accident which has occurred at electrically worked facing points. He attributes the accident to the fact that the points for some reason were not lying in their normal position; to the speed of the car being too great to allow of its being stopped before running into them, and to the sudden application of the brake on the curve. He remarks that great care is required on the part of the driver to make sure of the position of his controller handle when he is running past the contacts which operate the points.

Dundee.—Railless Traction.—The T.C. has been recommended to spend £6,000 on the Clepington Road, to put it in sound condition for the railless trolley cars. Bailie Malcolm was of opinion that the system had been a nuisance to the residents all along, and if setts were put down the nuisance would be greater. Mr. Johnstone (convener) pointed out that if the road was not put in proper order they were prepared to withdraw the cars. To talk about the cars being the cause of the damage was nonsense. To this Bailie Macdonald replied that the best thing in the interest of the public was to withdraw the railless trolley cars altogether. It was ultimately agreed to remit the matter to the Works Committee for further consideration.

East and West Ardsley. — Railless Traction Scheme.—The U.D.C. has approved of a railless traction system to connect East Ardsley and Morley. The cars are to be leased to the Leeds Corporation for 28 years.

Glasgow.—All-Night Service.—The Tramways Committee has decided to ask the T.C. at the next meeting to approve of an all-night service of cars from the centre of the city to the nearer suburbs. It is proposed to run a car on each main route, leaving the city at midnight, 1, 2, 3 and 4 a.m., the cars to return from the outer termini at 12.30, 1.30, 2.30, 3.30 and 4.30 a.m. Sixteen routes are suggested.

Hastings.—The "Front" Line.—The Dolter system of tramways having been abandoned on the Front, the Corporation has requested the immediate removal of the studs. At present only four of the converted tramcars (petrol propelled) have been delivered, but others are expected. Meanwhile the service on the Front is restricted, and passengers to and from Bexhill are required to change to and from the overhead system at West Marina.

Japan.—A project is under consideration for the construction of an electric monorail railway between Nagasaki and Mogi.

Liverpool.—Suggested Tube Railways.—Mr. C. W. Mallins, the tramways manager, has submitted to the Tramways Committee a scheme for solving the problem of the congestion of street tramway traffic by a system of tubes. He puts forward the suggestion of a main trunk tube running east and west, commencing at the Landing Stage and terminating at Queen's Drive, at a point equidistant from Knotty Ash and West Derby tramway routes. The portion of the main tube between the Landing Stage and London Road would be equipped with four sets of rails, and a branch tube would form a junction with the main tube in the neighbourhood of London Road, running in a south-easterly direction, and terminating at the junction of Queen's Drive and Menlove Avenue. A second tube would commence at the junction before referred to and running in a north-easterly direction would terminate at the junction of Queen's Drive and Walton Hall Avenue. By such a system of tubes, together with through bookings from and to the various tramway routes tapping the trunk system, 50 per cent. of the present passenger traffic coming into and leaving the centre of the city could be dealt with. On the financial aspect of the scheme, Mr. Mallins states that the suggested 11 miles of tubes would cost approximately £5,500,000 to construct and equip, which, borrowed at a low rate of interest, and repayable over a long period, possibly 70 years, would not overtax the income of the undertaking in the early years of its operation. The scheme could be carried out by the unification of the whole of the existing transport systems on both the Lancashire and Cheshire sides of the Mersey, viz., the Birkenhead and Wallasey tramways, the Wirral, Mersey, and Overhead Railways (with a possible connection with the other great railways), and the Liverpool Corporation tramways. Mr. Mallins firmly believes that the proposition is commercially sound, as the revenue derivable from the combined systems would, in the near future, amount to £2,000,000 per annum, which would be ample to discharge all liabilities in connection with the undertaking, and show a reasonable profit.

London.—A petition has been presented by the companies concerned asking leave to modify the scheme for physically connecting the Great Northern and City line with the Waterloo and City railway at the Bank. Property owners having objected that the new line would be insufficiently deep, it is now proposed to lower the railway level and construct an independent station under the existing Waterloo and City station, and connected to the latter by lifts, &c. It is pointed out that unless leave to amend is given, the whole Bill may have to be withdrawn.

Last week the new tube station of the Charing Cross and Hampstead line, under the Embankment, was opened, providing a direct connection between this line and the District and Bakerloo lines at this point.

Electric Vehicle.—Messrs. J. Lyons & Co., the well-known caterers, have put into service, as an experiment, an Edison 2-ton electric vehicle with van body for the delivery of food-stuffs to their various depôts.

Extensions Abandoned.—The City Corporation has now definitely refused to sanction the extensions of the tramways to Ludgate Circus and Aldgate, and the L.C.C. has been forced to drop the schemes.

The tramway extensions from Catford to Bellingham (part of the Catford-Southend extension), and from Woolwich to Abbey Wood were opened last week.

The annual budget of the L.C.C. Finance Committee states that the tramways have failed, for the first time, to provide the full amount required for redemption of debt out of revenue, and that £91,705 will be drawn from the reserve fund for that purpose. This result is put down to motor-'bus competition; it was hoped that the use of trailer-cars and the lowering of fares would improve the financial position, though they have not so far produced much improvement.

The London United Tramways Co. has received the conditional sanction of the House of Commons to run trailer tramcars on its system.

Manchester.—B. of T. Report.—The accident in which a tramcar overturned on the curve between High Street and Upper Brook Street, on February 25th, during a fog, is stated in the report of Lieut.-Col. von Donop, of the B. of T., to have been caused through the excessive speed of the car, considering the weather; the responsibility is therefore placed on the driver.

U.S.A.—Electric Cabs.—The New York Central Railway Co. has invited tenders for 100 electric motor-cabs for service in New York. The specification stipulates for a battery capacity of 100 miles per charge, including a three-hour boost and a stated speed on the level and on gradients.

Electric Postal Vans.—The Postal Transfer Service, Inc., is substituting 20 2-ton electric trucks for petrol trucks in its contract mail service between the railways, docks and Post Offices, south of 42nd Street, New York.

The Motor Delivery Co., which has a contract for another postal section of New York, has had 28 electric cars in service since 1909. In 1913 these vehicles ran 336,000 miles in 304 days. This company has used electric vehicles exclusively.

Wolverhampton. — Year's Working. — The total receipts of the Corporation tramways for the year ended March 31st, 1914, were £56,444, an increase of £2,481 on the previous year. The passengers carried numbered 12,616,881, an increase of 703,759, and the car-miles run totalled 1,195,326, an increase of 27,087. The receipts per car-mile were 11·3d., an increase of ·247d. Motor-'bus receipts amounted to £2,070, an increase of £360.

TELEGRAPH and TELEPHONE NOTES.

German-Italian Telephone.—On April 1st, as mentioned in our last issue, the telephone line between Berlin and Milan was thrown open to the public, and the communication established has so far proved very good. The line is of hard-drawn copper, 4·5 mm. in diameter, and has Pupin coils mounted on the posts at intervals of 10 km. The route is *via* Frankfort and the Simplon Tunnel, and is 1,350 km. in length; the charge for 3 min. conversation is 4s. during the day, and about 2s. 5d. at night. This charge compares favourably with that of 5s. for the use of the line, 1,200 km. long, between Berlin and Paris. The following are among the more important European international telephone lines:—Berlin-Vienna, 686 km.; Berlin-Budapest, 970 km.; Berlin-Paris, 1,192 km.; Paris-Rome, 1,600 km.; Paris-Madrid, 1,500 km.; Berlin-Paris-Bordeaux, 1,800 km.; Berlin-Paris-Marseilles, 2,100 km. It may also be noted that within Germany itself there are several lines which rank with these as regards length; for instance, Berlin-Memel (944 km.) and Berlin-Munich (665 km.), whilst all the chief towns in Rhineland are over 630 km. from the capital. The communication with Italy was last week extended as far as Rome, which is over 1,600 km. distant, so that this is the longest direct line in Europe, whilst the charge will be only 5s. Negotiations for a connection between St. Petersburg and Berlin have been in progress for years, but do not seem to approach fruition. Telephony between Berlin and London will not be attempted until a cable is laid from English to German soil, and as this cable alone would be 450 km. long, the working results of the Dutch-English cable are being awaited before any further steps are taken; this will be opened during the coming summer. The German Post Office estimates that a 3-min. conversation between North Germany and England will cost at least 10s.

Japan.—The Japanese Department of Communications is considering the establishment of a powerful wireless station on the Pacific coast to open direct service between Japan and America.

New Wireless Telegraph Stations.—A Marconi wireless telegraph station is to be erected at Stonehaven, near Aberdeen, as a substitute for the ordinary telegraph in the event of the main overhead lines to the North being interrupted, and for other purposes. There are now 10 wireless coastal stations around Great Britain.

Work has been begun upon the new wireless station of the Government at Leafield, in Oxfordshire, which forms the English base for the Imperial wireless chain. There will be 12 steel masts 300 ft. high.

Telegraph Employés.—The first annual conference of the Postal and Telegraph Clerks' Association, which has been formed by the amalgamation of the Postal Telegraph Clerks' Association and the United Kingdom Postal Clerks' Association, was opened on Monday last at the Westminster Palace Hotel, London. The delegates present numbered 310, representing more than 20,000 members.

Last week the annual conference of the Postal, Telegraph and Telephone Controlling Officers' Association was held at Edinburgh. A resolution was adopted expressing dissatisfaction with the Holt Committee's report.

The P.M.G. has issued a statement containing the decisions of the Government with regard to the recommendations of the Holt Committee. The total cost of the concessions is estimated at £640,000 in the first year, and £1,225,000 a year eventually.

The Telephone Service.—Last week the conference of the Amalgamated Society of Telephone Employés was held in London. A resolution to the effect that a separate State department should be constituted to control the telephone service was adopted, and it was resolved that the maximum salary for female telephone operators ought to be made equal to that of female telegraph operators. A demand for a joint committee of representatives from the department and the staff, presided over by an independent chairman, to reconsider the claims of the staff as laid before the Holt Committee, was adopted. A request from the Postmaster-General, that the society should be reorganised so that persons in a supervisory position should not be in the same organisation as those whom they were supervising, was agreed to.

Replying to a question in Parliament, Captain Norton states that the average time it takes at present to connect a new subscriber with the telephone system in the cities referred to is as follows:—London, 18½ days; Birmingham, 51; Liverpool, 26; Manchester, 40; Edinburgh, 18; Belfast, 40; and Dublin, 21½. These delays are due partly to the want of spare plant, which is being met as quickly as possible by new underground schemes, and partly to the abnormal amount of work on hand for the general development of the telephone service. They also include exceptional delays due to wayleave difficulties, or to circumstances arising out of the subscribers' private arrangements.

Wireless Fog Guns.—The Clyde Navigation Trust is testing the possibility of wireless fog guns for the guidance of navigators in foggy weather. At Roseneath Patch, on the Clyde, where a new beacon has been mounted, one of the experimental guns has been placed. The gun is charged with gas, and at Gourock Pier, about two miles distant, the wireless apparatus has been installed. The gun is fired by means of this apparatus, and so far the test appears to have been satisfactory.—*The Times.*

Wireless on Board Ship.—The frequent occurrence of sparking between metallic objects on board ship, due to induction from the wireless telegraph apparatus, has attracted attention recently, as it may constitute a source of danger on ships carrying inflammable cargo. The United States Bureau of Navigation is conferring with the Board of Trade on the matter.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — May 12th. P.M.G.'s Department. Standard batteries for all States; Schedule No. 1,010. See "Official Notices" April 3rd.

Victorian Railways.—May 13th. One hundred enclosed arc lamps. Deposit £5. Mr. E. B. Jones, acting secretary.

May 20th. Victorian Railways Commissioners. One three-phase slip-ring electric motor and accessories. Deposit £1. Local representation. A specification can be seen at the B. of T. Commercial Intelligence Department in London.

Melbourne. — April 27th. Overhead travelling cranes for sub-stations and lifting tackle for power stations, for Melbourne Suburban Railways. See "Official Notices" April 3rd.

Sydney.—July 20th. Box compound, meters, maximum demand indicators, arc lamp carbons, and straight stem insulators, for the Council. Specifications for each section 10s. 6d., from City Electrical Engineer, Town Hall.

Blackrock.—April 23rd. U.D.C. Buildings and engine foundations, overhead travelling crane, two Diesel generating sets complete, boosters, battery, switchboard. See "Official Notices" to-day.

Belfast.—April 29th. Electric cable, for the Harbour Commissioners. See "Official Notices" to-day.

Bootle.— April 22nd. Corporation. Supply of two 500-600-KW. rotary converters, transformers and switchgear for the electricity department. Forms of tender from the Borough Electrical Engineer, Electric Light Station, Pine Grove.

Bradford.—April 23rd. Corporation. Electrical installation at Central Baths, Morley Street. Specifications from the City Architect.

Belgium.—May 4th. Electric cables (eight lots) for the Bassin Canal extension.

May 18th. Three transformer equipments, for the municipal authorities. Cahiers des charges, 5d. in each case, from the Hôtel de Ville, Antwerp.

Denbigh.—April 30th. North Wales Asylum. 700 ampere-hour battery, with booster, switchboard, &c. See "Official Notices" to-day.

Devonport.—April 27th. Corporation Gas Department. Electrically-driven jib crane and coal hoppers. Specification, &c. (£1 1s.), from Mr. I. Carr, Widnes.

Dublin.—April 17th. Corporation. Twelve months' supply of arc lamp carbons. See "Official Notices" April 3rd.

April 21st. Corporation. Repair of Lancashire boiler for the Electricity Supply Committee. Specifications from the City Electrical Engineer, Fleet Street.

Edinburgh. — April 20th. Corporation. Extension switchboard, for McDonald Road station. See "Official Notices" April 3rd.

Farnworth.—April 18th. U.D.C. Switchgear and cables. Mr. H. J. Hutchinson, Engineer, Electricity Works.

France.—April 24th. The French State Railway authorities (Bureaux du Service Electrique, 3e. division) in Paris (72, Rue de Rome) are inviting tenders for the electric cables required in connection with the electrification of the first zone of the suburban railways on the left bank of the Seine.

Germany.—April 25th. The Prussian State Railway authorities at Saarbruck are inviting tenders for the supply of 1,420 metres of telephone cable.

Glasgow. — April 27th. Corporation. 12 months' supply of cables, meters, arc lamp carbons. See "Official Notices" to-day.

Hull. — April 29th. Corporation. Steel roofwork required for the tramway workshops, Liverpool Street, for the Tramways Committee. Particulars and forms of tender from the City Engineer.

Ilford.—April 28th. U.D.C. Battery booster, storage batteries, for Goodmayes Sub-station. See "Official Notices" to-day.

Ilkley. — May 11th. U.D.C. Electricity generating station buildings. See "Official Notices" to-day.

Ipswich.—The T.C. has decided to invite tenders for the duplication of the refuse destructor, the estimated total cost being £5,200.

Leeds.—May 11th. Corporation. Steam turbine, three-phase alternator and exciter, 12,000-KW., 1,000 to 1,500 R.P.M., and condensing plant. See "Official Notices" April 3rd.

Limerick.—April 17th. Corporation. Electrical accessories, service boxes, cables, &c. See "Official Notices" April 3rd.

London.—L.C.C. April 22nd. Installation, 218 wiring points, 283 lights, at Wilson Street Elementary School, Islington, N. See "Official Notices" April 3rd.

Fulham.—April 29th. B.C. Coal for the electricity department for 12 months. Borough Electrical Engineer.

Malvern.—April 27th. U.D.C. Vertical compound steam engine, direct coupled single-phase 150-KW. alternator, exciter, &c. See "Official Notices" to-day.

Manchester.—April 21st. Corporation. Power-driven rail-bending machine. Specifications, &c., Mr. J. M. McElroy, General Manager.

May 13th. Corporation. 5,000-KW. turbo-alternator complete. See "Official Notices" to-day.

New Zealand.—Wellington.—Aluminium cable, &c., for the Public Service Stores Tender Board. Time for receipt of tenders extended to May 6th. See last issue.

Rathkeale (Co. Limerick).—April 18th. Gas engines and suction plant, dynamos, storage battery, switchboard, overhead lines and street lamps, for Rathkeale Electric Lighting and Power Co. See "Official Notices" March 27th.

Spain.—May 15th. The municipal authorities of Soria are inviting tenders for the establishment of a central electric lighting station in the town.

May.—Four electric portal cranes for the port of Cadiz. Deposit with tender £185. Junta de Obras del Puerto de Cadiz.—*Board of Trade Journal.*

Torquay.—April 20th. Corporation. Two water-tube boilers, fuel economiser, steam pipes, valves, &c. See "Official Notices" April 3rd.

Tunbridge Wells.—April 30th. Corporation. 4,000 tons of small coal for use with Underfeed stokers. Borough Electrical Engineer.

April 22nd. Corporation. 300-kw. steam prime mover, alternator and exciter, condenser with air and circulating pumps. See "Official Notices" April 3rd.

Walthamstow.—April 24th. U.D.C. One water-tube boiler and pipework, overhead bunkers and conveying plant, cast-iron circulating water pipes, for the Electricity Department. See "Official Notices" April 3rd.

Wigan.—April 18th. Corporation. Electrical accessories, service boxes, cables, &c. See "Official Notes" March 27th.

April 18th.—Corporation. Tramcar accessories, brake blocks, overhead line material, &c. See "Official Notices" April 3rd.

April 20th.—Corporation. H.T. feeder cable, transformer and switchgear. See "Official Notices" March 27th.

CLOSED.

Aberdeen.—The Corporation Electricity Committee has accepted the offer of Mr. Alex. Cheyne for enlarging the pumping chamber at the electricity works for £388.

Ardee.—The Ardee (Co. Louth) Town Commissioners have accepted the tender of Mr. J. W. McKeever to light the town with electricity. The neighbouring town of Collon has accepted the tender of the same contractor for electric lighting.

Australia.—P.M.G.'s Department :—

VICTORIA :—

250 000 pattern "B" insulators, 2·55d. each ; 10,000 pattern "A" insulators 6·8d. each ; 26,750 tubes, &c.—Commonwealth Art Pottery & Insulator Co., Pty., Ltd.

12,000 shackle insulators, 4⅝d. each.—Lawrence & Hanson Electrical Co.

QUEENSLAND :—

One lamp signalling switchboard and recording desk, £2,361.—Western Electric Co. (Australia), Ltd.

N.S.W. RAILWAY DEPARTMENT :—

Two electrically-driven turbine pumps.—Falkiner Electric Co.

One 3,000-lb. battery lorry chassis.—Standard Waygood Hercules, Ltd.

SYDNEY MUNICIPAL COUNCIL :—

Transformers.—N. Guthridge, Ltd.

—*Australian Mining Standard.*

Barrow.—The T.C. has placed electricity department contracts as follow :—

Engine, cylinder, crank chamber and turbine oils.—Jas. Light & Son, Ltd.

Colza and linseed oils, &c.—J. B. Bolton.

Shellac varnish and black lacquer.—Griffiths Bros. & Co.

Insulating compound and bitumen.—Dussek Bitumen Co.

Switches and pin plugs.—J. H. Tucker & Co.

Lampholders and adaptor plugs.—Simplex Conduits, Ltd.

Tin, lead, &c.—B.I. & Helsby Cables, Ltd.

Electric meters.—Chamberlain & Hookham, Ltd.

Prepayment meters.—Ferranti, Ltd.

Electrolytic midget meters.—Reason Manufacturing Co., Ltd.

Tantalum lamps and Osram lamps.—Drake & Gorham, Ltd.

Pope metal-filament lamps and carbon-filament lamps.—Pope's Electric Lamp Co., Ltd.

Earthenware pipes and troughs.—Doulton & Co., Ltd.

Linen tape and rubber gloves.—[illegible]. Andrew & Co.

Brass saddles and pins.—British Thomson-Houston Co., Ltd.

25-in. flame carbons.—Engineering and Arc Lamps, Ltd.

Carbons and 12-in. flame carbons.—Ship Carbons, Ltd.

Arc lamp globes and shades.—The City Glass Co.

A quotation for a motor-driven centrifugal pump (price about £100) from the Pulsometer Co. was accepted, also the tender of the Electric Construction Co., Ltd., for the electrification of the existing reciprocating pumps at the sewage pumping station, and for a new centrifugal pump and motor, the total amount being £977.

Belfast.—The Corporation has accepted the following tenders for the Electricity and Tramways Department for three years' supply of stores :—

Trolley heads.—Till & Whitehead, Ltd.

Plumbing material.—J. Baxter & Co.

Paints, &c.—Simpson & Mitchell.

Insulating material.—Spicer Bros. & Co.

For one year's supply of the following stores :—

Tramcar fittings, screws, nails and hinges.—Till & Whitehead, Ltd.

Relacquering brass and gun-metal castings.—J. Baxter & Co.

Iron castings.—J. & J. McKeown.

Maleable iron castings.—Hopyard Foundries Co., Ltd.

Springs.—W. Griffith & Sons, Ltd.

Electrical accessories.—General Electric Co.

Lamps.—Siemens Bros., Ltd.

Iron and steel.—Gregg, Sons & Phenix, Ltd.

Lubricating and gauge glasses.—R. Paterson & Sons.

Rubber and asbestos goods.—G. MacLellan & Co.

Solder.—J. Blan.

Bricks.—J. P. Corry & Co., Ltd.

Firebricks and tiles.—W. D. Henderson & Co.

Carbon-filament lamps.—Edison & Swan.

Metal-filament lamps.—General Electric Co.

Overhead line materials.—A. Wiseman, Ltd.

Galvanised steel wire.—W. D. Brown & Co.

Vulcanised bitumen cables.—Callender's Cable and Construction Co., Ltd.

Bitumen.—W. H. Keys, Ltd.

Street box frames and crown.—Gregg, Sons & Phenix, Ltd.

Cast-iron pipes.—Stanton Ironworks, Ltd.

Wrought-iron pipes.—Wellington Tube Works.

Wood troughing.—J. Gilmour.

Feeder pillars, copper cable, connections, &c.—W. Lucy & Co., Ltd.

Arc lamp carbons.—Sloan Electrical Co., Ltd.

Stoneware troughing.—Doulton & Co., Ltd.

Conduits.—T. Wragg & Sons.

Electric meters.—Chamberlain & Hookham.

Time switches.—Venner Time Switches, Ltd.

Maximum-demand indicators.—Reason Manufacturing Co., and B.I. and H. Cables Ltd.

The Corporation has also accepted the tenders of Messrs. Birch & Workman for electrical wiring at Albert Road dispensary ; of Messrs. R. Dempster & Sons for extension of coke handling and telpher plant at £[illegible],020 ; and of the National Gas Engine Co. for the supply of three gas engines and Lancashire generators in connection with the electrical plant, at £2,19[illegible].

Bolton.—The Corporation has accepted the tender of Messrs. Siemens Bros. Dynamo Works for 12 months supply of tantalum lamps.

Bristol.—The contract for the whole of the electrical work for the Bristol International Exhibition has been placed with the Electrical Engineering and Equipment Co. Ltd. It includes the supply and connecting up of underground mains the complete system of lighting, comprising arc and metal lamps and strip lighting, together with main and distribution switchgear, also centrifugal pumps and motors for operating the waterfall and cascades.

Canada.—MONTREAL.—Messrs. Vickers, Ltd., of Montreal, have placed a contract with the Westinghouse Cooper Hewitt Co., Ltd., for Silica lamps for the lighting of their shipbuilding yard at Maisonneuve.

According to the *Canadian Engineer*, Messrs. Bruce Peebles and Co., Ltd., have secured contracts for two 350-KW. Peebles-La Cour motor-converters for Messrs. Armstrong, Whitworth & Co., of Montreal, and one 250-KW. ditto for the Canada Cement Co., of Montreal.

Cape Town.—The tender of Mr. A. E. Rutherford (local representative of the A.E.G. Co.) has been accepted for an electric goods elevator for Messrs. Hermann & Canard.

The tender of Messrs. E. A. Shaw & Co. has been accepted for an installation of electric lighting at the flour mills at Wellington, belonging to the South African Milling Co., Ltd.

Croydon.—The tender of Messrs. Wm. Cory & Sons has been accepted for the supply of 7,000 tons of Muirfield peas at the electricity works, at 16s. 3d. per ton.

Farnworth.—The U.D.C. has accepted the tender of the British Westinghouse Co., Ltd., for new plant for the electricity works.

Government Contracts.—The following tenders have been accepted during the past month by the Government Department named :—

POST OFFICE.

Electric lifts.—Medway's Safety Lift Co.

Protective apparatus.—British L.M. Ericsson Mfg. Co., and International Electric Co.

Telephonic apparatus.—Automatic Telephone Mfg. Co., British L.M. Ericsson Mfg. Co., Phoenix Telephone & Electric Works, Siemens Bros. and Co., and Western Electric Co.

Battery boxes.—Standard Woodwork Co.

Telephone cable.—B.I. & Helsby Cables, Ltd., Connolly Bros., Johnson and Phillips, Ltd., Siemens Bros. & Co., and Western Electric Co.

Insulators.—Doulton & Co.

Earth-plates.—T. & W. Farmiloe, Ltd.

Cable distribution plugs.—Siemens Bros. & Co.

Gravesend.—The T.C. has accepted the following tenders for additional plant :—

British Thomson-Houston Co., Ltd.—£3,772.

Mirrlees, Watson Co., Ltd.—Condensing plant, £885.

Bruce Peebles & Co., Ltd.—Converting machinery, £2,850.

Holland.—The A.E.G., of Berlin, have submitted the lowest tender (£6,296) for the supply of a 4,000-KW. steam turbine and generator for the municipal central electric lighting station at Utrecht.

Hounslow.—The Heston and Isleworth U.D.C. has accepted the following tenders for annual supplies :—

Troughs and tiles.—Leeds Fireclay Co.

Disconnecting boxes and wood bridge-pieces.—W. T. Henley's Telegraph Works, Ltd.

House fuse-boxes.—B.I. & Helsby Cables, Ltd.

House service-boxes.—Sykes & Sugden, Ltd.

Compound.—Limmer Asphalte Co.

Meters.—Reason Manufacturing Co., and Isaria, Ltd.

Oils.—Middleton Bros., J. Light & Son, and Stern-Sonneborn Oil Co.

Electrical sundries.—Cooper & Roberts, Sloan Electrical Co., W. T. Henley's Telegraph Works, Ltd., and General Electric Co.

Ilford.—The following tenders have been accepted by the U.D.C. for annual supplies to the tramways department :—

Tapes.—B.T.H. Co., Ltd., General Electric Co., Ltd., and R. W. Blackwell and Co., Ltd.

Armature coils.—P. R. Jackson & Co., Ltd.

Lampholders, &c.—Drake & Gorham, Ltd.

Carbon brushes.—Morgan Crucible Co.

Pinions.—British Hele-Shaw Patent Clutch Co.

Tires.—Brown, Bayley's Steel Works, Ltd.

Gear wheels, trolley heads, &c. Alfred Wiseman, Ltd.

Varnish.—Robest Kearsley & Co., Ltd.

Oil.—L. Light & Son, Ltd.

Elastic journal packing.—Hall & Co.

Trolley wheels.—Anti-Attrition Metal Co., Ltd.

London and Middlesbrough.—Messrs. Siemens Bros. Dynamo Works, Ltd., have received a contract from the Middlesbrough Corporation for tantalum, Wotan, and carbon lamps during the year ending March, 1915 ; also one from the Asylums Committee for the County of London for tantalum and Wotan lamps.

London. — L.C.C. — The Highways Committee has accepted the following annual tenders for the supply of tramway parts, equipment, &c. :—

Spares (motor and generator).—British Westinghouse Co., Ltd., Dick, Kerr and Co., Ltd., Dyer & Young, A. Clare & Co., Manchester Armature Repair Co.
Spares (controller, circuit-breaker and other switch, &c., details, and magnetic brake).—British Westinghouse Co., Ltd., Dick, Kerr & Co.
Contact fingers and parts, segments, &c.—E. Showell & Sons, Ltd., Tramway Supplies, Ltd., Dyer & Young, British Westinghouse Co., Ltd.
Electric cable, fuse and other wire.—London Electric Wire Co. and Smith's, Ltd., Liverpool Electric Cable Co., Ltd., Callender's Cable Co., Ltd., Hooper's Telegraph Works, Ltd., Saxonia Electrical Wire Co., Ltd., B.I. & H. Cables, Ltd.
Rubber details.—I.-R., G.-P. & T. Works Co., Ltd., J. G. Ingram & Son, Irwell & Eastern Rubber Co., Ltd., North-British Rubber Co., Ltd.
Moulded insulators (other than rubber).—British Westinghouse Co., Ltd., Ebonestos Mfg. Co., Turners & Manville, Ltd., Litholite, Ltd., Crystalate Mfg. Co., Ltd.
Fibre articles.—J. Burns, Ltd., A. Cort & Co., F. A. Hill & Co.
Mica and micanite articles.—G. Schultz & Co., Ltd., Micanite & Insulators Co., Ltd.
Car furniture.—J. M. Siddell, Howarth & Housen, E. Showell & Sons, Ltd., Brush Electrical Eng. Co., Ltd., Gabriel & Co.
Machined bronze bearings.—Anti-Attrition Metal Co., Ltd.
Machine-finished articles (brass and gunmetal, &c.).—Davis & Timmins, Ltd., Anti-Attrition Metal Co., Ltd., Player & Mitchell, Ltd., E. Showell and Sons, Ltd., J. Stone & Co., Ltd., Brecknell, Munro & Rogers, Ltd.
Machine-finished articles (iron, steel, &c.).—Bayliss, Jones & Bayliss, Ltd., British Westinghouse Co., Ltd., E. H. Bentall & Co., Ltd., Bevan Lock Nut Co., Ltd., F. W. Cotterill, Ltd., Davis & Timmins, Ltd., J. Holroyd and Co., Ltd., Ibbotson Bros. & Co., F. W. Rowlands & Co., Wilkes, Ltd.
Gear and pinion wheels, ratchets, worms, &c.—British Hele-Shaw Patent Clutch Co., Ltd., F. W. Rowlands & Co., J. Holroyd & Co., Ltd., Player and Mitchell, Ltd.
Iron and steel drop forged stampings.—Charles Bunn, Ltd., Vaughan Bros., Criterion Stampings, Ltd., Deritend Stamping Co., Ltd., Armstrong, Stevens & Son, Ltd., Woodall & Co.
Iron and steel forgings.—Male & Jordan, Brush Electrical Eng. Co., Ltd., Hurst, Nelson & Co., Ltd., Woodall & Co., Bayliss, Jones & Bayliss, Ltd., C. Bunn, Ltd., East Ferry Road Eng. Works Co., Ltd., Warren and Sons.

The Highways Committee states that for certain items two or more firms, some of them the present contractors, submitted the same prices, and the Committee has in most of these cases accepted the tender of the present contractors. The prices received for certain of the items are unfavourable, and the Committee recommends that none of the tenders therefor should be accepted.

The Highways Committee recommends that Messrs. J. Mowlem and Co.'s offer be accepted for the construction of the remainder of the authorised tramways in High Street, Wandsworth, and the authorised tramways from London Road to Forest Hill, based on their previous contract rates, with an addition of 7½ per cent. to such prices; also that the offer of Thermit, Ltd., be accepted for the supply of welding rail joint portions for the Council's tramways during 1914-15, at 19s. 6d. each. Messrs. Thermit will, in addition, supply 7½ additional welding portions free of cost for each 100 ordered by the Council. The tender of Messrs. A. Clare and Co. has been accepted for the supply of 150 trolley bases for use on Class A and D tramcars, at £3 10s. each.

Messrs. Napier-Kimber, Ltd., have secured the contract for H.M. Office of Works (bell-hanging section) for the next three years.

STEPNEY.—The Electricity Committee recommends that the following annual tenders for coal for the electricity works be accepted :—

A. Blackmore & Co., at 13s. 9d. per ton.
E. Foster & Co., at 13s. 8d. per ton.
J. Hudson & Co., at 13s. per ton.
The Shipping and Coal Co., at 13s. 9d. per ton.

ST. PANCRAS.—The Electricity Committee reports the receipt of the following tenders for the supply of open arc-lamp carbons during the ensuing year :—

	65,000 pr., 10 in.		140,000 pr., 12 in.	
	£	s.	£	s.
Tuchman, H.	204	15	444	10
Sloan Electrical Co., Ltd. (recommended)	186	17	483	0
Henrion Carbons	194	9	502	16
Ship Carbons, Ltd.	199	12	516	5
Geipel & Co.	200	8	518	0
Crompton & Co., Ltd.	206	18	534	6
Braulik, G.	214	17	550	1
Electrical Co., Ltd.	218	11	564	13
Siemens Bros. & Co., Ltd.	287	10	612	10
General Electric Co., Ltd.	282	15	735	0

The chief electrical engineer reported that the carbons offered by the Sloan Electrical Co., Ltd., gave the best all-round value for the Council's purposes.

The Committee recommends the acceptance of the tender of the General Electric Co. for the supply of 50,000 pairs of flame arc carbons for the "Angold" lamps for £216 5s., and that of Siemens Bros. & Co., Ltd., for 1,500 pairs of flame arc carbons for the "Beacon" lamps for £13 6s.

BATTERSEA.—The tender of Messrs. Davidson & Co., Ltd., has been accepted by the Battersea Electricity Committee, at £57 10s., for the supply of an electric fan.

SHOREDITCH.—For the supply of steam coal for 12 months, the Electricity Committee recommends the acceptance of the following tenders :—

Harrisons (London), Ltd.—9,000 tons Whitwick Eureka deep seam ⅞ in. slack, at 12s. 5d. per ton; 4,000 tons Manners Kilburn Tibshelf deep seam nuts, 15s. 11d.
J. Hudson & Co., Ltd.—8,000 tons Bank or Bridgeness Scotch-washed peas, at 14s. 1d.
G. I. Cockerell & Co., Ltd.—2,000 tons Yorkshire deep seam nuts, at 15s. 4d. per ton, subject to sample barge and guarantee of calorific value.

HAMMERSMITH.—The Electricity Committee recommends the acceptance of the following tenders for annual contracts :—

Electrical goods.—General Electric Co., Ltd.
Hour meters.—Isaria, Ltd.
Insulating compound.—Dussek Bitumen Co.

The Committee also recommends that an additional 2-H.P. motor be obtained from Messrs. Langdon-Davies & Co. for hire to Messrs. Benson, at £15 15s., and that six 100-KW. transformers be purchased from the B.E. Transformer Co., Ltd., at £85 each, subject to an allowance corresponding to the reduction in price of copper.

For the supply of six 10-KW. transformers for installation in switch pillars, the following tenders were received :—

	£	s.	d.	
Ferranti, Ltd.	£12	15	0	each
Ferranti, Ltd. (open type) (recommended)	12	0	0	,,
Electrical Engineering & Equipment Co.	12	7	6	,,
B.E. Transformer Co.	14	5	0	,,
Foster Engineering Co., Ltd.	14	5	0	,,
Johnson & Phillips, Ltd.	15	10	0	,,
Brush Electrical Engineering Co.	16	0	0	,,
British Westinghouse Co., Ltd.	29	10	0	,,
,, ,, (alternative)	17	10	0	,,

Sheffield.—The City Council proposes to accept the following tenders :—

Electric goods lift, £86 10s.—B. G. Smith.
Automatic passenger lift, £310.—Medway's Safety Lift Co.
80 sets transformer protection gear, £198.—A. Reyrolle & Co., Ltd.
Cable, to be made from 50 tons of H.C. copper wire and 40 tons of lead, at prices quoted.—W. T. Glover & Co., Ltd.

It is also proposed to extend the contract with Messrs. A. Reyrolle and Co., Ltd., for the supply of 14 panels of E.H.T. three-phase sub-station switchgear, at £1,682, to provide for a further 14 panels at the same price.

Stourbridge.—The U.D.C. has contracted with the British Westinghouse Electric and Manufacturing Co., Ltd., for the supply of gas engines for sale to consumers on the hire-purchase system.

Stretford.—The U.D.C. has accepted the tender of Messrs. Jardine & Co. for a rotary blower coupled direct to motor, including a 3-B.H.P. motor, for the Town Hall organ, at £72 10s.

St. Heliers.—For the electric lighting of St. Heliers, the tender of Messrs. Durell, Walker & Co., has been accepted.

Sunderland.—The T.C. has accepted tenders for the supply of cable from the B.I. & Helsby Cables, Ltd., and the Union Cable Co., Ltd.

Swindon.—The tender of the Davenport Engineering Co. has been accepted by the Council, at £496, for a new cooling tower at the electricity works.

Tynemouth.—The tender of Messrs. Ward & Son has been accepted by the Corporation for wiring work.

Wallasey.—The Corporation has accepted the tender of the British Westinghouse Electric and Manufacturing Co. for a 3,000-KW. turbo-alternator, with exciter, for £5,489, for the new works at Poulton.

Walsall.—The tender of Messrs. Johnson & Phillips has been recommended for acceptance, at £101, for a transformer, and that of Messrs. Callender's Cable Co., Ltd., for cables.

Walthamstow.—The U.D.C. has accepted the following tenders for electrical supplies for 12 months :—

Cables, flex, compound for glands, rubber and other tape.—W. T. Henley and Co.
India-rubber-covered wires.—Liverpool Electric Cable Co.
Box compound.—Dussek Bitumen Co.
Chatterton's compound.—W. Geipel & Co.
Soldering fluid, fuses, conduits, Sinclair insulators.—G.E. Co., Ltd.
P. and B. paint.—B.I. & Helsby Cables, Ltd.
Switches.—J. H. Tucker & Co.
Ceiling roses, lampholders, opal shades, bell wire.—Edison & Swan Co.
Opal and iron shades, teak blocks and key switch-holders.—British Westinghouse Co.
Fuse wire.—Wholesale Fittings Co.
Zinc rods, porous pots, dry cells, &c.—Pryke & Palmer.
Ordinary electricity meters.—Chamberlain & Hookham.
Hour meters.—Electrical Co., Ltd.
Carbons.—Sloan Electrical Co., Ship Carbons, Ltd., Siemens Bros. Dynamo Works, Ltd.
Car accessories.—British Westinghouse Co., J. W. Rowlands & Co., W. Wood & Co., Anti-Attrition Metal Co., L. Andrew & Co., Equipment and Engineering Co., Imeson, Finch & Co.
Supplies.—Electrical Manufacturing Co.
Lamps.—Cryselco Co. and G.E. Co.
Oils and grease.—C. C. Wakefield, Stern, Sonneborn Oil Co., and Vacuum Oil Co.

Warrington.—The tender of Messrs. Crompton & Co., Ltd., has been provisionally accepted, at £100, for a 35-KW. continuous-current dynamo.

West Bromwich.—The T.C. has accepted the tender of Messrs. Bruce Peebles & Co., Ltd., for a spare armature, at a cost of £1,000, to be met out of revenue.

Whitehaven.—The T.C. has accepted the tender of the Whitehaven Colliery Co. for a year's supply of dry and washed coal for the electricity works.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, April 17th. At 8 p.m. At 39, Victoria Street. Paper on "A Few Typical Carburettors," by Mr. R. S. Fox.

Saturday, April 18th. Visit to the Australia House, Kingsway.

Monday, April 20th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "Lines of Future Development in High Power Diesel Oil Engines," by Mr. J. Richardson.

Tuesday, April 21st. At Imperial Hotel, Birmingham. Meeting of Midland Section. Paper on "Military Engineering," by Mr. R. B. A. Ellis.

Friday, April 24th. At 8 p.m. At 39, Victoria Street. Paper on "A Visit to the Iron Districts of French Alsace," by Mr. G. Evetts. At 7.45 p.m. At Municipal School of Technology, Manchester. Meeting of North-Western Section. Paper on "Some Notes on the Application of Chain Gearing," by Mr. H. T. Hildage.

Institution of Engineers and Shipbuilders in Scotland.—Saturday, April 18th. At 7.30 p.m. At Rankine Hall, 39, Elmbank Crescent, Glasgow. Smoking Concert.

Tuesday, April 21st. At 8 p.m. At 39, Elmbank Crescent, Glasgow. Ordinary meeting.

Nottingham Society of Engineers.—Monday, April 20th. Visit to machinery works at Leicester.

Institution of Post Office Electrical Engineers.—Monday, April 20th. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment. Annual General Meeting.

Institution of Civil Engineers.—Tuesday, April 21st. At 8 p.m. At Great George Street, S.W. Ordinary meeting.

Friday, April 24th. At 8 p.m. Students' meeting. Frame Thomson lecture on "Engineering Contracts," by Mr. A. A. Hudson.

Faraday Society.—Wednesday, April 22nd. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Ordinary Meeting. Papers.

Association of Mining Electrical Engineers (West of Scotland Branch).—Wednesday, April 22nd. At Royal Technical College, Glasgow. Annual meeting.

Institution of Electrical Engineers.—Thursday, April 23rd. At 8 p.m. At Victoria Embankment. Paper on "Electrification of Railways as Affected by Traffic Considerations," by Mr. H. W. Firth.

(Newcastle Local Section).—Friday, April 24th. At 7 p.m. At Hugh Bell School, Middlesbrough. Paper on "Industrial Applications of Electrically-Produced Ozone," by Mr. E. L. Joseph.

(Scottish Local Section).—Tuesday, April 21st. At 8 p.m. At 207, Bath Street, Glasgow. Paper on "Current-Limiting Reactances on Large Power Systems," by Messrs. K. M. Faye-Hansen and J. S. Peck.

Institution of Mechanical Engineers.—Thursday, April 23rd. At Connaught Rooms, Great Queen Street. Anniversary Dinner.

Friday, April 24th. At 8 p.m. At Storey's Gate, S.W. Paper on "Application of Electrical Driving to Existing Rolling Mills," by Mr. L. Rothera.

Diesel Engine Users' Association.—Thursday, April 23rd. Annual Dinner.

North-East Coast Institution of Engineers and Shipbuilders.—Thursday, April 23rd. At 7.30 p.m. Paper on "Wireless Telegraphy," by Mr. H. Fothergill.

Friday, April 24th. At 7 30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

(Graduates' Section).—Saturday, April 25th. At 7.15 p.m. Paper on the "Gyroscopic Compass," by Mr. H. C. Stroud.

Physical Society.—Friday, April 24th. At 5 p.m. At Imperial College of Science, South Kensington. Ordinary meeting.

Batti-Wallahs' Society.—Friday, April 24th. Smoking concert.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued:—

Friday, April 17th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Saturday, April 18th.—Headquarters will be opened for regimental purposes from 10 a.m. to 12 noon.

Monday, April 20th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m. Miniature range practice, 7 to 9 p.m.

Tuesday, April 21st.—"B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Wednesday, April 22nd.—Technical instruction and drill (Recruits), 7 to 10 p.m.

Thursday, April 23rd.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Friday, April 24th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Saturday, April 25th.—Headquarters will be open for Regimental purposes only from 10 a.m. to 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

NOTES.

Foreign Trade in March.—The following are the electrical and machinery figures given in the official returns for March:—

Imports.	*Month of Mar.*	*Inc. or dec.*	*Three months, 1914.*	*Inc. or dec.*
	£	£	£	£
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	148,018	+ 30,828	429,729	+ 55,390
Machinery	724,947	+ 85,005	1,968,215	+134,323
Exports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	251,570	−564,103	763,609	− 776,747
Machinery	3,568,599	+803,639	9,989,948	+1,399,885

Copper.—With reference to the rumours mentioned in our leaderette pages to the effect that copper is being secretly stored on the Continent, close investigation has been made as to the truth of these reports, and without any success at all, and it can only be surmised, therefore, that the statistics correctly represent the situation. Meantime, with the more cheerful feeling which has prevailed, the producers have been able to raise their prices a little, and have done business steadily at the higher rates quoted, while there has not been so much competition on the part of the dealers to sell. These have, indeed, drawn upon their stores pretty freely within the last few weeks, and have, therefore, very little material left. With any improvement in the United States position, there might be a further advance in prices, and meantime considerable attention has been devoted to the American returns for March. These returns have now been made public, and they can only be regarded as satisfactory in so far as they indicate a revival of United States consumption, which, after being down to a little over 9,000 tons in December, have improved steadily until in March they were nearly 32,000 tons, or slightly over the average monthly takings for last year. The exports were phenomenal—40,000 tons—the nearest approach thereto being the 39,332 tons in December, 1910, while the stocks in the hands of the refineries decreased over 6,000 tons to a little less than 29,000 tons. The production, however, showed a very material increase, the total being 65,023 tons, which compares with 58,699 tons in February and 60,675 tons in January. The highest previous output in a month was 65,012 tons, in August, 1912, and the growth shown last month over recent months is naturally regarded as an unfavourable feature. The statistics were up to the more reasonable expectations which had been formed, especially in regard to home and export deliveries, but the growth of production had certainly not been looked for.

Messrs. Merton's statistical circular for the end of March shows stocks in England 9,948 tons, or 451 tons less than at the end of February, and European visible supplies 26 129 tons, a decrease of 824 tons on the month. Arrivals from North America have been brisk, from Spain and Portugal, always a small quantity, very good at 1,877 tons, against an average of under 1,200. A good supply is now derived from unclassified countries; lumped together in these figures in February these totalled 6,505 tons, and last month 5,968, and the average quantity is 4,400 tons per month. Chile shipments were just average, Australia slightly over. The total deliveries are exceptionally high, at 57,459 tons, and the steadiness of the price can only be accounted for on the grounds that the market is awaiting further information. American stocks for the end of February were 3,984 tons less than at the end of January. The world's supplies lost 2,975 tons during February, but are still a respectable figure at 61,940.

The Australian Association of British Manufacturers.—The annual general meeting of members of the Australian Association of British Manufacturers and their representatives was held at Scott's Hotel, Melbourne, on Friday, February 27th. The chairman, Mr. J. J. Horrocks, submitted the annual report, to which we have already referred (see Electrical Review, page 474).

The following members were unanimously elected as members of the Executive Council for the ensuing year:—President, Mr. Hubert Johnson; Vice-President, Mr. C. A. Cox (Cox & Mailer); Councillor, Mr. G. Smith Morison (Siemens Bros. Dynamo Works); Hardware Councillor, Mr. W. H. MacLellan; Machinery Councillor, Mr. C. W. U. Adamson (Babcock & Wilcox); Electrical Councillor, Mr. G. L. Just (Edison & Swan Electric Light Co.). A motion was unanimously carried expressing appreciation of the work done by Mr. J. J. Horrocks, as President, during the past year, and Mr. Horrocks replied suitably. Appreciative remarks were made regarding the work of the Secretary, and Mr. R. H. Butler, in replying, urged members to try to make greater use of the Association, and not to lose any opportunity of bringing forward any matters in which the Association might be of any assistance to them. He said that the Association was there to assist members, and that the greater the amount of work done the more satisfactory would matters be to all concerned.

Notes from the Rand.—Our Johannesburg correspondent writes as follows:—

An order for the electrical equipment of a large winding engine has been placed direct by the East Rand Prop. Mines, Ltd., with the British Westinghouse Electric and Manufacturing Co., Trafford Park, Manchester. The winder will be capable of raising 8 tons of ore from a vertical depth of 4,500 ft. at a speed of 2,200 ft. to 2,500 ft. per minute. The equipment consists of two 1,500-B.H.P. D.C. motors rigidly coupled to the winding drum, one on each side. These are supplied with current from a motor-generator set operating on the Ward-Leonard system, and comprising a 4,200-B.H.P., three-phase, 25-cycle, 3,000-volt motor, direct coupled to two 1,375-KW., 500-volt D.C. generators, with a direct coupled exciter for the generators and winding motors. The necessary control gear and switchgear are also to be provided by the British Westinghouse Electric and Manufacturing Co.

Thirty-five other similar installations, comparable in size with the above, have been supplied by the British Westinghouse Co., of which the following are a few examples:—

Six equipments for the "Village Deep" Gold Mine, and the "City Deep" Gold Mine, the winding motor of each equipment being of 3,400 B.H.P.

Three equipments for the Brakpan Mines, the winding motors of each being rated at 3,000 B.H.P. A similar equipment to the above is in operation at the Great Western Colliery Co., South Wales, two winding motors being installed, each capable of a maximum of 1,800 B.H.P.

The winding drum on the above E.R.P.M. installation, which will run at the speed of the winding motor, 33·4 R.P.M., will be 12 ft to 21 ft. in diameter, and 9 ft. 3 in. between the cheeks, and will wind a rope 2 in. in diameter. The capacity of the winder will be 160 tons per hour. The winding motors will be shunt-wound, and connected in series. It will be noticed that the speed is very low. The tendency on winders at the present time is to increase the load per wind and reduce the speed.

The brake and clutch engines on this winder will be operated by compressed air from a Westinghouse slip-ring motor-driven compressor.

The Johannesburg Lighting and Tramways Department has recently placed an order for six 500-KW. 50-cycle rotary converters with the British Westinghouse Co. for traction purposes. The Johannesburg tramways are at present supplied from one central station, but the length of routes has called for some rectification of the pressure drop on the outskirts. The installation of negative boosters was seriously considered, but it was eventually decided to erect three sub-stations, one at Yeoville, one at Parktown, and the third at Braamfontein, and each will contain two Westinghouse rotaries as above.

Institution and Lecture Notes.—INSTITUTE OF MARINE ENGINEERS.—On April 4th, a party from the Institute paid a visit to the Woolwich works of Messrs. Siemens Bros. & Co., Ltd., and went through the various departments. Some time was spent in examining the details of the Hopkinson-Thring torsion meter for determining the horse-power transmitted by turbine and other shafts. In the new machine shop, amongst various ingenious electrical devices, was a tell-tale for engine revolutions. This apparatus shows, by means of a flag indicator on the bridge or in any desired position, that the propellers are in motion, and the direction in which they are rotating, a definite indication being given for each revolution. A demonstration was also given of the company's loud-speaking marine telephones, the distinctive feature of which is that a very small current is used.

IRON AND STEEL INSTITUTE.—The annual meeting of the Institute will be held in the new house of the Institution of Civil Engineers, Great George Street, Westminster, on Thursday and Friday, May 7th and 8th, 1914, commencing each day at 10.30 a.m. Amongst the papers to be read is one by Sir Robert A. Hadfield, F.R.S., and Prof. B. Hopkinson, F.R.S., on "The Magnetic and Mechanical Properties of Manganese Steels;" another, by Messrs. E. Humbert and A. Hethey, B Sc., deals with the "Production of Steel Direct from the Ore." By the kind invitation of the Comité des Forges, the autumn meeting will be held in Paris on September 18th to 23rd, 1914. The annual dinner of the Institute will be held in the Connaught Rooms, Great Queen Street, London, W.C., on Thursday, May 7th, at 7 for 7.15 p.m., under the presidency of Mr. Adolphe Greiner.

INSTITUTE OF METALS.—Prof. E. Heyn, of Berlin, is this year to deliver the annual May lecture before the Institute on "Internal Strains in Cold Wrought Metals and Some Troubles Caused Thereby," on Tuesday, May 12th. The secretary of the Institute, Mr. G. Shaw Scott, of Caxton House, Westminster, S.W., will forward tickets to any readers who may desire to be present at the lecture.

IGRANIC ENGINEERING SOCIETY.—At the meeting of this Society, on April 1st, a paper was read on "The Electric Control of Laundry Machinery," by Mr. F. N. Pickett. The paper fully discussed the special characteristics of reversing washers, hydro-extractors, and flat-work ironers, and described the new automatic controllers which have been standardised by the Igranic Electric Co. for the correct driving and timing of reversing washers, and for the gradual acceleration of hydro-extractors. Special features of the hydro-controller are the means employed to ensure the operator's standing by during starting to guard against eccentric loading of the basket, and to prevent the current rushes to the motor becoming excessive under any possible starting conditions. The lecture was illustrated by a complete set of lantern slides, and was followed by an interesting discussion.

ROYAL INSTITUTION.—The following are among the forthcoming arrangements announced by this Institution:—

Friday evening, June 5th.—Prof. W. H. Bragg, on "X-rays and Crystalline Structure."

Tuesday afternoons, April 21st and 28th.—Dr. W. Wahl, on "Problems of Physical Chemistry."

Thursday afternoons, June 4th and 11th.—Prof. S. P. Thompson, on "Faraday and the Foundations of Electrical Engineering."

INSTITUTION OF ELECTRICAL ENGINEERS.—At the meeting of the Manchester Local Section on Tuesday last week, the paper by Mr. K. M. Faye-Hansen and Mr. J. S. Peck, on "Current-limiting Reactances on Large Power Systems," was read and discussed.

ILLUMINATING ENGINEERING SOCIETY.—On April 7th, Mr. E. Kilburn Scott read a paper on "The Lighting of Railway Carriages and other Public Vehicles."

Dinner.—The annual staff dinner of the Bournemouth and Poole Electricity Supply Co., Ltd., was held on April 1st, Mr. A. H. Sanderson, chairman of the company, presiding. About 50 persons sat down. Mr. Brightman proposed the health of the chairman and vice-chairman of the company. Dr. Hosker proposed "The Staff," and Mr. L. Ingram, the chief engineer, who replied, said he was looking forward to an output of four million units a year.

Radium.—Steps have been taken for the formation of a Central Radium Institute in Glasgow, and a public appeal is to be made for £8,000 or £9,000 for the purchase of 300 milligrams of radium for the hospitals.

Radium on Lightning Conductors.—At a recent meeting of the the Académie des Sciences, Mr. B. Szilard described experiments which have been made to determine the effect of radium when present on the point of a lightning conductor. The consequent ionisation of the air in the vicinity of the point increases its conductivity several million-fold, and the effect is detectable to considerable distances. This produces a far more intimate electrical contact between the surrounding air and the earth, reducing the potential of the former. Atmospheric charges are thus conducted harmlessly away in many cases, and the lightning flash is avoided.

Tramway Workers' Union.—In the course of an article in the *Manchester Guardian* of April 7th, it is stated that the Amalgamated Association of Tramway and Vehicle Workers increased its membership during 1913 by 6,000, making the total 27,192. There are 77 branches; the reserve funds have been increased by £3,045 to £50,037; the year's receipts were £30,797, against £27,083 for 1912. The Association is pleased to report a large number of concessions gained by negotiation; in no single case were extreme measures necessary. "To withhold labour and negotiate afterwards is a great mistake," says the general secretary.

Fatality.—An accident recently occurred at Hartlepool, by which Robert Butterly, 27, electric wireman, lost his life. Butterly was disconnecting a wire from the top of a pole at the new dock entrance. The wire had been slackened, and a section of it was resting on the ground across a railway track. An engine and train of wagons fouled the wire and drew it taut, and when, finally, the wire snapped, the pole, to the top of which Butterly was clinging, rebounded with a jerk, flinging him to the ground as though shot from a catapult. He fell on a heap of scrap iron and received injuries from which he died a few hours later.

Parliamentary.—ELECTRIC LIGHTING PROVISIONAL ORDER BILL.—No. 1 Electric Light Provisional Order Bill has been read a first time. The Bill is to confirm provisional orders made by the Board of Trade under the Electric Lighting Acts, 1882 to 1909, relating to Hawarden Rural District, Kenilworth, Ledbury, Llanfairfechan, Merthyr Tydfil (amendment), Newton-in-Makerfield, Oulton Broad, Ruthen, Slaithwaite, Thornton and Yeovil.

In the House of Commons on April 7th the Central London Railway Bill passed its third reading.

Appointments Vacant.—Mains assistant (£91), for Wishaw electricity department; mains superintendent for Worksop U.D.C. (£90). Particulars are given in our advertisement pages.

The London Electrical Dispute.—The electric wiremen's strike continues. The disability clause the men will not accept, nor will the masters withdraw it. Mr. Tate says that the L.E.M.A. cannot meet the men's representatives until they can go with authority to agree to the principle of the clause.

Educational Note.—CRYSTAL PALACE SCHOOL OF PRACTICAL ENGINEERING.—The new course will commence on Wednesday, April 29th. Examination for new students, April 28th. Particulars are given in our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—In connection with the incorporation in the City of Greater Cape Town of the Municipalities of Woodstock Mowbray, Rondebosch, Claremont, Kalk Bay and Muizenburg, Sea Point, and Maitland, the entire staff of the City Council has been reorganised. The recommendations of the Reorganisation Committee with reference to the electricity department are as follows, viz.:—Power station manager, Mr. J. W. S. Clunas, present salary £350, allowance £60, recommended £450; electrical assistant, Mr. W. E. Cooke, present salary £375, allowance £9, recommended £425; distribution engineer, Mr. W. Tarleton, present salary £300, allowance £45, recommended £400; installation superintendent, Mr. G. H. Swingler, recommended £400; senior shift engineer, Mr. H. Purves, present salary £250, recommended £275; district mains superintendents, Mr. W. R. Lewis, present salary £228, allowance £12, recommended £250; Mr. J. Hegarty, present salary, £240, allowance £60, recommended £250; Mr. F. E. Burgoyne, present salary £240, allowance £12, recommended £250; Mr. G. W. Peart recommended £220; shift engineers, Mr. W. Dawson, present salary £250, recommended £260; Mr. Moore recommended £260; Mr. Allen recommended £230; assistant installation superintendent, Mr. Power, present salary £200, recommended £230; draughtsman, Mr. D. J. Wallace, present salary £220, recommended £220; chief departmental clerk, Mr. R. Williams, present salary £325, recommended £336; clerks, recommended £210 and £190 respectively; ditto, recommended two at £150 each; consumers' inquiry clerk, recommended £200; shorthand clerk and typist, £150; clerical assistants and meter reading, £570; Mr. R. J. Rosser, assistant city electrical engineer, present salary £570, allowance £24 (to be retired on pension). The above recommendations were subsequently confirmed by the Council, subject to the salary of the chief departmental clerk being fixed at £337

The South Shields Council has advanced salaries in the electricity department, as follows :—Mr. G. Robertson, station superintendent, £200—£220; Mr. Jas. Edgar, mains superintendent, £200—£220; Mr. J. C. Petersen, chief clerk and commercial assistant, £156—£175.

Mr. B. Sankey, M.I.E.E., has been promoted from the position of assistant to be municipal electrical engineer at the Port Elizabeth electricity works. Mr. L. Bickell, mains superintendent, has been appointed assistant electrical engineer.

Gillingham (Kent) T.C. has appointed Mr. W. G. Sims, of Windsor, as shift engineer at the electricity works.

The staff of the Whitehaven Corporation electricity department were entertained to dinner on Wednesday evening, April 8th, at the Albion Hotel, by Mr. Eric Morton, one of the charge engineers, on the occasion of his leaving Whitehaven to take up an appointment with the Mersey Railway Co., at Birkenhead. On behalf of the staff, Mr. L. B. Hogarth, the chief engineer and manager, presented Mr. Morton with a suit case and a slide rule, and Mr. Morton responded in appropriate terms.

Mr. T. W. Hudson, of Bradford, has been appointed assistant superintendent of the Yorkshire Electric Power Co. at Ravensthorpe, near Dewsbury. Mr. Hudson was for six years works manager at the electricity works at Lancaster.

The Hove T.C. has decided to retain the services of Mr. C. B. Smith, of the Hove E.L. Co., as electrical engineer, together with his assistants and clerical staff.

The Barking Electricity Committee proposes to appoint Mr. W. Fraser as station superintendent, at an increased salary.

Mr. J. C. Banbery, of Carlisle, has been appointed shift engineer at the Barnes electricity works. There were 115 applicants.

Mr. A. Prentice, the station superintendent at the Walsall Corporation electricity works has had his salary increased from £200 to £225 per annum.

Mr. James Stanworth, electric mains superintendent at Nelson, has resigned his appointment.

Mr. E. Poole, assistant borough electrical at Durban, Natal, is leaving there on April 26th for a six months' holiday in England. His address here will be Pentowan, Hayle, Cornwall.

Tramway Officials.—Out of 39 applicants for the position of manager of the Todmorden Corporation motor-'bus department at a salary of £160 a year, Mr. E. E. Moseley, of Burnley, has been appointed.

General.—Our Cape correspondent says :—"An electrician named D. Mackenzie, lately employed at Messrs. Reynold's sugar estate, Esperanza, has disappeared. The police are making a search, but the worst is feared."

Mr. H. A. Pearson, recently of the City of London Electric Lighting Co., Ltd., has resigned his position, and in future will be representing Messrs. Allen West & Co., Ltd., and the Reason Manufacturing Co., Ltd., in London, and the South of England.

Mr. H. W. Lawrence, who has held an electrical appointment under the Soudan Government, and who has returned to this country in consequence of illness, has obtained a position at Barnsley, under the Yorkshire Electric Power Co.

Mr. Oliver Henry Kennedy, of the marine department, Messrs. Siemens Brothers Dynamo Works, Ltd., 66, Waterloo Street, Glasgow, was presented by the members of the Glasgow office staff with a silver tea set, on the occasion of his approaching marriage to Miss J. T. Muir, of Wimbledon.

Mr. George Balfour, London, has presented a solid silver cup to the Elder Park Model Yacht Club, Govan.

Mr. Maclean, district telephone manager at Reading, who is leaving to take up a similar position at Plymouth, has been presented by the staff with a combined dressing and suit case, and Mrs. Maclean with a wrist bag.

Mr. G. S. Corlett's address is now Midland Bank Chambers, Wigan. Telegrams: "Telroc," Wigan. Telephone: "No. 560 Wigan."

Obituary.—Mr. Geo. Parsons.—The death is announced from Morecambe of Mr. Geo. Parsons, of the firm of Parsons & Taylor, electrical engineers, of Bank Street and Harris Street, Bradford. Deceased, who was 66 years of age, joined the firm in 1869.

Lord Suffield.—We regret to record that the death occurred last week of Lord Suffield, who was for so long a period one of the most intimate friends of the late King Edward. Lord Suffield was a director and formerly chairman of the Westminster Electric Supply Corporation, Ltd.

We regret to learn that Mr. Robert Richardson, electrical engineer, formerly of Glasgow and lately of Leven, died at Paisley, on the 6th inst. Mr. Richardson in his early days carried out some of the first installations in Glasgow, and served for a time at Messrs. Thomson's, Clydebank, and was manager of the Faraday Co., of Govan. He was subsequently electrical engineer to the Wemyss Coal Co. and Fife tramways.

NEW COMPANIES REGISTERED.

Wright's Enterprises, Ltd. (135,162).—This company was registered on April 8th, with a capital of £5 000 in £1 shares (8,000 6 per cent. cumulative preference), to carry on the business of electricians, mechanical engineers, cinematograph and other theatre proprietors and managers, &c. The subscribers (with one share each) are :—A. T. Wright, 11, St. Edmund's Road, Bootle, Lancs., director; C. M. Thomas, 35, Penrhyn Avenue, Litherland, Liverpool, accountant's clerk. Private company. The number of directors is not to be less than two or more than five; the first are A. T. Wright and C. M. Thomas; qualification, one share; remuneration as fixed by the company. Registered office, 5, Castle Street, Liverpool.

Derrygonnelly Electric Supply Co., Ltd. (4,123).—This company was registered in Dublin on March 28th, with a capital of £[illegible] in £1 shares, to carry on the business of electricians, mechanical engineers and manufacturers, workers and dealers in electricity, motive power and light, &c. The subscribers (with 10 shares each) are :—D. Elliott, Derrygonnelly, merchant; P. McGourty, Derrygonnelly, sergeant R.I.C.; P. Leonard, Derrygonnelly, publican; W. J. Weir, Derrygonnelly, merchant; G. H. McBrien, Derrygonnelly, farmer; D. Smyth, Derrygonnelly, merchant; W. Robinson, Derrygonnelly, merchant; T. A. Smyth, Derrygonnelly, medical officer; H. Fletcher, Derrygonnelly; Rev. P. McQuaid, Derrygonnelly. The first directors are D. Elliott, T. Smyth, D. Smyth, W. J. Weir, G. McBrien, P. Leonard, W. Robinson, H. Fletcher, P. McGourty, and Rev. P. McQuaid; qualification, £10; remuneration as fixed by the company. Registered office, Derrygonnelly, Co. Fermanagh.

Venner's Electrical Cooking and Heating Appliances, Ltd. (135,159). Registered April 8th, by E. T. Lea, 52, Queen Victoria Street, E.C. Capital, £100,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in all electric heating and cooking devices, electricians, mechanical engineers, &c., and to adopt an agreement with R. F. Venner. The signatories (with one share each) are :—R. F. Venner, 6, Old Queen Street, Westminster, S.W., engineer; M. Tuite, Talbot Mansions, Museum Street, W.C., merchant; E. Gorer, 170, New Bond Street, W., fine art dealer; I. Simmons, 180, New Bond Street, W., art dealer. Private company. The first directors (to number not less than three or more than seven) are :—R. F. Venner (permanent, special qualification 2,000 ordinary shares), M. Tuite, E. Gorer, I. Simmons, M. Lewis, and others, to be appointed by the said R. F. Venner and the company in general meeting.

Chipping Norton Electric Supply Co., Ltd. (135,075).—This company was registered on April 4th, with a capital of £10,000 in £1 shares (5,000 5 per cent. cumulative preference), to take over the business of the Chipping Norton Electric Supply Co., and to adopt an agreement with W. A. Schultz. The subscribers (with one preference share each) are :—W. A. Schultz, 50, Cannon Street, E.C., chartered accountant; H. H. Mainwaring, 68, Breakspears Road, Brockley, S.E., civil engineer; H. T. Mainwaring, 50, Cannon Street, E.C., secretary; S. I. Ferrian, 10, Clive Road, Merton, clerk; A. E. Bower, 90, Calverley Road, Catford, S.E. clerk; C. Wright, 50, Cannon Street, E.C., chartered accountant; W. V. Collings, 50, Cannon Street, E.C., gas engineer. Minimum cash subscription, £1,000; the number of directors is not to be less than two or more than five, the first are W. A. Schultz (managing director), H. H. Mainwaring and J. F. Griffiths. Registered office, 50, Cannon Street, E.C.

Tilney Manufacturing and Testing Co., Ltd. (135,069).—This company was registered on April 3rd, with a capital of £5,000 in £1 shares, to acquire licences to manufacture and sell electricity meters, to adopt an agreement with the Electricity Meters Patent Development Syndicate, Ltd., to acquire and turn to account inventions, patents or licences, to carry out experiments, tests, calibration and standardisation of apparatus submitted for that purpose, to design or make models and appliances for inventors, to set up laboratories and workshops. The subscribers are :—H. T. Harrison, 11, Victoria Street, S.W., electrical engineer, 1 share; M. J. E. Tilney, Bray, Mildred Avenue, Watford, Herts, electrical engineer, 1 share. Private company. The number of directors is not to be less than two or more than five; the first are J. E. Tilney (managing director), and H. T. Harrison. Solicitor, H. I'Anson Jones, 62, London Wall, E.C.

Electra, Ltd. (135,048).—This company was registered on April 3rd, with a capital of £3 000 in £1 shares, to carry on the business of electricians, mechanical engineers, suppliers of electricity for lighting, heating, motive power or otherwise, &c. The subscribers are :—A. Hardie, Bandoola, Holly Park Gardens, Finchley, N., gentlemen, one share; J. Woolf, 1 and 2, Rupert Court, W., electrical engineer, one share; Mrs. M. E. Hardie, Bandoola, Holly Park Gardens, Finchley, N., one share. Private company. The number of directors is not to be less than two or more than five; the first are A. Hardie, J. Woolf and Mrs. M. E. Hardie, each of whom may retain office while holding one share.

A. W. Beuttell, Ltd. (135,006).—This company was registered on April 2nd, with a capital of £10,000 in £1 shares (5,000 6 per cent. cumulative preference), to take over the business of an electric light, power, illuminating and installation engineer and contractor, carried on at 203, Victoria Street, S.W., by A. W. Beuttell. The subscribers (each with one share) are :—A. W. Beuttell, 203, Victoria Street, S.W., electrical engineer; F. Woodbridge, 5, Serjeant's Inn, E.C., solicitor. Private company. The first directors are A. W. Beuttell (governing director), F. Woodbridge, and G. A. Houghton. Registered office, 8, Army and Navy Mansions, 109, Victoria Street, S.W.

Standard Turbine Co., Ltd. (135,037).—This company was registered on April 2nd, with a capital of £1,200 in £1 shares, to manufacture, buy, sell, let on hire, and generally deal in all articles capable of being manufactured under certain patents referred to in agreements (*a*) with Improved Mechanisms, Ltd., and (*b*) with Evan Clarke. The subscribers (with one share each) are :—A. W. West, 134, Strathyre Avenue, Norbury, S.W., clerk; R. A. Keen, 125, Alscot Road, Bermondsey, S.E., clerk. Private company. Table "A" mainly applies. Registered office, 10, Old Jewry Chambers, E.C.

CITY NOTES.

Canadian General Electric Co., Ltd.

In their report for 1913 the directors state that in view of the financial stringency that existed during the year and the consequent lessening of demand they are gratified at being able to present such a satisfactory statement. A profit of $2,029,898 was earned and after deducting $470,933 for depreciation and $222,654 for interest the net balance is $1,336,309. Deducting from this amount dividends on preference and common stock at the rate of 7 per cent. per annum and a bonus of 1 per cent. on the common stock, amounting in all to $776,634, there remain surplus earnings of $559,675; $328,134 has been added to reserve fund and £231,541 to the balance of $682,390 at credit of profit and loss. The patents, acquired from time to time, represent a very considerable outlay, and contracts, which include trade marks and agreements with the General Electric Co. and many other companies whose Canadian rights have been acquired from time to time, are of prime importance to the successful conduct of the business. Notwithstanding their great actual value to the company, the directors recognise that these assets are of intangible value, and therefore have decided to write them down to the nominal sum of one dollar. The item of borrowed capital shows a considerable increase, on account of very large contracts that were in process of completion and not available for collection before the close of the year. The policy of the company has always been to borrow funds to finance large contracts during progress so as to avoid a fixed dividend charge in the event of any serious recession in trade.

Calcutta Tramways Co., Ltd.

The directors' report for the year ending 31st December, 1913, states that the revenue, including interest on investments and deposits, amounts to £113,271 plus £4,626 brought forward. Debenture interest absorbed £15,750, Preference share dividend £12,162, and interim dividend on Ordinary shares of 2s. 6d. per share £17,201, leaving £72,784. Out of this the directors propose to pay a final dividend of 7s. per share, making 9½ per cent for the year, £18,163; to transfer to reserve for depreciation, etc., £15,000; to staff provident fund, £1,215; and to carry forward £8,405. The reserve at the commencement of the year stood at £71,682. After deducting therefrom £6,690 written off for renewals during the year, and adding £15,000 proposed to be allocated as above, it will stand at £79,992. The steady and continued growth of the business has produced a further record in traffic receipts, which, as will be seen from the accounts, amount to £225,339, against £215,271 for 1912, or an increase of £10,068. Notwithstanding the increased mileage which has been run during the year, the operating expenses in Calcutta show a reduction of £6,523 when compared with 1912. This amount is accounted for by the reduction in the power expenses, partly due to the increased efficiency of the plant after the thorough overhauling in 1912, and partly due to the exceptional expenditure in connection therewith charged in the accounts for that year. In order to provide for expenditure which is now being incurred in further increasing the efficiency of the power station, including the provision of a new sub-station, the directors issued, at par, 2,705 Preference shares, balance of the 20,000 shares offered to the shareholders in 1907, bringing up the total Preference capital issued to £250,000. The rolling stock has been well maintained and is in first-class order.

The meeting is called for April 22nd.

Musselburgh and District Electric Light and Traction Co., Ltd.

The directors' report for the year ended 31st December, 1913, shows that the balance to credit of net revenue account is £7,168 plus £122 brought forward. Interest on debentures absorbs £4,427, and £511 is set aside for redemption of debentures, leaving £2,351. Out of this there is put to reserve and renewals account (tramways) £1,600, (lighting) £400; £257 is carried forward. The profit on the lighting undertaking shows a small increase of £30 over that for 1912. This is satisfactory considering that the amount received for energy supplied to the tramway shows a decrease of about £400, due to the more efficient working of the tramways and re-arrangement of the service. The receipts from ordinary consumers, however, show an increase of over £100 compared with those for 1912. The cost incurred for renewals to the permanent way, the principal item being the substitution of granite for whinstone setts, has been charged to tramways reserve and renewals account. There is an increase of £1,323 in the profits as compared with 1912.

	1912.	1913.
Total revenue	£15,412	£16,356
Traffic revenue . . .	£15,224	£16,116
Passengers carried	2,312,537	2,440,770
Car miles run	430,021	411,302
Average receipts per c.m.	8.50d.	9.40d.
Average receipts per pass.	1.58d.	1.58d.
Cost of energy per c.m.	2.18d.	1.99d.
Percentage of operating costs to traffic revenue ...	71.86	67.03
Percentage of operating costs to total revenue ...	70.98	66.04

Mr. J. B. Schlesinger (Chairman) presided on April 7th at the offices, 3, Lawrence Pountney Hill, E.C., over the annual meeting. He said that in the working of the tramways there was an all-round improvement over the years 1911 and 1912, and although they had an increase in revenue there was a considerable reduction in the car mileage run, with a consequent decrease in the running expenses—a gratifying improvement. In regard to the lighting undertaking, the increase in the profit of 1912 was a small one, but it must be considered satisfactory when the consumption of electricity by the tramways was considerably less. The receipts from ordinary consumers showed a gratifying increase, and under the more energetic management now in force the revenue to be derived from this source was likely to be considerably increased. When he last addressed them he referred to the Port Seton golf course. This had now been opened, and was considered one of the best links near Edinburgh. The Port Seton Tea House Co., Ltd., had now practically finished their building; it would be ready early in June, and they were looking forward to increased traffic in consequence. The share capital remained the same, but the debenture capital had been reduced by £600 in respect of the debentures redeemed during the year. The reserve and renewals account during the year was charged with the cost of renewals to the permanent way, renewals to the cars, and depreciation for a motor 'bus sold. They had replaced nearly the whole of that expenditure by appropriating £2,000 out of the year's profits.

Mr. B. Bernheim seconded the motion, and the report was adopted without discussion.

General Electric Co., Ltd.—It is announced that the recent issue of shares was over-subscribed two and a half times.

Brush Electrical Engineering Co., Ltd.

The directors in their report for the year ended 31st December, 1913, state that the profit and loss account shows that after providing for general charges, maintenance of plant and buildings, and interest on the company's Debenture stocks, there remains a net profit of £20,062. This result has been realised from the ordinary manufacturing and trading business of the company, and is a substantial improvement over recent years, due primarily to more satisfactory prices having ruled. The directors recommend that the profit of £20,062 be applied as to £12,352 in writing down the property account to provide for depreciation in respect of the last two years, no provision for depreciation having been made for the year 1912, and as to the balance of £7,710 in reduction of the amount standing to the debit of profit and loss account in the balance-sheet. The scheme for reduction of capital submitted by the directors in 1912, and subsequently approved by the committee representing the shareholders and other interests, has been in abeyance, pending the re-establishment of an equilibrium of the profit and loss account. The scheme will now be proceeded with. The directors are of opinion that the profits may be materially improved if the company is enabled properly to exploit the Ljungstrom steam turbine, for which it holds manufacturing rights. The first turbine of this type, which, as mentioned in the last report, is installed at the Willesden power house of the North Metropolitan Electric Power Supply Co., duly completed its trial period of service, and has been taken over as a permanent unit of the station equipment. The invention is an important one which has aroused much interest by reason of its novel design and great economy in steam consumption. Valuable orders for turbines of this type have already been received, and are in course of execution, but to develop the business to the best advantage will involve some capital expenditure. The directors are giving their consideration to various alternative methods of dealing with this important development. So far, the volume of business during the current year has been well maintained, and the outlook continues favourable. The annual meeting is called for April 20th.

Indian Electric Supply and Traction Co., Ltd.

The directors' report for the year ended December 31st, 1913, states that the surplus on the year's working in Cawnpore, including £249 for interest accrued, was £10,145 (against £8,459 in 1912), and including further interest accrued in England and transfer fees, the credit side of net revenue account shows a total of £10,162; London expenditure was £1,335 (against £747 in 1912), and after providing for debenture interest, £3,600, there remains a net profit of £5,226, which, with £1,834 brought forward from last year, makes the balance at the credit of profit and loss account £7,060. Out of this amount the directors have placed £3,000 to reserve, and they recommend a dividend of 4 per cent. for the year, which will absorb £3,121, carrying forward the balance £940. The increase in London expenditure is due to the partial rectification of the secretaries' and directors' remuneration, which since 1907 has been on a voluntarily reduced scale. A chimney, an economiser and a condenser were built and installed during the autumn, and have been got into work since the new year opened, the benefits of which are now being felt.

Supply.	1912.	1913.
Units sold	1,189,892	1,750,368
Average price per unit	2·33d.	2·05d.
,, cost in India	1·07d.	1·00d.
Units delivered to tramway	261,680	261,960
Average price per unit	1·50d.	1·50d.
Traction.		
Miles of tramway	3½	3½
Number of cars	20	20
Passengers carried	2,859,499	2,869,481
Mileage run	263,382	269,328
Receipts per car-mile	5·00d.	4·89d.
Expenses in India	4·90d.	4·65d.
Average fare per passenger	·45d.	·45d.

Clevedon, Portishead and District Electrical Supply Co., Ltd.—A meeting of the shareholders in this company was held on the 8th inst., Mr. T. Richards presiding. The chairman, in moving the adoption of the report and accounts, said the undertaking was making steady progress, and the revenue had increased during the last three months by at least a third over the previous five months' working. Mr. F. Christy, in seconding the resolution, spoke of the need of further capital to extend the system to the Long Ashton district. The resolution was carried, and directors appointed.

British Columbia Electric Railway Co., Ltd.—The directors have declared an interim dividend at the rate of 8 per cent. per annum on the deferred ordinary stock, in respect of the last half-year of 1913.

South London Electric Supply Corporation, Ltd.—The recent issue of 6,000 6 per cent. cumulative preference shares was largely over-subscribed, and letters of allotment and regret were posted on 11th inst.

Altrincham Electric Supply, Ltd.—The directors' report for the year ended December 31st, 1913, says that during the year 114 new installations were connected to the mains, and the number of consumers on December 31st last totalled 1,182. Further capital expenditure amounting to £5,743 was incurred during the year. Of this, £3,741 was in respect of new plant, meters, &c., £1,748 for cable extensions, and £254 for the new order to cover the extended area. The accounts disclose a profit of £8,259 for the year, after providing for interest on debentures and loans, making, with £175 brought forward, an available balance of £8,433, which has been dealt with as follows :—Written off old stock, £612 ; machinery replacements, £317 ; debenture discount account, £250 ; debenture (sale of) account, £227 ; general reserve fund, £1,000, leaving £5,996 to be carried forward. Out of this the directors recommend a dividend of 8 per cent. for the year, absorbing £2,800.

Stock Exchange Notices.—Applications have been made for special settling days in :

Toronto Power Co., Ltd.—Prov. Scrip, fully and partly (£25 per cent.) paid, for £528,655 4½ per cent. consolidated guarantee debenture stock.

And for official quotations in the following :—

Columbia Gas and Electricity Co.—$50,000,000 capital stock in shares of $100 (renewed application).

Costa Rica Electric Light and Traction Co., Ltd.—Further issue of £30,050 5 per cent. first debentures, Nos. 2,557 to 2,722 and 2,757 to 2,766 (£100), and 1,631 to 1,879 (£50).

The Committee has appointed a special settling day as under :—

Tuesday, April 28th.—British Electric Transformer Co., Ltd.—Further issue of 16,336 ordinary shares of £1, fully paid, Nos. 119,115 to 135,879 and 135,394 to 135,464.

And ordered the following to be quoted in the Official List :—

British Electric Transformer Co., Ltd.—61,988 6 per cent. cumulative preference shares of £1, fully paid, Nos. 1 to 50,000 and 150,001 to 161,988.

Metropolitan Railway Co.—Further issue of 266,666 3½ per cent. "A" debenture stock.

Shropshire, Worcestershire and Staffordshire Electric Power Co., Ltd.—An extraordinary general meeting was held on April 8th at the offices of the Electrical Federation, Kingsway, under the chairmanship of Mr. E. Garcke, for the purpose of considering and if thought fit approving the Bill deposited in Parliament to confer further powers on the company. The chairman, in moving the formal resolution approving the Bill, said that it provided for the issue of further shares and for the reconversion of stock into shares, and contained the usual clauses relating to the issue of capital. It also removed the obligation to hold half-yearly meetings. It was a late Bill, but there was nothing controversial about it, and he did not think it would be contested in any way. The resolution was carried.

Launceston and District Electric Supply Co., Ltd.—The directors in their second annual report state that the rapid growth of the business in 1912 was continued throughout 1913, the number of customers at the end of the year was 174 and the lamps 4,500. The total revenue receipts were £959, and the working expenses £738, leaving a net profit of £220, plus £2 brought forward, making a total of £222. This the directors recommend should be allocated as follows :—2½ per cent. dividend on ordinary shares, less tax, £151, carrying forward £72. The number of units distributed during the year was 45,328. The whole of the company's plant and machinery has been maintained in perfect order. In November, 1913, 2,500 £1 5 per cent. preference shares were created, and the whole of these have now been issued. The directors do not ask for any remuneration for their services.

Direct United States Cable Co., Ltd.—The directors report that for the year ended March 31st, 1914, the reserve fund account shows a balance of £451,491, as compared with £487,474 at March 31st, 1913, a decrease of £35,983, which is accounted for by expenditure in connection with the repair of the main cable in mid-Atlantic in July, 1913. Three quarterly interim dividends of 2s. each per share (less income-tax), amounting to £34,301, have been declared and paid during the year, and a final dividend of 2s. per share (less tax) is now proposed, making a total distribution of 4 per cent. for the year.

Nairobi Electric Power and Lighting Co., Ltd.—The directors report that the results of last year's working show that the net profits for 1913 are largely in excess of those of 1912, and that in consequence they have resolved to pay by way of an interim dividend the whole of the arrears of dividend on the 6 per cent. preference shares up to the end of 1913 (24 per cent.), which will leave a substantial balance to be dealt with as may be decided later.

Stratford-on-Avon Electricity Co., Ltd.—The directors' report to December 31st, 1913, states that after writing off £200 to reserve and depreciation account and building sinking fund, the net revenue account shows an available balance of £480. The directors recommend a dividend of 4 per cent., requiring £296, and directors' fees absorb £50, the balance, £134, being carried forward.

Mexican Light and Power Co.—The directors have issued an announcement to the effect that as the conditions in Mexico have not improved they have now decided to suspend the half-yearly payment of the dividend on the 7 per cent. cumulative preference shares. The payment of dividends on the ordinary stock was discontinued in January.

Guildford Electricity Supply Co., Ltd.—Mr. H. P. Smallpeice presided at the annual meeting held recently. He said that the company had again made very satisfactory progress. The receipts amounted to £11,[illegible], as compared with £10,[illegible] for 1912. That was, unfortunately, gross revenue and that satisfactory increase had to be met by a considerable increase on the expenditure side, with the result that the balance applicable for distribution amounted to £1,165, which was only £91 in excess of the previous year. The increased expenditure on revenue account was mainly in respect of coal and other fuel, £940. After referring to other items he said, that considering all things, he thought they might fairly congratulate themselves that the directors were able to recommend the payment of the usual dividend of 5 per cent. on the ordinary shares, and carry forward a slight increase to the credit of the revenue account for the current year. It was resolved that the remuneration of the directors be increased from 200 guineas to 250 guineas.

Babcock & Wilcox, Ltd.—The directors' report states that the net profit during the year 1913 amounts to £446,073, plus £64,014 brought forward, making £510,087. The interim dividends of 3 per cent. on the preference shares, and of 7 per cent. on the ordinary shares, amounted to £119,200, and the directors recommend the following final dividends :—3 per cent. on the preference shares for the December half-year, requiring £3,000, 5 per cent. per annum to December 31st, 1913, on the second preference shares, £4,652, 9 per cent. on the ordinary shares (free of income-tax) for the December half-year, £149,400 ; placing to the reserve fund £150,000, and granting to the staff pension fund £10,000, and leaving £73,835 to be carried forward. The business continues to progress, and the orders on hand at January 1st, 1914, were in excess of those carried over at January 1st, 1913. "We are continuing to enlarge the scope of our business, in view of the fact that under the present conditions of manufacturing a larger output is required to keep up our profits. Our works have been maintained in excellent order, and extensions have been carried out."

Brisbane Electric Tramways Investment Co., Ltd.—The report for 1913 (according to the *Financial Times*) states that the dividend received from the Brisbane Tramways Co., Ltd., amounted to £115,922. There is an available balance of £115,848, which the directors have dealt with as follow :—In allocating to reserve fund (bringing it up to £50,000) the sum of £40,000 ; in payment of debenture stock interest £19,068, and of preference dividend £17,656, and of an interim dividend on the ordinary shares £18,000. The directors now recommend a balance dividend of 4s. per share, free of income-tax, on the ordinary shares (making 8 per cent. for the year), and that £3,123 be carried forward. The allotment letters for the 30,000 new ordinary shares of £5 each will be posted to the shareholders with the dividend warrants.

Thomas Tilling, Ltd.—In their report for 1913 the directors state that during the year the company has considerably increased its interest in the business of W. A. Stevens, Ltd., motor manufacturers and engineers, who are the patentees and manufacturers of the "Tilling-Stevens" motor vehicles. Substantial profits were earned by this company during the year 1913, and there is every expectation that now the works are nearly completed the profits for the current year will show a considerable increase.

Monte Video Telephone Co., Ltd.—The directors have declared interim dividends for the half-year to January 31st at the rate of 5 per cent. per annum on the preference shares and 6 per cent. per annum on the ordinary shares.

Sao Paulo Tramways, Light and Power Co., Ltd.—The directors have declared a dividend of 2½ per cent.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange returned from its Easter recess with more hope than conviction that the long end-April settlement will bring out more business than it enjoyed before the holidays. Notwithstanding the abundance of money and the difficulty of employing it at remunerative rates, there is still a disinclination on the part of the investor, and of the speculative investor as well, to embark upon Stock Exchange activities. In some few markets, particularly that devoted to oil shares, noticeable animation prevails ; but the business is very specialised, and at present gives little indication of broadening out into a more general stream.

The dullness of Consols is one of the things which acts as a drag upon purely investment securities. In spite of this, however, new issues continue to secure willing support from the public. As an instance, the success of the General Electric emission may be quoted, the subscription lists for Ordinary and Preference shares being closed in advance of the date specified in the prospectus, and a premium of 5s. being at once established upon each class of shares.

The new County of London Electrics are also better, the price in their case hardening up to nearly 10s. premium, buyers having come along for these in preference to the older shares, although realisations of the latter, in order to provide funds to take up the new issue, have now ceased. The South London Preference issue rapidly went, from all of which signs it may be judged that where a *clientèle* more or less ready-made can be appealed to with an offer of shares, there will be little difficulty in obtaining over-subscription.

It is proposed to eliminate from the pages of the Stock Exchange Daily Official List the quotations for Folkestone Preference, Newcastle Debenture and Oxford Debenture, on the ground that no bargains have been recorded in either of them since January 1st, 1913. Unless transactions are marked between now and the end of the month, the prices for these shares will be transferred to what is known as the "Removed List" of the Stock Exchange Weekly Intelligence.

The matter is worth mentioning, in view of the tentative proposals which have been made lately for combining some of the provincial electric lighting companies by means of a holding company in the nature of a trust. Many of the provincial companies, of course, do exceedingly well—as witness the 7 per cent. dividend recently declared by the Bournemouth and Poole Company; but the shares seldom move, because there is nobody to take sufficient interest in them for them to get distributed over any wide circle of holders. It is argued in favour of the proposal that many people, particularly in country localities, would be glad enough to acquire a holding in a trust company owning shares in first-class concerns paying good dividends; and more will probably be heard of this scheme before long.

Prices of the shares in the Electric Supply market are generally steady, though there is some dullness in Westminsters, and Cities remain at their previous quotation of $17\frac{1}{2}$. The withdrawal of the London Electric Supply Bill came as no surprise; in fact, its passage this session had not been generally expected. That there will be some revival of the scheme, although, maybe, in another form, is likely enough. Westminster Ordinary are $\frac{1}{4}$ down at $8\frac{1}{2}$, but Folkestones hardened to $4\frac{5}{8}$. Bournemouths rose to $10\frac{1}{2}$; probably this price could be obtained by a seller.

The Home Railway market arrived at the conclusion that the Labour trouble on the South Yorkshire Coalfield was not likely to be either extensive or prolonged. With the Easter prospects in sight, and in spite of half-hourly changes in the weather, prices were advanced, on the idea that bumper traffics would be secured, or, at any rate, that the newspapers which publish railway advertisements could be relied upon to write up the holiday traffics in their usual boom style.

With the improvement in the heavy stocks came modest advances in the Undergrounds. The opening of the new loop at Charing Cross had a strengthening effect upon Underground Electric shares, the "A" variety hardening to 9s. 3d., while the £10 shares rose 10s. and 6 per cent. Income bonds gained $1\frac{1}{2}$. London and Suburban Tractions have dropped a little. London United Tramways Debenture is a point down. Vague rumours about "funding the dividend arrears" helped the advance in Underground Electric £10 shares. Nothing tangible seems to be known.

The Marconi market was further upset by the official announcement that the American Marconi Company would not pay any dividend on its Ordinary shares in respect of the eleven months to December 31st, 1913. In the previous year, 2 per cent. was paid; but for 1913 the company earned a shade less than this on its capital, and the figures in the balance-sheet evidently frightened nervous holders, for the price dropped to 16s. This had the effect of bringing the parent shares on offer at $3\frac{3}{8}$, while Canadians were dull at 8s. 6d., though there has been a slight recovery from the lowest prices since the American Company's report appeared. It is announced that the parent company has just received a contract from the Government for erection of another station at Stonehaven.

The Telegraph market as a whole is quietly firm, business, however, having been on retail lines, and changes in quotations being so small as scarcely to call for mention. The Direct United States Cable Company has declared a dividend of 2s. a share, making 4 per cent. for the year, which was in accordance with market expectations. The report is a satisfactory one. Western Telegraphs are moving up again.

The Mexican see-saw this time has tipped against the shareholders in the various companies. Falls have occurred of 3 in Mexico Trams, of 4 in Mexican Light and Power Common, and 3 in the Preferred shares. Although another assurance has been received from one of the many generals in the field, to the effect that British property is to be respected, the action of the U.S. Government in sending its fleet to Mexico, is fraught with too many possibilities for the market in all Mexican securities to be anything but nervous. Shawinigan Water new stock is officially valued at 12 premium for temporary purposes, and the price of the old shares (138) is *ex* dividend and *ex* rights. Brazil Tractions have also receded a little, on the vagaries of the rate of exchange. The fall in other Brazilian securities, however, has been checked.

Babcock & Wilcox fell sharply to 3, a drop of $\frac{3}{16}$, on the declaration of a dividend of 9 per cent., making 16 per cent. for the year, the same as that for the previous 12 months. Better results than this had been expected, and the market in the North was evidently upset. On the other hand, Brush Debentures of both kinds have been put up, on the appearance of a favourable report, which had the effect of raising the quotations of both stocks to the extent of 3 points. Castner-Kellners are also harder, and Callender's Preference advanced to $5\frac{1}{2}$. Edison & Swan receded to the nominal price of 1s. 3d., and British Westinghouse Preference have gone back $\frac{3}{32}$, further sellers having come in on the top of the rise brought about by the improved position of the company, as shown by the recently-issued figures.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, April 15th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	$2\frac{7}{8}$d.	..
a „ Sulphuric	per cwt.	6/6	.
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£22	10s. dec.
a Lead, Nitrate	„	£30 10	..
a „ White Sugar	„	£28	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	$8\frac{1}{2}$d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	$8\frac{1}{4}$d.	..
a „ Perchlorate	„	$8\frac{3}{4}$d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	$7\frac{1}{2}$d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10	..
a „ Chlorate	per lb.	$8\frac{1}{2}$d.	..
a „ Crystals	per ton	£2 5	..
a Sodium Bichromate, casks ..	per lb.	8d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£86	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£112	..
b „ Sheet, in ton lots ..	„	£112	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	$7\frac{1}{4}$d.	..
c „ Tube (brazed)	„	$9\frac{3}{8}$d.	..
c „ „ (solid drawn) ..	„	8d.	$\frac{1}{8}$d. inc.
c „ Wire, basis	„	$7\frac{3}{8}$d.	..
c Copper Tubes (brazed)	„	10d.	..
c „ „ (solid drawn) ..	„	10d.	..
g „ Bars (best selected) ..	per ton	£82	£2 inc.
g „ Sheet	„	£82	£2 inc.
g „ Rod	„	£82	£2 inc.
d „ (Electrolytic) Bars ..	„	£68	£1 10 inc.
d „ „ Sheets ..	„	£66	£1 10 inc.
d „ „ Rods ..	„	£73 10	£1 10 inc.
d „ „ H.C. Wire	per lb.	$8\frac{7}{8}$d.	$\frac{1}{16}$d. inc.
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/-	..
h India-rubber, Para fine	„	$2/11\frac{3}{4}$	$\frac{1}{2}$d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	50/11	2d. inc.
„ Wire, galv. No. 8, P.O. qual.	„	£14	.
g Lead, English Pig	„	£18 10 to £18 15	£2 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7	..
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to $1/8\frac{1}{2}$	..
p „ „ rolled bars & rods	„	$1/0\frac{3}{4}$ to 1/2	..
p „ „ rolled strip & sheet	„	$1/2\frac{1}{2}$ to $1/5\frac{1}{2}$	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	$10\frac{3}{8}$d.	..
r Steel, Magnet, in bars	per ton	£65	..
g Tin, Block (English)	„	£166 to £167	£7 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/4	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd
p
r W. F. Dennis & Co.

Oldham, Ashton and Hyde Electric Tramways, Ltd.—In their report for 1913 the directors state that the total revenue was £35,496, and the expenditure (including £1,600 for debenture interest and £4,500 placed to provision for renewals account) £28,816, leaving a net profit of £6,679, plus £218 brought forward. The directors propose to place to reserve fund, £1,250; dividend, 5 per cent. per annum on the cum. preference shares, £2,500; dividend on the ordinary shares 7 per cent. per annum for the six months to December 31st, making, with the interim dividend, 6 per cent. for the year, £3,000; leaving to be carried forward £147. During the year £192 was expended on capital account. The directors ask sanction to the conversion of the preference and ordinary shares into shares of £1 each. The increase in the traffic receipts of £1,009 is due to the general prosperity of trade in the district. £4,500 has been charged through the revenue account to renewals account, as compared with £4,000 for 1912.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 14th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	5/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	½ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	+1	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	15½ — 17½	..	..
Do. Do. Deferred ..	100	..	..	6½ — 8½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	8	..	56 — 59	..	5 1 8
Do. 5 % Perp. Deb. ..	100	5	5	98 — 95 xd	..	5 1 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	79 — 82	..	5 9 9
Central London Railway, Ord. ..	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 5
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	—1	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 3
Lancashire United, 5 % Deb. ..	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord. ..	1	..	..	3/16 — 9/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	19/32 — 23/32	—1/32	6 19 0
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	78 — 83	—1	5 8 5
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	59 — 63	1	6 7 0
Metropolitan Railway Consol. ..	100	1⅝	1⅝	42¾ — 43½	..	3 15 2
Do. Surplus Lands	100	2¾	2¾	63 — 65	..	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	..	4 5 4
Metropolitan District Ord. ..	100	Nil	..	29¼ — 29¾	+ ½	Nil
Do. 6 % Deb.	100	6	6	138 — 141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	84 — 87	..	5 3 6
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 9
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 13 0
Potteries, Ord.	1	3½	..	⅜ — ½	..	..
Do. 5 % Pref.	1	5	5	17/32 — 21/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	3⅜ — 3⅝	+ ⅛	Nil
Do. "A"	1/-	..	..	7/16 — ½	+ 1/16	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 — 114	..	5 5 3
Do. 4½ % Bonds	100	4½	4½	99½ — 101½	+ ½	4 8 8
Do. 6 % Income	100	6	6	91½ — 92½	+1½	6 8 6
Yorkshire (West Riding), Ord. ..	5	Nil	..	5/16 — 9/16	..	Nil
Do. 6 % Pref.	5	3	4	4 — 4½	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	83 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations April 14th.	Rise + or Fall —	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅝ — 4⅞	..	5 12 10
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 9/16	..	6 0 7
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 — 106	..	4 14 3
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 — 100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	83 — 85	— ½	7 1 2
Brisbane Trams Invt., Ord. ..	5	8	8	7½ — 8	..	5 0 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 — 101	..	4 9 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	117 — 121	..	6 12 4
Do. Pref. Ord.	100	6	6	105 — 109	..	5 10 1
Do. 5 % Pref.	100	5	5	103 — 105	+1	4 15 2
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 — 101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	93½ — 95½	..	4 9 1
Calcutta Trams, Ord.	5	7½	9½	7 — 7½	+ ¾	6 6 8
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	6	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	N	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord. ..	1	..	..	¼ — ½	..	..
Do. Pref.	1	4½d.	6	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1⅛ — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
" Elec. Tr. (1904), Deb. ..	100	5	5	101 — 103	..	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ — 100½	..	4 19 6
Mexico Trams Com	$100	7	7	71 — 74	—3	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	79 — 83	..	6 0 6
Do. 6 % Bonds	100	6	6	78 — 83	..	7 4 7
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	3⅞ — 4⅜	..	11 8 6
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	89 — 92	—1	5 8 8
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97 — 99	..	5 1 0
Do. 5 % Mort. Bonds	100	5	5	90 — 92	+1	5 8 8
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	98 — 101	..	4 19 0
Singapore Trams, 5 % Deb. ..	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	95 — 98	+1	5 2 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations April 14th.	Rise + or Fall —	Present Yield p.c.
Bournemouth & Poole, Ord. ..	10	6	7	10 — 11	+ ¼	6 7 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10¼ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	+1	4 11 9
Brompton & Kensington, Ord. ..	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91½ — 94½	..	4 4 8
Charing Cross, West End & City	5	5	6	4⅞ — 5⅜	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10	17 — 18	..	5 11 1
Do. 6 % Cum. Pref.	10	6	6	12¾ — 13¾	..	4 7 3
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 7 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 — 103	..	4 8 1
County of London, Ord.	10	6	7	11⅞ — 12⅜	..	5 13 2
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	102½ — 105½	..	4 5 9
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 — 103	..	4 7 5
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅜ — 4⅞	+ ⅛	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4¼ — 4¾	..	5 5 3
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9
Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 8	..	5 12
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅝ — 1¾	..	5 2 7
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	92 — 95	..	4 4 1
Metropolitan	5	4½	4½	3⅝ — 3⅞	..	5 16 3
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford	5	7	7	5 13/16 — 6 5/16	..	5 11 0
St. James' and Pall Mall, Ord. ..	5	10	12	9¼ — 9¾	..	6 3 1
Do. 7 % Pref	5	7	7	6⅝ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2¾ — 3⅜	..	6 10 4
Do. 5 % First Mort. Deb. ..	100	5	5	98 — 101	..	4 19 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock ..	100	4½	4½	94½ — 97½	..	4 12 4
Urban, Ord.	£3	Nil	..	⅜ — ⅝	..	..
Do. 5 % Cum Pref.	5	3‡	4	2½ — 3 xd	..	6 13 4
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 12 3
Westminster, Ord...	5	10	10	8¼ — 8¾	— ⅛	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	5 1/16 — 5 5/16	..	4 4 9

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* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 14th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5 — 5½	..	5 14 8
Calcutta, Ord.	5	8½	5†	7⅜ — 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	5 8 0
Canadian Gen. El. Com.	$100	7	8	111 —115	..	6 16 9
Do. 7 % Pref.	$100	7	7	119 —121 xd	..	5 9 5
Cordoba Lt., Power and T., Ord.	1	5	..	⅞ — [illegible]	..	7 12 0
Do. 5 % Deb.	100	5	5	87 — 90 xd	..	5 11 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87 — 89	..	6 14 10
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ — 95½	..	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	6†	15/32 — 17/32	..	10 11 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103½ —106½	..	4 14 0
Mexican El. Lt., 5 % 1st M. Bds.	.	5	5	65 — 70	..	7 2 10
Mexican Lt. & Power, Common	$100	4	4†	38 — 43	—4	..
Do. 7 % Cum. Pref.	$100	7	7	75 — 80	—8	8 15 0
Do. 5 % 1st Mort. Gold Bds.	.	5	5	78 — 83	..	6 0 6
Do. 5 % 2nd Mort. Bonds	100	5	5	65 — 69	..	7 4 11

NAME.	Stock or Share.	Dividends for		Closing Quotations April 14th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	54 — 59	..	..
Montreal, Lt., H. and Power	$100	9	10†	228 —233	—2	4 5 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	245 —255	..	3 18 5
Do. 6 % Non-Cum. Pref.	Do.	6	6	103 —108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5½	6	136 —140 xd	..	4 5 9
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	101 —103	..	4 7 8
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 97	..	4 12 9
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 — 89	—1	5 12 4
Victoria Falls Power, Pref.	1	6	6	23/32 — 25/32	..	7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	102 —104	..	5 15 5

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 14th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	23/32 — 27/32	..	8 5 0
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	6 17 2
Babcock & Wilcox	1	16	16†	2 15/16 — 3 1/16	—1/16	5 4 5
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 8 6
British Aluminium, Ord.	1	..	5	31/32 — 1 1/32 xd	..	4 11 4
Do. 6 % Cum. Pref.	1	6	6	27/32 — 31/32 xd	..	6 3 9
Do. 5 % Prior Liens Debs.	100	5	5	96 — 99	..	5 1 0
Do. Deb. Stk.	100	5	5	88 — 93	..	5 7 6
B.I. & Helsby Cables	5	10	13	9¼ — 9¾	..	6 13 4
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	101 —104	..	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	2	Nil	5	1 1/16 — 1⅛	—3/32	6 13 4
Do. Deb.	100	4	4	73 — 75	..	5 6 8
Do. 6 % Prior Lien	100	6	6	100 —103 xd	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	42 — 46	+8	9 15 8
Do. 4½ % Second Deb.	100	4½	4½	26 — 30	+8	15 0 0
Callender's Cable	5	15	5†	11¾ — 12¼	..	6 0 0
Do. Pref.	5	5	5	5 — 5½	..	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	22½	2⅝ — 2⅞	+ ⅛	..
Do. Deb.	100	4½	4½	104 —107	..	4 4 1

NAME.	Stock or Share.	Dividends for		Closing Quotations April 14th.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	⅜ — ⅝	..	..
Do. Pref.	1	6	6	11/16 — 13/16	..	7 7 8
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	—1/16	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	62 — 67 xd	..	7 9 1
Electric Construction	1	5	..	17/32 — 21/32	..	7 12 6
Do. Pref.	1	7	7	15/16 — 1 1/16	..	6 11 7
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10¼ — 10¾	..	5 14 3
Do. Deb.	100	4	4	84 — 88 xd	..	4 11 0
Henley's, Ord.	5	15	20	13½ — 14½	..	6 17 11
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 9 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	7½	10½ — 11½	..	6 10 5
Do. Pref.	10	5	5	8¾ — 9¼	..	5 5 3
Telegraph Construction	12	20	20	36 — 38	..	6 6 7
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	64 — 68	..	5 17 8
Do. B 4 % Cum. Pref.	100	..	..	50 — 55	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 14th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾ — 6¼	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	.	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 —126	+1	6 7 0
Do. Collat. Trust	$1000	4	4	91 — 94	..	4 5 8
Anglo-American Telegraph	Stock	3	3	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	109 —110	..	5 9 4
Do. Def.	Do.	30/-	30/-	23¾ — 24¼	+ ¼	6 3 9
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7⅜ — 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80½ — 82½	..	4 17 0
Cuba Telegraph	10	6	6†	8¾ — 9¾	..	6 3 1
Do. 10 % Pref.	10	10	10	15¾ — 16¾	..	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7½ — 8	..	6 5 0
Direct United States Cable	10	4	4	6⅞ — 7⅛	..	5 12 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	132 —135	..	5 3 8
Do. 3½ % Pref. Stock	Do.	3½	3½	77½ — 79½	..	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	10	7	7	12⅜ — 12⅞	..	5 8 9
Do. 4 % Deb.	Stock	4	4	94½ — 96½	..	4 3 0
Globe Telegraph and Trust	10	6	6†	11⅛ — 11⅝	— ⅛	5 3 1
Do. 6 % Pref.	10	6	6	12½ — 13	..	4 12 4
Great Northern Telegraph	10	20	20	82 — 84	..	5 17 8
Indo-European Telegraph	25	13	5†	58 — 60	..	5 8 4
Mackay Companies Common	$100	5	5	85 — 88	..	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7

NAME.	Stock or Share.	Dividends for		Closing Quotations April 14th.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph	1	20	20	3 5/16 — 3 7/16	—3/16	5 16 4
Do. 7 % Cum. Partic. Pref.	1	17	..	2 11/16 — 2 13/16	— ⅛	5 15 8
Monte Video Telephone, Ord.	1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 14 8
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101	+ ½	4 9 0
Oriental Telep. and Elec.	1	10	8†	2⅛ — 2⅜	..	4 4 3
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	8 — 9	..	11 2 2
Submarine Cables Trust	Cert.	6	6	127 —130	+1	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 —100	+1½	4 10 0
United River Plate Telephone	5	8	6†	6⅜ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 9 0
West Coast of America	2½	2½	..	1 3/16 — 1 7/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	1½	2⅜ — 2⅝	..	4 15 8
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞ — 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref.	10	6	6	9 — 9½	..	6 6 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	10	7	7	13⅜ — 13⅞	+ ⅛	5 1 11
Do. 4 % Debs.	Stock	4	4	95½ — 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	95 — 98 xd	+1	4 11 10

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

A new Cinematograph Projector.—A new type of moving film projector, which has been particularly designed for lecture and educational purposes by Messrs. L. Kamm & Co., the patentees, was recently demonstrated at the Polytechnic, Regent Street. The apparatus embodies a device by which the film can be stopped, when required, without the danger of a celluloid film catching fire or of the gelatine coating melting in the case of a non-flam film, and thus allows time for the lecturer to demonstrate any special feature of the picture. This result is obtained by using a special form of shutter, situated behind, and in close proximity to, the film, each shutter blade being formed of two or more fan-shaped sectors. The shutter blades not only intercept a large amount of heat in revolving past the gate, but also blow air on to the film and keep the gate cool as well. The shutter is driven from the main projector drive and clutched to the film driving mechanism, and the clutch can be operated either by hand, or by an electromagnet controlled from a distance by the lecturer, this, of course, stopping the film, while the shutter continues to blow air on to it. Incidentally, the numerous and lengthy sub-titles which occupy a considerable amount of film can be replaced with a very short title section. The arrangement will undoubtedly add to the value of the moving-picture demonstrations for many purposes.

REVIEWS.

Application of Power to Road Transport. By H. E. Wimperis, M.A., M.I.E.E. London: Constable and Co., Ltd. Price 4s. 6d. net.

The electrical engineer, in perusing the series of six lectures delivered by Mr. Wimperis at the Finsbury Technical College in 1913, which form the basis of the work under review, naturally turns first to learn something of the author's views on the subject of the application of electric power to road transport.

Up to the present time, as the author says, "little has been written upon this subject," and "there is a paucity of published experimental data to serve as a substantial basis for design." But of petrol-electric systems more is known, and Mr. Wimperis goes into details of the Tilling-Stevens, Thomas and Macfarlane-Burge systems, details that are presented in a handy form for comparative purposes. Of electric road vehicles pure and simple there are, of course, only two main types—the storage battery vehicle and the trolley omnibus. Of the former we are told that 20,000 are in use in the United States—a remarkable contrast to the undeveloped state of the electric vehicle industry in this country, though possibly the advent of the Edison battery may improve our position. Mr. Wimperis shows that with energy at ½d. per unit an electric vehicle weighing 29 cwt. can be run for 0.167d. per ton-mile, the best figure for a corresponding petrol vehicle being 0.25d., which demonstrates that the electrical vehicle should be able to hold its own as far as power costs are concerned.

Trolley omnibuses, we agree, have not been running long enough to enable complete comparisons to be made with existing electric tramways. The system certainly does not present any special problems of scientific interest, since its electrical side is so similar to that of the electric tramcar, which has already been brought to a high state of perfection.

As the inventor of the accelerometer which bears his name, and which is adequately described, Mr. Wimperis has much to say on the subject of road tests and how these should be carried out. He suggests an ingenious method of testing on the road a car's potential hill-climbing powers in level country where no road undulations are available.

Much of the volume is of an elementary and historical character—we are reminded again of Macaulay's moralizing on the advantages of intercommunication of peoples—but nevertheless it is well and interestingly written, and is quite up-to-date, details being given of recent official trials conducted by the Technical Committee of the Royal Automobile Club.

The Practical Metallography of Iron and Steel. By John S. G. Primrose, A.R.T.C., A.I.M.M. Manchester Scientific Publishing Company. Price 3s. net.

Metallography is one of the newest sciences, and one which is of immense practical value. So accustomed have we become to judging metals by their structure as revealed by the microscope instead of by fracture only, that it is difficult to believe that twenty years ago the science of metallography was practically unknown.

Every steel works, and most important engineering works, nowadays employ skilled metallographists, whose business it is to examine under the microscope specimens of the metal produced or worked, and generally to obtain by photographic means a permanent record of the metal examined.

How such practical work is best undertaken, in the light of the latest researches, is well explained by Mr. Primrose in the book under review, with the aid of a wealth of microphotographs, of the excellence of which there will be no reason to doubt when it is said that the majority of these are by that pioneer in the world of metallography—Dr. John Edward Stead. The name of the latter scientist we note for the first time to be used to form the coined word "Steadite," meaning the eutectic of iron phosphide and iron.

Mr. Primrose's chapter on the heat treatment of iron and steel is very helpful, for so much depends nowadays on the exactness of the thermal treatment of metals, many of the newer alloy steels being ruined if the heating, quenching, and reheating are not done with absolute precision.

We do not remember having seen the subject of the pathology of iron and steel dealt with so fully before, and commend this feature of the present work. It would be desirable if the specimens examined by Mr. Primrose could be used to form the nucleus of a Pathological Museum of Iron and Steel similar to that established for the non-ferrous metals by the Institute of Metals.

In an Appendix, the author deals with the latest metallographic apparatus, but we would suggest that in future editions the advertisements appearing opposite the text in this section should be placed elsewhere. It is quite unusual in a work that has claims to be of a scientific character for advertising matter to be interleaved as has been done by the publishers of Mr. Primrose's otherwise commendable little handbook.

Electrical Meters. By Cyril M. Jansky, B.S., B.A. London: Hill Publishing Co. Price 10s. 6d. net.

Why do all the good books come from America? We do not wish to say that all the books that come from America are good, even when they are technical; but of useful books, serious contributions to technical literature, by competent and responsible authors, there is decidedly a boom over there and a slump in this country. So, at least, it appears to a fairly busy reviewer.

The present work is by the Associate Professor of Electrical Engineering in the University of Wisconsin, and belongs to the Engineering Science Series, prepared in the Extension Division of that University.

It may be, though we think it is not, known to our readers, that Professor Ely, of Wisconsin, delivered in May of last year, a course of six lectures at the London School of Economics and Political Science, on "The General Conception of Property in Economic Theory." The present reviewer attended these lectures, and was very favourably impressed by the clearness of exposition and grasp of the subject displayed by Professor Ely. The impression created by Professor Jansky's book is equally favourable, and we congratulate students at Wisconsin upon the presence on the University staff of two such men as these.

The book contains twenty-two chapters, and deals in the most exhaustive manner with the principles involved, and with the practical application of those principles. To some of the chapters the author appends a summary, with examples. This and an occasional lapse into the class-room manner are the only apparent signs of his professorial capacity—that is, that the book is primarily intended for students. Take, for example, p. 295, where he suddenly asks the question: "Can you explain this?"

In the preface Professor Jansky thanks manufacturers for supplying him with information and pictures. British manufacturers would be equally pleased to do this for British professors, but how often are they asked to do so? Much has been heard in recent years of "Co-operation in the electrical industry," and useful work has been done in this direction, with very beneficial results. Do not let us overlook the fact that electrical engineering is a scientific profession, as well as an industry. Co-operation, therefore, is necessary between all branches; between thinkers and constructors, between educators and educated, between theoretical and practical, between scientific and commercial. And although universities and colleges could not afford, and would never find it desirable, to buy a complete range of apparatus from every manufacturer; and although manufacturers could not afford to present a complete range of goods—meters or what not—to every educational institution; still something might be done by means of a common fund, out of which a representative selection of instruments might from time to time be purchased, say at cost, and sent round for the purpose of being lectured upon and demonstrated. The teachers and students would gain up-to-date knowledge, and the manufacturers—well, a fine advertisement, if nothing more.

To return, however—of course everything described, with very few exceptions, is American. We think Professor Jansky might usefully have referred a little more copiously to British and European practices. We have Weston voltmeters and ammeters, but no mention of Elliott Bros.; a woodcut of, and dissertation on, the Siemens dynamometer, but no mention of Siemens, either in this or any other instrumental connection; full descriptions of everything, obsolete or not, that the General Electric Co. has ever put forward, but no mention of the work of the British Thomson-Houston Co., or of the A.E.G., which has, in our opinion, frequently resulted in material improvements; a paragraph on the obsolete and almost forgotten Edison zinc-in-zinc-sulphate electrolytic meter, and—welcome exception to our complaint—a page or so on the Bastian, but no mention of the fifteen years of work that Reason has done in the electrolytic world; a description of the "maxicator," but nothing about Merz.

For Americans, these may not be serious matters, but for author and publishers, such points tend to restrict sales in this country, though the book is well worth reading in spite of these omissions.

We are glad to note that Professor Jansky is strict in his use of words. A meter for measuring the supply of electricity is not a "wattmeter," nor even a "recording wattmeter," although responsible firms have sent out meters bearing these descriptions. Moreover, electrolytic meters are always ampere-hour meters, although frequently misnamed watt, or even watt-hour, meters. Again, he is particular to point out that the percentage accuracy of an instrument should be given with reference to true value, not to indicated value. If the latter method is used, a meter indicating 25 per cent. of the load upon it is described as 300 per cent. slow, which means, clearly enough, that you must add to the meter's indication three times the value of that indication, or that the error is three times the reading. It is much better, however, to give the error as 75 per cent., meaning that that proportion of the true value is not shown.

In connection with supply meters, we observe, on p. 339, the statement: "Other things being equal, the watt-hour meter whose torque-weight ratio of moving element is largest, is the best meter." The saving clause, "other things being equal" just redeems this from being a mere reiteration of a parrot-like tag which was, some years ago, repeated *ad nauseam*. The form of the bearing, and the moment of inertia of the rotating part, are of more importance than weight, as such; and torque must bear a reasonable relation to losses, as well as to weight. We have no hesitation in saying that a great deal of nonsense has been talked on this point by manufacturers, with results that they now rue.

In the consideration of sources of error, reference is made to pen friction in recorders. This leads us to wonder if the intermittently-recording graphic meter shown, we believe, at the 1905 Olympia Exhibition, is still on the market. We must not fail to mention the—to us—new magneto-constriction type of ammeter, in which the current is indicated by the mechanical pressure induced by passing a current through mercury. If this instrument is known in this country, or on the continent of Europe, we shall be grateful for reference to it.*

Much more could be said, but space forbids. The few errors are typographical and immediately obvious. The book is properly indexed and methodically divided. It has interested us very much, and we congratulate the author upon it.

LEGISLATION? OR SAFETY FACTOR? IN MINING WORK.

By "COLLIERY ELECTRICIAN."

The Senghenydd Inquiry is now over, resulting in the usual clamour for further legislation.

It need hardly be pointed out that those who agitate for further legislation have little practical knowledge of mining work, especially of one section, which is a special branch to itself. The technicalities of electricity are as a sealed book to them, and as they do not understand it, they say "Throw it out." They have never considered that the safety of their members, numbering nearly 1,000,000, depends upon the competency of the electrician in charge, nor even considered the point of having a mining electrical expert permanently attached to their Representation Committee, but remain quite satisfied that an electrician is only worth a minimum wage of about 5s. per day net, equal only to a labourer's wage.

Take the evidence at the Senghenydd Inquiry on February 5th. Should such an electrician be allowed to be at a mine? It is not very complimentary to men who are competent electricians, to say the least of it.

On February 6th it was asserted that the signal bells rang continuously for three or four days after the explosion, upon which Mr. Smillie commented: "what a voltage there must have been!"

What a splendid advertisement for "Diana" cells if the bells were ringing continuously for three or four days on short or closed circuit!

Legislation may be very good when brought about by practical technical men, but what did the last revision of Electrical Rules bring forward:—

1. The appointment of a competent electrician to take charge of the plant and to be in daily attendance at the mine.

2. Increase in voltage on signal wires from 15 to 25 volts.

As regards item 1, the old rules stipulated a competent person should be on duty at the mine during the whole time the plant is running, and where 200-H.P. was delivered underground, a competent person should be on duty underground in addition to one on the surface.

Respecting item 2, it is now considered dangerous to use more than 9 volts because gas can be ignited with 11.9 volts, yet it has been proved conclusively that methane can be fired with the cell of an electric safety lamp at 3 volts only. It is now compulsory to have a water-gauge in fan houses. What use is this for an electrically driven fan run at a constant speed? Would not a recording ammeter be more indicative of faulty ventilation? Is the cry for mining electric safety lamps meant for greater safety or for better illumination at the coal face to enable the collier to increase his earnings? There is no doubt, of course, of its fulfilling both points, but which is foremost in the minds of the agitators? The extra 9d. per day seems to answer this. Any amount of agitation will not stop the collier from putting his pick point into the glass of an electric safety lamp or into the shield and gauze of an oil lamp or opening the magnetic lock of his lamp with a magnet of his own, or do away with his contempt of dangers underground.

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*See Elec. Rev., Sept. 24th, 1909, p. 505, and April 8th, 1910, p. 546.

If legislation is necessary, let it be in the proper direction.

If a manager, under-manager and other officials have to prove their competency by examination, why not the mechanical engineer and electrical engineer or electrician? What is necessary in maritime work should be necessary in mining work. The men who profess to know ask for one inspector for every 5,000 men, but say nothing as to one electrical inspector for 1,000,000 men or over 4,000 mines.

Taking into consideration the large amount of electricity used in mines to-day there is every scope for an electrical inspector to be attached to each mining district, not to act as a policeman to work up prosecutions, as the majority of present inspectors are doing to-day, but as advisers to colliery owners, managers, etc. in the first instance, and as policemen afterwards, if necessary.

What good would a workman's inspector be to discuss electrical matters with a technical electrical engineer who has specialised in mining work?

Perfect *ventilation* and perfect *insulation* are *the* factors for immunity from explosions or accidents from electrical causes, and any pit to-day should be absolutely safe if there is efficient ventilation. Why be satisfied at so many cubic feet of air per man? Why cannot the pit underground be as well ventilated as the underground railways in London? Stronger air currents will dilute gas to a non-explosive mixture and tend to carry away a lot of the dust which accumulates, and make underground workings as safe as an open-air quarry.

One of the objects of the Association of Mining Electrical Engineers is "To consider means for minimising the risks attending the application of electricity to the industry of mining and to promote the adoption of approved methods and devices tending to increase safety."

The founders were practical men who realised that a great safety factor lay in the determining first of the qualifications of those in charge of mining plants by examination, but apparently the last Commission were too shortsighted to see it. A Home Office certificate would relieve the manager of a lot of worry as to the competency of the electrician under him and make the electrician realise his responsibilities and official position all the more, especially if more visits were paid to collieries by *electrical* inspectors.

The Association hold their own examinations, certainly, but what good are the certificates granted except for framing? Even Mr. R. Nelson, H.M. Electrical Inspector of Mines, considers the examinations too academic, but does not offer suggestions as to Home Office examinations or certificates, as is compulsory with other mining officials.

For the benefit of the electrical trade and those engaged in connection with it, the Council of the A.M.E.E. ought to show the non-technical agitators that they have interests at stake as to the safety of electricity in mines, and of underground workers, and prove by their endeavours that they are just as much alive to the necessity of further legislation if it is needed.

Mining electrical engineers in actual touch with mining work should be qualified to speak and act on behalf of themselves and members of the same profession, and it is in the hands of the members to see that these men are appointed on the Council to represent them, if they consider that the Council is not sufficiently progressive at the present time.

Compulsory certification of mining electrical engineers or colliery electricians should be pressed forward and insisted upon. This would wipe out a lot of ignoramuses at present in charge of plants, tend to greater safety, give more confidence as to the safe working of electricity in mines, and elevate the status of those engaged in such applications, and, finally, wipe out of the minds of the non technical section of the mining industry the prejudice existing against the use of electricity in mining work.

This procedure would fulfil the question of perfect *insulation* as a chief factor of safety and the ques- to the colliery manager to come under his jurisdiction of perfect *ventilation*, of course, should be left tion.

HIGH-SPEED BEARINGS.

By GERALD STONEY, F.R.S.

(*Abstract of a paper read before the* N.E. Coast Institution of Engineers and Shipbuilders, *March 27th*, 1914.)

Tests show that so far as friction is concerned it is not well to use a large shaft and a long bearing, but experience shows that for high speeds and heavy loads long bearings are necessary, and they have also to be large to avoid vibration and critical speeds, and the risk of fracture due to vibration. To avoid this latter danger the bending stresses have to be kept to a figure which would be considered very low in ordinary practice, as there have been several cases of fracture of shaft ends. If the pressure is too high or the oil is too thin a bearing may run all right so long as there is no vibration, but if vibration occurs the oil film may be driven out and seizing take place. This is especially liable to happen with the shafts of electrical machinery, such as the armatures of dynamos and rotors of alternators, where there is always a liability to vibration occurs the oil film may be driven out and seizing that much lower pressures are advisable in such cases than in those of turbine rotors, which from their construction are not, as a rule, so liable to go out of balance.

This effect is reduced in very high-speed shafts, above, say, 2,000-R.P.M., by the use of the well-known Parsons flexible bearing, where there are two or more tubes outside the bearing bush with a small clearance between them in which the viscosity of the oil tends to damp out vibrations. In turbine work, a rule much used for deciding the size of bearings has been that the product of the speed by the pressure should not exceed a certain figure, but it is doubtful whether this rule is of much value, as it really assumes greasy friction and not perfect lubrication. In land work a product of 5,600 has rarely been exceeded, or 75 lb. per square inch at 75 feet per second. At lower speeds, higher pressures are used satisfactorily, as, for example, at about 35 feet per second a pressure of 130 to 150 lb. per square inch is admissible.

In a discussion on Prof. Christie's paper before the American Society of Mechanical Engineers in 1912, Hodgkinson stated that speeds of 80 feet per second and 100 lb. per square inch were commonly employed in America, and where there is no risk of heavy vibration there does not seem any reason why higher pressures should not be used. It has to be remembered that the heat to be carried off does not increase with the pressure, and that the real danger lies in the possible breaking down of the oil film by excessive pressure or vibration.

The temperature of the oil is limited by its loss of viscosity at high temperature, and by its liability to carbonise and oxidise and thus cause deposit in the pipes, oilways, etc. In land practice temperatures of 120 to 140° F. are common, but it is not well to go above 150 or 160° F., as most oils seem liable to oxidise and cause deposit above this temperature. At about 250° F. most oils cease to lubricate, as their viscosity becomes too low.

The friction is approximately inversely proportional to the temperature measured from freezing point, but after a certain temperature the friction rapidly increases and seizing takes place, due to the loss of viscosity.

In all high-speed bearings artificial means have to be used to carry off the heat, radiation from the bearings not being sufficient. The general plan is to have such a flow of oil through the bearing as to cause the heat generated to be carried away without an undue rise of temperature. Water-jacketing the bearings has been used in some cases, but it is not as satisfactory in general as the plan of supplying sufficient oil to carry off the heat. Oil coolers have therefore generally to be provided to cool the oil.

In some cases also the oil is circulated round the outside of the bearing in suitable passages so as to assist in cooling it, and this is probably necessary in the case of very large bearings running at high surface speeds. The heat to be removed is not only that caused by friction but also that caused by conduction from the steam; on the other hand the bearings near the condenser are cooled by the exhaust steam and heated by the gland steam. From Lasche's tests the heat produced in bearings running at a temperature of about 122° F. is that due to a shear of the oil film of about 0.46 lb. per square inch of the projected area, and this gives as the B.Th.U. per hour:—

$$\text{B.Th.U.} = 2.1\ d.l.v.$$

where d is diameter of bearing in inches; l is length of bearing in inches; v is surface velocity in feet per second.

The constant varies inversely as the temperature above freezing point.

It may be taken that this is approximately the heat that has to be carried off by the oil. Taking the specific heat of oil to be 0.31 and allowing a rise of 10° F. in the oil we require 20 lb. or about one-third of a cubic foot of oil per hour per square inch of projected bearing surface when the surface speed is 30 feet per second, and 40 lb. or two-thirds of a cubic foot of oil per hour with a surface speed of 60 feet per second. In practice these quantities are often increased by from 30 to 50 per cent. to allow for the unequal distribution of oil between the bearings and to ensure that there is no undue heating, also in some cases to allow for the flow of heat from the steam.

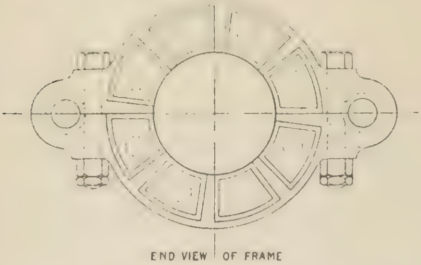

Fig. 1.

Thrust bearings are generally of the usual collar type, with the bottom and top halves separately adjustable to take up end play, and in land turbines, which are practically balanced, the pressures are very low, never exceeding 20 lb. per square inch. There are no tests available as to the friction of such bearings, but it is probable that it is fairly high, as perfect lubrication is difficult to attain, and as an approximation the total area, that is the area of the top and bottom halves together, might be added to that of the main bearings in estimating the quantity of oil required and the surface of the oilcooler. Such bearings have generally a high co-efficient of friction, owing to the low pressures employed, since, as it is impossible for a wedging action to take place and thus admit the oil, such as occurs in the case of journal bearings, the lubrication is rarely perfect. Michell in 1905 devised a thrust bearing which would admit of perfect lubrication. In this thrust bearing there are segmental blocks pivoted at the theoretical centre of pressure, which is about 0.6 of the length from the leading edge. By this device perfect lubrication is attained and pressures up to 1,500 lb. per square inch can be safely carried at high velocities with a consequent reduction of the co-efficient of friction to about one-sixtieth of what it is in an ordinary thrust bearing. Another advantage is that the end play in the thrust bearing can be greatly reduced.

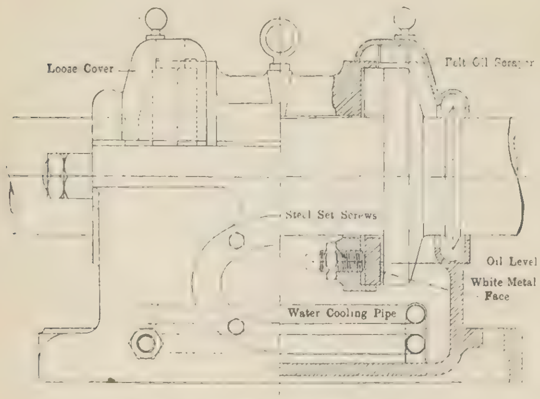

Fig. 2.

The same idea has been further developed by Sir Charles Parsons, in patent 8,266 of 1912, where the blocks are centrally pivoted, and it has been found that in cases where the pressure comes on gradually this works equally well in practice, and has the advantage that the shaft may run in either direction without the complication of shifting the point of support.

These principles have also been applied to journal bearings by Michell and Sir Charles Parsons, enabling greatly increased pressures to be used with a resultant reduction of the coefficient of friction and also a large reduction in the length of the bearings, and thus of the whole plant. The reduction of friction may in some cases reduce the consumption of steam between 1 and 2 per cent. in a turbine plant.

Figs. 1 and 2 show a thrust bearing of the Michell type designed by Mr. H. T. Newbigin for 23,000 lb. thrust at 550 to 570 revolutions per minute. The co-efficient of friction of such a bearing may be from 0.0008 to 0.003, and for such a pressure as 500 lb. per square inch may be safely taken as about 0.002, or say one-tenth to one-fifteen of that of an ordinary thrust bearing.

The Westinghouse Company of Pittsburgh made an interesting set of tests on such a thrust bearing for a steam turbine, the pressure being varied by throttling the balancing pipe to the dummy piston. The following are the particulars of this bearing:—

Outside diameter of collar ...	4¾ inches
Inside diameter of collar	2¾ ,,
Number of pivoted blocks	10
Total area of pivoted blocks ...	10.4 square inches
Revolutions per minute	3,470
Mean surface speed	54 feet per second

The blocks were of steel faced with white metal 1-16 in. thick, and were pivoted behind their centre of area, and with all the blocks in use 1,010 lb. per square inch was carried without heating. The number was first reduced to four blocks, and then to two, the corresponding pressures per square inch being respectively 2,620 and 5,420 lb. per square inch, which were carried without difficulty. The limit of pressure with such a bearing is the flowing of the white metal and not the failure of the lubrication; with pressures of 500 lb. per square inch there is an enormous margin of safety, and it is probable that three times this pressure will be found quite safe in practice.

CURRENT-LIMITING REACTANCES ON LARGE POWER SYSTEMS.

(*For abstract of paper read before the* Institution of Electrical Engineers, *see p.* 609).

Discussion at Birmingham.

Mr. F. H. **Clough** said that where large power supply undertakings existed, it was essential to take all reasonable means to ensure the continuity of this supply and the protection of the apparatus connected to the system. The use of large reactances between sections of the bus-bars might be considered as a semi-isolation; by properly proportioning these reactances the result of a short circuit or other breakdown could be limited to the section in which it occurred, but at the same time power might be supplied to any particular section from the adjacent ones so as to maintain the continuity of supply on the generators and also in the outgoing feeders, protected the that particular section. The use of reactances in series with apparatus rather than maintained the continuity of supply. Small generators could undoubtedly be designed so that they did not need reactances to protect them. For large generators they could be dispensed with provided close voltage regulation was not necessary, and in most cases it was not necessary. If a serious fault occurred in the winding of an alternator, it was usually sufficient to damage the machine very seriously, even if it were running by itself, and therefore any additional flow of current only made the burn-out more complete. When one looked at Fig. 1 (see page 610) and realised that wherever one reactance appeared on the diagram there must be three—one for each phase—one realised what a large space these must occupy, and wondered whether they could not be avoided. So far as the feeder was concerned it should be possible to make use of the Merz-Price and Merz-Hunter devices.

Mr. R. A. **Chattock** said that the importance of this paper could hardly be over-estimated in view of the altered conditions that had now to be met in the design and operation of large power houses. Reliability of supply must be one of the first considerations. It had been evident for some time that under certain conditions of operation, even the largest oil switches were damaged when they opened, and even on occasion failed to break the circuit, due to the enormous amount of energy that was concentrated on the bus-bars. This amount of energy was year by year growing larger, and it was evident that now the limit of safety in the switchgear had been reached. The proposal to sectionalise the switchgear by current-limiting reactances so that the energy to be dealt with by the switches now available might be kept within the limits of easy and safe control was one that would increase enormously the reliability of the supply. The chief objections to the use of reactance appeared to be the lowering of the power factor and the interference with the regulation of the voltage. A low-power factor could be met by designing the generators to supply the wattless current required and by providing for greater energy of excitation. This was the way in which one had to pay for the greater reliability of supply. The interference with the regulation was a more serious question. The balance of the load between sections must vary from hour to hour, and the constant adjustment of the voltage on the various sections of a large system, required by the insertion of reactances between them, must be a very difficult operation. The authors did not say much about this. Modern turbo-alternators usually had an internal reactance of about 12 per cent.; would they recommend this to be reduced and some of it put outside the generator, and did they consider that 12 per cent. total reactance would give sufficient protection? The point raised with reference to short-circuiting the bus-bar reactances through sub-station bus-bars, by means of feeders connected to different sections of the main bus-bars, could be met by dividing the sub-station bus-bars and inserting reactances between these sections. The possibility of overloading feeder cables by the angular displacement of the voltage was very undesirable and should certainly be guarded against.

Dr. **Kapp** thought that where feeder cables were joined by a ring main it would be advisable to have choking coils not only at the home end of each feeder as shown in the paper, but also at the far end. Such a precaution seemed to him unnecessary where the feeder was not a cable, but an overhead line, the inductance of which would be comparable with that of a choking coil; at any rate at the far end it would not appear to be necessary. Constructing the alternator so that the armature should contain a large amount of inductance was not practicable. One could not get high inductance without at the same time getting an unduly large armature demagnetising effect. External inductance would not worsen the regulation to so large an extent. The use of externally-applied inductances was quite compatible with good regulation, provided each generator was fitted with some kind of automatic regulator taking charge of the exciting current.

Dr. C. C. **Garrard** said that the introduction of reactances entailed a very considerable increase in complication of the lay-out of the generating station, but continuity of supply for public electricity supply stations was becoming of more and more importance every day. Was it not possible to construct turbo-alternators nowadays which would withstand dead short-circuits? It seemed that a solution of the problem of generator protection from this point of view might be attained. Another question was whether they had reached the limit of breaking capacity of oil switches. It appeared to be wrong to put in smaller switches and endeavour to limit the short circuit; rather should they spend the money in installing the proper size switches. If reactance coils must be installed in order to safeguard the oil switches, the use of a switch which in operating first cut in the reactance and then opened the circuit was to be preferred. In this case the reactance coil was normally short circuited. The first action of the switch was to remove the short circuit on the reactance coil, and the circuit was then opened after a certain time had elapsed. The really important point of view from which to regard this subject was that of drop in voltage. The reactance coils should be installed with the one object of preventing the volts falling to such an extent, in the event of a short circuit, as to cause synchronous machinery to drop out of step. Looked at in this manner it appeared that the reactances in the feeders offered the best solution. As regarded the use of iron-clad choke coils he did not quite understand the necessity of a "straight-line" relation between the voltage and the current. Did this simply mean that the iron must not get saturated to such an extent, on a short circuit, that the permeability fell to practically that of air? Dr. Garrard further stated he would like some further explanation of the "doubling effect." If the bus-bar was sectionalised by reactance coils, then each automatic regulator would have its pilot connected to that section of the bus-bar to which its own generator was connected.

Mr. H. K. **Trenchmann** said that two speakers had made reference to reactance coils and patent protective systems, from which it might be understood that these performed in some measure the same functions. This was not so, as current-limiting reactances were no more able to clear a fault than to prevent one occurring. No existing protective system could succeed in opening an oil switch before the current on a bad fault had reached quite large proportions, and it was almost impossible to plan a system of reactances which would successfully limit the fault current in any part of a large network, owing to its unavoidable complexity, and to the large amount of energy which might be fed back from almost any point of it. The cost of installing a bank of reactances into the run of a set of heavy bus-bars must be very much more than that of the apparatus itself, to say nothing of the extra space required. The designers of English generating stations had had, in the past, an unfortunate tendency to cut down the space for switchgear to an uncomfortably small amount, and the designs of most English oil switches reflected that tendency. An oil switch for dealing with heavy overloads must have a large body of oil, large clearances generally, and a good head of oil above the break; and many otherwise good designs were spoiled by an insignificant quantity of oil being allowed. An oil switch possessing only a little more than five inches of break had been tested with a dead short circuit on 23,100 H.P. of generating plant at 12,000 volts and successfully opened the circuit; the damage to the contacts, etc., was not sufficient to prevent it being closed easily afterwards. If some of the additional space were given to the oil switches and suitable designs of the latter installed, the use of reactances could be considerably curtailed in even the largest systems, and, further, the capacity of stations in which they were *not used at all* could be materially raised.

Mr. E. O. **Turner** said that if the armature winding of an alternator were regarded as a choking coil with a partial iron circuit, its reactance could be increased by simply burying the conductors deeper in the slots. Were this done the armature reaction would not be altered, and the regulation, especially at power factors of 0·8 and lower, would not be seriously affected. He would like to ask the authors whether this was feasible in practice, and whether generators having high reactance but normal regulation were being manufactured.

Mr. **Forrest** said Figure 1 showed a well-thought-out method of dividing up the bus-bars of a large power station by means of current limiting reactances, so that every oil switch installed there could be depended upon to open the circuit it controlled under conditions of dead short circuit. He supported the authors in their statement that it was very desirable to feed one sub-station, from one section only of the generating station bus-bars. One reason for this was stated in the paper; a second very important reason was as follows: —Assuming that a sub-station was fed from two sections, and that the sub-station bus-bars were divided so as to keep the two sections distinct, it was possible for these two sets of bus-bars to have a considerable difference in voltage. If this difference in voltage was steady, no particular difficulty arose, but in the event of a sudden transfer of load from one section to another at the generating station, a sudden rise or fall in the voltage of one of the sub-station bus-bar sections would also result. Since the whole of the sub-station rotary converters were connected in parallel by means of the D.C. bus-bars, a sudden rise or fall in voltage on one set of machines to the extent of, say, 5 per cent., would certainly result in something very like a temporary shut-down. The introduction of reactances between the feeders and the generating bus-bars must have a beneficial effect in preventing high-frequency potential surges set up in the net-work from unduly straining the insulation of the generators and switchgear.

Mr. E. P. **Hollis** said that engineers in charge of the operation of power schemes had accepted the benefits which it was claimed that reactance had, but a few of them had expressed the opinion that the whole of the reactance necessary could be embodied in the machine. It should, however, be realised that external reactance had special functions which could not be performed by internal reactance. Internal leakage reactance did not protect a generator against complete destruction by a heavy influx of power in the likely contingency of the generator breaking down. Internal leakage reactance did not protect the end windings of a generator against concentration of potential due to high-frequency current entering from the line. Once leakage reactance was embodied in the machine it could not be varied in value. Separate reactance coils were susceptible of such adjustment. It was doubtful whether the path of the leakage flux of many generators with large leakage reactance was adequate to enable that path to remain unsaturated on short circuit. An objection to reactance coils was that of cost. On the debit side of the balance sheet one had to place the interest and depreciation on the cost of the reactance, together with any additional sum which deserved to be debited owing to the floor space occupied by these coils. On the credit side one had to place a number of items, the exact value of which it was difficult to appraise, but which were nevertheless of great importance:—

(1) Insurance of the generators against breakdown from external short-circuits.

(2) Insurance against breakdown of the end-turns by high-frequency surges.

(3) Insurance of the protection of the windings from complete destruction in the event of an internal breakdown.

(4) A saving due to elimination of the necessity for quickly operating switchgear.

(5) Saving due to the fact that switchgear of a lower rating is possible.

(6) Saving due to the elimination of the necessity for installing elaborate protecting devices.

(7) Saving of penalties incurred due to complete or partial breakdown of the generating station.

Mr. A. M. **Taylor** said that Fig. 1 represented very closely the arrangements proposed for the new power station in Birmingham. The bus-bars were to be divided up into five sections, and the output on each section was 20,000 KW. What happened outside the generating station must on no account be overlooked. If the feeders from the various bus-bar sections led to common bus-bars in different sub-stations, the reactances in the generator bus-bars would be partially or entirely short-circuited by these trunk feeders. Even if the bus-bars in the various sub-stations were divided from one another by reactances, the reactances in the generator bus-bars were still partially short-circuited by these. Then again, most systems putting down stations of the size indicated would be already in possession of a station of perhaps one-third or one-quarter the size, which had to be paralleled on to one or more of the sections of the new station. He had reproduced in the figure herewith a rough approximation of the conditions which existed in a crowded town like Birmingham, where the whole of the power supply was concentrated within a comparatively small radius of the big generating stations as distinct from, for example, the Newcastle system, where the nearest large generating centres were some six miles apart. Allowance had been made in the diagram for the effect of synchronous machinery in the sub-stations. On the assumption that a short circuit occurred somewhere near the bus-bars "C," the admittance of the whole system into the section "C" had been worked out; it would be equal to 32 times the capacity of one bus section, or some 70,000 amperes. If they considered any one of a group of 5,000-kw. generators on one of the main bus sections, and assumed that the short circuit developed inside the winding of the generator, but near the terminals (which was, in fact, the position of greatest strain), there would be virtually no reactance between the bus-bars and the short circuit if there were no external reactance inserted in the generator leads, and there would be a tendency for this enormous current to pass through a short part of the generator winding. Such a current would be 100 times normal full-load current of the generator, and it was pretty certain that the armature conductors would be instantly ripped out of their place and much more serious damage done than would obtain if the generator were merely short-circuited upon itself. If the generator was fitted, as it should be, with instantaneous protective gear, the oil switch should be open and the generator disconnected in, say, one-fifth of a second from the time of the short developing—*i.e.*, in five complete cycles. Under these conditions it was probable that any real amount of damage, due to the burning of the armature conductors, would be avoided (provided that the field circuit of the generator were also open), and, therefore, if the generator could be protected against the tremendous rush of current from *outside*, indicated above, no damage of any moment would ensue, and the cost of repairs would be comparatively trifling; damage to the field poles, which might necessitate sending the field away for repairs and be extremely costly, should be entirely saved. If, on the other hand, there were *no* external reactance in the case above considered, the conductors near the terminals would undoubtedly be ripped out of their positions in the first quarter cycle—*i.e.*, in one-twentieth of the time taken by the circuit breaker to operate—and enormous damage would be done by the time the circuit breaker had operated. The only safe way to determine whether or not reactances should be inserted external to the generators was to work out, in this way, the actual admittance to the faulty section and see whether the currents which would pass would be such as to test any part of the machine more severely than its own short-circuit current, under which it was tested at the time of purchase. If the machine was constructed with, say, an internal reactance of 8 per cent. and an external reactance of 8 per cent., and if it were short-circuited on its own internal reactance and would stand up to this, then it would be equally safe from the incoming current from the other generators as from its own short-circuit current. Another advantage secured by having an external reactance was that the external reactance might be placed far away from the generator and close up to the switchgear, and might be so arranged that there were no cable or dividing boxes between the main bus-bars and the reactance. The cable and the dividing boxes were then protected from the bus-bars as well as the machine itself. The authors suggested a 50 per cent. reactance in the various sections of the main bus-bars. When this reactance was traversed by one-half of the full capacity of one section of the bus-bars, a condition that should certainly be made, there would be a 25 per cent. drop of voltage across the reactance, and this difference of potential would be perpetuated right away to the feeding centre or sub-station. Reactances had undoubtedly come to stay, and were a prime necessity in the bus-bars of a system of 100,000 kw., but the space taken up by them was very considerable, and their effect upon the power factor of the generators was also rather serious. About two years ago he worked out a switch which would short-circuit a section, or sections, of the reactance during normal working, and when the rush of current came it would open and deflect the current through the reactance in a period of time of the order of one five-hundredth part of a second. This switch had been fully designed and all the calculations had been verified, and he was now awaiting an opportunity of performing a crucial test upon it on a large scale.

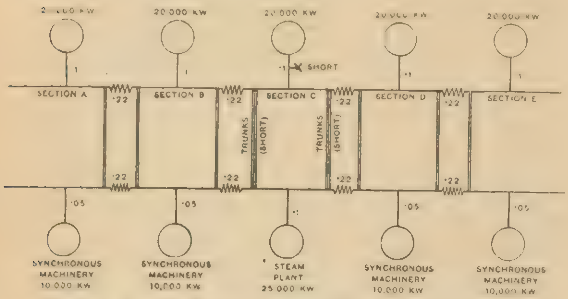

Diagram of Arrangement Proposed for Birmingham New Station.

Bus-bar reactance taken at 22 per cent.
Generator ,, ,, 10 ,,
Rotary Converter ,, ,, 5 ,,
Total discharge into Section C = 70,000 amperes, neglecting "doubling effect" = 140,000 amperes, including it.

Dr. Kahn said that the necessity of using current-limiting reactances in large alternating-current supply systems had been generally recognised; on the other hand it was certainly desirable to restrict the use of this apparatus to a minimum, as apart from the additional cost such apparatus required considerable floor space and introduced an additional piece of apparatus in the already complicated system. It seemed to him that the best compromise which could be effected was to put the reactance in the bus-bars, and to use alternators with as high a reactance as possible. The reactance in the alternators themselves would then, to a large extent, take the place of reactance in the alternator circuits, and in the feeder circuits. This had at the same time the advantage of reducing the current flowing in the alternator in the case of any breakdown on the terminals, and gave a more efficient machine. In large turbo-alternators the bulk of the losses was made up by iron loss and windage loss. By increasing the reactance the flux in the machine could be decreased with a corresponding decrease in iron loss. Further, the length of the machine could usually be decreased, and the amount of cooling air required could also be decreased due to the reduction in iron loss. As the windage loss depended on the amount of air required, and on the cylindrical surface of the rotor, which could both be reduced on machines with high reactance, the windage loss of such machines would be lower than the loss in the machines with low reactance. The coarser voltage regulation of the machine due to the higher reactance was of minor importance, as machines of the size in question were invariably used in connection with automatic regulators, and the load in stations for which reactance coils were required was usually steady.

HOME OFFICE RULES FOR FACTORIES AND WORKSHOPS.

A Sub-Committee of the Switchgear Section of the British Electrical and Allied Manufacturers' Association recently asked H.M. Electrical Inspector of Factories for his guidance towards the settlement of certain difficulties which they found to arise on the Electrical Regulations issued by the Factory Department of the Home Office (Factory and Workshops Acts, 1901 and 1907; Electrical Regulations [Form 928: February, 1910.])

Mr. G. Scott Ram very courteously welcomed the suggestion of discussion with him, and the Sub-Committee, during the latter part of 1913, waited upon him several times and fully discussed their difficulties. As a result, all present questions of interpretation have been set at rest, and Mr. Scott Ram's answers are now embodied in the agreed text given below which, it is understood, will be added to and form a part of the existing text of the published Memorandum on the Regulations as soon as a new edition is printed. In order to facilitate the reading of this text, the questions put by the Sub-Committee, as well as Mr. Scott Ram's answers, are given. We are indebted to the Secretary of the Association for the particulars:—

Protection of Cables: Regulation 2: Page 16.

Question 1.—It is not clear from the Regulation or the Memorandum exactly what cables should be armoured. Advice is required on this point.

Should an inter-connecting cable for coupling up two E.H.T. switchboards in one station be armoured or otherwise protected, or is it sufficient to rely upon the lead covering or, in the absence of such, the cable insulation? This applies to all cables other than those in trenches.

Note to follow par. 1, page 17.

Answer 1.—In electrical stations it is not sufficient to rely on the insulating coverings of high-pressure or extra high-pressure cables, as although the cables may be safe to handle whilst the insulating material is new, they may after a few years become dangerous to touch. Such cables should therefore be "further protected" by lead sheathing or metallic armouring or casing. Armouring or equivalent protection is required where the cables are liable to mechanical damage. The protection of tail ends of cables at generators, motors, transformers, etc., should not be overlooked.

Unarmoured cables of whatever pressure, especially those having rubber or bituminous insulation, if brought close together as in trenches or at switchboards, should be prevented from touching and where practicable should be separated by fire-resisting casings or divisions, either single or in groups, to prevent the spread of fire from one cable or group of cables to another. Where such cables pass through floors, the latter should be constructed of fire-resisting material, and where practicable the openings therein should be closed up with fire-resisting material so as to prevent the possibility of fire passing upwards.

Regulation 5.

Question 2.—Is it permissible to mount main fuses behind switch panels, provided the correct dimensions of passage-ways are adhered to? This arises particularly in respect of medium-pressure switchgear, where for economical reasons and possibly for the sake of simplification of connections, fuses are sometimes mounted behind the panels. This also involves Regulations 16 and 17 (a).

Note to follow par. 4, page 21.

Answer 2.—It is undesirable for similar reasons that main fuses should be placed behind the panels of low-pressure or medium-pressure switchboards. The blowing of a fuse, particularly under heavy short-circuit conditions, on a station switchboard, might readily lead to a short-circuit between other neighbouring conductors.

Similarly as regards small fuses for instruments, pilot circuits, etc. If placed at the back of the switchboard they should be guarded so that an arc cannot extend to other conductors, and their position as regards accessibility for purposes of renewal without danger to the attendant should be carefully considered (see under Regulation 16). Small bare wire lighting fuses have sometimes been used as instrument fuses on station switchboards, but they are quite unsuitable, as they would be unable to clear on a short circuit. A good type of enclosed fuse having ample break, or an efficient fuse of the "cartridge" type, should be used. Unless protected by a switch, all such fuses should be so constructed or mounted that they can be handled without danger of touching the live parts (Regulation 3 [c]).

Note to follow par. 1, Regulation 16, page 38.

Answer 2 (*a*).—It is particularly undesirable that main fuses should be placed behind switchboard panels. There is obviously more danger to the attendant in inspection and renewal of fuses so placed than if on the front of the board. Similarly as regards small fuses for instruments, etc., these should never be placed behind the switchboard panels in positions involving danger to the attendants, *e.g.*, close to bare bus-bars or other conductors, involving danger to the attendant in renewing them through contact with the conductors and sometimes involving risk of making short-circuits between conductors (see also, under Regulation 5, par. 2).

Area set apart for Switchboard: Regulation 15.

Question 3.—Advice is required as to exactly what is meant by an area "set apart for the purpose." Manufacturers generally have been under the impression that an electricity station in itself could be regarded as such an area, but recent recommendations by H.M. Electrical Inspector have shown this interpretation to be incorrect, and in order that switchboards proposed by manufacturers should uniformly comply, it is advisable to elicit his advice.

Note to follow par. 1, Regulation 15, page 38.

Answer 3.—In electrical stations, there are often auxiliary switchboards away from the main switchboard, *e.g.*, near rotary converters or in the boiler-house or in condenser pits or pump rooms, etc. Such switchboards are not in an "area set apart for the purposes thereof" if they are placed where people are liable to pass close to them for purposes other than for attendance thereon. In such cases it is necessary, in order to effect the setting apart, to place a rail or fence so as to prevent persons passing along the working platform, or behind if there are bare conductors exposed at the back. If a switchboard is placed where the working platform or back passage-way is used as a passage for other purposes, and consequently is not in an "area set apart for the purposes thereof," it will require to be fenced or enclosed accordingly, and if the space for the working platform or at the back is less than that required by Regulation 17, the apparatus and conductors will require to be totally enclosed, the switches being provided with covers, as on an ordinary factory motor panel.

In transforming sub-stations, the switchboard passage-ways and working platforms are seldom required for purposes other than for the switchboard, but if otherwise used, *e.g.*, for access to a store room, fencing or guarding of the switchgear is required.

Two-panel Switchboards against Wall, Regulation 17.

Question 4.—Where boards are installed consisting of two panels only is it permissible to place these near to a main wall and allow for inspection at either side providing no passage-way?

As addition to end of par., page 41.

Answer 4.—Sometimes narrow switchboards are placed so close to a wall that there is no room for a person to get behind, and there is, in consequence, no "switchboard passage-way" at the back. Although the connections and other parts at the back may be within reach for cleaning, tightening nuts, etc., by the attendant merely putting his arm behind, the arrangement is obviously not desirable for boards which cannot in practice be made dead, as there is risk of danger from shock or burns through short circuit in working thus in such a confined space, and the arrangement would be contrary to the requirements of Regulation 1. Where the exigencies of space require that a board, which cannot in practice be made dead, be placed close up to a wall, the connections and all parts which may require attention should therefore be on the front.

Adequate Means of Access, Regulation 17.

Question 5.—For E.H.T. switchboards, is it necessary to provide means for exit at each end of the passage-ways? This seems to be advisable.

For insertion after "cut off" in line 21, page 40.

Answer 5.—It is difficult to make a definite rule as to where there should be alternative means of access, as the danger of a person being trapped in a passage-way depends not only on the length and width of the passage-way, but also on the power available to maintain an arc should one occur, that is to say, on the power which is being supplied to the system. Thus in a short passage-way, say only ten feet in length and of the minimum prescribed width, there might be danger to a person at the far end of the passage in case of an arc occurring at the panel nearest the entrance should there be a large amount of power on the system. Generally, therefore, it is necessary that there should be means of access at each end of a "switchboard passage-way." On the other hand, if the passage-way is very wide, say two or three times the minimum prescribed in Regulation 17, a second means of access may be unnecessary in stations of moderate power.

Protection by Screens and Doors, Regulation 18 (a).

Question 6.—Are either hinged or lift-down doors considered to comply with the requirements for enclosing, which also stipulate that the passage-way must not be obstructed? Hinged doors are obviously advantageous for convenience of operation in certain cases, but it is possible that with such doors the passage-ways must in many cases be temporarily obstructed.

Note to follow par. 1, page 42.

Answer 6.—In the protection of cells by screens or doors the following points should be considered. For most purposes where lift-off screens are used they are preferably made of non-metallic material, such as asbestos slate, as being lighter than iron and less dangerous in view of their being allowed accidentally to touch a live conductor in being lifted on or off. Where doors hinged at the side are used, in order that the passage-way should not be blocked or unduly obstructed, they should be made capable of opening 180°, and there should also be at least 15 inches space between the edge of the door when open 90° and the opposite wall of the passage. Where necessary, in order to provide this clearance, the doors should be divided down the centre, each half being hinged on either side of the cell. Doors may be conveniently arranged to slide on runners, in which case there should be two lines of runners, the doors being hung alternately on the front and back runners, so that any door may be opened without having to move others. Doors of expanded metal offer the advantage that the apparatus can be seen without removing the protection.

Protection otherwise than by Screens or Doors, Regulation 18 (a).

Question 7.—In certain instances, where rooms have been reserved purely for E.H.T. switchgear, it seems unnecessary to provide screens in the front of the cubicles, and advice is required as to whether, in such cases, provided the rooms are kept locked and only accessible to authorised persons, such screens are necessary. An instance can be given, where such screens were recommended, which shows that this matter can be advantageously discussed.

Note to follow new par. 2, page 42.

Answer 7.—Where protection by a rail is adopted, the rail should be at such a distance out from the cells that it is impossible for a person to touch a live conductor from outside the rail. Although only authorised and competent persons (Regulation 15, second par., and Regulation 28) are allowed in such rooms or passage-ways, and there is little danger so far as ordinary routine duties are concerned, this method of protection is not recommended, as when any work has to be done (*e.g.*, cleaning) temporary screens must be provided (Regulation 18 [d]), and experience shows that even authorised and competent persons will take risks, some of which have resulted in serious and even fatal accidents, merely to save themselves the trouble of putting up the temporary screens provided. It is therefore far better to provide permanent screens in the first instance.

Screening of Isolation Switches, Regulation 18 (d).

Question 8.—Where isolating switches are installed to disconnect oil switches or for other purposes, certain instances have arisen where H.M. Electrical Inspector has recommended barriers to be placed between such isolators and the oil switches to protect the operator.

Where isolators and other apparatus, such as current transformers, are mounted in the same cubicle, cannot the transformers be considered as a part of the main conductors, or is it necessary to insert further barriers between such apparatus and the isolating switches?

Note to follow par. (d), page 42.

Answer 8.—Where isolating switches are installed for disconnecting oil switches or other apparatus (*e.g.*, potential or current transformers) or conductors which it may be required to make dead for working upon, the isolating switches should be placed in a separate compartment so as to be entirely screened when the work is in progress.

Temporary screens, although permitted by the Regulation, are not recommended for new work, as experience again proves that even "authorised persons" will fail to use them when provided, and fatal accidents have occurred from such neglect.

Where, however, in existing switchboards, temporary screens are relied upon for screening off the live side of the isolating switches, safe means should be provided for their insertion by the provision of suitable guides.

Screens between phases, Regulation 14 (d).

Question 9.—On E.H.T. installations, under what circumstances are barriers required between adjacent phases? This point has been raised on different occasions and some ambiguity exists.

Note to follow first par., page 38.

Answer 9.—On high-pressure and extra high-pressure switchboards of 2-phase and 3-phase systems, it is desirable that there should be divisions between the phases at all places where an arc is liable to be accidentally started, *e.g.*, at isolating switches, and sufficient space between the conductors of the different phases should be allowed for this purpose.

Provision of Isolating Switches on both sides of Oil Switches on Feeders, Regulation 22.

Question 10.—No provision appears to be made for protecting life by calling for isolators on both sides of each feeder oil-switch when the same could be alive from a sub-station and thus be a source of danger. Manufacturers differ in their views, but they agree that, were some standard adopted it would be beneficial, as, seeing that competition is largely on price, there is a definite tendency to omit such safeguards in order to cheapen the cost of the switchgear installation.

Note to follow par. on Regulation 22, page 46.

Answer 10.—On high-pressure and extra high-pressure switchboards, it is recommended that isolating switches should be placed on both sides of oil-switches on feeder circuits where the feeders are capable of being made live from the distant end.

Potential Transformer Fuses, Regulation 5.

Question 11.—Certain shunt transformers are constructed with the E.H.T. potential fuses mounted immediately above. Is there any objection to this arrangement; and what facilities for shutting down the switchboard must exist to comply with the correct interpretation of the Electricity Regulation?

Note to follow last par. under Regulation 5, page 27.

Answer 11.—On high-pressure and extra high-pressure switchboards, the bus-bar potential transformers and their fuses, which are generally attached thereto or placed elsewhere in the same compartment, should be protected by isolating switches placed in a separate compartment of the switchboard, so that by means of the isolating switches the transformers and the fuses and all conductors in their compartment can be made dead. This protection is needed in view of the requirements of Regulation 18 (d) should the transformer require attention, as well as in regard to the requirements of this Regulation (5). The objections to the renewal of the fuses whilst the contacts are live are the risk of accident to the attendant through touching a live conductor, even though insulating tongs are used, and through violent rupture of the fuse should one be replaced on a short-circuit due to a faulty transformer.

Definition of "high-pressure."

Question 13.—Are combined traction and three-wire supply switchboards, where the difference of pressure between the positive traction conductors and one of the conductors of the three-wire system exceed 650 volts, to be regarded as high-pressure switchboards?

Answer 13.—In combined traction and three-wire direct-current supply stations, both the traction and three-wire systems are sometimes taken to a common switchboard. Each system by itself is of medium pressure, generally 500 volts for the traction system and a maximum of 500 across the outers for the general supply system. As the traction system has the negative pole earthed, and the lighting system has the neutral conductor earthed, there will be a pressure of 750 volts or so between the positive traction conductor and one of the outers of the supply system. This difference of pressure, although exceeding 650 volts, the limit of medium pressure, exists only between two different systems, and the high-tension regulations do not therefore apply to the switchboard. It is important, however, in such cases, that the fact of this larger difference of pressure between certain conductors should not be overlooked, and particular attention should be paid to the requirements of Regulation 14 (b), (c) and (d).

To follow last par. under Regulation 14, page 38.

In combined traction and lighting switchboards, it should not be overlooked that the pressure between certain conductors will be the sum of the pressure of the traction system and that of one side the three-wire system. Particular attention should therefore be given in regard to such conductors to the requirements (b), (c) and (d) of this Regulation. See also under definition of "high-pressure."

THE OPERATION AND UPKEEP OF ELECTRIC MOTORS.

By E. F. BUTLER.

(*Abstract of an informal paper read before the* Junior Institution of Engineers, *on February 27th*, 1914.)

The objects of maintenance are twofold: first to run the plant with as few stoppages as possible, and secondly, to do so without excessive cost. To get the best results, the upkeep of the plant should be considered before it is installed, and it should be laid out with the objects kept in view of suitability, accessibility, the minimum number of sizes, and everything possible standardised so that the smallest number of spare parts and replacements need be stocked.

A large number of shops belonging to a certain firm were changed over to electric driving by degrees, the process extending over several years. Motors were bought one or two at a time, and, in some cases, simply replaced existing engines. As a result they have over 30 motors, seven of which are over 50 H.P.; out of 26 motors, there are 19 different sizes and nine different makes. If, at the outset, plans had been made to drive the whole of the works, and a modified group drive adopted, a lot of shafting and old-fashioned gearing would have been eliminated, and only about five sizes of motor would have been necessary. The additional first cost would probably have been recovered in less than three years.

In this case, the cost of upkeep is high, as there are too many sorts of motors to keep any spare parts, and so the running of the plant depends entirely on the personal element. One of the best installations from a maintenance standpoint, that is, plant laid out with the object of economical operation and upkeep, is a riverside warehouse handling peas, beans, grains, etc. These are conveyed, sorted, washed, dried, split and sacked. On deciding to go in for electric driving, the owner hired a motor and a recording ammeter. He spent six months in experimenting, and at the end of that time knew exactly what he wanted. As a result there are only three sizes of motors used, all well above their work, and one size of brush fits any motor in the place. Similarly, one of the biggest printing works in London has 130 motors with only four sizes. A spare motor and starter of each size are kept in stock; the complete motor or starter is changed, which takes under half an hour, and the repair is done properly in the workshop.

As one object of maintenance is to prevent breakdowns, an analysis of 100 breakdowns may be given. Thirty-eight were on motors and 62 on control gear.

Of the motors three had damaged shafts, one being broken, one bent, and in one case the armature was loose on the shaft. Six machines had bearing or lubrication troubles, namely, four throwing oil, one hot bearing and one bearing seized. Fourteen stoppages were due to brushes, brush gear, or commutator troubles; in five cases the brushes were worn out, in three cases they were sticking from dirt, in two cases the motor had flashed over due to dirty commutators, in two machines the insulation of the brush spindles had broken down owing to dirt, one machine had the holders loose on the spindle, in the remaining one the wire had become unsoldered in the thimble.

Nine motors had winding troubles, two being burnt-out field coils, four burn-outs were on armatures, in one case the shunt winding was in contact with the compounding, in another the end was knocked off a field coil during cleaning, and in one case there was trouble owing to bad connections between the lugs on the commutator and the ends of the armature coils.

Six were miscellaneous faults and included one earth on terminal box, two armature bands off, one pole piece loose, one wrongly connected, and one had the key out of pinion.

The 62 breakdowns on the control gear were made up as follows:—

Twenty-eight on starters which included 14 contacts or segments burnt, seven resistances burnt out, three handles broken, one arm loose in slate, one no-volt coil burnt out, one arm sticking in full-on position, and one arm not holding up owing to contacts on overload coil not dropping.

Sixteen on fuses; in five cases the fuses had simply blown and were replaced; in the other 11 damage was done usually by bare fuses arcing on to the metal case.

Ten on switches, about half being bad contacts or arcing to cover; the remaining half more or less fell to pieces.

The remaining eight were miscellaneous and comprised the failure of one shunt-breaking resistance, four circuit breakers gave out, in one case the end burnt off the coil, two had burnt contacts, and one was fixed upside down, one starter was condemned by the Home Office and replaced, and two installations had faults on the wiring. Out of a hundred breakdowns, 12 can be considered unavoidable, 17 were overcome by some alteration or modification, and the remaining 71 were due almost entirely to neglect or ignorance—in other words, to lack of maintenance.

The following points should be kept in mind when selecting a motor:—The commutator should be of generous size, to allow for trueing up several times. The segments should be of hard copper, insulated only with pure mica; micanite should be avoided. The ends of the armature coils should be brought down and soldered directly to the commutator segments. The bands which hold the coils in the slots should not increase the diameter of the armature at all. The stampings under the band should be smaller than the remainder, so that the band comes flush with the surface. This lessens the chance of its coming off, and by not interfering with the clearance gives the bearings a longer life.

The next point to look to is the brush gear. The rocker should be in two pieces so as to allow of its removal if necessary. The insulation of the spindles should be of mica, and the spindles themselves of brass and large enough in diameter to prevent vibration or chattering. The connections from spindle to spindle in machines of more than two poles should be of rod or strip taped and enamelled, and preferably arranged one on the face of the rocker and one on the back to avoid any possibility of them short-circuiting.

In shunt machines it is sometimes an advantage to have the leads to the brush-holders long enough to enable the motor to be reversed by moving the rocker. The holders themselves should be of the type in which the brush slides in a box and is pressed down by an adjustable spring. A screw should be provided to take the end of the flexible connection to the brush, and so prevent the current from passing through the spring; this screw should not be the screw that clamps the holder on to the spindle. It should be possible to remove the holders from the spindle without disturbing anything else. The holders should be so constructed that nearly all the brush can be used up. For ordinary work the bearings should be of hard brass. White metal can be used but requires more supervision. For the heaviest work it is worth while going to a little more expense and using phosphor bronze. In all except the smaller sizes, two oil rings working in separate grooves should be provided. The oil well should be large and painted internally. This provides against any sand being left inside. The cover of the oil well should be hinged and fitted with a spring; this will ensure its being closed. Covers that are loose or hung on pieces of chain usually get lost, and dirt gets in. The overflow should be large enough to carry away excess oil as fast as it can be put in with a pint feeder. The best type of overflow is the one in which a piece of pipe is screwed through the bottom of the oil-well to the right height; the surplus oil then drops clear and does not trickle down the sides of the frame. All field coils should have terminal blocks or connectors to facilitate disconnection for testing. It should be possible to remove the armature from either end of the machine. Any covers that may be fitted should be capable of being put on or taken off while the machine is running, without the possibility of touching live metal or dropping screws or bolts inside. In the case of belt drives slide rails should be provided, and the ends of these should be open. Some makers use square or tee-headed bolts to hold the motor down with nuts on top. A better plan is to have square nuts inside the rails and use setscrews, then if the motor has to be slewed round or moved it can be easily done, otherwise it is necessary to pack up the motor clear of the holding-down bolts and slew it on the packing. The best way to fit a pulley is to fit it up to a shoulder on the shaft with a feather key, tap out the end of the motor shaft and fit a set-screw and a circular plate larger than the shaft. This method is particularly necessary with ball-bearing motors, as the pulley cannot be knocked or wedged off without damage.

(To be concluded.)

PROTECTION OF LARGE POWER SYSTEMS: SEPARATE REACTANCES.

By EUSTACE THOMAS, B.Sc.

The paper read recently by Messrs. Faye-Hansen and Peck, and reproduced in this journal, puts forward a manufacturer's view of the advantages of separate reactances. Some large stations are adopting these, and it is of interest to consider some other aspects of the same question.

The object is to limit currents when short-circuits occur, and thus to diminish: (*a*) the loads which the oil switches may have to break; (*b*) the stresses on the generator windings; (*c*) the liability to shut down the system.

In the first place, it will be accepted as a first principle that each part of the system ought to be strong enough for its obvious duty without outside protection. Thus oil switches ought to be able to open the circuit under any condition that can possibly arise. They are the protectors of the system, and it is wrong and it is unnecessary that they should be too weak for their duty and need extraneous protection. Generator windings should be supported strongly enough to withstand short-circuit conditions, and they can be so built.

These obvious requirements are further strengthened by the fact that reactances afford an imperfect protection only, and cases arise where they do not protect at all. For instance, a very serious shut-down occurred recently in a large system on the station cables, and reactances could not have stopped this. Again, a short in the generator or between it and the reactances finds it quite unprotected. And the reactances themselves actually introduce a further weak link.

In the discussion which followed the reading of the paper in Manchester, the advantage of retaining a considerable reactance in the generator windings was put forward and Dr. Rosenberg appeared to agree with this. Many of the older machines by first-class makers had much higher reactance than modern machines, and the steady short-circuit current at full load excitation was little over one and a half times full load current. Such machines are not more unwieldy nor more expensive, but they would still have to be built to withstand the very much more severe instantaneous conditions at short circuit.

The whole argument for reactances is based on the desire to protect against short circuits. But while there is no real protection unless oil switches and generators are each built to withstand short circuits, as they can be, there is reason to think that precautions can be taken which will practically eliminate short circuits or render them so infrequent that the introduction of more weak links in reactances would introduce much more danger than they remove. Mr. Mackenzie pointed out that in Manchester, although they have had many breakdowns in feeders, some close to the station, they are without noticeable effect on the station itself. Although the cables are three-core, it is the insulation to earth of one core which breaks down first. The station is earthed through a current-limiting resistance, and the relays have a short time limit. The current to earth is thus limited, and before the damage has spread from core to core the cable is cut off. Previously, when long time limits were used, trouble came in.

Dr. Rosenberg endorsed the value of this by anticipating that in the future we may return to single-core feeders instead of three-core. This will ensure that an earth must occur before a short, and will limit the damage. Moreover, single-core cables introduce reactance in themselves, and thus self-protect points far from the station. For long feeders single-core cables might be used for a certain distance, and three-core beyond.

But the same method of protection appears to be applicable to the generators. In these the "active" part of the windings is embedded in iron and the phases are separated by earthed material. But earth shields can be placed between phases on the end connections also. When this is done a breakdown must be to earth; and by discriminating relays and by the limiting earth resistance, the machine can be at once cut out when an earth occurs before the damage has spread. It would be easy also to make the relays at the same time cut off the excitation, and thus limit the damage the machine can do to itself. The relays would include the cables from generators to switchgear, which should be single-core.

The oil switch, above all, calls for urgent attention from station engineers. Considering that the safety of the whole system depends ultimately on these switches, it is astounding what makers will offer and station engineers accept. Switches have been guaranteed to break 20,000 kw. with a few inches of travel with the contacts a very few inches under the surface of a few gallons of oil carried by flimsy tanks. A very small proportion of the cost of space required by reactances would enable large tanks to be used with contacts far below the surface and with long travel. And no one doubts that with a long and rapid break well under the surface of a large body of oil, a circuit can be broken of any capacity that will ever be reached. Switch contacts might be burnt and they and the oil might need replacement; but that is a minor evil which no one would complain of if the system were adequately protected. The present oil switches do wonderfully well considering their size and crudeness, and they show that the construction of a really good switch is not a matter of great cost or difficulty. If money and space can be found for reactances, a part of it can be better spent on the switches.

It would thus appear that protection for large stations is best obtained as follows.—Generators to be designed for higher reactance; generator windings to be strong enough to stand the stress of short circuit; generator end windings separated between phases by earth shields; discriminating relays with small time limit to act when an earth occurs on the machine or cables; generator cables to be single-core; the system to be earthed through a limiting resistance; feeders to be single-core for some distance from the station; oil switches to have contacts buried sufficiently deep in plenty of oil in a strong tank, and to have sufficient break; oil switches to be capable of ready and frequent inspection and cleaning.

There is nothing here to tax an unprejudiced designer; and if station engineers insist on having it all they will get it. But before everything it is time station engineers take the specification of oil switches into their own hands and lay down such rules as will ensure them a more adequate protection than they now get. There is, however, so much to say on this matter that it must be reserved for a further occasion.

Smoke Inspectors' Examination.—On April 24th and 25th, the Royal Sanitary Institution, of 90, Buckingham Palace Road, are holding an examination for smoke inspectors. These examinations are being held from time to time at various centres about the country. We believe this is the first of the series to be held in London, and it is important that this should be known to all who wish to avail themselves of the opportunity of obtaining the Institution's certificate. Other examination centres for this year are Leeds, Manchester, Sheffield, Birmingham and Newcastle.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

NEWFOUNDLAND.—The Government have introduced a Bill by which it is proposed to levy a surtax of 15 per cent. upon the amounts payable in respect of Customs duties on any goods imported with the exception of coal. Whenever it appears to the satisfaction of the Governor in Council that the operation of the above-mentioned surtax is producing a revenue in excess of the requirements of the public service, the Governor may, by Proclamation in the Royal Gazette, reduce the surtax to such an extent as is considered desirable.

AUSTRALIA.—The Commonwealth Government have decided that in the case of commercial travellers' samples imported into Australia a drawback of duty paid may be allowed on re-exportation provided that there is no doubt that the goods have not since importation been "used" (in the ordinary meaning of that term) and that they are worth the duty.

Forms have been laid down for Powers of Attorney given for Customs purposes in the Commonwealth by individuals, firms, or partners to a firm, as appropriate to the circumstances. Copies of these forms are available for inspection by British traders interested, at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

SOUTH AFRICA.—The Union Customs authorities have decided that electric ozonators are to be dutiable at the rate of 12 per cent. *ad valorem* if of British origin and at the rate of 15 per cent. *ad valorem* if foreign.

TURKEY.—The Customs authorities have issued a notice to the effect that no certificates of origin will be required for goods imported into Turkey, to date from March 15th last. The requirement of certificates of origin was instituted during the recent Balkan War.

HONDURAS.—The new tariff of Honduras, which took effect from August 1st last, has created some dissatisfaction, and the Chamber of Commerce of Tegucigalpa has appointed a committee to bring about a revision. The tariff changes recommended by this committee were intended to be presented to the President and to Congress during the present session.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

7,949. "Spring retaining or controlling devices for tramway points and switches." D. Carnegie and S. C. Gladwyn. March 30th.

7,974. "Telephone transmitter." C. H. Pritchard. March 30th.

7,975. "Electrical heaters." A. E. French. March 30th.

7,984. "Single-line intercommunication telephone systems and apparatus thereof." J. A. Romer. March 30th.

8,010. "Electric Switches." G. Cherbroc. March 30th. (Complete.)

8,019. "Electric heaters." J. R. Quain. March 30th.

8,021. "Devices for the transformation of electrical alternating currents into sound waves, use being made of resonators tuned for different frequencies." Kemp & Lauritzen. March 30th. (Convention date, March 29th, 1913, Denmark.) (Complete.)

8,038. "Switches." G. W. Hart. March 30th. (Convention date, April 1st, 1913, United States.) (Complete.)

8,042. "Vapour electric devices." British Thomson-Houston Co., Ltd. March 30th. (General Electric Co., United States.)

8,049. "Transmitters." J. J. Comer. March 30th. (Convention date, March 31st, 1913, United States.) (Complete.)

8,052. "Electric Recorders.' J. S. Withers. March 30th. (Charles O Sanders, United States.) (Complete.)

8,058. "Shade-ring remover for removing the shades from electric lampholders." L. W. Turton. March 31st.

8,062. "Protective casing for electric cables." R. McGeoch. March 31st.

8,118. "Electrolytic meters." H. S. Hatfield and G. Hookham. March 31st.

8,131. "Electric accumulators." Tudor Accumulator Co., Ltd. March 31st. (Lorenz Lucas, Germany.) (Complete.)

8,135. "Attachment of electrical conduit tubes to junction pieces." T. A. Smith and W. H. Owen. March 31st.

8,138. "Composition of matters to be used as an insulating-compound." F. J. Hadley. March 31st. (Complete.)

8,145. "Electric incandescent lamps." W. Keppel. March 31st. (Complete.)

8,146. "Instrument for measuring Rontgen rays." R. Grisson. March 31st. (Convention date, April 25th, 1913, Germany.) (Complete.)

8,147. "Cooling device for the electrodes of vacuum tubes, particularly Rontgen tubes." March 31st. R. Grisson. (Convention date, October 14th, 1913, Germany.) (Complete.)

8,148. "Dynamo machines." H. Leitner. March 31st.

8,166. "Electrolytic apparatus for preparing solutions for bleaching and other purposes." O. Sumner. March 31st.

8,173. "Protection of alternating-current electric generators, rotary converters, and the like." British Thomson-Houston Co., Ltd., and F. H. Clough and J. Whitcher. March 31st.

8,174. "Electric lamp." British Thomson-Houston Co., Ltd. March 31st. (Allgemeine Elektricitats-Ges., Germany.)

8,178. "Automatic starters for dynamo-electric machines." F. Newton and Newton Bros. March 31st. (Complete.)

8,184. "Construction and method of arranging induction coils for loading [illegible] cable double telephone lines worked on the Pupin system." H. B. M. [illegible] and A. H. Olsson. March 31st. (Convention date, May 13th, 1913, Sweden.) (Complete.)

8,185. "Construction and method of arranging induction coils for loading [illegible] double overhead telephone lines worked on the Pupin system." H. B. M. [illegible] and A. H. Olsson. March 31st. (Convention date, May 9th, 1913, Sweden.) (Complete.)

8,189. "Starters and combined starter regulators for electric motors." J. G Stirk. April 1st.

8,218. "Electric self-starter for internal-combustion engines." R. W. Pruggmayer. April 1st.

8,224. "Electric flashing and constant contact combined switches for pocket and dry flash batteries." J. W. Mander. April 1st.

8,239. "Telephone system in which the lines are interconnected by the aid of electro-mechanically controlled switches." F. Aldendorff. April 1st. (Addition to 2,530/14.)

8,258. "Polyphase-commutator electric machines." Siemens-Schuckertwerke G.m.b.H. April 1st. (Convention date, April 3rd, 1913, Germany.) (Complete.)

8,269. "Recording pyrometers, galvanometers, barometers and like instruments." A. Onwood. April 1st.

8,280. "Periodical interrupter for electric circuits and more particularly applicable to heating-apparatus." R. Arno. April 1st. (Complete).

8,286. "Safety devices for electrical winding mechanism." H. Wauchope and Stothert & Pitt, Ltd. April 1st.

8,310. "Apparatus for switching on and illuminating advertisements in connection with a liquid-spray diffuser." F. Krauss. April 2nd. (Complete.)

8,336. "Speed indicator and controlling device for vehicles, motor-cars, and the like, having or being driven by internal-combustion or other means of mechanical or electrical propulsion." J. P. Haworth. April 2nd.

8,345. "Fronts of electric and other lamps.' W. H. Dee and F. J. Edginton, trading as W. H. Dee & Co. April 2nd.

8,349. "Electric plug connectors." M. Matthaey & Co., G.m.b.H., and H. Eickmann. April 2nd. (Convention date, April 2, 1913, Germany.) (Complete.)

8,353. "Pocket electric lamps adapted to be used as target-illuminating devices for pistols and the like." P. Schmidt and C. Dobslaw. April 2nd. (Convention date, April 28th, 1913, Germany.) (Complete.)

8,358. "Alloys for dental, electrical, and other purposes." R. Marston and R. W. Marston. April 2nd.

8,360. "Electrical terminals." E. R. Beney. April 2nd.

8,367. "Electrolytic apparatus." Maschinenfabrik Surth G.m.b.H. April 2nd. (Convention date, September 3rd, 1913, France). (Complete).

8,369. "Electrical control of signals." Compagnie de Signaux Electriques pour Chemins de Fer. April 2nd. (Convention date, April 3rd, 1913, France.) (Complete.)

8,370. "Electrical control of signals." Compagnie de Signaux Electriques pour Chemins de Fer. April 2nd. (Convention date, April 3rd, 1913, France). (Complete.)

8,385. "Rotary converters provided with boosters." E. Rosenberg. April 2nd.

8,398. "Railless electrical vehicles." W. H. Turner and W. H. Isherwood. April 3rd.

8,404. "Electrically-heated boiling apparatus." Frederick Barron. April 3rd.

8,441. "Pocket and other electric flash-light batteries." J. W. Mander. April 3rd.

8,442. "Pocket and other electric flash-light batteries." J. W. Mander. April 3rd.

8,456. "Combination electric switch and fuse." A. H. Short. April 3rd.

8,465. "Gas and electric flash signs and the like." R. J. Crouch. April 3rd.

8,473. "Indicating-devices for electric installations." Siemens Bros. & Co., Ltd., and W. H. Grinsted. April 3rd. (Complete).

8,499. "Electric cut-outs." British Thomson-Houston Co., Ltd. April 3rd (General Electric Co., United States).

8,504. "Electric time switches." P. Dresla. April 3rd. (Convention date, April 3rd, 1913, Germany). (Complete).

8,505. "Arc-light carbons." H. Ayrton. April 3rd. (Addition to 22,319/13)

8,512. "Electric furnaces." J. L. Dixon. April 4th.

8,513. "Electric furnaces." J. L. Dixon. April 4th.

8,526. "Electrical indicating-apparatus." H. M. Harding. April 4th.

8,565. "Alternating electric-current machines having bar winding." Allmanna Svenska Elektricka Aktiebolaget. April 4th. (Convention date, April 11th, 1913, Sweden). (Complete.)

8,595. "Electric welding machines." Allgemeine Elektricitats Ges. April 4th. (Convention date, April 4th, 1913, Germany). (Complete).

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

12,076. Apparatus for use in Wireless Telephony. W. T. Ditcham & Grindell-Matthews Wireless Telephone Syndicate, Ltd. May 23rd.

12,129. Apparatus for Heating Liquids Electrically. British Electric Heater Co., and C. Kratt. May 24th.

12,157. Switching Arrangements for use in Wireless Telephony and Wireless Telegraphy. W. T. Ditcham and Grindell-Matthews Wireless Telephone Syndicate, Ltd. May 24th.

12,872. Annealing of Wire. M. Woods. June 4th.

13,903. Methods of Exciting Rontgen Ray Tubes. Siemens & Halske Akt. Ges., K. Bangert & E. Utecht. June 16th. (Additions to 9,499/12.)

14,229. Telephone Exchange or Other Switching Systems. Telephon Apparat Fabrik E. Zwietusch & Co. June 19th. (July 5, 1912.)

14,427. Magnetic Separators. Fried Krupp Akt. Ges. Grusonwerk. June 21st. (July 15th, 1912.)

14,795. Methods of and Apparatus for Sintering Metal. R. B. Walling. June 28th. (October 7th, 1912.)

14,951. Arrangements for Controlling the Feed of Recording Instruments. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.) June 28th.

15,286. Joining or Binding the Junctions of Metallic Sheathing or Armouring of Electric Conductors. L. Sunderland. July 2nd. (Addition to 22,550/11.)

16,396. Manufacture of Porcelain Articles. J. A. Jeffery and B. A. Jeffery. July 16th.

16,468. Processes of Making Boron Nitride. British Thomson-Houston Co. (General Electric Co.) July 17th.

16,641. Railway-signalling Apparatus. Soc. d'Electricite Nilmelior & J. E. [illegible] July 16th. (July 20th, 1912. Addition to 827,10.)

17,713. Electric Lamp Signalling. Siemens Bros. & Co. (Siemens Halske Akt. Ges.) August 1st.

18,728. Spark-plug Socket for Oil and Gas Engines. E. C. Male. August 18th.

19,268. Electric Clocks. T. Rushton. August 25th. (Addition to 10,100/13.)

1914.

340. Electric Switches. G. W. Hart. January 6th.

357. Sparking Plugs. O. Freiberg & O. Petzsche. January 6th. (October 8th, 1913.)

1,729. Connections and Fittings for Electric Conduits. C. Birch. January 22nd.

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THE RIGHT TO WORK.

THE strike of electrical wiremen in the London District has been a half-hearted affair from the beginning, because it was generally recognised from the first that an increase in wages was due. Quite a number of the best contractors were paying their men more than the Trade Union rates when the dispute commenced, and it seems certain that 10½d. will be the recognised rate for wiremen working within the London area. While the number of men on strike is a comparatively small proportion of the total employed, we hope that the strike will not end without a definite agreement being come to between the Electrical Masters' Association and the Electrical Trades Union. If this is not done the industry will suffer from isolated strikes on points which should be settled now. We believe we are correct in stating that the big point of difference outstanding is that of the right of any man who is not a member of the Trade Union to work in any capacity. This point is raised in the first rule of the set recently issued by the Electrical Masters' Association, which reads:—

> No exception shall be taken to the employment or non-employment of any workman in the electrical trade on the ground that he is or is not a member of any organised trade society, neither shall any exception be taken to the employment of a workman in any other trade on the ground that he is or is not a member of a trade society.

The Electrical Trades Union has strongly objected to this clause, but we believe that the older and stronger Unions are more intimately concerned. Their endeavour has been for years to make themselves so strong that they can prevent a non-Union workman from obtaining any employment which will necessitate his working alongside of a Unionist.

The numerous strikes which have had their origin in this endeavour have widened the breach between employers and employés, as they have also retarded trade developments. In the present instance, if this clause is not agreed to, an electrical employer, even assuming that all his men on a certain job should happen to be members of the Electrical Trades Union, will be liable to have them come out on strike, because one man employed, say, in asphalting the forecourt of a large public building which is being wired for electric light, is not a member of a recognised Union.

We have received from the Manchester, Salford and District Building Trades Employers' Association a copy of an agreement signed on April 9th by this Association and also by the representatives of the District Committee of the Electrical Trades Union. We reproduce this agreement elsewhere in this issue, because it seems to us that it should help to clear up the dispute in London. We would especially call attention to Rule 10, which deals with points raised above, and which reads as follows:—

> 10. While agreeing not to place any obstacle in the way of men joining the Union, employers do not agree to employ Union men only.

We fail to see why if this rule is accepted by the electrical workers in Manchester, their Union should raise strenuous objections to a similar clause for London.

We also commend Clause 13, which prevents a strike or lock-out starting until the matter in dispute has been referred to a joint committee of employers and operatives.

A clear set of rules like these, signed and held to by both sides, would be worth the trouble and expense of the present dispute.

At the moment of writing, it is announced that among the proposals of the National Conciliation Board for the settlement of the building trades dispute is one for deleting the disability clause.

The Press reports relating to the conciliation proposals are, however, as usual conflicting. The *Times* report says that: "The members of the London Building Industries' Federation are to agree to work peaceably with non-unionists"; but a financial paper says that: "By the deletion of the disability clause and the alterations to the conciliation clauses," the men "will gain the right for the first time, to protest and object to the employment of non-society men."

THE MINIMUM WAGE.

After a fortnight's enforced idleness, which has cost the Yorkshire Miners' Association £120,000 in strike pay, the men have gone back to work on practically the same terms as they had before the strike. It is estimated that the total cost of the strike has been about £1,000,000 (one report multiplies this figure by five), and all because a few men—who were undoubtedly doing their best—could only earn wages very little above those who took things easy and got the minimum wage, whether they earned it or not. This was the real trouble in the area where the strike started, as in other districts where men were earning good wages the strike was very unpopular. In the Doncaster district it very nearly caused a split in the Association, in fact, we shall not be surprised if the men in the Doncaster area eventually form an Association of their own. The miner is very human, after all, and when he is personally doing well, and knows there is nothing more to be gained, he wants to be left alone; in this case it was only the influence of the Association leaders which kept the men out on strike.

As to the terms of settlement, it is practically decided that the collieries in Yorkshire shall be divided into groups or classes of mines with different minimums, *i.e.*, the minimum rate of wages will be fixed by the Joint District Board. Thus a lower minimum will apply to those pits where the seams are thin and more difficult to work on a profitable basis, than to the thick seams in the Doncaster district. Any colliery company can only pay such wage as is afforded by the selling price of the coal, and hence the prices obtained by the collieries vary, as well as the cost of working. In the Doncaster area, where prices obtained are good, owners can afford to pay good wages, and the men employed at these collieries are receiving probably one shilling a day more than those in the Barnsley or Rotherham areas. But no Act of Parliament can alter these conditions; hence the necessity for a low minimum wage, if this is to apply throughout the whole county. Unfortunately, however, the men seem to think the minimum wage ought to be the *average* wage of the county, and instead of its being a "piece work" wage, it is fast coming to be looked upon as a time or day-rate wage, without any responsibility as to tonnage produced. Such conditions in a mine—except, perhaps, where the "butty" system is in operation—are impossible, owing to the difficulty of efficient supervision. In the "butty" system one man is responsible for a number of working places or a length of "long-wall" face, and has a contract price for getting the coal out, doing all timbering, stone work, &c., and employs the workmen under him and pays them. Frequently the "butty-man" may have left for himself £10 or up to £20—but he has to see that the other men work and that the coal is got out, or he may get nothing. But this system does not suit the workmen, and they are beginning an agitation to have it entirely abolished, or to secure that *all* the money earned shall be "pooled." They object to the butty-man having so much money, and likewise to his "bossing" propensities. Hence there are difficulties all round.

In Durham and Northumberland an agitation is proceeding to have the minimum wage made into the county average wage. At present the minimum is below the county average, but the point that smarts most is the rule that no workman is entitled to receive the minimum wage unless he has worked *full time*. In Yorkshire and other districts the workmen are asked to put in 80 per cent. only, and the north-country workmen want to know why? They forget that they work less than *eight* hours per shift—from 6½ to 7 only—and not only that, but they make every alternate Saturday a holiday, or only work 11 days per fortnight, against 12 in other districts. Again, the wages are lower because the men are provided with free houses and free coal, whereas, in other districts, workmen have to pay rent and buy coal. Owners in Northumberland and Durham would be very glad indeed to put their pits into line with those in other districts—that is, to pay higher wages on condition that the men work the full eight hours and pay house rent and buy coal. This, however, is not what the men want; they wish to retain all the advantages over their brother workmen in other parts of the country, and to be paid the same rate of wages.

In Scotland, too, the miners are resisting a claim by the owners for a reduction of wages of 1s. per day. Their present earnings are 7s. 6d. per day, and the owners say they cannot afford to pay this rate, owing to the increase in working costs and the reduction in the selling price of coal, which has dropped 1s. 6d. per ton from the recent high prices. Lord Balfour has been appointed neutral chairman, and his award is final and must be accepted by both parties. Unless, however, the award is in favour of the workmen, we doubt very much whether they will accept it peaceably, judging from what has occurred in other districts.

There should never have been any Minimum Wage Act, or any Eight Hours Act—the men undoubtedly are disappointed with both, as at Cannock Chase district, where both Acts have resulted in the men earning less money than they did previously, and it would be a great blessing to this country if both these abominable and mischievous pieces of legislation could be repealed. We are afraid, however, that the rank and file supporters of the Government of this country have much to learn before this will happen. The only other way is for the coal owners to combine and fight—as undoubtedly they will have to fight sooner or later—and the Minimum Wage Act, unless repealed before bad times come upon us, will be responsible for very much trouble and suffering, which will not be confined to the coal trade, but will more or less involve every industry in the country. We are still a long way from the millennium, which the pitman so earnestly desires—it is likely to remain far distant so long as workmen are taught that the less work they do the more there is left for everyone else—and the pitman especially must learn that he cannot expect to go on continually receiving 7s. 6d. for only 7s. worth of goods. At present the 6d. he does not earn is coming out of the pockets of the public, but they will find out in time, and we think whe they do so they will begin to object, and will probably tak a hand in giving the miner a lesson which he is beginni to stand in need of very badly.

London's Electricity Supply.

The supply of electricity in the metropolitan area, covering 700 sq. miles, and affecting a population of some seven millions, is a gigantic problem, offering immense possibilities, and involving equally grave responsibilities. At present, viewed as a whole, it is notoriously heterogeneous and unorganised; were it not so serious and lamentable a fact, it would be nothing short of ludicrous to observe that within that area no fewer than 49 different systems of supply are in vogue, and that if a consumer moves from one parish to the next, the chances are at least 10 to 1 against his lamps, motors, cookers and radiators being suitable for use in his new quarters.

The situation is absolutely without a parallel throughout the world, and throughout the history of electricity supply, and like many other anomalies, its origin is undoubtedly traceable directly to the action of Parliament in the early days of the industry. To aggravate the absurdity of the position, large new power stations are now being erected within the area, which will bear no intentional relation to those already existing. It was high time, indeed, that the London County Council, as the leading authority concerned, should institute an inquiry into the subject with a view to finding some way to bring order out of this wild chaos, and the report of its technical advisers, Messrs. Merz and McLellan, of which we commence an abstract elsewhere in this issue, will be read with interest, though with mixed feelings by many of those immediately affected. So weighty and complex a matter calls for the most authoritative and impartial discussion, and we are glad to be able to place before our readers a review of the report by Mr. C. H. Wordingham, whose position is a guarantee of freedom from bias and whose reputation entitles his remarks to respectful consideration. Whatever course the Council may decide to follow, there is no question but that the matter is of urgent importance, and no time should be lost in arriving at a firm decision upon its future policy, which will have an intimate bearing upon the well-being of every inhabitant of the metropolitan area.

Lead.

After the sharp reduction in prices which followed as the result of the fright due to the rather heavy selling here of American lead, the market has assumed a steadier tone, and at the reduced prices ruling a very fair business has been done by consumers. The market was badly jarred by the sales of United States domestic lead, for the necessity of finding an outlet abroad for such material, showed beyond all question that general trade across the Atlantic was in a bad way. Under ordinary conditions the United States is a large consumer of imported lead mainly from Mexico, hence the fact that not only had the country sufficient material of domestic production to provide fully for home needs but to permit of exports, came as a shock. The severe fall in the price had the effect of putting a stop to further selling, at all events for a time, for the London price was well below New York parity, and this condition still persists. It seems to be the present policy of leading London interests to keep the price here at a level sufficiently below that of New York to check shipments from the United States to Europe, and their efforts in this direction have so far been rewarded with success. Of course there is a chance that things may go worse in the United States again, and that the reduction of prices across the Atlantic would permit of further selling for export, but for the present this phase seems to have passed. The outlook is moderately satisfactory again meanwhile, and it remains to be seen what direction things will take across the Atlantic. There has been a fair quantity of United States lead come into this country lately, all of it to Liverpool and Manchester, and there is a good deal still to come, though some of the estimates of the total quantities sold for export from America are regarded as being exaggerated. The arrivals from the other side of the Atlantic have helped to relieve some of the more pressing needs of consumers, while invisible stocks can hardly be said to exist so far as the works of consumers are concerned. There has been an increase in the arrivals of lead this year for the three months of about 2,400 tons, the total being 55,278 tons, against 52,878 tons in 1913, so that it seems apparent that in spite of the shut-off of supplies from Mexico, there has been an increased output elsewhere. If not this, then the consumption in other parts must have fallen off to an extent sufficient to enable material to be forwarded to the British market, which otherwise would have been consumed elsewhere. For the time being the outlook is for a moderately steady market at the reduced prices now ruling. Unless America improves there is not much likelihood of prices in London being advanced to any extent As far as the United States is concerned, things in pretty nearly all industrial channels seem to be rather bad, notably in the iron and steel trades, while although lately the consumption of copper as reflected in the monthly deliveries published by the American Copper Producers' Association has improved from the miserably low total seen at the end of last year, there is still ample room for improvement in the electrical trades across the Atlantic. A restriction in the consumption of other staple metals cannot have proceeded without a restriction in the consumption of lead, and the position across the Atlantic therefore deserves close watching. It may be taken for granted that in the recent instance at all events, the holders of the lead which was sold for export wanted the money which it represented more than they desired to hold an accumulation of base metal. It is possibly significant of a continued relaxation in the position that April lead should have been declared as long ago as last week.

That Lost Ticket.

It is surprising how many people there are up and down the world who are unacquainted with their legal rights, notwithstanding that everyone is presumed to know the law.

We constantly hear of cases in which a tramway passenger having lost his ticket, refuses to buy another, and is consequently brought to book by the company. In a case of this character recently heard at Cardiff Police Court, it was made clear that people who ride on the Corporation tramcars must not only pay their fares, but must also preserve their tickets to show they have done so, and the only way to meet a case of a lost ticket is to buy another. A man was summoned for riding on a Corporation car without having paid his fare. It was proved that the defendant could not produce a ticket to show he had paid it Defendant said the conductor knew he had paid. Defendant said he had paid his fare, and when he saw the inspector come on the car he looked in every pocket for the ticket but could not find it. When the inspector told him to look in his pockets, he told him that he had already done that without success. He found the ticket after he left the car and had written to the manager explaining the facts.

The Stipendiary, in addressing the defendant, said:—"You must know, as an intelligent man, that it is the duty of the inspector to have some evidence that you have paid and the only evidence he can have is your ticket. It would be the easiest thing in the world for dishonest people to say 'I have paid my fare and lost my ticket.' What would be the result to the Corporation? The cars would be run at a loss, and the ratepayers would have to suffer. You are fined 10s. and costs, or 14 days."

What the public wholly fail to realise with reference to a case of this kind, is that on making application to the company the fare overpaid will be refunded. The company would be practically bound to refund, and any Court of Justice would compel it to do so on the sworn statement of the passenger that he paid twice over. No doubt the cost of recovery would make the remedy expensive. The 1d stamp on the letter claiming repayment would cancel the 1d stamp sent by the company. But the remedy is there and those who rail at tramway companies for making a very sensible rule as to showing tickets should keep this fact in mind.

LONDON ELECTRICITY SUPPLY.

By C. H. Wordingham, M.Inst. C. E.

Messrs. Merz and McLellan's views on the way in which London can be best supplied with electrical energy were described by them with great thoroughness in the witness box, some eight or nine years ago, when they were promoting the Administrative County of London Bill. These views, as shown by the lengthy Report, with longer Appendices, which they have just presented to the London County Council, have undergone but little change, except that they now apparently realise that they must not rely upon power alone for getting the enormous load which it is necessary to assume in order to justify their conclusions, and they fall back on a phenomenal development of electrical heating and cooking. The importance of the distribution, as compared with the generation, of electrical energy is now more fairly recognised than at the earlier period referred to.

One cannot but be struck by the sense of absolute confidence that the authors have in their own views which pervades the whole Report. They refer to other "schools," but they seem rather concerned to demolish all arguments that do not accord with the scheme they favour than to weigh judicially the opposing considerations. In other words, their attitude towards the technical portion of the problem set them seems rather that of the witness, or counsel, than the judge, but it does not necessarily follow that their conclusions are on that account wrong.

The scheme propounded is no less than the absolute scrapping of all existing metropolitan generating stations, whether owned by companies or municipalities, and, to a large extent, of their distribution systems also.

There can be little doubt that the main principles enunciated are correct if virgin ground lies before the engineer. They are well-known, and, in fact, lie at the root of the idea of a central station, as compared with a number of isolated installations:—diversity, with consequent improved load factor; increased scale of operation, with consequent larger units of plant, securing lower outlay per kilowatt, decreased cost of attendance, &c. All this is the oldest of ancient history, and there can be few who do not take these principles as axioms of central station design.

Exactly where the limit to increased economy by concentration must be set may be open to discussion; Messrs. Merz and McLellan point to 30,000-KW. generators as *faits accomplis*, and say that 50,000-KW. generators are in sight. They may be, but it is more than doubtful if there is any appreciable gain in economy in going above 15,000-KW. or 20,000-KW. sets, and certain drawbacks necessarily attend the larger sizes. On the basis of 50,000-KW. sets they put the maximum size of single station at 500,000 KW.

The authors anticipate great economy and substantial advantages from putting the generating stations a long way down the river. The former is based chiefly on the ground of lower cost of coal; the latter comprise facilities for coal storage (a very important point in view of the increasing severity of strikes); the possibility of by-product recovery, and the hygienic advantages of burning the fuel out of London. No clue is given to the kind of by-product in mind, but gas engines of 50,000 KW. can hardly be contemplated. Great stress is laid on the hygienic gain, but it may be doubted whether much need be made of this if the scheme is otherwise sound; it is not the factory chimneys, but the tens of thousands of domestic fires that poison the atmosphere. If Messrs. Merz and McLellan's new stations can abolish these, they may well be forgiven their station chimneys, even if situated in the heart of London.

It is admitted that the cost of transmission would be heavy, but it is stated that this would be more than compensated for by the advantages. Like a good many more *ex cathedra* statements in the Report this may well be doubted.

Some of the arguments used in support of the scheme are less sound. For example, the myth of there being some essential difference between lighting and other uses of electrical energy is brought out. The load factor of street-lighting compares very favourably with a large proportion of motive power, while all-day basement lighting easily beats any power load and still more a heating load, which, after all, is just as much a winter load as ordinary lighting, though, of course, it has a better *daily* load factor. Cooking, except in large restaurants and hotels, cannot be expected to give a very high load factor, and it may well come on a very nasty part of the load curve.

After reading the Report, one cannot help asking oneself: What is the magic talisman which the authors possess that will enable them to do the same work as existing concerns at a vastly lower cost? Let it be granted that the use of very large units will reduce their capital outlay for generating plant and some of their running costs, they will still have to pay the same as other people for cables, for excavation, for re-instating of pavements, and for all the miscellaneous etceteras that run up the cost of every consumer's service. Many of the existing undertakings are run by engineers of long years of experience in central station work, dating back to the inception of the industry, men who join conspicuous business ability to ripe and sound engineering knowledge. They have the same market open to them as Messrs. Merz and McLellan: why are all their efforts doomed to failure and to be hardly worthy of consideration, while success is certain to crown the new undertaking and enormous reductions in costs of generating and distribution are to be made? Surely not because their stations are above instead of below the bridges and because they use 15,000-KW. instead of 50,000-KW. generators.

The real crux of the question lies in the fact, however, that the engineer is not confronted with virgin ground. He is not dealing with a prairie in which a great city is going to be erected round his mains. The ground is already covered with a network of mains traversing all streets in which a profitable demand exists (and some in which it does not), and this network is supplied from generating plant which is in existence and which has cost money to buy. Unless spoliation is to take place, this money has got to be written off somehow, and it must be a burden on the new undertaking. It means that twice as much plant as is necessary at the present time is to be provided, and, to a large extent, twice as many mains. Piling up capital expenditure must tend to keep up the price to consumers rather than to lower it, and it is difficult to see how any substantial reduction on present prices, in view of these augmented capital charges, can be made unless a very large annual loss is faced for a number of years, and where is the money to come from to make this good? Unless the price is brought phenomenally lower, how is the enormous demand to arise? and if the enormous demand is not there, how are the costs of production to be lowered in the striking manner foreshadowed so confidently?

Messrs. Merz and McLellan say, in effect: Never mind, you have got to wipe out all this plant because it was not bought to-day, and is not the biggest that *can* be built at some distant date in the future; the sooner you do so the better it will pay you. But will it? It may be doubted, too, whether it is wise policy to be in such a hurry to wipe out plant much of which is, after all, of the most modern, such, for example, as recent additions to Deptford, Lot's Road, and the L.C.C. Tramways generating station. Finality in generating plant has certainly not yet been reached, and the London County Council, who recently scrapped nearly new reciprocating engines with their alternators at their Greenwich works, may well pause before they say that the plant referred to in the Report is so much better than that they have just installed that the latter must be scrapped; the new plant may want similar treatment itself in two or three years' time, and what then? Surely the scrapping process must stop somewhere.

The practical difficulties of carrying the scheme into effect are enormous, quite apart from the cost. It is seriously contemplated to lay new distributing mains throughout the area; this necessarily means taking up all the streets, and, apart from the public inconvenience, the difficulty of finding room for the mains in the congested space beneath the footpaths (for distributing mains would hardly be tolerated under the roadways) is far greater than the authors appear to contemplate. Some of the provincial towns are bad enough, but the conditions in London must be experienced to be believed.

In addition to these low-pressure mains, a whole network of high-pressure mains is contemplated. It is rather airily stated that transformers would have to be installed "at intervals" to give the supply to the low-pressure mains; these transformers would require sites for their erection which would be costly and difficult to obtain.

Other difficulties connected with minor points would arise which would be found to be of very serious proportions in practice. The greater number of consumers are proposed to be supplied from three-phase mains, though a favoured few are to have continuous current at a pressure of 250 volts. No consideration appears to have been given to the scrapping that the unfortunate consumer would have to do to get the advantages of the new supply. The experiences of those companies which have simply doubled the pressure to their consumers would not show the problem which the new authority would have to face in regard to this matter alone in a very alluring light.

Into the merits of the scheme itself it is unnecessary to enter, but it seems a doubtful benefit to a consumer to be given three-phase instead of continuous current, especially if he have arc lamps or variable-speed motors to run, or electric vehicles to charge, or even to have the pressure of his continuous current put up to 250 volts. From the suppliers' point of view, too, it is a serious drawback to be shut out from the use of batteries on the network for all time, especially in view of the recent practice in such large towns as Manchester and Birmingham.

In forecasting the future of electrical supply in London, one very important factor does not appear to have received consideration, viz.: the cost of consumers' apparatus. The whole fabric of the Report rests on the assumption of a very large demand, and it is assumed that this will arise if energy be supplied at a very low price. This, however, is only half the tale, as every station engineer knows to his cost; at however low a rate he may offer his energy, he has always to meet the difficulty of the high first cost of electrical gear, and this must militate against the vast development contemplated. It may be argued that standardisation of pressure, frequency, &c., would tend to lower this first cost of gear, but it is open to question whether any one town, even if of the size of London, would be able to affect the cost of manufacture to any appreciable extent by standardising within its borders. Even if the sales of plant and apparatus in London were great enough to affect appreciably the cost of their manufacture, it would, in the important case of incandescent lamps, tend rather to augment the price, there being nothing the lamp maker wants less than a rigid standardisation of pressure, because he would then have no market for his throw outs of lamps intended for the standard pressure.

The authors, having laid down the lines on which they consider the future supply should be provided, proceed to discuss the ways and means of carrying their recommendations into effect, having regard to the complications of the existing state of things "65 authorities (apart from traction undertakings) supplying electricity upon 49 different systems from 70 generating stations, containing 585 engines." It must be confessed that this is not a promising basis for the introduction of the scheme laid down as ideal, but the authors attack the problem boldly, and examine the various courses open in a very complete manner.

Bulk supply, though useful, they do not think would go nearly far enough, and without powers for compelling the existing authorities to take the bulk supply provided, progress would be slow and the financial prospects poor. More rapid progress they think would be made if the new concern were allowed to compete on Power Act terms, and the commercial results would be better. Much better results, however, from the point of view of the new undertaking would ensue if it were to compete with existing undertakings without the limitations imposed by the Power Acts, and the public would stand to gain, as the competition would certainly lead to lower prices. The gain would naturally be at the expense of the unfortunate existing authorities, and although they were never actually granted a monopoly, yet they would, it is recognised, be somewhat hardly used, and they might be granted a little consideration, such as permission to postpone the date of being taken over, or to insist upon being taken over at once before they were strangled.

The authors point out, however, that the most rapid and certain way of effecting the objects which they desire would be the amalgamation of all the existing undertakings. This might be done either by means of a public body or by private enterprise under suitable control, each course being accompanied by certain advantages and drawbacks which are pointed out. The conclusion arrived at is that the only complete and satisfactory solution is the establishment of a new undertaking with such powers as will enable it to concentrate production, standardise and unify distribution, and bring about the amalgamation of the various undertakings.

The form which this new undertaking should assume is then discussed briefly. A combination of all existing authorities is dismissed at once, and a combination of the company-owned concerns is not thought to be much more promising. In laying stress on the want of unanimity and cohesion among existing authorities, Messrs. Merz and McLellan have unquestionably a strong argument. It is now some nine years ago since they were threatened with the Administrative County of London Bill, and, instead of putting their house in order, the authorities have let the golden opportunity slip, and it now lies with those seeking to do away with them to question their ability to unite and their zeal in carrying out any unification if attempted, as well as the possibility of their raising the necessary funds. Due stress is also laid on the problem of including the municipal concerns. Such a scheme would, the authors think, be worth consideration if certain safeguards were provided.

Attention is called to the difficulties that any such scheme of amalgamation would put in the way of ultimate purchase by the London County Council, but if the best means of providing a cheap supply for the public is the only object in view, it seems rather inconsistent to attach any weight to such considerations.

Other alternatives are next considered, *e.g.*, an independent new company, a public authority, or, finally, municipal ownership and control with operation by a private authority. After going into the pros and cons of each, the last is finally recommended. It is admitted that there is no precedent for such an arrangement in this country, but it has found favour in a number of foreign towns, and an analogous arrangement exists in connection with the Indian railways.

Like many large schemes, this one appeals to the imagination on account of its very magnitude. It all sounds so sweeping, so grand, so evident. But in sober fact, less ambitious and less attractive projects often effect the object in view far better. It seems as though it cannot be right to waste so much valuable work already done, and to throw away so much modern and highly efficient plant. It ought to be possible to develop the best of the present stations and to shut down the inefficient ones without undue cost, and every effort ought to be made to bring the various owners together without destroying their several properties. Notwithstanding what is said to the contrary in the Report, a number of inter-connected stations should give a security of supply at least as great as the scheme proposed, and there ought to be no insuperable difficulty in generating and distributing at a very low rate.

There would be this important advantage over the big scheme: the undertaking would not be burdened with capital expenditure or duplication of plant and mains, but would be able to start reduced prices at once without loss. The spent capital has got to be written off in any case; it must surely be better to do this without spending additional money.

Detailed though the Report is in some ways, there is much vagueness as to how the proposal recommended would be worked out. One cannot help feeling that if such a scheme is to be carried to a successful issue, it must involve heavy loss on those who have borne the burden and heat of the day, and if this were the case, low-priced electrical energy for London would be too dearly purchased.

The Report Summarised.

The report of Messrs. Merz and McLellan to the Special Committee of Electricity Supply of the L.C.C., which has been awaited with considerable interest, is a lengthy document with numerous appendices; the authors point out that it does not deal with questions of general policy or with arguments for and against the different forms of control except in so far as these affect the technical and commercial aspects of the problem.

Whatever form of control is adopted, they recommend the establishment of a new undertaking to carry out the technical changes which they show to be necessary.

Their investigations, they say, prove that it is possible gradually to bring electric lighting, heating, and cooking within the reach of the majority of Londoners, as well as to extend industrial electrical uses, and when this takes place the ultimate demand will be so great that the mistakes made in the past should not prevent the early initiation of a new policy

Since the L.C.C. first considered the question of bulk supply, there has been a serious increase instead of a decrease in the number of electrical authorities and generating stations in Greater London, and the authors attribute the present state of affairs to the action of Parliament in attempting to safeguard the supply of electricity. They point out however, that the competition of other forms of light and power is a most important factor in reducing prices.

The authors consider that on a conservative estimate the electrical requirements of the near future will be more than twenty times the present output of the London lighting undertakings, and refer to the necessity of improving the load factor—as a means of reducing the price—by developing particularly the heating and cooking load.

With the comparatively small amount of heat required under London temperature conditions, any difference in cost between electricity and other forms of heating is often more than counterbalanced by the convenience, cleanliness, and saving of domestic electric heating.

Fundamentally to obtain the highest load factor involves the use of electricity for as many purposes as possible, which can only be attained if the selling price is reduced to a satisfactory figure, which in turn can only be done by initiating a new policy at an early date. They consider that the conditions in London are such as to make it one of the finest fields for electricity supply in the world, and that its credit and ability to raise capital are unparalleled, and add that the capital already expended upon electric supply in London, though a large sum, is not large in relation to its ultimate needs, and should not prevent the initiation of a new policy which will improve the existing state of affairs.

The report discusses two alternatives under the heading "generation," viz.:—(a) the extension of 8 or 10 of the best existing stations and gradual abandonment of others, and (b) the gradual abolition of all stations in or near the Metropolitan area and concentration of production on sites well outside.

The former would be easier to carry out and might save transmission cost, but the latter would effect a saving in production cost more than sufficient to balance the increased cost of transmission, and would allow for unlimited expansion and by-product enterprises.

The choice between the two courses is considered fundamental, and the most important step in deciding the policy to be adopted by the Council. The areas considered are the Metropolitan Police area and a central area of 100 square miles covering most of the County of London.

The investigation has not been confined to a comparison with existing stations, but calculations have been made of the cost of production with ten "model" stations erected approximately on existing sites. This is compared with the costs of production and transmission with a station equivalent to the ten, but situated down the river.

Stress is laid on the influence of the size of generating plant, and it is pointed out that as a general rule it is economical to continue concentration so long as it is possible to do so by increasing the size, not the number, of the individual generating units.

The large unit relatively costs less, is more efficient, and requires less labour than the small one; generating units of 25,000 KW. are in use to-day, and 30,000 to 40,000-KW. machines have been developed.

The present arrangement of generating stations, mostly unconnected with each other, is unfavourable to reliability of supply; the abandonment of the existing stations would be gradual, and before its completion the area would be obtaining its supply from several different interconnected sources, the new plant being housed in several separate stations on both sides of the river, where sufficient water and fuel storage facilities could be obtained, which would not be the case were three or four existing up-river sites utilised.

Consideration has also been given to the possibility of generation on the coalfields, but the report suggests that this matter should await the further development of the Kent coalfields; that freedom should be retained to obtain coal from as many sources as possible, and that increased transmission costs would cover any saving in carriage, except for loads at high load factor.

The following conclusions are arrived at as the result of this investigation into the question of generation:—

(1) Assuming all the existing generating stations for the supply of light and power in the central area were in the hands of one authority, it would pay that authority to shut them down, sell most of the plant, and generate all the energy they produce, on sites down the river.

(2) The saving in *working costs** which the existing undertakings in the "central area" could effect by obtaining their current from such a concentrated plant supplying for all purposes would be not less than 18 per cent. or about £170,000 a year, *after allowing* for all capital charges on the new plant and mains.

(3) The initial capital outlay required for this purpose, allowing for growth of demand during the next 4 years, would be between £6,000,000 and £7,000,000.

(4) It is not advisable at the present stage to generate at stations situated at the coalfields.

(5) To supply the general domestic demand from 10 model stations on any of the present sites would cost, including capital charges, at least 20 per cent. more than from plant concentrated on sites down the river.

(6) If the comparison be made, not with ten new stations, but on the assumption that the existing plant in the 10 best existing stations be re-arranged and utilised to the best advantage, the policy of extending on the existing sites shows to still less advantage.

(7) If the necessary concentration of plant could be effected by extending two or three of the existing stations "below bridge," the saving in the cost of transmission would be outweighed by the disadvantages of such a policy, even on financial grounds.

(8) A policy initiated by the concentration of production on sites down the river is the right one for London, on financial grounds, apart from its other great advantages. Its immediate adoption is essential to economy.

The conclusions are based upon technical and commercial considerations. It can be shown that the actual financial gain to London which would result from such a change would be much greater than the direct economies.†

On the subject of "distribution," the Report states that one-third of the 27 millions invested in electricity undertakings in Greater London is represented by cable and house services. Some 49 different systems and pressures of distribution are in use, which might be gradually reduced to about one-third without very prohibitive expenditure, but further reduction would be costly. In nearly all cases the existing networks would be quite unable to cope with the great increase in the demand for power and heat, especially in residential districts, which would result from a general reduction in price.

To obtain this price, the cost of distribution must be reduced, and this could only be done by the introduction of alternating current distribution for dealing especially with the demands other than lighting.

The conclusion arrived at is that the present distributive systems in the various districts, instead of being generally extended, should be supplemented as required by a high-pressure, 3-phase, system—transformers being installed at intervals for supplying the consumer at low pressure through distributing cables. Such a system when laid would cost at least £10,000,000 less than the extension of the existing direct current networks which would otherwise be necessary to meet the general domestic demand. Its adoption would, in addition, result in reducing the total operating expenses of the undertaking by 12 per cent. As and when this new network was laid, all additional power, heating, and in some cases lighting would be supplied from it. As the supply given through it would be at a lower price than that from the existing mains, it is obvious that many consumers would also change over their present installations to it, and it would usually not be necessary to extend the existing distribution systems.

In some districts the existing networks might suffice to supply the heating and power loads also, for a time, but one of the aims would be to encourage in all possible ways the *gradual* laying down of a standard 3-phase network with a view to the ultimate standardisation of distribution in London. This might possibly be assisted in some cases by the loan of capital for the purpose from some central authority, to existing authorities.

There should be two systems of distribution standardised for London:—

(1) A 3-phase high-pressure system, as referred to above. This would be laid as the existing systems became loaded up, and would eventually replace the existing systems entirely in most districts.

(2) A 500 volt 3-wire D.C. distribution system for lighting, consisting largely of existing networks. This might eventually be done away with in many districts, but where it was wise or economical to retain it, it would be retained.

Stress is laid on the urgency of standardising the primary distribution throughout London, that is of high-pressure mains laid for supplementary use or connecting up existing stations. The frequency of 50 cycles per second is considered the most suitable. While it is regarded as essential that production and primary distribution should be in the hands of one authority, and important that the secondary distribution should gradually be standardised, it is not considered as absolutely essential that the distribution and sale of electricity should be entirely carried out by one authority—at least at first—though that arrangement would probably lead to the most rapid development.

The reporters state:—

While in our opinion the time is ripe for beginning the standardisation of distribution methods *technically*, it is not essential at the moment so completely to unify the *commercial* side of retail distribution. If there were a number of different bodies using different commercial methods of selling electricity it would not impede the development of electrical supply as much as if a number of different technical methods were used.

After carefully considering the whole matter, we have come to the conclusion that having in view the large amount of development work that has been done by both local authorities and companies in London, the most practical arrangement as regards distribution would be one on the following general lines, though, in practice, numerous modifications would doubtless be employed in different districts.

Under the scheme suggested:—

(1) No general extension of the existing networks would take place, but there must of course be slight additions and alterations from time to time as well as connections to new consumers.

(2) In a certain number of districts the complete undertaking would be immediately, and in other districts gradually, taken over by some central authority.

(3) At any rate in the majority of other cases a bulk supply would be taken.

Under these conditions the following would be the best arrangement in connection with the existing and proposed new networks, respectively:—

Existing Networks—Extensions.—Except in cases where the whole undertaking is acquired by the central authority, house services and short extensions might still be done by the existing authority.

Operation and Maintenance.—The same applies to the operation and maintenance of existing networks.

Sale of Electricity.—In cases where the network is retained by the existing distributors, selling might also be retained by them. In some cases the sale of electricity might be retained by them even though the network was handed over to the central authority.

New Networks.—As regards the new networks which we recommend should be laid to supplement the existing networks as these become loaded up, we think the following should govern the policy adopted:—

Design.—This must in all cases be in the hands of the central authority.

Laying.—The actual work of laying, or at least the breaking-up of streets and reinstatements, might be retained by the existing authority, if so desired.

Ownership.—The new network might be in the hands of either the central authority or the existing authority, the other terms of the arrangement being varied accordingly.

Operation and Maintenance.—Except as regards the breaking-up and reinstatement of streets, this would, as a rule, need to be in the hands of the central authority.

House Services.—Here again except possibly for actual breaking-up of streets, both the laying and the maintenance would usually have to be in the hands of the central authority.

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*This saving, in conjunction with the present sinking funds, would enable the existing generating plant to be written off by 1931.

†Some recent and careful investigations into this question elsewhere, indicate a possible saving approaching £5 per head of population per annum.

> Sale of Electricity.—The sale of electricity to all retail consumers might usually, if desired, be retained by the local distributers, whether they own the network or not.

It is obvious that many modifications of the above arrangements based on the same general principles are possible, such for example, as combination of neighbouring authorities' distribution systems. Overlapping of existing mains should, of course, be abolished.

Ultimately, throughout London, both generation and distribution may be carried out by one organisation; in the meantime it will be necessary when making arrangements with the different distributors always to keep in view two points, viz. :—

(1) That nothing be done to hinder the ultimate unification and standardisation of distribution in London.

(2) That everything be done to reduce the price of electricity to the consumer and to increase its use. A sliding scale or other means of protecting the consumer should be negotiated for or insisted on in any new arrangements that may be made.

The report then proceeds to consider the possible methods of effecting unification of supply, the alternatives being: (*a*) bulk supply, (*b*) competition, (*c*) amalgamation, and (*d*) some combinations of these alternatives.

Bulk supply would not even remove the difficulties of the Council in 1931, and it would be difficult to make the adoption of such a supply compulsory by existing undertakings, although steps might be taken to prevent the extension of existing stations.

(*To be concluded.*)

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

A special Civic Committee was formed recently in Montreal to consider the question of tube railways, and, generally, the transportation problems of the city. Nothing has yet been done, however, and it seems that, as a new set of aldermen will be in office before long, it has been thought better that a new Committee should go into these matters.

More than 2,000 delegates, representing a large number of Ontario municipalities, went to Ottawa a few days ago to ask the Dominion Government for the subsidy of $6,400 per mile for hydro-electric radial railways (as they are being called here), to which reference was made very recently in these notes.

The Premier promised that the Government would give the matter the fullest consideration. As this is one of the largest deputations which has ever presented itself at the Federal Parliament buildings its request is not likely to be forgotten.

Further examples of the extension of municipal ownership are shown by the ratepayers of Brantford, Ontario, having recently voted by a very large majority in favour of buying the local tramway system and by those of Kalso, B.C., having just decided to buy the plant of the Kootenay Electric Co.; these cases may be offset, however, by the town of St. Thomas, Ontario, where the municipal tramway system does not pay, and one of the citizens has offered to take it over and operate it for five years.

The City Council of Prince Rupert, B.C., the terminal point of the Grand Trunk Pacific Railway, is spending some $380,000 on an initial unit for a municipal hydro-electric plant. This city is likely to become a place of considerable importance during the next few years; it is situated on Kaien Island, about 500 miles north-west of the city of Vancouver.

The railway company has in progress works which will cost altogether about $7,250,000, while the Dominion and Provincial Governments are spending $450,000 and $300,000 respectively on public buildings, and the city is planning works which will take nearly $1,000,000.

Calgary, in Alberta, is to vote shortly on by-laws which, if passed, will authorise the expenditure of $1,734,600 on public works, $300,000 of which will be devoted to electrical requirements.

The electrification of the C.P.R. branch to New Westminster, in British Columbia, as well as several others in that Province, is said to have been decided upon.

The Nova Scotia Legislature has before it a proposed Bill for the incorporation of the Nova Scotia Tramways and Power Co., Ltd., with an initial capital of $5,000,000, with power to increase to $10,000,000.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A Two-Rate Switch.

We have received from the Kartret Engineering Co., of Queen Anne's Chambers, Westminster, S.W., particulars of their Kartret patent two-rate switch, built in sizes for from 10 to 150 amperes running current.

This apparatus is designed to protect a two or three-phase squirrel-cage motor-circuit at starting, as well as during running; the circuit is fused at a higher capacity when starting than during normal running.

There are two switches in each phase, and each switch is in series with a fuse. The first operation closes all the switches together, when each pair of fuses is paralleled; directly the operator removes his hand, *i.e.*, when the motor attains running speed, this allows the handle to move forward slightly, and one switch on each phase opens circuit and cuts out its own fuse. To switch off, the handle is operated in the ordinary way.

The fuses for starting can be selected to suit the conditions, and in case of accidental overload the fuses will blow, whether the switch is in the starting or running position.

The switches are of the firm's patent type, with laminated brushes and sparking tips, and the apparatus is of enclosed iron-clad construction.

Ferodo Brake and Clutch Linings.

The Herbert Frood Co., Ltd., of Chapel-en-le-Frith, send us particulars of some tests carried out on fabric friction surfaces by the National Physical Laboratory during 1913.

The importance of such fabrics has increased greatly during recent years, and we understand that all the underground railways of London and Paris have for many years relied exclusively upon Ferodo fabrics for braking purposes, and that such fabrics generally last about three times as long as chilled iron. The N.P.L. tests were instituted by the company, and extended over 12 months; they bear out the firm's own experience. From the data obtained it appears that with standard Ferodo bonded asbestos, tested at speeds of 600, 2,900 and 5,600 ft. per min. and pressures per sq. in. of 20-176 lb., the coefficient of friction remained very uniformly at ·30 to ·32; similar tests with die pressed Ferodo bonded asbestos at speeds of 600 and 2,900 ft. per min. and pressures up to 66 lb. per sq. in. gave coefficient values of ·30 to ·33.

As regards the bonded asbestos, it is pointed out that such material is of great value because of its heat resisting qualities and small wear; the results show that hydraulic compressing improves the wearing qualities.

Similar tests as regards coefficient value of Ferodo fibre, at 600, 2,900 and 5,500 ft. per minute, and pressures of 16 to 39 lb. per sq. in., show results of ·70-·73, ·63-·64, and ·56 at the three speeds mentioned. Comment is made on the high coefficient value and slow wear. Increased temperature raised the coefficient value, which effect also followed an increase of pressure and speed; the value of the coefficient when lubricated was satisfactory, and the work absorbed high.

A comparison with other materials was made, from which it was found that Ferodo fibre absorbed 39,000 ft.-lb. per sq. in. per min. at 1 000 ft. per min., Ferodo die pressed bonded asbestos, 18,000 ft.-lb., and Ferodo standard bonded asbestos, 15,500 ft.-lb., at pressures of 60, 60 and 50 lb. per sq. in. respectively.

Nine other competitive materials tested gave values of 10,800 to 3,100 ft.-lb., under pressure varying from 40 to 10 lb. per sq. in., the test conditions being similar. The pressures for these nine materials were the maximum possible owing to the breaking up of the test pieces; similarly cut samples of Ferodo fabric were tested up to 176 lb. per sq. in. before commencing to give way.

The test results will obviously repay perusal by engineers and others interested in brake and clutch mechanism.

Copper.—Returns for mid-month (as tabulated by Messrs. H. R. Merton & Co., Ltd.) show an increase in European visible supplies and slight easing of price. Supplies in Great Britain on April 15th were 10,597 tons, or 109 tons more than at the end of March. French supplies had increased 329 tons in the same period, and total European risen from 26,755 to 27,203 tons.

Arrivals from S. America during the fortnight were well up to the average, and from Spain just on it. Shipments from Chile were very low at 550 tons, while Australian were average. Total deliveries for the fortnight still indicate a fairly brisk month, though not like March.

American supplies for March 31st, at 28,843 tons, show low, and with a considerable drop from February. The world's supply on March 31st, 54,972 tons, shows a loss of 6,968 tons on the month.

ELECTRICAL TRADES BENEVOLENT INSTITUTION.

IN fulfilment of our promise, we now publish the complete list of contributions collected by Mr. Hugo Hirst as chairman of the Annual Festival Dinner. The Institution is placed under a great debt to Mr. Hirst for such a splendid achievement. We shall print the secretary's list of Dinner contributions, and other contributions received during the year, in our next issue.

	£	s.	d.
Acme Elec. Mfg. Co.	1	1	0
Acme Screw Co.	0	10	0
Adams, H. W.	0	10	6
Adams, L.	1	1	0
Addressograph, Ltd.	1	1	0
Alexander, G.	1	1	0
Allan, F. G.	0	5	0
Allan & Meggitt	0	5	0
Allen, David, & Sons, Ltd.	2	2	0
Allen, F. G.	0	5	0
Allen, Strong, & Co.	1	1	0
Allen, West & Co.	2	2	0
Alwood, K.	1	1	0
American Hard Rubber Co.	0	10	6
Anderson, Anderson and Anderson	0	10	6
Anderson & Anderson	0	10	6
Anderson & Munro	0	10	6
Anderson & Son, Ltd.	1	1	0
Andrews, F. E.	0	10	0
Angold, A. E.	1	1	0
Angus, G., & Co.	0	5	0
Anonymous	5	5	0
Anonymous	5	5	0
Anonymous	1	1	0
Anonymous	0	12	0
Anonymous	0	10	6
Anonymous	0	10	6
Archer, G. A.	0	5	0
Arculus & Co.	1	1	0
Armstrong, Stevens & Co.	1	1	0
Arnold, W. A., and Sons	5	5	0
Aron, Manfred	5	0	0
Aron, Maurice	1	1	0
Aron Electricity Meters, Ltd.—			
(Donation)	15	15	0
(Subscription)	10	10	0
Art Reproduction Co.	0	5	0
Ash & Lacy, Ltd.	0	10	0
Assersohn, D.	22	1	0
Attwater & Sons	2	2	0
Ault & Wiborg Co.	1	1	0
B. & D. C.	0	10	6
B. (F. W.)	1	1	0
Babb, T. G.	0	10	6
Bacon & Curtis	0	10	6
Bailey, W. P.	1	1	0
Baker, C.	0	5	0
Baker, C. E.	1	1	0
Baker, D. R.	0	10	0
Balcke & Co.	1	1	0
Balding & Mansell	2	2	0
Baldwin, J. W.	0	10	6
Baldwin, J., & Sons	1	1	0
Baldwin, Ltd.	5	5	0
Ball, F. W.	0	10	6
Ball, J.	0	10	6
Ball, S. W.	0	10	6
Barbour, J.	2	2	0
Barker & Allen	1	1	0
Baroni, A. M.	1	1	0
Barras, G.	0	10	6
Barry Graving Dock Co.	2	2	0
Bartlett, A. T.	1	1	0
Barton & Sons	1	1	0
Barton, F. J.	0	5	0
Barwell, C. J. W.	1	1	0
Bateman & Co.	1	1	0
Baughan, A. H.	0	10	6
Baxter, A. & F.	0	10	0
Bazeley & Sons	1	1	0
Beach, H.	1	1	0
Bean, R. F.	2	2	0
Beaven, C.	0	5	0
Becks, A. T., & Co.	0	10	6
Behrens, Miss	0	6	0
Bellows, J.	0	5	0
Bennett & Thorne	0	10	0
Bentley, H. L.	1	1	0
Bergtheil & Young	2	2	0
Berk, F. W.	1	0	0
Berkeley, A.	0	10	0
Bernstein, P.	1	1	0
Berry, Harrison, & Co.	1	1	0
Berry, Henry, & Co.	2	2	0
Berry, Skinner & Co.	5	5	0
Bielefeldt, P.	4	0	0
Birch & Workington, Ltd.	0	5	0
Birchter, K.	0	5	0
Birmingham Products Co.	0	10	6
Black, Mrs. M. W.	3	3	0
Blackburn & Powell	0	10	0
Blades, N.	0	5	0
Bland, H.	0	5	0
Blay, W. F., Ltd.	0	10	6
Blume, Charles	0	5	0
Blenheim, W.	0	5	0
Blessett, B.	0	5	0
Bohler & Co.	1	0	0
Boker & Kreuger	4	18	0
Bolding & Sons	0	10	6
Bolton & Sons	1	1	0
Bolton, W. M.	0	10	6
Bond, A.	0	5	0
Bonnella Bros.	1	1	0
Bonnella, D. H., and Sons, Ltd.	1	1	0
Booth, J., & Co.	1	1	0
Booth, J. G.	0	5	0
Boston, Thomas	0	10	6
Boston, P., & Sons	2	2	0
Bourne, A., & Co.	0	5	0
Bourne, J., & Sons	1	1	0
Bowerman Bros.	0	10	0
Bowthorpe, H.	0	10	6
Bowthorpe, W.	0	10	0
Boyd, W. R. E.	2	0	0
Boyes, L. F.	0	10	0
Boyes, F.	1	1	0
Bradley Steel Strip Co.	1	1	0
Bradstreet, W. J.	0	5	0
Braham, A. F.	0	5	0
Bray, Gibb & Co.	2	2	0
Brecknell, Munro and Rogers, Ltd.	0	5	0
Brefitt, E., & Co.	1	1	0
Bressman, F. A.	1	1	0
Bridge, David, & Co.	2	2	0
Briggs, Thomas	0	10	6
Briscoe, W. H., & Co.	2	2	0
Bristol Elec. Safety Lamp Works	1	1	0
Bristows, Cooke and Carpmael	10	10	0
British Central Elec. Co.	0	10	0
Brittains, Ltd.	1	1	0
British Electric Calibrated Fuse Co.	5	5	0
British Electrical Equipment, Ltd.	1	1	0
British Petroleum Co.	0	10	6
British Sherardisers, Ltd.	1	1	0
British Systems, Ltd.	1	1	0
British Telep. Supply Co.	1	1	0
Brit Thomson-Houston Co.	10	10	0
"British Trade Review"	1	1	0
British Traders' Association	3	3	0
British Uralite Co.	1	1	0
Brit. Vacuum Cleaner Co.	1	1	0
Broad, J. V.	0	5	0
Broadbent, F.	1	1	0
Broadhurst & Co.	1	1	0
Brocklehurst & Sons	1	1	0
Brooke, C. F.	1	1	0
Brook, L. H.	0	10	0
Brookhouse, R. H.	5	0	0
Brooks, Ward & Co.	0	10	6
Brunker, T. E.	0	10	6
Bruty, J.	0	5	0
Buchanan & Curwen	1	0	0
Bucknell, P.	0	10	6
Bullard, King & Co.	2	2	0
Bullers, Ltd.	5	5	0
Bullows, J., & Co.	0	10	6
Burrows, H. G.	0	10	6
Burton, Griffiths, C. W., and Co.	2	2	0
"Bury and Norwich Post"	0	5	0
Butler & Spragg	0	10	6
Byng, E. G.	100	0	0
Byng, F. G.	5	0	0
Byng, H. G.	23	3	0
Byng, L. G.	40	0	0
Byron Dyeing Co.	0	10	6
Byworth, J.	2	2	0
C. B.	0	10	6
Cable Accessories Co.	3	3	0
Cadby, G., & Sons	0	10	0
Calmon Asbestos Co.	0	5	0
Cameron, J. W., and Co.	0	10	6
Camilinat, E., & Co.	0	5	0
Canning, W. C.	1	1	0
Cannon, A. V.	0	10	6
Carbone, Le	0	10	6
Carbon Paper Supply	1	1	0
Cardboard Box Co.	0	10	6
"Car Illustrated"	1	1	0
Carless, Capel and Leonard	1	1	0
Carlton Studio	1	1	0
Carlyle, Chirm & Co.	1	0	0
Carr, A. L. F.	0	10	6
Carrs (Saltley), Ltd.	0	10	6
Carter, J., & Co.	0	10	6
Cartwright, J. P.	1	1	0
Cash, F. T.	1	1	0
Cash, H. J., & Co.	1	0	0
Caslake & Co.	10	10	0
Casperd, H. A.	0	10	6
Castle Rubber Co.	0	10	0
Cattell, C. S.	1	1	0
Chamen, R. A.	1	1	0
Chance, W. E., & Co.	5	5	0
Chaplin, S. H.	0	10	6
Chapman, F. M.	2	2	0
Chapman, Mrs. F. M.	1	1	0
Cheiloti, G.	1	1	0
Childe, E. A.	10	10	0
Chloride Elec. Storage Co	3	3	0
Churchill & Co., Ltd.	1	1	0
Chutter, L.	0	5	0
City Glass Co.	0	5	0
Clayton, A. J.	1	1	0
Cleave & Co.	0	10	6
Clement, J.	1	1	0
Cleveland Iron Co.	2	2	0
Clifton & Kersley Coal Co.	0	10	0
Clouth, F., & Co.	4	4	0
Coates, H. J.	1	1	0
Cochrane, A. R.	1	0	0
Collings, J. H.	1	1	0
Colson, Thomas	5	0	0
Concordia Elec. Wire Co.	5	5	0
Conley Foil Co.	1	1	0
"Contractors' Record"	1	1	0
Cook, Edward, & Co.	0	10	6
Cook, F. W.	0	10	6
Cooper & Goode	1	1	0
Cooper, C.	0	10	0
Coote, E.	0	10	6
Cottis, W., & Sons	1	1	0
Courtenay, A. R.	0	10	6
Coveney, F.	1	1	0
Cowan, C. R.	0	10	0
Coward, Philipson & Co.	2	0	0
Cox, W.	2	2	0
Craig, K. C.	0	10	6
Craig, L.	0	10	0
Cramb, Alexander	1	1	0
Crampton & Co.	2	2	0
Crawford, F.	1	10	0
Crawshaw & Sons	1	1	0
Cresswells, Ltd.	1	1	0
Croal Spinning, Ltd.	1	1	0
Crowley & Sons	0	5	0
Cruickshanks, R., and Co.	0	10	6
Crypto Electrical Co.	2	2	0
Crystalate Mfg. Co.	2	2	0
Curtis Manufacturing Co.	1	1	0
Curtis, W.	1	1	0
"Daily Chronicle"	5	5	0
"Daily Express"	1	1	0
"Daily Telegraph"	10	10	0
Dark, M. S.	0	10	6
Dashwood, E. S.	1	0	0
Davidson, C. S.	1	1	0
Davis & Timmins	5	5	0
Davis, A. R., & Co.	0	10	0
Davis, H. M.	2	2	0
Davis, S.	1	1	0
Dawson, J., & Son	1	1	0
Dawson, Philip	2	2	0
Deeley, J. H.	0	10	0
De Garrs & Allen, Ltd.	5	5	0
Dennis, R.	0	5	0
Dernier, Louis, & Co.	5	5	0
Deverill, A. G.	0	10	0
Dixon (Walter) & Co., Ltd.	2	2	0
Docker Bros.	1	1	0
Dockrell, Thos., and Sons	0	10	6
Dodimead, A. E.	2	2	0
Donnison, Sillem, and Co	1	1	0
Dornier & Co.	2	2	0
Doulton & Co.	2	2	0
D. P. Battery Co.	1	1	0
"Drapers Record"	1	1	0
Dray, G. W., & Sons	0	5	0
Drennan, Glover, and Cooper	1	1	0
Drury Bros.	0	10	0
Duckitt, T.	0	10	6
Du Cros, W. & G., Ltd.	1	1	0
Duncan Watson & Co.	2	2	0
Durran, J., & Sons	0	10	0
Dussek Bitumen Co.	0	10	6
Dutilh, D. A., & Co.	1	0	0
Dyer & Young	1	1	0
Earle, Bourne, & Co.	0	10	0
"Eastern Daily Press"	0	10	6
Eaton, A.	0	10	6
Ebonestos Mfg. Co.	0	10	6
Eckstein & Heap	5	5	0
Edey, F. G., & Co.	1	1	0
Edwards & Barnes	2	2	0
Edwards, G. W.	1	0	0
Edwards, R. A. S.	1	0	0
"Electrical Industries"	0	10	6
Electrical Installations, Ltd.	1	1	0
Electrical Press	2	2	0
Electric Battery Co.	0	10	0
Electric Control, Ltd.	1	1	0
"Electrical Times"	5	5	0
"Electrical World"	1	1	0
"Electrician" Printing & Publishing Co.	2	2	0
Ellermann City Lines	2	2	0
Elliott Metal Co.	1	1	0
Ellis, Simpson and Saunders	10	0	0
Ely, N. W.	1	1	0
Emery Bros.	1	1	0
"Engineering," Ltd.	1	1	0
Engineers' Standard Catalogue	2	2	0
Escombe, McGrath & Co.	1	1	0
Essex Accumulator Co.	3	3	0
Espir, Ferdinand	1	1	0
Evans, J. Wesley	0	10	6
Evans, W. E.	0	5	0
Everitt & Co.	5	5	0
Evershed, W.	0	10	6
Evershed, W. J.	0	10	6
Export Dept.'s Staff, G.E.C.	0	17	0
Facsimile Letter Printing Co.	1	1	0
Fairclough, T. M., and Co.	2	2	0
Falshaw, R.	3	3	0
Farthing, J. H.	1	1	0
Feld Bros.	3	3	0
Felten & Guilleaume	10	10	0
Fenestre, Cadisch & Co.	1	1	0
"Financial News"	5	5	0
"Financier," The	0	10	6
Fisher Renwick, Ltd.	0	5	0
Fisher, W. C.	1	1	0
Flaxman, A. E.	0	5	0
Fleming, J., & Co.	1	1	0
Fletcher, E. W.	1	0	0
Fletcher, H.	0	5	0
Fletcher, J. Y.	2	2	0
Flower, J. B.	0	5	0
F[illegible] & [illegible], Ltd.	1	0	0
Ford, Ltd.	1	1	0
Forman, Thomas, and Sons	1	1	0
Foster, J. R., & Co.	1	1	0
Fothergill, A. E. ([illegible] & Sons)	1	1	0
Fox, J.	2	0	0
France, W. M.	1	1	0
Francis, W.	0	10	6
Franklin Co., The	0	5	0
Fraser, G. R.	2	2	0
Fraser, J.	2	2	0
Frederick Crane Chemical Co.	1	1	0
Freeman, A.	0	5	0
Fry, Claud	1	1	0
Gamage, A. W., and Co.	1	1	0
Gaskell & Grocott	1	1	0
Garcke, E.	100	0	0
Gardner, J.	0	10	6
Garrard, Dr.	2	0	0
Gay Bros.	0	5	0
Gee & Watson	0	5	0
Geipel & Co.	1	1	0
Gem, H. A. & G. P.	1	1	0
General Electric Co.	100	0	0
General Transport Co.	0	10	6
Gentry, S.	0	10	6
Gerstle, S.	1	1	0
Gibbons, B., & Sons	0	10	0
Gilbertson, H.	0	5	0
Gilkes, J. C.	0	5	0
Gill, A. B.	10	10	0
Gill, W.	0	10	6
Gillman, J., & Sons	1	1	0
Gilson, C. J., & Co.	2	2	0
Gilson, D., & Co.	2	2	0
Girdlestone & Co.	0	10	6
Glanmor Foundry Co.	0	10	6
"Glasgow Herald"	1	1	0
Godrich, A. E., & Co.	1	1	0
Goldsmith, E.	0	10	6
Goligher & Smith	2	2	0
Goodwin, J. A.	0	5	0
Goodyear, S., & Sons	0	7	6
Gorham, J. M.	1	1	0
Gosling, A. S.	0	10	6
Graham, Alfred, & Co.	2	2	0
Grainger, T. J.	1	1	0
Granville Electro-Plating Co.	1	1	0
Gray, J. Hunter	5	5	0
Gray, John	5	5	0
Greaves, T. W.	0	10	0
Green, F., & Son	0	10	6
Green, F., & Sons	0	10	6
Green, J. C.	0	5	0
Greenwood, L. A.	0	5	0
Grevener, J. & H.	3	3	0
Griffith, J. W.	0	10	0
Griffiths Bros & Co.	2	2	0
Grigsby, B. J.	1	1	0
Grigsby, P.	1	1	0
Groom, H. R. L.	0	10	0
Grothe & Sons	1	0	0
Grove, Edward	0	10	6
Gullet, W.	0	5	0
Gunn, N.	1	1	0
Gunn, Thomas, Ltd.	2	2	0
Gunner, C. E.	0	5	0
Gunzburg, R.	20	0	0
Gunzel & Rosenberger	0	10	6
H. B.	0	10	6
Haddock & Parker, Ltd.	2	2	0
Hadley, A.	0	10	0
Hagen, Jonas, & Co.	0	10	6
Hague, H. B.	1	1	0
Hague, H. B., & Co.	0	10	6
Haken, C. E.	0	10	6
Hale, F. H.	0	10	6
Hall & Pickles, Ltd.	1	1	0
Hall, J., & Co.	2	2	0
Hamburger, A.	1	1	0
Handford, F.	0	5	0
Hann, E. W.	1	1	0
Hanson, Brown, & Co.	0	10	6
Hardman, C. A.	0	10	6
"Hardware Trade Journal"	1	1	0
Hardy, J. North	1	1	0
Harper, W., Son, & Co.	0	10	0
Harriman, S.	1	1	0
Harrison, H.	0	10	6
Harris, A. E., & Co.	1	1	0
Hatton, Charles & Co.	0	10	6
Hawkins, A., & Sons	0	10	0
Hawkins & Sons	0	5	0
Head, Henry, & Co.	2	2	0
Heath, W. G.	1	1	0
Heaton, W. H.	1	5	0
Hecht, Levis & Kahn	1	1	0
Heckford, A. E., & Co.	0	10	6
Heilbut, Symons & Co.	5	5	0
Helbing & Passmore	10	10	0
Henderson, George	10	10	0
Henderson & Walker	1	1	0
Hernu, Peron & Co.	1	1	0
Herve, L.	9	9	0
Heward, S. Barclay	5	0	0
Hewitt Bros.	1	1	0
Hicks, H.	1	1	0
Hicks, H. B.	0	2	6
Higson, J.	1	1	0
Hill, Craven & Hay	1	1	0
Hill — (Moberley and Perry)	3	3	0
Hill, W. W., Sons, and Wallace, Ltd.	1	1	0
Hillebrant, I. J. H.	10	0	0
Hills, W., & Co.	2	2	0
[illegible]	1	1	0
[illegible]	1	1	0
[illegible]	100	0	0
[illegible]	1	1	0
[illegible]	1	1	0
[illegible]	0	10	6
[illegible]	0	10	6
[illegible]	0	5	0
[illegible]	0	10	6
[illegible]	1	1	0
[illegible]	2	2	0
[illegible]	0	5	0
[illegible]	1	1	0
[illegible]	2	2	0
[illegible]	0	5	0
[illegible], H. H.	1	1	0
[illegible], W. H., & Sons	1	1	0
[illegible], Ltd.	2	2	0
[illegible], L. C.	1	1	0
[illegible], M.	0	5	0
[illegible], M.	0	5	0
[illegible], J. L.	2	2	0
Hook, C. M.	1	1	0
Horsfall, L.	0	10	6
[illegible], Ltd.	1	1	0
Houlder Bros., Ltd.	2	2	0
[illegible], Dr. [illegible]	1	1	0
Hudson & Sons	1	1	0
Hughes, J. H.	1	1	0
Hughes, J. & J.	1	1	0
Hughes Stubbs Metal Co.	2	2	0
Hunt, F.	0	10	0
Hunt, J. A. H.	1	1	0
Hurburgh, L. H.	3	3	0
Huth, Fredk., & Co.	5	5	0
Hyde, J. B., & Co.	5	5	0
Ickelheimer, Max	2	0	0
Ide, A. E.	1	1	0
Ide, G. H.	5	5	0
Igranic Electric Co.	5	5	0
"Illustrated London News"	2	2	0
"Illustrated Sporting & Dramatic News"	1	1	0
Imhoff & Lange	1	1	0
Industrial Waste Eliminators	1	1	0
Ingram, J. G., & Sons	1	1	0
"Investors Guardian"	1	1	0
Ireland, A. J.	1	1	0
"Ironmonger, The"	2	2	0
Jackson & Boyce	0	10	6
Jacob & Valentin	1	1	0
Jacobs, H.	0	5	0
James, H. V.	1	1	0
Jaroslaw, D.	2	2	0
Jeffcoat, C. H.	0	10	6
Jenkins & Son	0	5	0
Jenks, A. E., & Cattel	1	1	0
Jepson, A. E.	0	7	6
Jessop, J. F.	0	10	6
Jeynes, A., & Sons	1	0	0
Johnsen & Jorgensen	10	10	0
Johnson & Phillips, Ltd.	10	10	0
Johnson, Clapham, & Morris	1	1	0
Johnson, Matthey & Co.	5	5	0
Johnson Iron & Steel Co.	1	1	0
Jones, B.	1	1	0
Jones Bros.	1	1	0
Jones, C. W.	1	1	0
Jones, G. R. & Co.	0	10	6
Jones, Manley, & Co	1	1	0
Jones, Price, & Co.	0	10	6
Joseph, W.	0	5	0
Joyce, E. A.	0	5	0
Joyce, Mrs. E. A.	0	5	0
Juniper, C.	0	5	0
Juttke, Dr.	1	1	0
Kahl, A. R.	1	1	0
Kahn, Dr.	0	10	6
Kahn, H.	1	1	0
Karteret Engineering Co.	0	7	6
Kemnitz & Uhlig	1	0	0
Kempton, C., & Sons	2	2	0
Kenney & Co.	0	10	6
Kensington Stamping Co.	10	10	0
Kerr-Jones, T.	0	10	6
Key & Whiting, Ltd	1	1	0
Kidd, J., & Co	1	1	0
Killick, Martin & Co	1	1	0
Klingenstein, W., & Co.	1	1	0
Kipping, P. P.	3	3	0
Kloster, Veitsdorf	1	[illegible]	3
Knight, C. J.	0	10	6
Knight, C. S.	0	10	6
Koettgen, C.	5	5	0
Kramer, H. von	1	1	0
Kr[illegible], F., & Co.	1	1	0
Kratscher, H.	1	0	0
Krause, A.	1	1	0
Krausse & A[illegible]	1	1	0
Kroianker, [illegible] Lowenstein & H[illegible]	10	10	0
Krupka & J[illegible]	1	1	0
Lacey, J.	0	10	0
Lake, S.	0	5	0
Land, S. T.	0	5	0
L[illegible] Works	0	10	0
Langdon, C.	0	10	6
Langford, O. C.	0	10	6
Larmouth, T., & Co	5	5	0
L[illegible] & P[illegible]	0	5	0
Lawrie & Bishop	1	1	0

	£	s.	d.
Lawton M (Albion Clay Co)	2	2	0
Lee & Hunt	1	0	0
Lees, J. B. & S.	2	2	0
Lehmann Bros.	1	1	0
Lench, T. W., Ltd.	2	2	0
Leo, W. A.	0	10	6
Les Fils de Isidoro Kisch	0	8	0
Levinger, M.	2	2	0
Lewis, Thomas, Ltd.	1	1	0
Liebmann, Adolf, Dr.	10	10	0
Linde British Refrigeration Co.	5	5	0
Lines, John	1	1	0
Lister, George	0	10	6
Litholite, Ltd.	1	1	0
Lloyd, R., & Co.	1	1	0
"Local Government Journal"	1	1	0
Locke, W. J.	0	10	6
London Elec. Supply Co.	2	2	0
London Elec. Wire Co. and Smiths, Ltd.	3	3	0
"London Opinion"	1	1	0
London Sand Blast Decorative Glass Works	1	1	0
London Parcels Delivery Co.	1	1	0
Lord, F. A. B.	5	5	0
Lord & Shand	1	1	0
Lucas, J., & Co.	3	3	0
Lunge, E.	2	2	0
MacGowan, Wild, & Co.	0	10	6
McGregor, Gow, Norris, & Joyner	2	2	0
Macintyre, Jas., & Co.	2	2	0
McKechnies, Ltd.	1	1	0
Mackintosh, Charles, & Co., Ltd.	1	1	0
Maldon, J. C.	0	5	0
Maling, C. T., & Sons	1	1	0
Mallandain, A. E.	1	1	0
Manchester Bill Posting Co.	3	3	0
Marelli, Ercole, & Co.	5	5	0
Marr, J. B., & Co.	0	10	6
Marshall Engraving Co.	0	5	0
Marsh Bros.	0	10	0
Martin, W. C., & Co.	0	10	6
Martin & Clarke	0	10	0
Martin, W. Winn, & Co.	1	1	0
Maskowski, P.	1	1	0
Mason, James & Co.	1	1	0
Matthews, E., & Co.	0	10	0
Maurice, G.	2	2	0
Mavor & Coulson, Ltd.	5	5	0
Maxwell, Butcher, & Co.	0	10	6
May, W. J.	0	5	0
Mayer, S.	1	1	0
Mead, W.	1	0	0
Meaby, W.	3	3	0
Meek, Thomas, & Co.	0	10	6
Mehne, J. & G.	2	0	0
Meirowsky, A. G., & Co.	2	2	0
Mercer, J.	1	1	0
Mercer, J.	0	10	0
Merton, Hy., & Co.	10	10	0
Meyer, A., & Co.	5	5	0
Micanite & Insulator Co.	1	1	0
Middleton, V. G.	1	1	0
Midland Ironworks, Ltd.	1	1	0
Miller, W. C., & Co.	1	1	0
Mitchell, H. E.	0	10	0
Mitchell, J. & W.	2	2	0
Mitrovitch Bros.	2	0	0
Mittelhausen, Mrs.	1	1	0
Mole & Sons	1	1	0
Molineaux, Webb & Co.	0	10	0
Mond, E. S.	1	1	0
Money, F.	1	1	0
Moore, A., & Co.	5	5	0
Morgan, A. F.	1	1	0
Morgan, E.	0	5	0
Morgan, G.	1	1	0
Morgan, J.	0	5	0
Morgan Crucible Co.	5	5	0
Morgan, Reeve, & Co.'s Staff	0	17	3
Morret, Victor	0	7	11
Morris & Morris	1	1	0
Morris, W., & Sons, Ltd.	2	2	0
Morton Bros.	0	10	0
Morton (Francis) & Co.	1	1	0
Mosses & Mitchell	1	1	0
Mottet, V.	0	5	0
Mould, J. T.	0	10	6
Mueller, F. R., & Co.	1	1	0
Mullock, W.	1	1	0
Multiplex Advertising Machine Co.	2	2	0
Munzing, H., Ltd.	0	10	6
Murray, J. O'Hara	3	3	0
Myers, Leo. M.	1	1	0
Nash, H.	0	10	6
National Gas Engine Co.	1	1	0
"Nemo"	0	5	0
New, M.	2	2	0
New British Elec. Supply Co.	1	1	0
New British Ever-Ready Co.	5	5	0
Newberry, G.	0	5	0
Newby & Sons	2	2	0
New Eccles Rubber Co.	0	10	6
Newgass, B.	10	10	0
Newgass, B., & Co.	5	5	0
Newgass, Edgar	0	15	0
Newnes, George, Ltd.	2	2	0
Newport Enamel Plate Co.	0	10	6
Newton & Co	0	10	6
New York and Hamburg Rubber Co.	1	10	6
Nicholls, M. N.	0	5	0
Nicholson, C. S.	2	2	0
Nield, F. A.	0	5	0
Nielson, J. F.	1	0	0
Nippon Yusen Kaisa	1	1	0
Noble, W.	1	1	0
Noble, W. McD.	0	5	0
North-Eastern Novelties Co.	0	10	6
Northern Elec. Wire Co.	2	2	0
Northern Mfg. Co.	0	10	6
Norton & Gregory, Ltd.	0	5	0
Nugent, P. H.	1	0	0
Oberlander, Otto, Dr.	10	10	0
Ochie, Albert	0	10	6
Odhams, J. & G.	0	10	6
Oliver Arc Lamp Co.	0	10	0
Olver, P.	0	10	0
Opel Motors, Ltd.	1	1	0
Oriental Tube Works	1	1	0
Orsettich, R.	2	2	0
Ormiston, P., & Sons	5	5	0
Osborne, Samuel, & Co.	0	10	6
Osborn & Hunter	0	10	6
Osram Lamp Works	100	0	0
Owbridge & Co.	1	1	0
Page & Miles, Ltd.	2	2	0
Page, W. L.	0	5	0
Pakenham, W. L.	1	1	0
Palmer, H. Clifford	2	2	0
Palmer, W. H., & Co.	1	1	0
Paris, E. A.	5	0	0
Parish, Thomas, & Son	0	10	6
Parker, F., & Co.	1	0	0
Parkhall Pottery Co.	1	1	0
Parshall, H. F.	2	2	0
Parsons, G.	1	1	0
Partridge & Sons	0	5	0
Paterson, W.	0	5	0
Peare, W. F.	0	5	0
Peel-Conner Telephone Works	21	0	0
Peglar, C.	0	10	0
Pender, Sir James	1	1	0
Perian, H. W.	1	1	0
Perlbach, H. J., & Co.	1	1	0
Perrin, W.	0	10	6
Peter, Brotherhood, Ltd.	1	1	0
Phelp, J. A.	3	3	0
Phosphor Bronze Co.	1	1	0
Pilditch, G. F.	0	10	6
Pinchbeck Bros.	1	1	0
Pinchin, Johnson & Co.	4	4	0
Pinna, H. de, & John Venn	2	2	0
Pirelli & Co. (Milan)	20	0	0
Pirelli, Ltd.	2	2	0
Pitman, M.	0	10	6
Pitt, G. H.	0	10	6
Pitt, H. S., & Co.	1	1	0
Planchon, F. J.	6	0	0
Plutte, F.	3	3	0
Plutte, Scheele & Co.	1	1	0
Pohl, G.	1	1	0
Pooley, H., & Sons	1	1	0
Pope, H. P., Ltd.	1	1	0
Porte, F. C.	3	3	0
Potter, E. H.	0	10	0
Poulter, R. C. M.	1	1	0
P. Q. Cable Co.	1	1	0
Preece, L.	0	10	0
Preston, A.	1	0	0
Price, S. L.	0	10	6
Price, Waterhouse & Co.	1	1	0
Priestman, T. G.	0	5	0
Priestman, T. J.	0	10	6
Proctor, C. F.	0	10	0
Pugh, E., & Co.	1	1	0
Putzler Bros.	2	10	0
Pyne, H. B.	1	1	0
Quitman, C.	1	1	0
Railing, Dr. A. H.	20	0	0
Raling, M. J.	40	0	0
Ranken, A. W.	0	10	0
Rauschert, C. P.	3	0	0
Rauschert Porcelain Works, The Paul	3	0	0
Rayner, O.	0	5	0
Record, O. L.	0	5	0
Reed, H. M.	0	10	6
Rennie, J. T., & Sons	1	1	0
Renton & Co.	1	1	0
Renwick, H. B.	1	1	0
Reynolds, J., & Sons	0	10	6
Richardson, C., & Son	1	1	0
Richardson, H. G., & Sons	1	1	0
Richardson, J.	2	2	0
Riches, W. R.	0	10	0
Richford, E. M., & Co.	1	1	0
Riddle, Smith & Duffus, Ltd.	2	2	0
Ridout, F.	1	1	0
Riech, S., & Co.	1	1	0
Rigby, R	1	1	0
Rigby, T.	0	5	0
Rigby, W H.	0	5	0
Riley, Thomas	0	10	6
Risch, F.	1	1	0
River, S.	0	7	6
Robb, W.	0	10	6
Robins and Felt	1	1	0
Roberts, H. Wynne	1	1	0
Roberts, William, & Son	2	2	0
Robertshaw, J., & Sons	1	1	0
Robertson Elec. Lamp Works	21	0	0
Robertson, R. (Dobson, Molle & Co.)	2	2	0
Robertson, W. B.	0	5	0
Robinson, J. & T.	0	10	6
Robinson, R. E.	1	1	0
Robson, C. H.	0	10	6
Robson, J W.	0	5	0
Rock, A. F	1	1	0
Rogers, H.	0	10	6
Roneo, Ltd.	1	1	0
Rook, J. W.	2	2	0
Round, A.	0	10	6
Royle, W. R., & Sons	2	2	0
Rubery, Owen & Co.	1	1	0
Rudders & Paynes	1	1	0
Ruddle, M	0	10	6
Rudenberg, E.	1	1	0
Russ, S. C.	1	1	0
Russell, L., & Co.	0	10	6
Ryland's Glass & Eng. Co.	2	2	0
Rylands, L., Ltd.	0	10	0
S. B. W.	1	1	0
St. James & Pall Mall Elec. Lighting Co.	5	5	0
Sale, D.	0	5	0
Salomons, Sir David	100	0	0
Samuelson, F.	3	3	0
Sanders, Thomas, Ltd.	2	2	0
Sanders, William	1	1	0
Sands, O.	0	10	0
Sankey, J., & Sons	5	5	0
Schenker & Co.	1	1	0
Schmidt, Conrad W., Ltd.	0	10	6
Schultz & Co.	1	1	0
Schultz, E. (Loewenstein & Hecht)	5	0	0
Schwabe, Franz, & Co.	5	0	0
"Scotsman"	0	10	6
Scott, G. M.	1	1	0
Scott, J. W.	0	5	0
Scrivener, J.	0	5	0
Scupham & Wood, Ltd.	1	1	0
Seabrook, A. Hugh	1	1	0
Selinger, S.	1	0	0
Sells, Charles	1	1	0
Sells, F. S.	20	0	0
Sergeant, Longstaff, & Co.	1	1	0
Shannon, Ltd.	1	1	0
Shepherd, Swine & Markham	1	0	6
"Ship Building and Shippers' Record"	2	2	0
Shrimpton, G., & Sons	0	5	0
Shrimpton, George, & Sons	1	1	0
Siddaway, E.	0	10	0
Siddons, J. & J.	1	1	0
Simon, A.	1	0	0
Simon, H. F.	1	1	0
Simpson, Alfred, Ltd.	1	1	0
Simpson, C. L.	1	1	0
Sims, P. J.	3	3	0
Sinclair, D.	0	10	0
Sinnott, J.	0	7	6
Sisson, W., & Co.	1	1	0
Smallman & Sons	1	1	0
Smith, F., & Co.	1	1	0
Smith, J. Archer	1	11	6
Smith, R. Wilson	2	2	0
Smith, Thomas	1	1	0
Snell (Albion) & Partners	1	1	0
Snowden, W. H.	0	5	0
Spence, J.	1	1	0
Spicer Bros.	1	1	0
Spicer, T. D.	0	10	0
Staff of Publication Dept. (G.E.C.)	0	12	0
"Standard, The"	5	5	0
Stearn Electric Lamp Co.	1	1	0
Stearn, Frederick & Co.	2	2	0
Steel Barrel Co.	2	2	0
Steel Conduit Co.	2	2	0
Steinbach & Hohn	3	0	0
Stevens & Williams	5	5	0
Stiles, T. P.	1	1	0
Still & Co., M. C.	1	1	0
Stinton, H. O.	0	10	6
Stolbenberg Patent File Co.	1	1	0
Storey, W.	0	5	0
Strachan, J.	1	1	0
Stranack, H. E.	0	5	0
Stothert & Pitt	1	1	0
Stuart, K. R.	0	10	6
"Sunday Times"	1	1	0
Sutro, L., & Co.	2	2	0
Sutton & Co.	1	1	0
Swift, Levick & Sons	1	1	0
Swinburne, James	1	1	0
Swinton, A. A. C.	5	5	0
Swiss Bankverein	2	2	0
Symington, W., & Co.	2	2	0
"Sympathiser"	0	5	0
Tannahill & Co.	1	1	0
Taylor, A. L.	1	1	0
Taylor, C.	1	0	0
Taylor, J. A., & Sons	0	10	6
Taylor, S., and Co.	0	10	6
Taylor, T.	1	1	0
Taylor, Tunnicliff & Co.	6	6	0
Terry & Co., Ltd.	2	2	0
Terry, H., & Sons, Ltd.	0	10	6
Thames Paper Mills Co.	5	0	0
Thom & Cook	2	2	0
Thomas, J.	0	5	0
Thompson, H. F.	0	5	0
Thornhill & Cowley	0	5	0
Thornley, Samuel, & Co.	5	0	0
Todd, J., & Sons	0	10	0
Touche, G. A., & Sons	2	2	0
Townshend, Bros.	0	10	0
Traun, H., & Sons	1	1	0
Trefileries et Laminoirs du Havre	10	10	0
Treherne, J., & Sons	0	10	6
Trezise, J. N. C.	0	10	6
Trippe, C. F.	0	10	0
Tubbs, Franklin	1	1	0
Tufnell, C. F.	1	1	0
Tullis, J., & Sons	1	1	0
Turner Aspirator Co.	0	6	0
Turten, J. A.	0	10	6
Ullman, J., & Co.	1	1	0
Underwood Typewriter Co	1	1	0
Ungley, Edwin	0	10	0
Union Castle Mail Steam Ship Co.	2	2	0
United Flexible Metallic Tubing Co.	0	10	6
Unsworth, A., & Co.	2	2	0
Utting, J. W.	1	1	0
Varley Magnet Co.	0	10	0
Vaughan, Edgar, & Co.	1	0	0
Vaus & Crampton	0	10	0
Vickery, George	10	10	0
Vitrite Works, Ltd.	5	5	0
Wakefield & Sons	1	1	0
Walker Bros. (London), Ltd.	1	1	0
Wallis, A. L.	1	1	0
Walpole Rubber Co.	2	0	0
Walsham, Ltd.	0	5	0
Walter, A. J.	5	5	0
Wansborough, Skelsey & Cooper	0	10	6
Wares, O. S.	0	12	0
Warneker, G. H.	0	10	6
Warneker, J.	0	10	6
Warnoch, G. W.	0	10	6
Watson, S. J.	0	10	6
Waygood, R., & Co.	2	2	0
Weaver, C. A.	2	2	0
Weaver, R. B.	2	2	0
Webster & Bennett, Ltd.	1	1	0
Weeks, G., & Sons	1	1	0
Weir, G. & J., & Co.	1	1	0
Weiss & Biheller	1	1	0
Welsbach Light Co.	2	2	0
Wesson, A. E.	0	5	0
West, E.	1	1	0
West End Engraving Co.	0	10	6
Wheatley, G. W., & Co.	1	1	0
W. H. H.	5	0	0
Whillon, T.	0	5	0
Whipp & Bourne	1	1	0
"Whitby Gazette"	0	5	0
White, S. D.	2	2	0
White, William, & Co.	5	5	0
White, W. S.	0	10	0
Whiteley, W., & Co.	0	10	6
Whitfield, H., & Co.	1	1	0
Whitfield, H., & Co.	2	2	0
Whittall, F. G.	1	1	0
White & Pyke	2	12	6
Wiggin, H., & Co.	5	5	0
Wilcox, F. W.	0	10	0
Wild & Collins	2	2	0
Wiles, E. P., & Co.	1	1	0
Wilfore, P. H.	0	5	0
Wilkins & Wright	10	10	0
Wilkins, John, & Co. (London)	5	5	0
Wilkins Wire Rope Co.	0	10	6
Wilkinson, H. D.	2	2	0
Wilkinson, J.	1	1	0
Wilkinson, J., & Sons	1	1	0
Willcox & Gibb	0	5	0
Willey, W. H., (London Elec. Wire Co.)	1	1	0
Williams, F.	0	10	6
Williams, Howard	1	1	0
Willis & Bates	2	2	0
Wilmhurst, J. J.	1	1	0
Wilson, C.	2	2	0
Wilson, E.	1	1	0
Wilson, J. W.	0	5	0
Winn, Charles, & Co.	1	1	0
Winser, E.	0	7	6
Winship, R. R.	0	5	0
Winter, F. G.	2	2	0
Wiseman, Alfred, & Co.	1	1	0
Witton Carbon Works' Staff	2	12	0
Wittusen, H., & Co.	2	2	0
Wolf, S., & Co.	1	1	0
Wood, W. W.	1	1	0
Wood & Kendrick	1	1	0
Woodbridge, S.	1	1	0
Woodhouse & Rixson	2	2	0
Woods, M. W.	1	1	0
Wollett, Airey & Co.	1	1	0
Workman, G.	0	10	6
Worsnop & Co.	3	3	0
Wright's Forge & Eng. Co.	2	2	0
Wrigley, E. G., & Co.	2	2	0
Wylie, F., & Co.	0	5	0
Yates, J. R.	2	2	0
Yorkshire Cable Co.	1	1	0
Yorkshire Copper Works	1	1	0
Young, G.	0	10	6
Zettel, Dr. T.	2	2	0
SUNDRIES.—Amounts of less than 5s. collected per:—			
Collection Box	0	16	2
,, ,,	0	4	2
Book 65	1	11	0
,, 69	1	3	3
,, 70	0	12	6
,, 75	1	6	7
,, 83	0	8	6
,, 84	1	11	6
,, 85	0	1	0
,, 90	0	5	0
,, 91	0	16	6
,, 92	1	13	0
,, 97	1	11	9
,, 98	2	0	4
,, 102	1	1	0
Card 3	0	12	0
,, 4	0	12	6
,, 5	0	8	0
Card 8	1	5	6
,, 16	0	13	9
,, 23	0	12	0
,, 24	0	7	6
,, 25	0	2	0
,, 27	0	5	6
,, 28	0	5	0
,, 29	0	19	6
,, 30	0	15	6
,, 31	0	2	6
,, 32	0	12	6
,, 33	0	7	6
,, 34	0	5	6
,, 35	0	5	0
,, 36	0	7	0
,, 37	0	7	6
,, 39	0	12	6
,, 40	0	10	0
,, 41	0	3	6
,, 42	0	7	6
,, 43	0	7	6
,, 44	1	1	0
,, 45	0	7	6
,, 52, 53	1	2	6
,, 59	0	6	6
,, 60	0	17	0
,, 64	1	6	0
,, 65	0	14	3
,, 75	0	4	0
,, 77, 78	0	12	6
,, 83	0	2	6
,, 88	0	12	6
,, 90	0	8	0
,, 91	0	2	6
,, 92	0	5	0
,, 93	0	14	0
,, 94	0	7	0
,, 95	0	17	6
,, 96	1	11	6
,, 97	0	14	6
,, 98	0	2	6
,, 99	0	10	0
,, 100 and 367	0	18	0
,, 101	0	5	0
,, 103	0	5	9
,, 104	0	19	0
,, 107	0	4	0
,, 128	0	16	6
,, 129	0	13	3
,, 130	0	15	6
,, 131	0	5	0
,, 132	0	3	9
,, 133	0	5	0
,, 145	0	13	6
,, 146	5	5	0
,, 155	0	18	0
,, 157	0	16	6
,, 159	0	8	3
,, 160	0	12	0
,, 161	0	13	6
,, 167 and 369	2	7	0
,, 168	0	18	0
,, 169	1	7	6
,, 176	1	10	3
,, 178	0	19	3
,, 186	0	12	6
,, 187	0	19	6
,, 191	0	19	0
,, 195	0	8	6
,, 206	2	1	0
,, 207	0	1	0
,, 209	1	11	1
,, 210-11	0	4	0
,, 212	0	3	0
,, 213	0	19	0
,, 214	0	3	0
,, 215	0	10	0
,, 216	1	18	6
,, 219	1	6	6
,, 224	0	13	6
,, 224-235	3	12	6
,, 238	4	4	0
,, 240	0	8	0
,, 241	0	5	6
,, 242	0	9	0
,, 248	1	13	0
,, 256	4	5	0
,, 257	0	8	6
,, 258	0	5	3
,, 259	0	7	6
,, 260	0	3	0
,, 261	0	17	0
,, 262	0	14	1
,, 264	0	6	8
,, 265	1	16	4
,, 266	1	2	6
,, 267	0	16	2
,, 268	0	19	7
,, 269	0	10	0
,, 271	0	10	6
,, 274	0	5	0
,, 275	0	3	9
,, 278	0	17	0
,, 281	4	1	6
,, 288	0	14	6
,, 296-304	1	17	6
,, 312	0	7	0
,, 322	0	5	0
,, 323	0	4	6
,, 324	0	5	0
,, 325	0	14	6
,, 326	0	11	0
,, 327	0	17	6
,, 328	0	9	6
,, 329	0	4	6
,, 331	1	1	6
,, 346	0	2	0
,, 347	0	12	0
,, 348	1	5	6
,, 366	1	9	0
,, 367	1	1	6
,, 368	1	9	3
,, 372	0	15	0
,, 400	0	12	0
,, 408	0	9	0
,, 410	0	6	0
,, 411	0	2	6
,, 412	0	10	6
	£2,468	15	1

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Modern Motor.

As another workman who has had considerable experience in the maintenance of ancient and modern motors, I have been very much interested in Mr. E. F. Butler's article and Mr. Henry Fowler's letter.

Mr. Fowler's remarks remind one of the story about the editor of *Punch* who, on being told that his paper was not as good as it used to be, replied "No! it never was."

If Mr. Fowler is so pleased with the "old makes" that run so well, perhaps he will tell us why he has had "the pleasure (?) of taking out many of these old armatures."

In the good old days machines frequently did not carry such heavy loads in relation to their H.P. as they do to-day, and the life of a motor should be judged by the work it does and not by the time it takes to do it.

To-day we have machines that will run without sparking from no load to overload with a fixed brush position.

"Thick" commutators were necessary in the days of copper brushes—would Mr. Fowler like to see these back? they were indeed "rare sights," but where is the necessity for a heavy commutator to-day, there being practically no wear if it is properly looked after?

I quite agree with Mr. Fowler *re* the Crocker-Wheeler brush gear being a good type to use.

Practically all the old motors were of the open type; to-day motors are either semi or totally enclosed. This makes a great difference to their "get-at-ableness."

Where the box type of brush-holder is used, it would be advisable to insulate the tension spring from the brush. One or two makers are trying to do this by inserting fibre between the spring and brush, depending upon the flex for the carrying of the current, and thus preventing the overheating and consequent loss of tension of the spring.

The articles of Mr. Butler are most useful, and so was the recent correspondence on interpole motors.

Hoping that you will publish more of this class of article for the benefit of the maintenance men.

L. Seno.

With reference to Mr. Henry Fowler's letter in last week's issue, he appears to have been more fortunate with the older machines than I have, although a number of them worked, and are still working, very well, and will continue to work when some of the modern ones are on the scrap heap. I know of an old Gramme machine which has been in use continually for over 30 years, and still runs all day. I cannot share his enthusiasm for the early American motors with their wooden brush rockers, holders without any adjustment for tension, and no pigtails to the brushes. Breakdowns were numerous, due to the insulation of the windings only being suitable to the drier and hotter climate of America.

He also states that motors are not built now for rough handling or for taking adrift easily. The latter is true enough. No designer appears to think that a motor is ever likely to break down or even require cleaning, but ability to stand rough handling is where the modern motor does score. The older machines would not stand up to the conditions met with in a steel works or colliery, nor yet meet the demands of reversing motor planers or gear-driven machine tools with a speed variation of 3 to 1. As the result of experience, improved design and the better utilisation of material, the better present-day makers have reduced both weight and cost for the same output.

With regard to his statements on flashing over, of course any machine will flash over if the brushes are rocked far enough into the wrong position. This, however, is not due to faulty design but improper operation. I have seen the machines referred to in my article flash over with half load or even less suddenly thrown on them. This is independent of the position of the brushes, and appears to be due to the average volts between the segments being too high. The machines are fitted with interpoles, and probably have a large number of turns per slot and too few commutator segments.

The type of brush-holder he mentions which swings from the spindle and grips the brush in a claw at the end is practically obsolete, its place having been taken by the type in which the brush slides in a box, tension being applied by means of an adjustable spring. This type of holder, when well made, is very satisfactory, and I have brought several old machines up to date, and increased their output by fitting them with this improved form of brush gear. In conclusion, I may say that I am not interested in any particular make, but gave a few impressions as the result of an experience covering over 2,000 motors.

Ernest F. Butler.

London, *April 20th*, 1914.

Vacuum Cleaners v. Chimney Sweeps.

May I venture to ask you to let me show through your columns how the above invention can supersede the services of a live sweep, and therefore further minimise the ordeal of spring cleaning?

The method can consist of either pushing a funnel-shaped bit up the chimney as far as the register and connected with the vacuum cleaner with a 6-ft. length of hose, causing the vacuum cleaner to blow the soot upwards out at the top of the chimney if such chimney be cowled; or, in the case of uncowled chimneys, the vacuum cleaner, in the case of detached houses and country ditto, could be fitted with a long tube screwed together in lengths, having at top a bent arm attached to a cap fitting over the chimney top. The soot could then be blown down the chimney into a sack at base of chimney within near the register. This sack's mouth would be kept open by a wire, and so remain wide open for the reception of the soot.

Henry James Saint Benno Cunliffe (M.A., Oxon.).

London.

Current-Limiting Reactances.

With reference to the remarks made by myself at the discussion in Birmingham on Messrs. Faye-Hansen and Peck's paper on the above subject, I wish to correct an impression that may be formed from the diagram published by you, and to state that the diagram was only intended to be approximate in the representation of certain conditions that had been investigated, and was given to show the serious results which might accrue in the case where all the details had not been properly considered. It does not represent the final arrangements which have been decided upon as regards the connections of the outside stations.

The amount of future synchronous motor load has also been over-estimated, and, generally speaking, the figures should only be taken as a first approximation to the conditions, and with a view rather to indicate the manner in which the problem should be tackled than the final conditions obtaining.

My point was to show that it was perfectly useless generalising in a case like this, and that each particular case must be treated on its merits with some approximation at least to the numerical values of the impedances obtaining in the different parts of the system.

I note that your printer has added to the diagram sent you, which was not labelled in the manner which you have done, and it is likely to give the impression that this is the final word in the Birmingham lay-out.

A. M. Taylor.

King's Heath, *April 18th*, 1914.

Speed Regulation of Induction Motors.

There is, I understand, a system of speed reduction of an induction motor by impressing suitable frequencies on the rotor (lower than the supply frequency).

What are the limitations of this method, and what its efficiencies and first cost? *i.e.*, is it commercial? I have not seen any of these details in print, and do not know where to put my hand on them.

R. E. M.

London, *April 18th*, 1914.

Protection or Tyranny ?

The first paragraph of the letter appearing over the signature "Facts" in your current issue shows a capacity for misapprehending plain English which detracts much from the value of the rest of their letter.

In my previous statements I put the case as concretely as possible, giving to the "rule" a very definite form, and this form—and the *form* only—has been repudiated by the B.E.A.M.A. and by "Facts."

But surely it requires very little intelligence to understand that the main point at issue concerns the remedying of the serious discontents at present existing in the electrical trades—discontents which, rightly or wrongly, are attributed to the methods of the B.E.A.M.A. If the writers using the signature "Facts" are ignorant of this widespread dissatisfaction, without making any reflections on their business capacity, I would remind them that their evidence at best is negative, and refer them to the case of the Irishman who, accused of theft on the evidence of a witness who saw him stealing the articles concerned, retorted that he could bring a hundred witnesses who had not seen him.

Moreover, whilst the rule, as given by me, is repudiated with much useless rhetoric by "Facts" and by the officials of the B.E.A.M.A., the much more important letter of Mr. Fletcher, voicing as he does the ideas of an accredited Association, is passed over in a very suspicious silence. Can it be that Mr. Fletcher's statement is nearer the mark—as regards form ?

I should be very glad to see a categorical statement with respect to Mr. Fletcher's letter from the officials of the B.E.A.M.A.

Little is asked of the Association. The existence of such dissatisfaction is detrimental alike to the interests of employers and employed, and frankness, rather than evasion, of the main point at issue is the first essential to a satisfactory solution of the problem.

The matter rests with the members of the Association. Will they seriously inquire into, and do their utmost to remove, the causes of this dissatisfaction ? They will then earn the gratitude of all concerned with the electrical trades. Are they content to leave matters as they are ? If so, we shall know precisely what value to assign to their rhetorical assertions of philanthropic motives.

With that portion of "Facts'" letter which concerns the points raised by Mr. Purse, I have nothing to do. Mr. Purse has shown such marked ability to take care of himself, that any intervention on my part would be distinctly superfluous.

Junius.

[In his letter, printed in our issue of March 20th, page 477, Mr. A. Bruce Anderson, chairman of the Council of the Association, said :—"If any such rule, or any semblance of such rule, or any latent desire for anything in the nature of such a rule, existed in the Manufacturers' Association, Lord Ampthill would not be its President, I should not be chairman of the Council, nor, I am sure, would any member of the Council be content to occupy that position."—Eds. Elec. Rev.]

I have been following the correspondence which has appeared under this heading in your columns during the last few weeks, and have been surprised at the attitude taken up by members and officials of the B.E.A.M.A.

One or two letters have appeared from their side, in which they profess that the ideals and objects of their Association are of the most laudable character, and yet it is difficult to understand how such ideals and objects are to be attained by the methods they are employing in this controversy.

Their failure to answer Mr. Fletcher's letter can hardly help to remove the belief—mistaken or otherwise—which exists in the minds of a great many men that some rule or understanding of the nature stated in Mr. Fletcher's letter, or the earlier one from "Junius," is practised.

I may say, for the benefit of both sides, that several cases of what appears to be the use of such a rule have been brought to my notice ; their very nature, of course, makes them practically unproveable by the people who have an interest in proving them, so I can do no more than draw attention to what has been told me, and point out that the information comes from high officials of the firms concerned, and that the firms are members of the B.E.A.M.A., and rank amongst the largest in the country.

If the B.E.A.M.A. as a whole, or groups of its members, are not guilty of any such practices as are alleged, it is surely very easy for them to say so with unmistakeable clearness ; if they are guilty, the policy of silence, which the chairman indicated was the desire of the Council, is their best defence and their surest proof.

Pollux.

April 18th, 1914.

Economy in Electric Lighting.

I enclose copy of a letter I have received from one of our consumers, which I thought might be of interest to you. This gentleman lives in a house, the rent of which is about £20 per annum, and is a fair sample of some of the consumers we have to deal with.

S. Pauls,
Borough Electrical Engineer.

Middleton, *April 18th*, 1914.

Dear Sir,—I enclose herewith my electricity account, and would like to ask if you think it fair to reduce the amount for the following reason. As soon as we came to the house we found that the hall lamp could not be switched off. We called in the electrician, who stated that the cause was dampness, and the lamp would probably go allright when the house was properly dry. After several weeks, however, there was no improvement, and we accordingly sent for the electrician again. It was then found necessary to completely renew one of the wires.

The lamp was really burning continually for two months, and I fancy this has been responsible for more than one half the units we are charged with, because, as I am out every evening, the house is mostly shut up at night, and we use very little electricity. Under the circumstances, perhaps you will be prepared to make an allowance.

On hearing from you I will immediately settle the account.

[The invoice charges for 29 units at 4d., 9s. 8d. ; meter rent, 1s. ; total, 10s. 8d., less 3d. discount.—Eds. Elec. Rev.]

Cable Corrosion.

I shall be obliged if you can give me an explanation of the corrosion of rubber-insulated cables drawn into earthenware ducts.

Quite recently I have had to deal with the repair of this class of cable on a direct-current network, and am of the opinion that the corrosion cannot take place unless there is an actual leakage of current at the point of corrosion.

The method of repair I have used has consisted of cutting out the corroded parts and re-insulating the whole length of cable with tapes coated with compound.

I am, however, doubtful as to this preventing further corrosion, and it might be useful to have related any experiences of your readers with this class of cable repair.

Mains Superintendent.

Review of Electrical Meters.

In the review of the above volume which appears in the current issue, your Reviewer asks whether the "Intermittently Recording Graphic Meter" which he saw at the 1905 Electrical Exhibition at Olympia is still on the market. He evidently refers to the inkless graphic instruments which we exhibited for the first time on that occasion, and we may say in reply that not only are they still "on the market," but that they are in constant demand and an enormous number have been supplied to meet almost every possible requirement.

When for electrical or other reasons the working forces cannot be made adequate, they offer almost the only solution of the problem of eliminating the effects of pen friction. Besides doing away with frictional errors, the inkless graphers have the advantage of requiring no attention whatever for a month or more at a time, and of ensuring the absolutely correct timekeeping of any number of instruments worked off a common control clock.

As mentioned by the Reviewer, these graphic instruments do not find a place in this volume, which is exclusively devoted to American apparatus.

While writing, may we be allowed to join issue with your Reviewer when he advocates expressing the error of an instrument as a percentage of the true value rather than of the reading. Thus, to take the example given by him, it is suggested that if a meter dial indicates 75 units, and is said to be 75 per cent. slow (a fairly large error we should imagine, even for America, where they never do things by halves), then the correct value would be 300 units. That is to say, 75 per cent. of the 300 units have not been metered.

Quite apart from the question whether such a definition is logical, which we venture to doubt, its adoption would be extremely inconvenient in practice. Seeing that it is to the instrument reading that the correction is to be applied, a large amount of calculation is avoided by expressing the error as a percentage of that reading. It may be added that that is the convention adopted by the National Physical Laboratory in all their certificates.

Everett, Edgcumbe & Co., Ltd.

London, *April 21st*, 1914.

Electricity in Coal Mining.

The statement *re* paraffin wax for joint boxes, on page 623, is one that is open to a lot of discussion. You will see I mention the subject in a paper (enclosed) read before a joint meeting of the A.M.E.E. and N.A.C.M., at Swansea, on February 14th, 1914.

I should be glad to hear the comparisons of other electrical engineers on the subject of the last paragraph of my paper, viz., energy consumption per ton of output of coal.

Since these figures were obtained the output has reached 6,500 tons in five days' working, with a consumption of 37,580 units for six days' running, or an increase of 1,380 tons of coal for an increase of 751 units for screening, haulage and winding.

I should also like to hear comparisons as to units generated per ton of coal burned, as I cannot find any data on this point from technical journals recording running costs, &c.

A reason for asking the last item is to find out if the use of anthracite coal is more economical than that of bituminous coal when working under similar conditions. My experience has been that on trying bituminous coal under our boilers the consumption was double that of anthracite and entailed much extra work for stokers.

J. Glynn Williams.

Cwmgwrach, *April 12th*, 1914.

THE OPERATION AND UPKEEP OF ELECTRIC MOTORS.

By E. F. Butler.

(*Abstract of an informal paper read before the* Junior Institution of Engineers, *on February 27th*, 1914.)

(*Concluded from page* 679.)

When the motor runs all day and is only stopped at meal times, a plain starter with a no-voltage release will usually be sufficient. The function of a starter is to start the motor; it is not intended to be used as a switch. If the circuit is to be made or broken it should be done by means of a suitable switch which makes and breaks quickly and preferably has auxiliary carbon contacts and a magnetic blow-out. All contacts should be renewable from the face. Except at starting no current should pass through the starter arm or spindle. The cover should be so constructed that it can be removed without interfering with the cables, and that it is not possible for the current to arc on to it.

The resistance coils should be vertical and firmly supported, and when wound on uralite or asbestos should have earthenware ends. It is an advantage to have the slate and coils mounted so that they can be lifted out together without disturbing the connections. As an alternative the case may be fitted with four removable covers.

The no-volt coil should be wound so as to release the arm before the motor is at half speed, and the iron keeper should be fitted with brass adjusting screws for this purpose. The ends of the coil should be connected to terminals on the opposite side to the starter arm. This is necessary, as cases have occurred in which the coil ends have got trapped between the arm and the magnet and caused trouble by breaking the shunt circuit. Although the no-volt coil is usually connected in series with the shunt field, this is not always the best way. A variation in speed of 3 to 1 by means of shunt regulation is common, and at the higher speeds the field current is often too small to keep the arm up. Also, to comply with the Home Office requirements it is sometimes necessary to arrange to stop the motor from several points. In such cases the no-volt coil should be connected in series with a resistance and as many push buttons as necessary, and placed across the mains. Then by pressing a button the hold-up circuit is broken and the arm flies back. When it is necessary to regulate the speed of the motor by introducing resistance in the field circuit it is important to provide an electrical interlock so that it is impossible to start the motor up on a weak field. This, especially in printing equipments, is the cause of a great deal of trouble, burning of contacts, and flashing over in motors.

One way of doing this is to use a starter with two arms. The first arm starts up the motor in the usual way, the field resistance being short-circuited until the arm is at "full on" position. In this position the other arm can be moved until the desired speed is obtained. When the current is shut off both arms drop back and the field resistance is again short-circuited. In the case of motors having to start up under a heavy load, it is often advisable to have a starter of a somewhat larger capacity than the motor. If on the other hand the motor can be started up light, a starter of smaller size can be used. The greatest trouble with starters is due to getting the arm on the first contact and then moving it back to "off" position. A destructive arc is set up which burns the contacts, and often arcs to the cover. It is better to do away with the "off" position altogether, and replace the stud or segment on which the arm rests when in the "off" position by a metal one connected to the first section of the resistance. Then the motor gets current as soon as the switch is closed, and all making and breaking of current must take place on the main switch. This was done on a 70-h.p. motor working on 480 volts and taking twice full-load current at starting. After two years the contacts are as good as new, and show no signs of wear.

In a number of instances the no-volt coil gives trouble by working loose on the slate, and it is well to anticipate this by the use of either lock nuts or small spring washers. Another fitting that has the habit of working loose is the stop-block or buffer, on which the starter arm rests. Here again lock nuts or washers may prevent damage, and should the arm have a powerful spring, two buffers should be fitted so that the arm hits both of them. Automatic starters, generally speaking, require very little upkeep. The plungers should be coppered, or the solenoids lined with thin brass tube to prevent sticking. Carbon contacts should be fitted which definitely make contact before and break after the main contacts. Practically all forms of automatic starters are fitted with a resistance which is inserted in series with the lifting coil when the plunger is at the end of its stroke; most of the trouble in this type of apparatus arises from this resistance. It is well to replace such resistances with carbon-filament lamps mounted in back plate holders.

To facilitate the cleaning and inspection of motors a small wall socket should be fitted whenever possible, controlled by a fuse and tumbler switch and connected to the live side of the motor switch. This can be used for an inspection lamp, and if the size of the installation warrants it, for a small power blower to remove the dust and dirt from the motor and also from the control gear. The cost is not excessive. When open-type motors have to work under bad atmospheric conditions, such as acid fumes, special precautions are necessary. The motors should be taken apart and well coated with a good-quality acid-resisting enamel—armature, field coils, frame work, brush spindles and insulators, as much of the brush-holders as possible, and even the pigtails of the brushes. The commutator should be cleaned frequently and vaseline applied frequently while the motor is running. The starter, switch and fuses should be treated in a like manner. Motors so treated can be worked under very bad conditions without giving trouble. The running of motors fitted with fans in dusty places can often be improved by enclosing them in a box and running sheet-iron pipes to the outside of the building.

The greatest trouble with the ordinary D.C. motor arises at the commutator or brush gear, and usually shows itself in the form of sparking. There are in all about 36 different causes of sparking. The most common of these troubles is high mica or low segments, usually termed flats. In the case of belt-driven machines about 90 per cent. of the flats are due to bad joints or unsuitable belt fasteners. Excepting in the smallest sizes all belts should be properly spliced and sewn. Other causes of flats may be looked for in flywheels out of balance, gears irregularly worn, or motors unsuitably wound for their work, such as plain shunt motors on flat-bed printing presses, punches or planers. As a makeshift the mica can be cut slightly below the surface or recessed. Another cause of sparking is lack of tension, and is generally caused by neglecting to increase it as the brushes wear down. Sparking is also caused by brushes not fitting properly.

Some of the softer varieties of brushes swell when hot and stick in the holders. A too-loose fit on the other hand will cause chattering, and in a reversing motor will cause two wearing surfaces, finally becoming rounded or wedge shaped at the end. This will also in time wear the holder out of shape. This fault is aggravated if the holder is too far away from the commutator. The proper distance from the bottom of the holder to the face of the commutator should be from ⅛ to 3-16 inch. One type of holder which swings from the spindle and grips the brush in a claw at the end, although not much used now, is common to a number of the older machines. If the brush wears down or falls out, as it very often does, the holder drops on to the commutator and damage is done to both. One way of preventing this is to drill a hole in the tip of the holder and fit a small peg or stop of insulating material to prevent the holder from making contact with the commutator. A better way is to scrap the holders and replace them by others of the box type; very often an old type of motor may be brought up to date and its performance improved by the substitution of a more modern type of brush gear.

It is often possible by slightly modifying the holders to use up more of the brush and so reduce the cost of running. In some machines the brush has to be replaced when less than half of it has worn away.

Many machines are sent out with the oil overflow set too high, and require adjusting so that the oil comes out of the overflow instead of getting into the motor. In motors having fans or in which the armature acts as a fan, oil creeping is somewhat common and can often be cured by fitting a cap over the end of the commutator bearing, and an iron plate or piece of leather on the driving end fitting closely to the shaft. Another cause of trouble is due to the oil grooves inside the bearing extending for part of the way along the bearing and then terminating. When this is the case, a recess should be turned in each end of the bearing, the oil grooves led into it, and a small hole drilled through the grooves at the bottom of the bearing to return the oil into the well. Very often the oil grooves are too small, and can with advantage be made wider and deeper.

THE SIGNALLING OF A RAPID-TRANSIT RAILWAY.

By H. G BROWN, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 2nd*, 1914.)

The maximum headway which it is possible to obtain is primarily determined by the acceleration and deceleration rates and the maximum speed of the rolling stock, and the length (in time) of the station stops. The result is to a certain extent influenced by the geographical lay-out of the line, and also by the character of the limitations imposed by the signalling system, which must necessarily be installed for the purpose of creating safe conditions of operation.

With any of the present systems of signalling it is necessary to divide the line into signal sections, a signal being provided at the entrance of each section for the purpose of indicating the condition of the section, *i.e.*, whether occupied or unoccupied.

An automatic system can be arranged to allow of a far greater number of trains being operated than with any system of manual block signalling that affords an equivalent degree of safety. The apparatus of an automatic system operates practically instantaneously, while with the manually-operated system time is required for the performance of the manual operations. Under conditions that require a frequent train service it will be found that an automatic system is the cheapest per unit section.

On rapid-transit lines which are equipped with an installation of automatic signals, it is customary to provide train stops, which are located at the signals. These train stops assume an operative position when the signal is at danger, and should a train run past a danger signal, they co-act with the brake mechanism, causing an emergency application of the brakes, the train being stopped thereby.

Fig. 1 illustrates one arrangement of automatic sections. Signal 1 assumes the danger position when the front end of the train enters section A, and remains at danger until the rear end of the train has passed out of the section. Section A controls signal 1, section B signal 2, section C signal 3, and so on. It will be noted that these sections overlap the signals in advance. This results in signal 1 not assuming the clear position until the rear of the train has passed signal 2 by a predetermined distance. A train passing a signal at danger at its maximum speed has its brakes applied by the train stop, and is thereby brought to a stand before it has travelled far enough to collide with a preceding train. The length of this overlap is influenced by alignment and grade, and is usually nearly double the length required for an emergency deceleration from maximum speed. This extra allowance is necessary because of the possibility of the deceleration rate being less than is considered normal, due to imperfect brake adjustment or greasy condition of the rails.

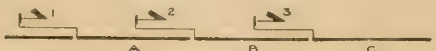


Fig. 1.

The time interval between trains being the important factor, the length of sections is considered in terms of time instead of distance; and it is obvious that the section in which a station is included may, on account of the station stop, be a longer section in time than a section between stations that is many times its length lineally, because between stations it can be assumed that the train is travelling at its maximum speed. The time occupied in a station section is long because, in addition to the time required for the stop, the average speed when the train is moving is lower than it is between stations, as the station section includes both a deceleration and an acceleration. When providing signalling arrangements for a short train interval, it will be found that the station sections are the ones most difficult of arrangement.

Fig. 2 is a train diagram showing the maximum headway through an ordinary station, and is based on the following data:—Maximum speed of trains, 25 miles per hour; acceleration, 1 mile per hour per second; service deceleration, 1·8 miles per hour per second; length of train, 300 ft.

Signal 1 is controlled by the section C E, and is usually called the home signal. The overlap B C is 400 ft. long. The overlap between D and E is 300 ft. long. The length of this overlap has been reduced by 100 ft. because the section beyond E—being the starting section—is a relatively long one, and it can be assumed that a train stopping in this section would stop at the next signal. The distance A B is what may be termed the sighting distance.

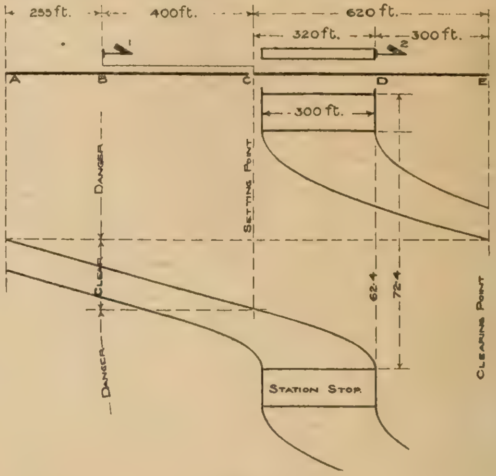


Fig. 2.

With a deceleration rate of 1·8 miles per hour per second, if a train is travelling at the maximum speed of 25 miles per hour, it would be necessary to apply the brakes at a point 255 ft. in front of signal 1 in order to enable the train to be stopped at the signal.

The minimum interval between trains is determined by the time elapsing from the moment that the front end of the train passes A until the moment that the rear end passes E, and, as shown, this time equals 62·4 seconds plus the time elapsing while the train is standing in the station. Assuming a 10-second stop, the maximum headway possible would be 72·4 seconds. Should the station stop of the first train equal 21 seconds instead of 10, signal 1 would move to the clear position 11 seconds later than the time shown on the diagram. The resultant delay to the following train, however, would, from various causes, mentioned by the author, amount to 19·45 seconds, and under all conditions is greater than the original delay; the delay is quickly felt by all trains in the rear, and is accumulative. In addition, each train arriving after an interval greater than the normal finds more than the usual number of people on the platform, and thus the 10-second stop is likely to be exceeded. Hence the minimum train interval which is practicable with the signalling arrangements illustrated would probably not be less than double the theoretical minimum interval shown in fig. 2.

The station section is the critical one from the standpoint of time, and if a more frequent service is required the signalling arrangements at the station must be modified. The first step would be to provide one inner home signal, and it is possible that it may be considered advisable to install two or three inner home signals. This enables the trains to be run at shorter intervals without liability to disorganisation of the traffic.

If it is wished still further to increase the service, there is yet another arrangement of station signalling which is considered very satisfactory where it has been installed, and undoubtedly further reduces the time elapsing between the starting of the first train and the arrival of the next. With the speed-control system the second train is allowed to decelerate to a position very near the rear end of the train standing in the station, while in all the signal arrangements described a 400-ft. overlap has been provided. A train approaching an occupied station and decelerating properly finds that each signal clears just before it is reached, but if it fails to decelerate at a sufficiently rapid rate the brakes are applied by the next train stop because it has travelled through the approach section in too short a time.

e advisability of the use of the speed-control system as at
nt installed is open to argument, and the author is of the
on that in the majority of instances it is better to maintain at
mes a definite minimum distance between trains.

Discussion.

t. Roger Smith said that two types of signal were likely to
veloped for railways, track signalling by train and cab sig-
g by locomotive; and for electric traction the signal and
ting engineer had to use the same rails. There would come
when the risk from stray currents would be too great for
ignal engineer, and the A.C. track circuit could then be
uced; this could be superposed on either D.C. or A.C. of a
nt periodicity. It was important that the railway and signal
ers should get together at the beginning and fix the terms
which they would work. On the District line 44 trains per hour
tually been run, and it was proposed to run 50; he asked
er this number had been reached, as it appeared from the
m was possible.

Blackhall said his company had the signalling problem
it and was going to use an automatic system with three-
n signals, controlled by A.C. track circuits, and arranged to
the brakes automatically and give audible signals to
. It was thought that it would have to be supplemented
dles, because it was doubtful whether an A.C. track circuit
work properly with light engines and trucks on the line.

Firth said he regretted that nothing was said about
ing at junctions and terminals, and asked how far automatic
ing would decrease their limitations, as those were just the
where automatic scored over manual signalling. Manual
g was good on straight through routes, but rapid junction
could not be worked except with some automatic system.
rred to the influence of train design on station stops, and
ow the carrying capacity was affected by non-stop trains.
vould be the effect on the signalling system shown if the
of train increased with growing traffic?

Author, in reply, said it would be possible to operate at
a twice the theoretical stop if the stations were suitably
nd there were only one or two "critical" ones. It was
t the District ran 44 trains an hour, but it was a strenuous
ion. There were a number of short overlaps on that line,
y obtained dispensations from the powers that be, on the
that otherwise it would have been impossible to operate.
ften necessary and practicable to reduce overlaps to 250 ft.
ontrol was excellent so long as the drivers operated in a
mined manner, but he found it was not being generally

BUSINESS NOTES.

ate Arrangements.—The Electromobile Co.,
ertford Street, Mayfair, London, W. — The creditors
l herein were called together on April 16th, at the Con-
Rooms, Kingsway, W.C. The chair was occupied by Mr.
Cole, chartered accountant, of Sardinia House, Kingsway,
been appointed to act as the liquidator of the company
luntary liquidation. The chairman stated that he had
appointed to act as Receiver for the prior lien debenture-
The position of affairs at present was that there were
l creditors for £1,600. The claims of the prior lien deben-
ers amounted to £2,000. That debenture bore interest at
of 6 per cent., and was issued on May 20th, 1913. There
first mortgage debentures bearing interest at the rate of
t. for £50,000. Of that amount £40,000 was issued in
1910, and the remaining £10,000 in August, 1911. In
there were second mortgage debentures carrying interest
cent. for some £10,000 or £11,000. The lease of the
at Hertford Street was mortgaged for £18,000. That
total mortgage and debenture charge of £80,000. When
ossession as Receiver there was cash at the bank of £230,
ther assets consisted of book debts estimated to realise
ad stock of stores, tires, furniture, &c., valued at £1,500.
ficult to say what the lease of the premises was worth,
he present purposes he placed upon it a figure of £25,000,
the mortgage of £18,000. The company was registered
er 17th, 1902, with a capital of £50,000, divided into
the face value of £1 each. In 1908 the capital was
to £75,000, and the following year it was increased to
. During the first year the company made a loss of about
In 1905 there was a profit of £337, while in the succeed-
nths the profit increased to £3,598. In 1907 the profit
er increased to £4,681, but since that time losses appeared
been made. The losses had been as follows:—1909,
1910, £4,800; 1911, £6,400; and 1912, £5,400. In
there were certain heavy depreciations which had
written off. The total deficiency at the present
s about £120 000. The chairman added that he was
Receiver on October 17th last, and entered into
two days later. He had since been carrying on the
at a loss. With the sanction of the first debenture-
for whom another Receiver had been appointed, arrange-
d been entered into for the sale of the assets to the
Street Motor Hiring Co. Under the terms of the sale
the prior lien debenture holder would be paid in full together with the interests and costs. The preferential claims of £1,400 or £1,500 would also be discharged. So far as he could see at present there was no prospect of anything being paid to the first mortgage debenture-holders or the unsecured creditors.

In answer to questions, Mr. Cole stated that the whole of the assets were being sold to the Hertford Street Motor Hiring Co. Roughly, the buyers were giving about £4,000 for the assets of the company. They were also taking over the book debts.

A creditor asked what was the book value of the assets that were being transferred. Mr. Cole replied that originally the lease was valued at about £53,000, but the buyers were not taking over the lease. The first debenture-holders had entered into possession of the lease. By an arrangement between them and the mortgagees of the lease, the buyers were to take over the premises and pay the rent. The latter was payable to the first debenture holders. The purchasers would take over the unexpired term of the lease. Any equity in the lease remained the property of the first debenture-holders. According to a balance-sheet of the company the stock of tires, furniture, &c., was valued at £1,500, the plant, tools, &c. at £5,000, and the stock of stores, tires, liveries and batteries at £7,000. Of the book debts, which were of the face value of £[illegible], at least £1,200 were bad. The chairman added that the expenditure on the batteries had been terrible. That had been the real trouble in running the business. There were 40 carriages, which were held under a sort of hire-purchase agreement, but they had been removed.

No resolutions were passed, and the voluntary liquidation of the company will, therefore, be continued, with Mr. Cole as liquidator. The following are creditors:—

Hamburg and Vienna India-Rubber Co.	£31	Kalker & Co.	£17
Fletcher Lawrence	491	Hobdell, Way & Co.	14
Simpson & Sons	41	Continental Tyre Co.	17
Greenberg & Sons	20	Berk, F. W., & Co.	37
Lange, C.	44	Parsons, T., & Sons	60
Tee, E. E. & A.	26	Spottiswoode Advertising Agency	14
Hayward's Stores	15	Veritys Ltd.	18
Williams, J., & Sons	31	Fenton & Barnes	12
Whittingham, Thos. & Wilkin	15	Manifoldia, Ltd.	34
Maple & Co., Ltd.	12	Premier Motor Clothing Co.	30
Matshall Tyre Jacket Co.	22	City and West End Laundry Co.	17
Hyde Archer & Co.	24	Patrician, The	26
Hill, T. H.	87	Wood, C. Gilbert	16

Ozonair Ventilation.—The following are among the ventilation installations which have been recently completed by Messrs. Ozonair, Ltd., London:—

London.—Hong-Kong and Shanghai Banking Corporation; Excess Insurance Co., Ltd.; offices of the Metropolitan Asylums Board; Lloyd's Royal Exchange; and Euston and Edgware Road Tube Stations.

The Birmingham Exchange, and nine large picture theatres in Newcastle, Bradford, Leeds, Nottingham, Glasgow, Manchester and Edinburgh.

Stores of Messrs. Harrod's, Ltd., and those of Gath & Chaves, Ltd., both at Buenos Ayres.

House of Commons, Ottawa, and the Parliament House, Wellington, New Zealand.

Contracts now in hand include the ventilation of:—

The Town Hall and the Public Halls at Blackburn; Murray's Club, Ltd., London; and an installation for the Government of New South Wales at Sydney.

A deodorisation plant is being supplied for the press house of the Bradford Municipal Sewage Works, and a beeswax bleaching plant for the Russian Church Candle Works.

Installations of ozone generators for air purification have recently been fitted in London in the following:—

National Bank of India.
Standard Bank of South Africa.
Banca Commerciale Italiana.
La Société Générale.
Rubber Estates Agency.
Junior Constitutional Club, &c.

Catalogues and Lists.—Messrs. Krupka & Jacoby, Ltd., 26 to 36, Chapter Street, London, S.W.—Priced leaflets relating to the Kajok dry cell and Dr. Lessing's dry battery.

Messrs. Dick, Kerr & Co., Ltd., Preston, Lancs.—Price card of Britannia metallic-filament lamps, made under Patent No. 11,455 of 1912, stating also the terms of the firm's indemnity.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End.—New leaflet, giving brief information and prices of their convertible table and bracket electric fans, and of the "Prangnell" combined lamp carrier and fan adapter.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, London, S.E.—Twenty-four-page catalogue (No. 537, new edition), giving full illustrated information and tabulated prices, weights, dimensions, &c., of their Siemens-Obach dry cells for general and ignition purposes, also ignition coils, Hellesen dry cells, Dura cells, Siemens transport cells, &c.

The Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, London, W.C.—Catalogue of 32 pages, illustrating and giving prices of a large variety of electric advertising signs. These include a number of "Day and Night Signs" with raised luminous opal letters, as designed for particular businesses; fixed signs for theatres; programme indicators for music halls and cinemas. various box signs with accompanying bracket work; hotel and restaurant signs; shop window signs, artistic indoor signs, "Mirrorgraph" counter, collapsible and other signs. Any reader interested in the sign business will receive a copy of this catalogue on application.

Messrs. Langdon-Davies Motor Co., 110, Cannon Street, London, E.C.—Sixteen-page well-illustrated pamphlet, containing specification of their standard A.C. motors, accompanied by a 20 page price list of single phase (40 to 125 periods) and polyphase (25 to 50 periods) motors; prices of different types and sizes are tabulated in detail. A third publication is devoted to "Megger" testing sets.

Messrs Turners & Manville, Ltd., Hopetoun House, Lloyd's Avenue, London, E.C.—Revised edition of their illustrated price list of high-tension "Noark" fuses for from 2,500 to 22,000 volts, embodying their latest practice in this direction. Some 15 pages are occupied with a telegraphic code.

Messrs. J. H. Heathman & Co., Parson's Green, Fulham. S.W. —A set of illustrated price lists of extending ladders and ladder towers, telescopic trestles and ladders, fire escapes, and other specialities in a class for which the name Heathman has long been a household word.

The Dussek Bitumen Co., Canal Bank, Deptford, London, S.E. —Two pamphlets: one entitled "Joint Box Compound and its Tests," giving some particulars of "Trinidite" compound together with a report on tests of same made by Dr. Alex. Russell, and some comments by the firm respecting other box compounds, which it is thought will interest engineers. The second pamphlet consists of a list of electricity supply authorities using "Trinidite," and copies of testimonials.

Messrs. Lester B. Betts & Co., Ltd., 9, London Street, London, E.C.—No. 2 of *Betts's Bulletin* describing and illustrating a variety of electrical manufactures, and giving tabulated current market rates for a number of accessories and supplies.

Messrs. Ferranti, Ltd., Central House, Kingsway, London, W.C.—New catalogue of electric heating and cooking appliances. It comprises a collection of illustrated and descriptive price lists dealing with electric fire disks, reflector electric fires, pedestal and screen electric fires with disks, pedestal fires and boiling plates, stew pans, grills, breakfast cookers and electric ovens.

Sir W. H. Bailey & Co., Ltd., Albion Works, Salford, Manchester.—12-page illustrated list (No. 3,713) fully describing the "Strebor" cylinder escape valve.

Lantern Slides.—We have often pointed out the educational and advertising value of lantern slides showing electrical apparatus and machinery, and have noted with pleasure that a number of electrical firms have provided themselves with sets of slides, which are available for lectures, &c., on application. But not only apparatus, but also electrical phenomena can be dealt with in this way, as the Cambridge Scientific Instrument Co., Ltd., recently demonstrated by preparing a series of lantern slides from oscillograms obtained by Dr. J. A. Fleming, which show the phenomena involved in the discharge of condensers of various capacities through inductive circuits of various resistances. These slides are very suitable for lecture purposes in technical colleges. Other phenomena are included in the series, and obviously the idea can be applied to a variety of subjects for the instruction of students, as well as of the public generally.

Liquidations and Dissolutions.—The Grindell-Matthews Wireless Telephone Syndicate, Ltd.—Under a compulsory winding-up order made last January, on a creditor's petition, the report of Mr. H. E. Burgess, Official Receiver, has been issued to the creditors and shareholders. The statement of affairs shewed liabilities £6.239 made up of unsecured debts, £3,083; preferential claims, £178; and loans on debenture bonds, £2,978. The assets are returned at £31,000, representing the value placed upon the patent rights, outfit, instruments and equipment. There is, consequently, a surplus of £24,761 in assets above liabilities, and one of £2,199 as regards contributories.

Mr. Burgess reports upon the formation and history of the syndicate, some particulars of which appeared in our issue of March 20th. He adds that the promoters (F. Rouse, Pool & Co.) had obtained an option to acquire the patent from Mr. H. Grindell-Matthews (the inventor), and they formed the syndicate in order to raise funds to enable them to exercise their option and to perfect the invention with the view to a sale to a larger company. The syndicate were to have the benefit of any further inventions in wireless telephony by Mr. Matthews, and the exclusive right of applying for, and obtaining, patents in the United Kingdom and foreign countries. According to the annual accounts the expenditure to September 30th, 1912, upon the development of the patent, demonstrations, stations, equipment and administration expenses was as follows:—Development of patent, staff, salaries, rent, erection of buildings, experimental and general expenses, £4,244; erection of workshop, equipment, outfit and instruments, £2,096; administration expenses, £2,565 = £8,905.

The total cash expenditure under the above heads amounted at the date of the winding-up order to about £11,000. The company have obtained patents in this country for the invention and for various improvements therein. Foreign patents have been taken out in the following countries:—France, Austria, Hungary, Canada and the United States of America. Options have been given by the company to acquire the patents and plant for cash and shares in a larger company to be formed to commercially exploit the invention, but such options have not been exercised. The present position of the company is partly attributed to the failure of other parties to exercise an option to take over the patent involving an obligation to discharge certain pressing liabilities, in respect of one of which the winding-up order was made. The value placed upon the patent rights, outfit, instruments and equipment by the officials in the statement is based upon the possibility of a scheme being carried out to continue the exploitation of the patents. Apart from this it is highly improbable that the value referred to can be realised. As the result of the statutory meetings held on March 10th, the Court has appointed Mr. H. Wilson, incorporated accountant, of 23, Devereux Count, Essex Street, London, W.C., to be liquidator of the company, with a Committee of inspection

Wright Electrical Sales Co., Ltd.—This company is winding up voluntarily, with Mr. A. France, of West Bar Chambers, Boar Lane, Leeds, as liquidator. A meeting of creditors is called for April 27th, at Leeds.

Davis Electrical Co., Ltd., London.—Date of release of liquidator—Mr. H. de V. Brongham—April 16th.

E.M.F., Ltd.—This company is winding-up voluntarily, with Mr. G. Little, of 57, Moorgate Street, E.C., as liquidator.

Leicestershire and Warwickshire Electric Power Syndicate, Ltd.—This company is winding-up voluntarily, with Mr. T. W. Holland, of 34, Coleman Street, E.C., as liquidator. A meeting of creditors is called for April 30th.

Book Notices.—"Continuous and Alternating Current Machinery." By H. F. Morecroft. London: Chapman & Hall, Ltd. Price 7s. 6d. net.

"Ornamental Lathework for Amateurs." By "C. H. C." London: Percival Marshall & Co. Price 3s. 6d. net.

"Post Office Electrical Engineers' Journal." Vol. VII, Part 1. April. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"Science Abstracts." Sections A and B. Vol. XVII, Part 3. March 28th. London E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Proceedings* of the Institution of Railway Signal Engineers 1913." Manchester: H. Rawson & Co.

"*Journal* of the South African Institution of Engineers." Vol. XII, Nos. 7-8. March. Johannesburg: The Institution. Price 2s.

"*Proceedings* of the American Society of Civil Engineers." Vol. XL, No. 3. March. New York: The Society.

"*Bulletin* Scientifique de l'Association des Ecoles de Gand. March. Gand: Imprimerie Plantijn. Price 1 fr.

"*Bulletin* of the Association des Ingénieurs Electriciens." Vol. XIII, No. 3. March. Liége: The Association.

"*Giornale* ed Atti della Associazione Elettrotecnica Italiana." Vol. I, Nos. 7 and 8. April 5th and 15th. Milan: The Association. Price L. 1 each.

"*Journal* of the Institution of Electrical Engineers." Vol. LXII, No. 232. April. London: E. & F. N. Spon, Ltd. Price 3s. 6d.—This issue contains a paper on "Current-Limiting Reactances in Large Power Stations," by K. M. Faye-Hansen and G. S. Peck.

"*Bulletin* of the Imperial Institute." Vol. XII, No. 1. January-March. London: John Murray. Price 2s. 6d. net

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Vol. LVII, Part VI. April. Glasgow: The Institution.

"The Port of Hull Annual, 1914." Hull: H. E. C. Newham.

"The Physical Review." Vol. III, No. 3. March. Lancaster, Pa.: The American Physical Society.

"Factory Administration and Accounts." By E. T. Elbourne. London: Longmans, Green & Co. Price 25s. net.

"Catalogue of Lewis's Medical and Scientific Circulating Library." London: Lewis's Library. Price 2s. net.

"*Transactions* of the University of Toronto Engineering Society." Vol. VIII, No. 11. March. Toronto: The University.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 4. April. New York: The Institute Price $1.

"*Transactions* of the Illuminating Engineering Society." Vol. IX, No. 2. New York: The Society. Price 75 cents.

"*Journal* of the Franklin Institute." Vol. CLXXVII, No. 4. April. Philadelphia: The Institute. Price 50 cents.

"*Journal* of the American Society of Mechanical Engineers." Vol. XXXVI, No. 4. April. New York: The Society. Price 35 cents.

"L.C.C. Report on Trade and Technical Education in France and Germany." London: P. S. King & Son. Price 1s.

"Publicacion Mensuel de la Asociacion de Ingenieros Industriales Agrupacion de Barcelona." February. Barcelona: The Association. Price 1 pta.

"*Bulletin* de la Société Internationale des Electriciens." Vol. IV, No. 33. March. Paris: Gauthier-Villars. Price 2 fr. 50.

"Practical Illumination." By Justus Eck. London: S. Rentell and Co. Price 1s. net.

Trade Announcements.—Messrs. J. Dodimead and Sons announce that their telephone exchange has been altered from Central to Museum, the number remaining unaltered—1137.

Messrs. T. W. Broadbent, Ltd., of Huddersfield, announce that Mr. J. D. Mackenzie, formerly their Scottish agent, has now ceased to represent them, and they have arranged with Messrs. James C. Fisher & Co., 62, Robertson Street, Glasgow, to act for them for the sale of A.C. and C.C. generators, motors, &c., in Scotland.

Messrs. W. & R. Jacobs have opened a depôt at 19, West Campbell Street, Glasgow, where Mr. H. M. Atkins will deal with all their clients in Scotland.

Messrs. Mawdsley's, Ltd., have appointed Mr. F. J. Lyons-Davis, of 23, Victoria Avenue, Cardiff, as their sole agent in South Wales for the sale of "Zone" dynamos and motors.

Messrs. Mickelwright, Ltd., of Alperton, have appointed Messrs. Phillips & Turner, 115, Edmund Street, Birmingham, as their agents for the Midland Counties.

Ebonite Telephone Parts.—The New York Hamburg India-Rubber Co., Ltd., of 89, Milton Street, E.C., has sent us some samples of finished ebonite parts for a hand set, which are highly finished, and appear to be admirably adapted for the purpose.

Barcelona Exhibitions, 1917.—It is the intention of Barcelona to make 1917 a very important year by means of two Exhibitions. The idea for an Exhibition of Electrical Industries has been followed by a project for an Exhibition of native products. Both Exhibitions will take place together, and we are given to understand that both have for their organisation and management a mutual Council board, on which sit the highest and most intelligent trade and political personages of Catalonia.

The International Exhibition of Electrical Industries and their applications of Barcelona, will embrace

(*a*) Machinery and apparatus which produce electrical power.

(*b*) Materials which accumulate, transform, transport and distribute electrical power.

(*c*) Apparatus, machinery and instruments operated by electrical power.

Group I.—Production, transformation and accumulation of electrical energy.

Group II.—Transmission and distribution of electrical energy.

Group III.—Apparatus and methods of investigation, demonstration and measurement of electrical power.

Group IV.—Electric lighting, domestic uses of electricity.

Group V.—Electric applications to manufacturing industries.

Group VI.—Electric traction, electro-mechanical maintenance.

Group VII.—Telegraphy, telephony and radio-telegraphy.

Group VIII.—Electric applications to hygiene and therapeutics.

Group IX.—Electro-chemistry, electro-metallurgy.

Group X.—Electricity in Army, Navy, and general sea services.

Group XI.—Electricity in agriculture.

Group XII.—Electricity in the exploitation of the sub-soil.

Group XIII.—General electric culture.

Bankruptcy Proceedings.—J. W. Garsden (J. W. Garsden & Co.), electrical engineer, Blackburn.—A first and final dividend of 6s. 2d in the £ is payable on April 28th, at 27, Ainsworth Street, Blackburn.

D. Smith & Co., dealers in electric lamps, 2 and 3, Red Lion Court, Fleet Street, E.C.—First meeting, April 29th. Public examination, May 26th. Both at Carey Street, W.C.

W. H. Pease, of 17, Princess Royal Terrace, Scarborough, lately carrying on business at 19 and 20, Baxter Gate, Doncaster, electrical engineer.—A receiving order was made at the Sheffield County Court last week. The order was made on the debtor's own petition. First meeting, April 28th, at Official Receiver's offices. Public examination, May 14th, at County Court Hall, Sheffield.

Meter Contracts.—Messrs. Venner & Co. have received the contract for both ordinary and prepayment Chamberlain and Hookham meters for Colchester. Messrs. Chamberlain and Hookham, Ltd., have also obtained the contract for meters for Birmingham, West Hartlepool and Holyhead.

LIGHTING and POWER NOTES.

Ardee.—E.L. Tender.—The Town Commissioners have accepted the tender of Mr. J. W. McKeever for the lighting of the town with electricity.

Argentina.—The Municipality of Salto (Buenos Ayres) has granted a concession for 20 years for the electric lighting of that town. The contract provides for 100 arc lamps of 1,000 c.p. each at $27 per month. The concessionaire may also carry on private lighting.—*Review of the River Plate.*

Ashton.—L.G.B. Inquiry.—Mr. Hooper held an inquiry on Tuesday into the application of the T.C. for sanction to borrow £53,476 for the purposes of the electricity undertaking. It was stated that £34,924 of the amount was part of the application made in April, 1910.

Australia.—The Toowoomba (Queensland) Electric Lighting Co., which has acquired a new site for its power house, has arranged to install, at a cost of about £20,000, an entirely new plant.—*Tenders.*

Ayr.—Proposed Loan.—The T.C. has decided to apply to the Secretary for Scotland for consent to a loan of £25,000 for the extension of the electricity works, in connection with the inclusion of Prestwick in the supply area. The electrical engineer has been authorised to advertise for tenders for the necessary buildings and plant.

Banstead.—Prov. Order Granted.—The prov. order for E.L. applied for by Mr. Gilbert Allom has been granted, subject to the extension of the compulsory area of supply and the consent of the Epsom R.D.C. to the inclusion of part of its district.

Bispham.—The B. of T. has decided not to proceed further with the application of the U.D.C. for an E.L. extension order to supply electricity in Cleveleys.

Burton-on-Trent.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £2,000 for additional generating plant.

Carlisle.—Loan Sanction.—The T.C. has received from the L.G.B. sanction to a loan of [illegible] for additional plant and extensions at the electricity works. The Board has asked for further information before sanctioning a further loan for a second turbo-alternator and rotary converter.

Continental Notes.—Germany.—The question of the initiation of regulation in regard to the supply of electricity in Germany is engaging Government attention in that country. According to statements made by the Prussian Minister of Commerce in the Lower House of the Prussian Diet in March, negotiations have been proceeding between the Prussian Government and the Imperial Government for some time past in respect to legislative action concerning the Imperial regulation of the public supply of electricity. It appears that Prussia in contradistinction to Bavaria, Baden and other Federal States does not possess any roads which are under State control and it is therefore impossible for Prussia to exercise a determining influence on the use of the roads for the installation of mains from public supply works. Such an influence, however, is considered necessary if the monopolistic endeavours of the large electricity companies are not finally to lead to the prejudice of the interests of the community. As electricity enterprises enjoy freedom of trading under the Imperial trade regulations, it would only be possible for Prussia to obtain an influence on the former by an alteration in these regulations, or by the passing of a special law.

Bulgaria.—The municipal authorities of Kustendil have decided to establish an E.L. undertaking in the town.

Hungary.—The municipal authorities of Budapest have decided to take over the E.L. undertaking from the concessionaires for a maximum sum of £100,000.

Austria.—The authorities of the Steinkohlengewerkschaft, of Dzieditz, have decided to establish a large generating station in connection with their collieries, with the view of supplying electricity to the many small towns and villages in the district.

Sweden.—The agreement between the South Swedish Power Co. and the North Zeeland Electric Works has been sanctioned by the Swedish and Danish Governments. The works will in a few years transmit 15,000 h.p. by submarine cable from Lagan, in Sweden, to North Zeeland. The cable under the Sound will be about 4¾ miles in length. The concession has been granted for 40 years.

Belgium.—La Société des Charbonnages du Sacré Madame has decided on the electrification of its entire plant. A power station is to be established in conjunction with the pits, but pending its completion current will be taken from the Compagnie d'Electricité du Bassin de Charleroi.

Netherlands.—A concession has been granted to the province of North Brabant for the construction of works for the supply of electricity.—*B. of T. Journal.*

Turkey.—The National Electric Construction Co. has completed in Constantinople the formation of a company, called La Société Anonyme des Tramways Eclairage et Force Electrique de Bagdad, for the construction and working of tramways and lighting undertakings in Bagdad. Important modifications of the concession have been arranged with the Turkish Government. The period of the concession has been extended from 50 to 70 years. The municipality does not participate in the profits for the first 20 years.

Deal and Walmer.—Prov. Order Granted.—The B. of T. has granted the prov. order for E.L. applied for by the Gas Co., but the powers in respect of the Borough of Sandwich and the whole area of the Eastry R.D.C. have been deleted. The Walmer U.D.C. has secured the option to purchase the E.L. undertaking, without the gasworks, at the end of 42 years, or any subsequent period of 10 years.

Dudley.—New Sub-Station.—The Worcestershire, Staffs. and Shropshire Electric Light Co. has acquired a site in Oakeywell Street for the erection of offices, and a 2,200-kw. sub-station, in connection with the Corporation undertaking recently taken over. The public lighting of the town has also been modernised, and further improvements are contemplated.

East Grinstead.—L.G.B. Inquiry.—An inquiry was held on April 16th into the application of the U.D.C. for a loan of £3,700 for a refuse destructor. The only objection raised was as to the position of the site.

Edinburgh.—New Generating Station.—The T.C. has approved of a site at Westbank, Portobello, for the erection of a new electricity generating station; the total cost of the site of 8¼ acres will be £15,800, and it will allow for the anticipated developments for the next 50 years. Sea water will be available for condensing, and a railway siding will be taken over with the land.

Ellon.—Hospital Lighting.—It has been decided to install electric light and a telephone in the Gordon Hospital.

Farnworth.—Year's Working.—The report of the Electricity Committee shows that for the year just ended, the units sold numbered 1,101,564, an increase over the previous year of 208,717, and the net profit was £256. The breakdown of two motor generators in December last cost the Committee between £200 and £300. The agreement with the Lancashire E.P. Co. for a bulk supply was extended, and a contract for new plant at the electricity works was sealed during the year.

Girvan.—Proposed E.L.—The T.C. is considering a suggestion for the electric lighting of the town. Messrs. Purves consulting engineers, Edinburgh, have offered to carry out a scheme, but a section of the Council favours a municipal scheme.

Guisborough.—Proposed E.L.—The U.D.C. has decided to engage the services of the electrical engineer for the Skelton and Brotton scheme to inspect the Guisborough district and report on the question of E.L. for the town.

Inverurie.—E.L. Scheme.—The T.C. has decided to obtain an engineer's report on the various E.L. schemes for the town. The G.N. of Scotland Railway Co. has been asked to quote for a bulk supply of about 10,000 units, and the establishment of a municipal generating station is also to be considered.

Kingstown (Co. Dublin).—Prov. Order.—The U.D.C. has decided to oppose the prov. order for E.L. for which Mr. W. M. Murphy is applying, and has appointed a deputation to visit London in support of a municipal scheme.

Leigh.—A sub-committee has been deputed to consider upon what terms the Corporation would be prepared to give the Anchor Cable Co., a stand-by supply, equal to the full capacity of the company's present demand. The company is considering the erection of an electricity generating station.

London.—Marylebone.—The working of the electricity undertaking for the nine months to December last shows a credit balance of £75,135, as against £72,391 for the corresponding nine months of 1912. Due to the abnormally fine and warm autumn, the increase in output during the quarter to December was very slight, except for the last three weeks. An interesting investigation was carried out by the department in regard to this circumstance. The income from several blocks of flats, supplied through the owners and not directly by the department, in which case there is lighting only, was found to be 12½ per cent. less than in the December quarter of 1912. In a case where the department deals directly with the tenants, the income was increased by 13 per cent. due to the use of current for heating and cooking. The publicity and sales department account for the December quarter shows a net credit balance of £126, as against a deficit for the corresponding period of 1912 of £230. It is anticipated that the economies due to the new plant will represent a saving of £3,800 during 1914-15, but capital charges will be £3,300 greater; a net surplus of £6,578 is anticipated after meeting interest charges, £72,055, and reducing capital liabilities by £48,177. In connection with the hiring of cookers, it is recommended that ¼d. per unit be added to the present price of energy for such use, and that the hiring rate be reduced from the present quarterly charge of 15s. to 3s. 6d., the fixing charge being also done away with. The extra ¼d. per unit will be credited to the hire of cookers' account. It is proposed to add a third rotary converter at Manchester Square substation, at a total cost of £3.202; to duplicate the canal condensing equipment, at a cost of £2,322, and application is to be made to the L.C.C. for sanction to the necessary loans.

Lossiemouth.—Street Lighting.—The T.C. has decided to light Gregory Place, Seatown, by electricity.

Lytham.—Bulk Supply.—The T.C. has come to an agreement, to hold for 10 years, with the St. Anne's T.C. for a bulk supply of electricity to Lytham. The Lytham Council retains its right to put down its own plant after 10 years, and is to receive a percentage of the revenue derived from the supply of current to the tramways company after May, 1917, when the agreement between the St. Anne's Council and the company terminates. A L.G.B. inquiry was to be held to-day into the Lytham Council's application for sanction to loans for its E.L. undertaking.

Nelson.—Year's Working.—The Corporation electricity and tramways departments have had an exceptionally successful year. The estimated profit from the E.L. department was £249, whereas the actual profit amounts to nearly £2,000. A profit of £2,000 has also been made by the tramways, against the estimate of £652.

Newton-in-Makerfield.—Prov. Order.—The U.D.C. has been informed that the B. of T. proposes to grant the prov. order for E.L. applied for by the Council.

Paisley.—Proposed Extensions.—The Electricity Committee is considering the extension of the E.L. system to the south of the town before next winter.

Redditch.—Reconstruction Scheme.—The report of Messrs. Handcock & Dykes on the U.D.C. electricity undertaking, to which we have previously referred, makes most interesting reading, and one or two items are worth placing on record. We pass over the recital of boiler defects, and generators which have lost their original partners (gas engines) and received new ones of the steam variety, which appear to range from 35 kw. to a 300-kw. mixed-pressure turbine, which, however, can only be worked at high pressure, and come to load conditions. It appears that the annual output sold amounted to 1,323,878 units, with a load factor of 23·9 per cent.; this, however, required the use of 11·3 lb. of coal per unit, and the power factor of the supply was some 60 per cent. The plant is single-phase, 2,100 volts, 70 periods, and the reporters say they have been unable to find any instance of any of the sets being run together successfully in parallel, each set being run separately on a separate feeder or group of feeders. Even the feeders running out of the station are carrying double the maximum load usually considered desirable, and a complete overhaul of the L.T. system is also advised. The station buildings and sub-stations evidently fall short of modern requirements. Messrs. Handcock & Dykes's proposal for putting the undertaking on its feet is to install two 500-kw. turbine plants, and a three-phase supply for power, with which existing single-phase circuits and plant would be inter-connected, at a total cost of £18,000, and slightly to increase the charges for power.

Rhyl.—Loan Sanction.—The U.D.C. has received sanction to borrow £3,491 for the provision of a new Diesel engine set at the electricity works.

Rochdale.—Year's Working.—The past year's working of the Corporation electricity department has resulted in a net deficiency of £330, which will be taken from the reserve fund. In the previous year the undertaking contributed £2,000 to the relief of the rates. The total income for the year just ended was £30,471, an increase of £3,405, but the gross profit decreased by nearly £2,000.

Swanage.—Proposed Mains Extension.—The E.L. Co. proposes, if additional capital is subscribed locally, to extend its mains to New Swanage, at an outlay of £1,500.

Swinton.—Year's Working.—At the end of the last financial year the U.D.C. electricity undertaking, for the first time, showed a surplus. Application for a further loan is to be made shortly owing to extensions which have been carried out.

St. Albans.—The B. of G. has appointed a Committee to consider the question of introducing electric irons into the laundry, and the advisability of using dimming switches in the Infirmary.

St. Margaret's (Kent).—The P.C. has informed the B. of T. that the Dover T.C. has failed to supply the parish with E.L., and has asked whether it cannot be relieved from its obligation to take a supply from Dover. As the Council is dissatisfied with the position, the chairman has undertaken to interview the B. of T. officials in London.

Taunton.—Loan Sanction.—The T.C. has received the permission of the L.G.B. to a loan of £4,765 for electricity purposes.

Truro.—E.L. Scheme.—The E.L. Committee has recommended the T.C. to apply to the B. of T. for sanction to the acquisition of the Newnham site for the purpose of an electricity generating station.

Wolverhampton.—New Mains.—The Corporation Electricity Committee has decided to lay a H.T. main from School Street sub-station to Tettenhall Road sub-station, at an estimated cost of £1,575.

Yarmouth.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for a loan of £3 000 for cables, in connection with the electricity works.

TRAMWAY and RAILWAY NOTES.

Argentina.—Railway Electrification.—A Decree has been published approving the provisional plans for the electrification of the Buenos Ayres Great Southern Railway, on condition that the work is completed by December, 1915. It is proposed to distribute the present train movement at Once station between it and the subterranean transhipping station of Plaza Once de Septiembre, and to work electrically the service in the urban zone of Once to Versailles, which would be concentrated at the underground station named, connecting with the Anglo-Argentine tramway system.

The Compania Andina de Electricidad, which is under the control of the Compania Anglo-Argentina de Electricidad, has acquired the electric tramway concession which the Government of San Juan granted to Mr. Basualdo. Mr. Dirks, of the Siemens-Schuckert Co., is making the final studies in order to have the work started at once. The first line will join up the city of San Juan with Desamparados.

A decree has been issued approving the plans presented by the Central Argentine Railway Co., of the electric power station to be erected on the San Fernando Canal in connection with the electrification of the railway from Retiro to Tigre.—*Review of the River Plate.*

Birkenhead.—Year's Working and Estimates.—The traffic receipts of the T.C. tramways for the past year amounted to £67,782, an increase of £6,539 on the previous year. For the coming year the receipts are estimated at £67,000, and a balance of £3,577 is anticipated.

Canada.—The Ontario Legislature has voted £1,000,000 for the construction of a Government electric radial railway system and the supplementing of the present hydro-electric transmission lines.

Chesterfield.—Loan Sanction.—The T.C. has received the sanction of the B. of T. to a loan of £3,000 for three new tramcars (£2,550), and the extension of the tramcar shed (£450).

Continental Notes. — AUSTRIA. — NEW ELECTRIC 'BUSES.—Battery 'buses have now been running between Volksoper and Stephansplatz (Vienna) for nearly two years, and with such satisfactory results that the Akkumulatoren Fabriks A.G. (Vienna) has offered to replace the municipality's existing horse-'buses by electric vehicles seating 29-33 passengers (as compared with 18 passengers in the existing electric vehicles). Weight and power requirements are to be reduced by using a light type of geared motor. The Austrian Daimler Co. is supplying the electric chassis and half a dozen experimental vehicles will be fitted with various types of bodies, having open and closed-in top seats, &c. Two Spängler bodies will be tried, these having low-step centre entrances and seating 33 passengers.—*E. u. M.*

According to the *Wiener Zeitung*, tests have recently been carried out on the Innsbruck-Scharnitz section of the Mittenwaldbahn to determine the practicability of increasing the number of carriages in the passenger trains. Hitherto no more than 17 axles have been allowed per train, but the present tests show that the power of the electric locomotives (draw-bar pull corresponding to 110 tons maximum load), and the Westinghouse brakes are sufficient for 25 axles. Working at the increased capacity is to be commenced this spring.

ITALY.—The Milan Provincial Authorities have sanctioned the scheme for the conversion of the Milan-Saronno Railway to electric traction. The question of converting the steam railway between Rome and Tivoli to electric traction, is also under consideration.

SWEDEN.—Some trials are being made in Sweden with a new type of locomotive having a Diesel engine as prime mover, with electrical transmission to the wheels. The machine, in full running order, weighs about 33 tons, and is able to attain a speed on the level of 34 miles an hour, and on gradients of 1 in 10, up to 20 miles per hour. The new locomotive is stated to be specially intended for use on small local lines, where only a single carriage is needed to meet the traffic requirements.

GERMANY.—A short railless trolley line has recently been opened in Steglitz, a suburb of Berlin, and the local authorities have sanctioned several extensions. It is probable that during the next year a considerable network of such lines will be opened, as a company (Gleislose Lloydbahnen, Bremen) is seeking and obtaining concessions from a number of local authorities in the suburbs of Berlin. These lines are not in rural districts, but in thickly populated suburbs, and intersect an extensive existing tramway system. The principle reason for this difference from the English applications of railless traction is that whereas in Prussia town roads are usually asphalted, county roads have execrable surfaces; very cheap construction is also sanctioned for rural tramways. The railless system referred to above resembles the "Bremen" system as applied in Stockport, except that the two wires are in the same horizontal plane, the four-wheel over-running collector resembling a miniature crane crab, whilst an improved spring device takes in the slack cable effectively. The cars exchange collectors when passing. The vehicles are of the pay-as-you-enter type, with rubber tires, and motors built into the back wheels. They closely resemble the British railless cars in some respects, and represent a great improvement upon the earlier German cars.

In Bremen the railless trolley line has been replaced by ordinary tramways.

Glasgow.—ALL-NIGHT SERVICE.—The T.C. has approved of the principle of instituting an all-night tramcar service in the city.

Hounslow.—ELECTRIC VEHICLE REPORT.—Following a recent report by Mr. Carey, the surveyor, the Council has decided to purchase an electric vehicle for house refuse collection. Tests with steam and petrol wagons showed that these were each capable of displacing the same number of horsed carts as the electric wagon. The cost per year of horse traction amounted to £405; the cost per annum of the electric battery vehicle for seven years is estimated at £333, showing a saving over horses of £72—or if hired teams are used, of £145. The comparative costs of steam and petrol on the same basis are given as £338 and £404 respectively.

The electric vehicle was an Edison truck, tare weight 3 tons 4 cwt., carrying 4,000-6,000 lb., priced at £840; the others were a 3-ton Garret steam wagon, tare weight 4½ tons, costing £617, and capable of hauling a trailer, and a 3 ton 4 cwt. Thornycroft petrol wagon, tare weight 3 tons 6 cwt., costing £815. Fuel costs are taken at: Electric, £23; steam, £23 8s.; petrol, £75 8s.; driver's wages at 30s. for the electric, and 35s. in each of the other cases; one day per month is allowed for overhauling for the electric and petrol wagons, and two days for the steam wagon, during which time hired carts would be employed. We notice that the items for tires and insurance are reckoned the same for all three vehicles, although there should surely be a saving in the case of the electric truck, in these items.

Japan.—A charter has been granted to the Nagoya Electric Tramway Co. for the construction of a light railway, about a mile long, between Kiyosu and Shinkawa, in the Prefecture of Aichi.

Leeds.—YEAR'S WORKING.—For the year ended March 31st, the traffic revenue on the Corporation tramways was £423,516; the gross income, including a sum of £3,822 for advertising on the cars, was £427,455. The traffic revenue showed an increase of £15,914, which is a record. The working expenses were £226,382, leaving a gross profit of £201,072. Deductions from gross profit include sinking fund charges, £51,932; interest on capital, £12,176; permanent way renewals, £[illegible]. The net profit in relief of the rates is £[illegible], which is equal to a rate of 8d. in the £.

Luton.—The B. of T. has extended the date for the completion of the tramways authorised by the Luton Corporation Tramways Order, 1905 from August 11th 1915 to August 11th 1916.

Manchester.—ESTIMATES FOR 1914-15.—The estimates of the Tramways Committee for the coming year put the expenditure at £950,000, compared with £[illegible] for the past year.

Padiham.—The T.C. has decided to object to the granting of an extension of time for the completion of the Blackburn, Whalley and Padiham Light Railways for which Messrs. Warwick Webb & Co. are applying to the B. of T. The Council has been recommended to negotiate with the Burnley Corporation for the extension of the existing tramway to the western boundary of Padiham.

Southport.—NEW CARS.—Subject to the approval of the T.C., three more toast-rack tramcars are to be purchased.

Yarmouth.—YEAR'S WORKING.—The total receipts of the T.C. tramways for the year ended March 31st, 1914, amounted to £25,712, an increase of £2,090 on the preceding year and the passengers carried numbered 4,930,718, an increase of 415,847. Application is to be made to the B. of T. for permission to double part of the Regent Road tramway track.

TELEGRAPH and TELEPHONE NOTES.

American Marconi Shares.—Last week the hearing of the charges against Mr. C. E. Fenner, stockbroker, was in progress at the Mansion House, London. Evidence was given regarding the purchase of 200 American Marconi shares for Mr. G. R. B. Smith-Bosanquet, on the advice of Mr. Fenner, who quoted the favourable opinion of the Master of Elibank with regard to these shares.

Replying to a question in the House of Commons, the Prime Minister stated that the two Ministers who had held American Marconi shares had divested themselves of these.

Australia.—The Pacific Cable Board announces that arrangements have been made for the telegraphic transmission throughout of "week-end cable letters" to Australia without addition to the existing charge of 9d. per word, and to reduce the minimum number of words from 24 to 20, making the minimum charge 15s. instead of 18s. The arrangement will come into force in a few weeks' time.

Arrangements have been made under which, from May 1st, all week-end telegrams to and from Australasia will be delivered to the addressee on Tuesday, without extra charge. Registered addresses will be accepted for all week-end letter telegrams.

Imperial Wireless System.—The Post Office authorities of South Africa are considering the establishment of a wireless telegraph station at Springs, east of Johannesburg, to communicate with Nairobi, and thence with Malta, at a cost of £120,000 sterling.

Memorial to Wireless Operator.—On Wednesday last week, the second anniversary of the loss of the *Titanic*, a memorial was unveiled at Godalming to John George Phillips, the chief wireless operator, who was a native of that town. The memorial took the form of a cloister and tablet.

Telephone Contracts.—In reply to questions in Parliament, the Postmaster-General stated that the values of contracts at present placed for the construction of underground conduits for telephone cables and for telephone cables respectively, and the lengths in miles of the ducts and cables contracted for, were as follows:—

	London.	*Provinces.*
Contract value of underground conduits	£28,331	£401,[illegible]
Miles of single ducts	146	1,86[illegible]
Contract value of cables	£186,700	£1,139,[illegible]
Miles of single wire	28,550	[illegible]

The values of contracts at present placed by the Post Office for telephone exchange equipments for London, and for other telephone areas throughout the United Kingdom, were as follows:—

	London.	*Provinces.*
Central battery	£239,465	£109,198
Automatic	£4,379	£149,151
Magneto	Nil	Nil

Telephone Employés.—The Postmaster-General last week received a deputation representing the Amalgamated Society of Telephone Employés, who laid before him grievances from which the various sections of the transferred telephone staff say they are still suffering. The interview was adjourned

The Telephone Service.—A new exchange has been opened in Bloomsbury, called "Museum," with an ultimate capacity of 10,000 lines. This district has hitherto been served by the Central Exchange in the City, which will be much relieved by the transference of subscribers to the new exchange.

The P.M.G. states that space exists for additional subscribers' lines, aggregating 38,783 at 11 of the principal exchanges in London. Spare capacity is also available at practically all the suburban exchanges.

At the annual Conference of the National Chamber of Trade, at Blackpool, on Monday, resolutions were passed declaring that it was unfair to impose agreements upon telephone subscribers which did not admit of any appeal from the statements of the Post Office telephone department.

CONTRACTS OPEN and CLOSED.

OPEN.

Argentina.—The Municipality of Castelli, Buenos Ayres, is calling for tenders for the construction of electricity works.—*Review of the River Plate.*

Australia. — May 12th. P.M.G.'s Department. Standard batteries for all States; Schedule No. 1,010. See "Official Notices" April 3rd.

May 26th. Adelaide Tramways Trust. Overhead tramway equipment and construction. B. of T. Commercial Intelligence Department in London.

Victorian Railways.—May 13th. One hundred enclosed arc lamps. Deposit £5. Mr. E. B. Jones, acting secretary.

May 20th. Victorian Railways Commissioners. One three-phase slip-ring electric motor and accessories. Deposit £1. Local representation. A specification can be seen at the B. of T. Commercial Intelligence Department in London.

Sydney.—July 20th. Box compound, meters, maximum demand indicators, arc lamp carbons, and straight stem insulators, for the Council. Specifications for each section 10s. 6d., from City Electrical Engineer, Town Hall.

Belfast.—April 29th. Electric cable, for the Harbour Commissioners. See "Official Notices" April 17th.

Belgium.—May 20th. The Belgian Post and Telegraph authorities in Brussels (Salle de la Madeleine). Supply and laying of a quantity of telephone cable in the Brussels district.

Bridgend.—May 6th. Glamorgan County Asylum. Electrically-driven lift for cold store. See "Official Notices" to-day.

Bulgaria.—The Bulgarian post and telegraph authorities in Sofia are about to invite tenders for a large quantity of telephone apparatus, cables and other accessories required in connection with the extension of the telephone service in the recently acquired extension of the country.

June 6th.—State coal mine at Pernik. Double electric elevator, complete with plant, at an upset price of 10,000 fr. (£400). Further particulars from the "Commission d'Adjudication, Bureau de Finances, Prefecture de Sofia," Sofia. Local representation. At the Commercial Intelligence Branch of the Board of Trade, London, a copy of the specification (in Bulgarian), together with drawings, may be seen.

Denbigh.—April 30th. North Wales Asylum. 700 ampere-hour battery, with booster, switchboard, &c. See "Official Notices" April 17th.

Devonport.—April 27th. Corporation Gas Department. Electrically-driven jib crane and coal hoppers. Specification, &c. (£1 1s.), from Mr. I. Carr, Widnes.

Dundalk.—May 11th. U.D.C. Diesel generating plant, balancer and booster, motor generator, switchboards, battery, mains, crane, oil pipe line and storage tank. See "Official Notices" to-day.

Edinburgh.—May 6th. Corporation. Twelve months' supply of lead-covered, paper-insulated cables, for the Electricity Department. Specification from Mr. F. A. Newington, engineer, Electricity Supply Station, Dewar Place.

France.—Rochelle. April 30th. Tenders are invited for two groups of pumps worked by electricity at the Rochelle municipal pumping station at Périgny, 4 kilometres from Rochelle. This plant comprises two transformers, two motor pump groups with accessories, and high and low tension switchboards with accessories complete for working. Application must be made by letter to "le Maire de Rochelle" for permission to compete before April 30th (5 p.m.). Those allowed to compete will be apprised by letter enclosing particulars of the competition.

Glasgow.—April [illegible]. Corporation. 12 months' supply of cables, meters and arc lamp carbons. See "Official Notices" April [illegible].

Hull. — April 29th. Corporation. Steel roofwork [illegible]. City Engineer.

Ilford.—April 28th. U.D.C. Battery booster, storage batteries, for Goodmayes Sub-station. See "Official Notices" April 17th.

Ilkley. — May 11th. U.D.C. Electricity generating station buildings. See "Official Notices" April 17th.

Leeds.—May 11th. Corporation. Steam turbine, three-phase alternator and exciter, 12,000 KW., 1,000 to 1,500 R.P.M., and condensing plant. See "Official Notices" April 3rd.

London.—Fulham.—April 29th. B.C. Coal for the electricity department for 12 months. Borough Electrical Engineer.

Lambeth.—April 28th. B. of G. Electric motors for Brook Street Infirmary, wiring and fittings at Children's Infirmary, &c., Crown Hill, Upper Norwood, S.E. Specifications, &c. (£2 in each case) from the offices, Brook Street, Kennington Road, S.E. See "Official Notices" April 17th.

Metropolitan Asylums Board. — May 6th. (1) Electric light installation at Grove Fever Hospital; (2) rewiring fire alarm and telephones, &c., at Southern (Lower) Fever Hospital; (3) milk pasteurising and motor-driven plant for Eastern Fever Hospital. See three "Official Notices" to-day.

Malvern.—April 27th. U.D.C. Vertical compound steam engine, direct coupled single-phase 150-KW. alternator, exciter, &c. See "Official Notices" April 17th.

Manchester. — May 13th. Corporation. 5,000-KW. turbo-alternator complete. See "Official Notices" to-day.

Portugal.—Lisbon.—May 22nd. Construction and working of a 12-km. line of electric tramway between Lamego and the right bank of the Duro. Particulars of the Direccao-General das Obras Publicas e Minhas, Lisbon.

Sheffield.—May 2nd. B. of G. Installation of telephone and fire-alarm system at the Workhouse, for the Guardians, Ecclesall Bierlow Union. Specification from the Clerk, Union Offices, The Edge, Sheffield.

Tunbridge Wells.—April 30th. Corporation. 4,000 tons of small coal for use with Underfeed stokers. Borough Electrical Engineer.

Walthamstow.—April 24th. U.D.C. One water-tube boiler and pipework, overhead bunkers and conveying plant, cast-iron circulating water pipes, for the electricity department. See "Official Notices" April 3rd.

Warrington.—May 12th. Extra-high and medium-tension paper cables, for electricity department. See "Official Notices" to-day.

York.—May 12th. Feeder cables for electricity department. See "Official Notices" to-day.

CLOSED.

Admiralty.—The Edison & Swan United Electric Light Co., Ltd., have secured part of the contract for the supply, for 12 months, of Royal Ediswan lamps to the British Admiralty. The new Cunard liner ss. *Acquitania* is being installed throughout with these lamps.

Australia.—According to *Tenders*, the tender of the British Insulated and Helsby Cables, Ltd., at approximately £300,000, for overhead electrical equipment for the electrification of the Melbourne suburban railways, has been accepted in London by Messrs. Merz & McLellan.

P.M.G.'s Department:—

Victoria.—600 lead earth plates, 7s. 6d. each; 500 ditto, 7s. 9d. each.—J. Bartram & Son, Pty., Ltd.

South Australia.—310 magnetic wall telephones, £2 11s. 6d. each; 350 c.b. table pattern telephones, £1 10s. each.—J. Bartram & Son, Pty., Ltd.

New South Wales.—Ammeters and voltmeters, £57.—I.-R., G.-P. and Telegraph Works Co., Ltd.

300 magneto bells, £132; 2,300 three-part plugs, £153.—James Paton & Co.

1,100 condensers, £110.—B.I. and Helsby Cables, Ltd.

1,300 conductor cords, £116.—Lawrence & Hanson Electrical Co., Ltd.

Howlers, strip indicators, keys, number plates, receivers and translators.—Western Electric Co. (Aus.), Ltd.

Victorian Railways Department.—Automatic telephone sets, £169.—Automatic Telephones (Aus.), Ltd.

N.S.W. Public Works Department.—Walsh Island workshops.—Paper-insulated, lead-covered, steel-tape armoured cable and accessories, £1,219.—W. T. Henley's Telegraph Works Co., Ltd.—*Tenders.*

Bedford.—The T.C. has accepted the tender of Messrs. Siemens Bros. for cables. The lowest tender was for Italian-made cables which were not in accordance with the specifications.

Belfast.—The Harbour Commissioners have accepted the tender of British Insulated and Helsby Cables for 36 cwt. of copper wire and 36 cwt. of copper strip.

The tender of Messrs. W. Coates & Son, Ltd., has been accepted for an electric installation in St. George's Church.

Bristol and Newport.—The tender of Messrs. Siemens Bros. Dynamo Works Co., Ltd., for carbon filament lamps has been accepted by the Bristol City Tramways; their tender to the Newport Corporation for a quantity of similar lamps has also been accepted.

Bootle.—The Corporation has placed a contract with the British Thomson-Houston Co., Ltd., for one year's supply of their M.H. type mercury meters.

Canada.—The Regina City Council has awarded the contract for the erection of a new electric power house to Messrs. Wilson & Wilson, at $90,800, and has placed the following contracts for copper wire:

75,000 lb., $14,197.—Northern Electric Co.
70,000 lb., $13,034.—Whiteford Bros.
70,000 lb., $13,160.—Deering Electric Co.
69,000 lb., $12,989.—H. W. Laird Co.—*Canadian Engineer.*

Consett.—The Consett Iron Co. has accepted the tender of Sir W. H. Bailey & Co., Ltd., for a "Kosters" patent electrically-driven air compressor.

Colchester.—The Corporation has accepted the following tenders for stores for the electricity department:—

Ironmongery, tools, oilmen's stores, castor oil, prepayment installations.—Joslin, Ltd.
Castings.—Stanford & Co.
Fuse-boxes.—Lucey & Co.
Ordinary meters.—Venner & Co. and Reason Manufacturing Co.
Prepayment meters.—Venner & Co.
Carbon and metal-filament lamps.—Drake & Gorham, Ltd.

Coventry.—The B. of G. has received the following tenders for installing electric light in the old infirmary block, balconies and verandahs:—

	No. 1 Scheme.		No. 2 Scheme.
H. W. Burbury & Co.	£144		£350
T. Reynolds & Co.	£120		£316
Lee, Beesley & Co.	£148	(accepted)	£252
F. C. Brown & Co.	£96		£223

Messrs. Lee, Beesley & Co.'s tender (No. 2 scheme, £252) was accepted.

France.—La Société des Ateliers de Constructions du Nord de la France, has secured a contract from the Société des Tramways de Paris for the supply of 25 electric motor tramcars, and from the Metropolitan Railway, of Paris, for 36 passenger carriages equipped with motors.

Glasgow.—The Tramways Committee has accepted the following tenders:—

Special trackwork.—Lorain Steel Co.; Titan Trackwork Co., Ltd.
Torch lamps.—J. T. Donald & Co.
Steel work for new turbine foundation, Pinkston.—Redpath, Brown and Co., Ltd.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

Admiralty.—Contract Department.

Distributing, section, junction, &c., boxes.—Callender's Cable Co., Ltd.; Cantie Switch Co., Ltd.; Chadburn's (Ship) Telegraph Co., Ltd.; Crompton & Co., Ltd.; Edison & Swan Co., Ltd.; Hawker's, Ltd.; W. McGeoch & Co., Ltd.; Player & Mitchell; Spagnoletti, Ltd.; Telford, Grier & Mackay, Ltd.

Works Service.

New wireless telegraph station at Lerwick.—G. Hall.

War Office.

Overhead conductors and supports for electricity supply, Netheravon.—G. E. Taylor.

Crown Agents for the Colonies.

Alternators.—Electric Construction Co.
Switchboard.—British Thomson-Houston Co.
Telegraph material.—F. Smith & Co.
Telephone material.—Siemens Bros. & Co., Ltd.

India Office: Store Department.

Cables.—London Electric Wire Co. & Smiths.
Electric plant.—Gilbert Gilkes & Co.
Insulators.—Bullers, Ltd.
Panel plates.—Smith & McClean.
Sounders.—Automatic Telephone Manufacturing Co.
Copper Wire.—F. Smith & Co.; Shropshire Iron Co.; T. Bolton & Sons; Callender's Cable, &c., Co.
Iron wire.—Dorman, Long & Co.; White Cross Co.; Shropshire Iron Co.

Post Office.

Protective apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; Gent & Co.; London Electric Wire Co. & Smiths, Ltd.; Phœnix Telephone and Electric Works; Western Electric Co., Ltd.
Battery boxes.—British L.M. Ericsson Manufacturing Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telephonic cable.—B.I. and Helsby Cables, Ltd.; Johnson & Phillips, Ltd.; London Electric Wire Co. & Smiths, Ltd.; Siemens Bros. & Co. Ltd.; Western Electric Co., Ltd.
Insulators.—Bullers, Ltd.
Telegraph paper.—Waterlow & Sons, Ltd.
Cable distribution plugs.—Siemens Bros. & Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; B.I. and Helsby Cables, Ltd., Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co., and Smiths, Ltd.
Copper wire.—T. Bolton & Sons, Ltd.; B.I. & Helsby Cables, Ltd.; Elliott's Metal Co., Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. and Smiths, Ltd.; J. Wilks, Sons & Mapplebeck, Ltd.
Galvanised iron wire.—Ryland Bros., Ltd.
Electric lifts, Birmingham Telegraph Factory.—Medway's Safety Lift Co.
Electric lift, Glasgow Parcel Office.—Wm. Wadsworth & Sons, Ltd.
Electric lifts, Leeds Telephone Exchange.—Medway's Safety Lift Co.
Laying lines of ducts, Dover, [illegible].—W. [illegible].
Do., Holborn Circus, E.C., and Kennington Park Road, S.E.—J. Mowlem & Co., Ltd.
Do., Leeds, Bradford, [illegible].—[illegible] Lewis & Co., Ltd.
Do., [illegible], W.—[illegible].
Laying lines of pipes and [illegible], Halifax and Dewsbury (Huddersfield section).—J. A. Ewart, Ltd.
Telephone exchange extension equipment (Bristol).—Western Electric Co., Ltd.
Do., London (Official).—Automatic Telephone Manufacturing Co., Ltd.
Do., London (Victoria).—Peel-Conner Telephone Works, Ltd.
Do., North Shields.—Automatic Telephone Manufacturing Co., Ltd.

Hastings.—The Council has accepted the tender of Messrs. Tangyes, Ltd., for twin gas engines of 81 B.H.P., together with suction gas plant and three-throw pumps to deliver [illegible] gallons of water per hour for the Corporation waterworks at Filsham, at £1,650.

The Hastings Corporation has accepted the tender of Messrs. Ayers, Rose & Co., for the supply of 150 tons of best Welsh anthracite coal, at 28s. 1d. per ton delivered. The coal is required for the suction gas plant at the various water pumping stations.

London.—St. Marylebone.—The Electricity Committee recommends the acceptance of the following tenders for underground cables:—Electrical Engineering and Equipment Co. (Ateliers de Constructions Electriques, Charleroi), 12 items; H. W. Butler & Co. (Ateliers de Constructions Electriques du Nord et de l'Est, Jumont), four items; house wires and cables: Geipel and Co. (I. Suddeutsche Kabelwerke A.G. Mannheim).

Londonderry.—The Corporation has accepted the following tenders for the supply of stores for the Electricity Department:—

Engine room stores.—Maxwell, Greer & Co., Ltd.
Electric meters.—Ferranti, Ltd.
Cables.—Western Electric Co., Ltd.
Bitumen.—Dussek Bitumen Co.
House fuse-boxes.—Reason Manufacturing Co.

Newport (Mon.)—The T.C. has accepted the tender of Messrs. Walter Scott, Ltd., of Leeds, for 206 tons of tramway rails and fishplates, at £1,587.

Paisley.—Messrs. Richardsons, Westgarth's tender for the supply of a turbine and alternator, with Siemens condenser, &c., has been accepted, at £9,100.

Salford.—Messrs. Siemens Bros. Dynamo Works, Ltd., have received a contract from the T.C. Tramways Department for Wotan, tantalum, and carbon-filament lamps for 12 months.

Swindon.—The Corporation has accepted the tender of the Electrical Apparatus Co., Ltd., for D.C. meters of 2½ amperes capacity for the ensuing year.

West Hartlepool.—The Corporation has accepted the tender of the Bastian Meter Co., Ltd., for the supply of Bastian meters up to 10 amperes.

Walthamstow.—The U.D.C. is recommended to accept the tender of Messrs. John Baker & Co., Ltd., for the supply of steel tires for tramcars, at £15 10s. per ton, for the period ending March 31st next; also that of Messrs. A. Usher & Co., for an annual supply to the Electricity Works, of Griff, Kingsbury Shipley and Ansley Hall peas, and Baddesley beans coal, at 12s. 6d. per ton—between 10,000 and 11,000 tons.

Wolverhampton.—The Corporation Tramways Committee has decided to purchase three motor equipments from Messrs. Dick, Kerr & Co., Ltd., at £765. Messrs. T. & S. Ham have received the contract at £2,595 for extensions to the buildings at the Commercial Road Station. The quotations of the Holly Bank Coal Co., Ltd., and Messrs. Brentnall & Cleland for the supply of fuel for the electricity works, have been accepted.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued:—

Friday, April 24th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Saturday, April 25th.—Headquarters will be open for Regimental purposes only from 10 a.m. to 12 noon.

Monday, May 4th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m. Miniature range practice, 7 to 9 p.m.

Tuesday, May 5th.—"B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Wednesday, May 6th.—Musketry at Purfleet from 1 p.m. to dusk.

Thursday, May 7th.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Friday, May 8th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Saturday, May 9th.—Headquarters will be open for regimental purposes only from 10 a.m. to 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant,
For Officer Commanding L.E.E.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, April 24th. At 8 p.m. At 39, Victoria Street. Paper on "A Visit to the Iron Districts of French Alsace," by Mr. G. Evetts. At 7.45 p.m At Municipal School of Technology, Manchester. Meeting of North-Western Section. Paper on "Some Notes on the Application of Chain Gearing," by Mr. H. T. Hildage.

Monday, April 27th. At Birmingham. Meeting of the Midland Section.

Friday, May 1st. At 8 p.m. At 39, Victoria Street. Paper on "The Control and Organisation of the Engineering Profession," by Mr. S. T. Robson.

Institution of Civil Engineers.—Friday, April 24th. At 8 p.m. Students' meeting. Frame Thomson lecture on "Engineering Contracts," by Mr. A. A. Hudson.

Institution of Electrical Engineers (Newcastle Local Section).—Friday, April 24th. At 7 p.m. At Hugh Bell School, Middlesbrough. Paper on "Industrial Applications of Electrically-Produced Ozone," by Mr. E. L. Joseph.

(Newcastle Students' Section).—Monday, April 27th. At 7.30 p.m. At Armstrong College. Paper on "Electric Ship Lighting," by Mr. B. S. Orme.

(Dublin Local Section).—Saturday, April 25th. At 8 p.m. At Lecture Theatre, Leinster House, Kildare Street. Conversazione.

(Manchester Local Section).—Tuesday, April 28th. At 7.30 p.m. At the University (Physical Laboratory). Lecture by Prof. J. A. Fleming, F.R.S.

(Students' Section).—Wednesday April 29th. At 7.45 p.m. At Victoria Embankment. Annual General Meeting. Discussion, "The Students' Section."

Institution of Mechanical Engineers.—Friday, April 24th. At 8 p.m. At Storey's Gate, S.W. Paper on "Application of Electrical Driving to Existing Rolling Mills," by Mr. L. Rothera.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, April 24th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

(Graduates' Section).—Saturday. April 25th. At 7.15 p.m. Paper on the "Gyroscopic Compass," by Mr. H. O. Stroud.

Physical Society.—Friday, April 24th. At 5 p.m. At Imperial College of Science, South Kensington. Ordinary meeting.

Batti-Wallahs' Society.—Friday, April 24th. Smoking concert.

Royal Society of Arts (Colonial Section).—Tuesday, April 28th. At 4.30 p.m. At John Street, Adelphi. Paper on "The Administration of Imperial Telegraphs," by Mr. C. Bright.

Wednesday, April 29th. Paper on "The Need for a Better Organisation of Economic and Industrial Resources," by Mr. C. R. Enock.

Royal Institution of Great Britain.—Tuesday, April 28th. At 3 p.m. At Albemarle Street, W. Paper on "Problems of Physical Chemistry: (2) Structure of Matter at Low Temperatures," by Dr. W. Wahl.

Electrical Contractors' Association.—Wednesday, April 29th. At 6.30 p.m. Reception, 7 p.m. Dinner at Grand Hotel, Leicester.

Salford Technical and Engineering Association.—Saturday, May 2nd. Visit, Park Works, Newton Heath.

NOTES. –

Concert.—To-morrow night (Saturday), at 7.30 p.m., at the Great Hall, Cannon Street Hotel, E.C., the third annual smoking concert of the electrical engineers' department of the Great Eastern Railway is to be held. Mr. H. W. Firth, M.Inst.C.E., electrical engineer to the G.E.R., will take the chair. The artistes are as follows:—Miss Violet Oppenshaw, Miss Marjorie Bowen; Messrs. Peter Dawson and George Foxon; Mr. Ernest Hastings, entertainer at the piano; Mr. Olley Oakley, banjo soloist; Mr. George Blackmore, humorist; Dr. Lynn, prestidigitator; Mr. Bernard Flanders, accompanist and musical director.

Fires in London.—Last year there were 158 fires in the City, of which 16 were caused by defective electrical fittings. On Wednesday last week fire broke out in the Mansion House on the floor of a service room beneath a plate-warming apparatus *fed by gas jets*. The flooring was found to be well alight. The fire brigade were called and the fire was quickly subdued, though not until a considerable space and depth of flooring had been burned through. There is no record of any previous fire in the Mansion House during its existence of 161 years.

A Boston Campaign.—In order to stimulate the volume of sales and the general growth of the business, the Edison Electric Illuminating Co. of Boston is conducting a campaign among its employés looking to the securing of a connected load of over 4,000,000 50-watt equivalents before July 1st. The campaign began about February 1st, when the company's load was 3,764,000 equivalents, and interest has been aroused and stimulated by means of a letter from Superintendent W. H. Atkins to every employé, in which he urged every person in the company's service to join in this campaign. the company publication, *Edison Life*, carried forward the project through advertisements and editorially calling upon the employés to work towards the desired end. Placards posted throughout the company's offices call attention to the same thing, and a "thermometer" indicates the progress of the campaign. Every letter passing between the various departments bears the following slogan, stamped upon it:—

Four million or more
July first or before.

On March 27th the company's total connected load was 3,814,852 equivalents. The average of 1,900 equivalents per day is needed to reach the goal.—*Electrical Review and Western Electrician.*

Output of Coal.—The Home Office issued on Satur an advance proof (subject to correction) of the tables relatin the output of coal and other minerals in the United Kingdom, the number of persons employed at mines during 1913. document shows that the output of coal from mines under Coal Mines Act, which was 260,398,578 tons in 1912, rose last y to 287,411,869 tons, an increase of 27,013,291 tons. The tota the highest on record. There was a total of 1,127,890 pers employed at mines under the Coal Mines Act, an increase 38,800 on the previous year. The increase in the output of c is at the rate of 10·37 per cent., the increase in the number persons employed at the rate of 3·56 per cent.

Electric Cooking on Submarines.—Writing in recent issue of the *Pall Mall Gazette*, its Naval correspondent, referring to a rumoured new type of British submarine, states th the electric cooking range is installed in the E class, "and a v handy little apparatus it is. You can cook a five-course dinner it, and it occupies a space represented by about 2 ft. × 4 ft. 3 ft."

Fraud.—At a special sitting of the Newcastle-on-Ty Police Court on Monday, William Walton, *alias* Currie (34), w was stated to have swindled electrical firms in all quarters of t kingdom, was sentenced to six months' imprisonment on thr specific charges of fraud. The solicitor for the prosecution, opening the case, said prisoner was a man of education and abilit It was not a case where a poor creature had been tempted to crim but one in which the accused had deliberately chosen to follow course of fraud. One of the three cases, which had been select out of many upon which to base the prosecution, related to tw dynamos, two switchboards, one bulb case and six electric bulb valued at £31 8s. 11d., alleged to have been obtained from Messr S. Smith & Sons, Ltd., of 185, Great Portland Street, London, W During the short while he had operated from Newcastle, 24 firm had been defrauded, and the value of the goods amounted t £182 11s. 2d. Trading as W. Walton & Co., from an office for which he paid 7s. per week rent, but which contained no furniture whatever, he sent out his orders broadcast. When the goods were delivered, they got no further than the passage, where they were promptly redirected to an address at Bolton. And here the prosecution was placed in some difficulty, because one of the witnesses on whom they had depended, named Thomas Cooper, had that morning admitted the writing of certain letters to prisoner, from which it was assumed that he had participated in the frauds. Moreover, it was only the inability of the criminal law to deal with a man and his wife on a conspiracy charge that prevented the prisoner's wife from appearing in the dock by his side. The Newcastle police proposed to communicate the whole of the facts to the Bolton police, and leave them to take such action against Cooper as was necessary. Up to 1911 prisoner appeared to have held a most lucrative position as a commercial traveller. During the latter part of 1913 he carried on a business under the name of Briggs & Co., at Preston. From there the goods received were sent on to Blackburn, and there converted into cash. Pleading for clemency, accused's solicitor said his client was educated to the finger-tips, and connected with a well-known Edinburgh family. For 13 years he carried on a remunerative business, but, unfortunately, he overdrew at the bank to the extent of £250. Ill-luck followed him, and at last he gave way to the temptation of going the wrong way. He promised faithfully, however, to do his level best to retrieve. The Bench, in passing sentence, said they had a certain amount of sympathy with him, but, at the same time, they realised that traders must be protected against frauds of the kind before them. The term of six months' imprisonment would be without hard labour.

The Effect of Dirt on Reflectors.—In a review of a book on "Factory Lighting," by Mr. C. E. Clewell, published in our issue of the 10th inst., the reviewer referred to some figures which the author gave showing the loss of light due to dirt deposited on lamps and reflectors, and incidentally commented adversely on Holophane shades, to which he applied some of the author's results, as compared with opal and metal shades. It is but fair, however, to state that throughout the chapter in which these data occurred, the author made no explicit reference to any particular make of shade, and did not institute any comparisons between one class of shade and another. In fact, his object was to show the importance of cleaning both lamps and reflectors at regular and frequent intervals, and he was not testing the efficiency of the shade *per se*. The deterioration in any given case depends upon the conditions obtaining in that case, and the type of reflector should be chosen to suit those conditions; when this is done, the prismatic reflector is capable of holding its own with opal, metal, or any other type of reflector, and data are extant of prolonged tests which prove this.

Accident.—With reference to the reports in the daily Press concerning an accident which occurred last week to three employés of the Shoreditch electricity department, we find upon inquiry that the facts of the case were as follows:—

At 11.45 a.m. on April 15th an intermittent earth occurred on the 1,100 volt D.C. trunk main between Whiston Street and Coronet Street power stations, which eventually developed into a short-circuit and broke down the trunk main. Three men who were in the neighbourhood of the manhole where the trouble occurred were injured when the explosion took place. One of them had to be sent to the hospital, and was detained for one night, but the other two men were not injured seriously and are at work again.

Institution and Lecture Notes.—Association of Mining Electrical Engineers. At a meeting of the South Wales Branch on February 14th, Mr. J. Glynn Williams read a paper on "Electrical Equipment for Low Energy Consumption," in the course of which he said that some electrical engineers advocated the use of paraffin wax for filling joint boxes, but he was satisfied to take the experience of paraffin candle moulding-machine makers, who found that paraffin wax ate into the copper and lead. For this reason they were compelled to use pure tin for moulds, although the cost of tin was several times higher than copper. They also relied on the shrinkage of the wax when cold to allow the candles to be expelled from the mould, and this pointed to the fact that there would be shrinkage in a joint box if wax were used. This would allow moisture from a humid atmosphere such as was met with underground to creep into the box. It was always advisable to put a layer of pure rubber strip over a joint before using Empire tape which had been paraffin-waxed. Oil-immersed controllers and reversing switchgear should have large oil tanks. A 350-H.P. motor stator reversing switchgear was immersed in a tank which held about 100 gallons of oil, and this oil had not required changing for 18 months. A 150-H.P. motor stator reversing switchgear supplied by the same maker had only about three gallons, but it required changing at least every month, which added considerably to the maintenance cost. The operations of the 350-H.P. motor were about four to one of the 150-H.P. motor. The following figures were obtained at a South Wales colliery where electricity was the sole motive power. It had an output of 5,120 tons a week, but the output was increasing rapidly, and with very little extra current consumption. The time of working was from 2 p.m. Saturday to Saturday in the following week. The generating plant consisted of high-pressure impulse-type turbo-alternators (with condensing plant), 3,300 volts, three-phase, 50 cycles. The steam was generated in Lancashire boilers fired with anthracite coal, and the steam was superheated. During one week the total units generated were 48,800, with a consumption of 84 tons of coal—that was to say, 581 units per ton of coal. Of this output only 36,829 units were used at the colliery, the various applications being as follows:—

	Total units for week.	Units per ton output.
Ventilation	20,160	3·94
Pumping	1,266	0·247
All surface and underground lighting, lamp-cabin motors for cleaning and charging accumulators	456	0·089
Screening	2,357	0·46
Haulage	6,042	1·18
Winding*	6,548	1·279
	36,829	7·195

* This should work out less in shaft winding on account of balance load.

The underground haulages were all main-and-tail, and all the coal was collected from the various districts and concentrated at the drift bottom. It was then taken up the drift, which was 500 yards long, having a gradient of 1 in 3. The total ton-mileage including winding was 6,550·5 ton-miles, and the units per ton-mile for haulage and winding worked out at 1·92.

The fifth annual meeting of the members of the South Wales Branch will be held at the Castle Hotel, Neath, on Saturday, May 9th, at 4.30 p.m., when the branch president, Mr. Godfrey H. Williams, will deliver his presidential address, supported by the Association president, Mr. Alex Anderson, and other gentlemen. At the close of the meeting the members will dine together.

Birmingham and District Electric Club.—On April 18th, Mr. E. A. Hildage read a paper on "The Selection of Chain Gearing." He stated that the chief factors affecting the question of chain gears were power, speed, gear ratio, the position of the drive, the distance between the shafts, and the direction of rotation. Much valuable information was given of the design of chain drives, and convincing examples showing the savings in power and increased efficiency were given and illustrated by lantern slides. The importance of adequate lubricating arrangements, and the advisability of gear cases where possible, were emphasised, as affecting the life and satisfactory running of the chain. Figures were submitted showing that in many cases the first cost of a chain drive was lower than that of a belt or rope drive, while the life of a chain was invariably greater than the life of ropes or belts.

The Concrete Institute.—A paper was read by Mr. Oscar Faber, B.Sc., entitled "The Design of Steel and Reinforced Concrete Pillars, with Special Reference to Secondary and Accidental Stresses," at the meeting on April 16th.

Electricity in Poultry Cultivation.—Experiments carried on by Mr. Randolph Meech at Poole, during recent months, with a system of Mr. Thorne Baker, on some thousands of chickens, indicate that electrical treatment accelerates growth by about 50 per cent.; at the same time the mortality amongst the young birds is greatly reduced, and their appetite is lessened. The system consists in the application of intermittent positive electrical discharges together with a high-frequency alternating field.

Faraday House Scholarships.—At the recent examination for entrance scholarships held at Faraday House Electrical Engineering College, Mr. W. G. Radley, of Leeds Modern School, was awarded the Faraday Scholarship of 50 guineas per annum, tenable for two years in college and one year in works, and Mr. C. H. B. Ewbank, of Epsom College, the Maxwell Scholarship of 50 guineas per annum, tenable for one year in college and one year in works.

Tramway and Light Railway Congress.—The preliminary programme has just been issued in respect of the eighteenth annual International Tramways and Light Railway Congress, which is this year to be held in Buda Pesth. A large number of reports are, as usual, to be presented to the gathering, among them being the following:—M. Duval Arnould, of the Paris Municipal Council, and Dr. Kuhles, of the Munich Municipal Council, will deal with (a) The Influence of New Means of Transport on the Development and Extension of Large Cities, and (b) Tramway and Suburban Railway Fares Reduced "Correspondence" Tickets, and their Influence on Receipts and Season Ticket Rates and Systems for their Calculation. Herr Busse, the chief engineer of the Berlin tramways, and M. Rosal, manager of the Bordeaux tramways and omnibuses, will report on the subject of the Undulatory Wear of Rails. M. Bacqueyrisse, tramway engineer to the Paris General Omnibus Co., and Signor Minorini, manager of the Milan Municipal Tramways, will deal with the subjects of the Best Shape of Rails and Tires to give a Minimum Traction Coefficient, and least Wear of Rails on Curves; the Influence of Wheel Base on Curves; and the Use of Manganese-Steel Rails. The question of the Economy of Energy due to the Use of Ball and Roller Bearings on the Axles of Electric Tramway and Railway Vehicles will be reported upon by M. Largiader, manager of the Zurich Tramways, Herr Schoerling, manager of the Hanover Tramways, and Herr Tobias, manager of the tramway works in Buda Pesth. M. Noirfalise, general manager of the Liége Tramways, will deal with the qnestions of the Training of Motormen (Drivers), Conductors and Checkers, the Methods of Issuing Bundles of Tickets to Conductors, and the Handing Over of the Receipts. A report on the Special Provisions necessary on the Wagons of Narrow-Gauge Railways to Facilitate the Transfer of Goods to the Rolling Stock of Standard-Gauge Railways, will be presented by M. Sapin, managing director of the Compagnie Centrale de Chemins de Fer et Tramways Electriques, of Paris. M. Sekutowicz, of Lyons, will deal with the question of Underground Electric Feeders, especially as regards the Requirements of Armoured Cables, the Use of Aluminium as Conductors, and the Life of Underground Cables. Herr Sieber, manager of the Nuremburg-Furth Tramways, will take up the subject of using a Higher Voltage for Suburban Tramways than for those in Towns, while Mr. Dalrymple, of the Glasgow Corporation Tramways, and M. Sarrat, of Brussels, will report on the question of the Advantages and Drawbacks of the Various Systems of Converting High-Tension Alternating Current to Continuous Current.

Electrical Enterprise in Norway.—The two largest electrical concerns in Norway are the Rjukan Co. and the Aura Co., of which the latter is making arrangements for harnessing between 250,000 and 300,000 H.P. It is now reported by our Norwegian correspondent that Mr. Blakstad, the director of the Aura Co., is working on another scheme, which will be a good third in regard to size. About 10 years ago, Mr. Blakstad acquired all the water-rights of the Toke River, which flows through the western part of Telemarken in the south of the country, and thus through the same district as Rjukan. As soon as the titles had been secured, the river was surveyed and plans were prepared in due course, which resulted in an application to the Government for a concession about four years ago. This application was, however, withdrawn owing to certain political difficulties. The regulation of the whole river is first of all dependent on the regulation of the Totakoand, which is a lake, from which the river comes. The Toke River has at the present time to pass around a large mountain, the Eidsborgfjeld, which lies at the upper end of a valley, through which it flows later. It is now according to the plans the intention of altering the course of the river by leading the water through a tunnel through the Eidsborgfjeld. At the end of this tunnel the water will enter huge pipes, which are going to be laid along the very steep hillside, and will thus be conducted direct to the power station, which is to be erected at the foot of the mountain, and for which the necessary site has been acquired. This represents the most important fall of the river, but there is still a fall of several hundred metres to be reckoned with further down, which also can be utilised, and the total quantity of power can thus be brought up to anything between 250,000 and 300,000 H.P. Owing to the mountainous character of the country the district itself offers no opportunity for the erection of manufactories, as the transport of the products to and from these would be very difficult. The power, therefore, cannot be employed on the spot as at Rjukan, hence it is the intention to transmit it to the coast, the main portion of it most probably to Skien, which is the shipping port of the products from Rjukan and will no doubt become a great industrial centre. It is assumed that the energy will chiefly be used for electro-metallurgical purposes.

Under the name of Aktieselskapet Hoiangsfaldene, a company was formed some time ago for the purpose of acquiring the water rights of the Höiangsfaldene, with the view of harnessing the falls, which are situated in the neighbourhood of Bergen, and are estimated to be able to produce in all 70,000 E.H.P. The company has now submitted an application to the Government for a concession. In the first instance, it is the intention only to make use of about one-third or one-fourth of the whole amount of power available; the remaining portion will come into question later on. The power to be produced by the preliminary installation is to be employed for the electrical smelting of iron-ore, and the ironworks to be built is later on to be supplemented by a steelworks, in which the products of the ironworks can be turned into steel. All the shares of the new company are in Norwegian hands, and the promoters of the enterprise are men of good financial standing, who are chiefly engaged in the shipping and whaling business.

Late Legal.—J. & R. Oldfields, Ltd., *v.* Electric Battery Co.—By this action, which was heard by Mr. Justice Neville in the Chancery Division on Wednesday, April 22nd, the plaintiffs a Birmingham firm, sought relief in respect of an alleged infringement of their catalogue by the defendants, who carried on business in London.

From the opening statement of Mr. Butcher, K.C., who represented the plaintiffs, it appeared that towards the end of 1911 they had prepared for them a catalogue with a description of their electric lamp, which catalogue was largely circulated amongst the public and the trade. In June, 1912, a further catalogue was issued, containing descriptions of other things besides electric lamps, but retaining the original description and advertisement of the lamps The copyright of both catalogues was now vested in the plaintiffs. In February, 1913, they discovered that the defendants had printed and circulated a catalogue of their E.B.C. dynamo and electric lighting installations, which contained a description of an electric motor-car lamp which, it was alleged, was copied from, or was a colourable imitation of, the description of the lamp in the plaintiffs' catalogue. The plaintiffs' lamp, said counsel, was described as a lamp into which "no dust could enter . . . . owing to a tightly fitting flange." In the defendants' catalogue they had "highly fitting flange" instead of "tightly." Counsel called attention to a number of other similarities, and said that so far as they could find, no other manufacturer had used the same descriptive language as was found in the plaintiffs' catalogue. It was significant also, he said that the defendants had published a previous catalogue in which different language was used, and it would appear, he submitted, that the plaintiffs' language being much more attractive than the defendants', the latter had abandoned their own and used the plaintiffs'.

Mr. Woodgate, for the defence, denied that the defendants' catalogue was in any way copied from the plaintiffs' and called evidence in support of that contention.

Without calling upon plaintiffs' counsel to reply, his Lordship gave judgment for them, with 40s. damages and costs.

Adventure of a Motor.—The British Thomson-Houston Co., Ltd., of Rugby, supplied one of their DG type motors to Messrs A. & F Manuelle, of Guernsey, some six months ago; this machine was coupled to a pump, and was mounted with it on a combined baseplate. On being unloaded from the ship at Guernsey, the combined set was deposited on the top of a stack of timber on the quay. Owing to the action of a strong wind, and also probably to faulty stacking of the timber, the whole pile collapsed, and the machines were precipitated into the sea. The height from the quay to the sea floor at this point is 30 ft., and the water at high tide attains a depth of about 20 ft. It was impossible to recover the machines until low water, so that in addition to the effects of the impact on the sea floor, the motor was subjected to the action of sea water, at a considerable pressure, for a matter of half a day. When recovered, in addition to a bent shaft, the motor was found to have one foot broken off, and the endshield at the commutator end cracked through. As the machine appeared to be electrically in good condition with the exception of the wetting, Messrs. Manuelle proceeded to repair the mechanical defects. The cracked endshield was patched, a wrought-iron foot was fitted, and the armature shaft was straightened, as far as was practicable, in a lathe. The motor was then reassembled and the set installed. No dressing of any sort was applied to the windings, and the machine was left to dry itself out in service. In spite of the fact that the shaft is still slightly sprung the motor has been running satisfactorily ever since it was installed, and although the supply pressure is 420 volts, no leakage of current is perceptible. This happy result speaks well for the methods used by the makers for insulating the windings of their machines, the cotton covering of the conductors being thoroughly impregnated with insulating varnish, and all the material used of the highest quality. The ability to survive so serious an accident is an excellent testimonial to the merits of the electric motor.

Marylebone Battery Arbitration.—The following letter reached us after our "Correspondence" pages were closed:—

"Referring to the note which appeared in your issue of 10th inst. regarding the battery at Rathbone Place belonging to the Marylebone Borough Council, where it is stated that this company was not disposed to carry out the necessary work, I shall be much obliged if you will afford me space to state that the question at issue with the Corporation is whether the further repairs which are necessary to the battery, and which are to be carried out by this company, are to be borne by the Corporation or the company.

"It has been mutually agreed to appoint an Arbitrator to decide the question of payment.

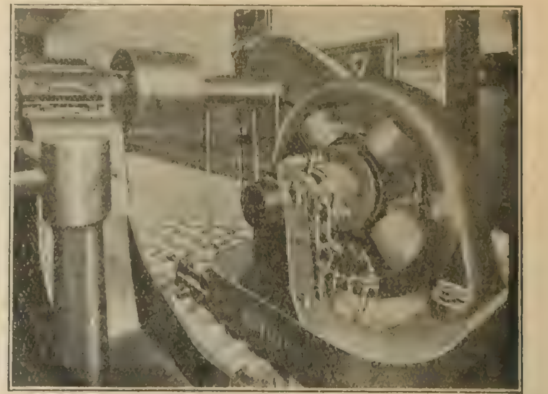
"Electrical Power Storage Co., Ltd.

"Malcolm Leggett, *Secretary.*

"London, E.C., *April 22nd*, 1914."

Appointments Vacant.—Switchboard attendant (20s. to 25s.), for Erith; jointer, for Blackburn Corporation electricity department; switchboard attendant for Dundalk electric supply undertaking (25s.); assistant mains engineer (250 taels, or £30 per month) and mains foreman (200 taels, or £25 per month), for Shanghai Municipal Council. Particulars are given in our advertisement pages.

A Mill Lighting Plant.—A typical example of mill lighting plant is shown in the accompanying view which represents a General Electric dynamo of 30 kw., 220 volts, installed at the Leigh Manufacturing Co.'s sheds under the direction of Mr. R. S. Greenhalgh, of Atherton. This machine is driven from the main shaft of the mill engine through a Hans Renold chain, and is situated in the engine house. We understand that electricity is being generated at a cost of ·6d. per unit, including interest and depreciation.



Chain-driven G.E.C. Dynamo.

Strengthening Foundations.—According to the *Times*, grouting experiments which have been in progress at the old Post Office site, with a view to determining the possibility of strengthening the foundations of St. Paul's Cathedral by injecting liquid cement into the subsoil, have been successful. A number of borings have been made, and the liquid cement has been forced into them by compressed air. The cement has permeated the subsoil for a considerable distance round each of the borings; and not only gravel and sand, but also clay has been transformed into a solid concrete mass. It is probable that the process will now be applied to the subsoil under St. Paul's Cathedral. The process may be found useful by engineers who find the foundations of buildings under their charge in an unsatisfactory condition.

Charging Batteries from A.C. Supply.—A correspondent, one of whose clients requires a supply of current for charging purposes, finds that a motor-generator would not be suitable for this, and would like to know whether any reader has found some standard apparatus which is satisfactory for charging batteries from an alternating-current circuit with a frequency in the neighbourhood of 80.

Electric Smelting of Iron Ore.—According to an article published in the *Canadian Mining Journal*, a company at Toronto has evolved a type of electric furnace specially adapted for the smelting of Canadian magnetite iron ores. The metal produced is said to be very sound and fluid, and when used for steel casting gave very clean surfaces, such as are ordinarily obtained only in grey iron castings.—*Board of Trade Journal.*

For Sale.—Ayr T.C. have for disposal one 100-k.v.a. Siemens alternator, direct-coupled to a Marshall horizontal engine. Particulars are given in our advertisement pages.

Correction.—With reference to the paragraph published on page 619 of our issue of April 10th respecting an electric lighting scheme for Bawtry, by an inadvertence our correspondent stated that the scheme was being provided by Messrs. Best and Turner, of Bradford. The partnership between Messrs. Best and Turner was dissolved in August, 1912. For the Bawtry scheme Mr. C. H. Best has as his colleague, Mr. C. Pullan, electrical engineer, of Bradford.

Educational Note.—Goldsmiths' College, New Cross. Eight special lectures on Wireless Telegraphy are to be given during May and June, as announced in our advertisement pages to-day.

International Electrotechnical Commission.—At the Berlin meeting of the I.E.C. held in September, 1913, an account of which appeared in our issue of September 19th, it was agreed that meetings of the (International) Special Committees should be held in Madrid towards the close of the present month. These Special Committees deal with symbols, standardisation rules for electrical machinery, nomenclature and prime movers for electrical plant. It has, however, been found impracticable to hold these meetings at the present time, and they have, therefore, been postponed until the autumn. It is probable that they will take place in London.

Publication 28 of the I.E.C. International Standard of Resistance for Copper, has recently been issued and should prove of considerable interest to the electrical industry. We will refer to it more fully in a later issue. It can be obtained from the General Secretary of the I.E.C., 28, Victoria Street, Westminster, S.W., by sending a P.O. for 2s. 1d.

Sixteenpence for Fourpence.—The following passage which occurred in an Editorial note in our esteemed contemporary, the *Electrician*, last week gives food for furious thought: "According to Mr. Clarkson, the fuel cost for a 3 ton petrol-driven vehicle is 2d. per car-mile with petrol at 1s. 4d. per gallon. With coke at 19s. per ton, the fuel cost of a steam driven vehicle of the same capacity is 0·4d. per mile. This is equivalent to saying that when petrol is at 1s. 4d. a gallon, and coke at 19s. per ton, the fuel costs of the two types of vehicles are equal."

In other words the greater is equal to the less, and much study is a weariness to the flesh. The solution of the mystery, after all, appears to be fairly obvious. Our contemporary has been reading some of the veracious circulars in which it is proved that electricity at 4d. a unit costs as much as gas at 14s. per 1,000 cb. ft., and the figures have got mixed.

International Electrical Congress.—We understand that Mr. A. G. Collis, who has made a special study of switchgear, has been invited to read a paper at the Congress in San Francisco next year, and has chosen for his subject "The Effects of Rupturing A.C. and D.C. Circuits."

Annual Dinner.—The employés of the West Ham Corporation electric supply department held their fifth annual dinner on Saturday, April 4th, Mr. J. W. Beauchamp (engineer and manager) presiding over a company numbering over 60. The dinner took place at the Princess Alice Hotel, Romford Road.

Radium Frauds.—In view of the popular demand for radium treatment, the Medical Committee of the British Science Guild has issued a warning as to the danger that the claims made for radium as a curative agent may lead to the fraudulent sale of substances alleged to contain radium, or to harmful treatment by unqualified persons.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. W. A. STREET, district superintendent on the sales department of the borough of St. Marylebone electric supply, is resigning his position in order to join the Sturtevant Engineering Co., London.

MR. H. GREGG, late mains engineer to the Woking E.L. Co., has been presented by the staff with a gold signet ring bearing his monogram.

MR. H. ORFORD has resigned his position as senior shift engineer with the Kidderminster and District Electric Lighting and Traction Co., to enable him to take up similar duties at Messrs. Mitchell and Butler's power station, Birmingham.

MR. WM. SILVERWOOD, of Heckmondwike, has been appointed works fitter at the Lancaster Corporation Electricity Works, in succession to Mr. T. W. Hudson, who has been appointed to a post under the Yorkshire Electric Power Co.

General.—MR. W. G. WATSON, of Sydney, who has been in Europe for the past nine months, leaves for Australia *via* America in the course of a week or two.

With reference to our article of last week describing the hydro-electric installation for working the mines of the Tekkah Mining Co., Perak, Malay States, we learn that this plant was installed under the direction of the late MR. O. F. DOMON, M.I.E.E., of the Oerlikon Co. Mr. Domon unfortunately died out in the Malay States as the victim of fever contracted in the forest during the putting up of the transmission lines.

MR. ALFRED W. BEUTTELL has removed to 109, Victoria Street, Westminster, S.W.

The *Manchester Courier* states that MR. J. N. PRING, who is attached to the department of Physics in Victoria University, occupying the position of lecturer and demonstrator in electro-chemistry, has been nominated to a "table" at the Mosso Laboratory, which is situated at a high altitude on Monte Rosa. At this centre he will engage in investigations relative to the conditions of the upper atmosphere. Mr. Pring has received a grant of money from the Royal Society to aid his research work on Monte Rosa.

The *Review of the River Plate* states that MR. ERNESTO NEWBERY, hitherto sub-director of municipal lighting and electrical installations, Buenos Ayres, has now been named director in succession to his brother, the late Mr. George Newbery.

The British Electrical Friendly Society held the ninth annual dinner of the Potteries District of the Society on 16th inst. Mr. W. Thom, general manager of the Potteries Electric Traction Co., presided. Mr. G. C. Kent proposed "Success to the British Electrical Friendly Society." Subsequently Mr. Cornwallis West, acting for the members, presented an oak bureau to MR. WASHINGTON HALL, in recognition of his services as secretary.

The marriage took place, at Holy Trinity Church, Rugby, on April 11th, of MR. JOHN R. BLYTH, of the staff of the British Thomson-Houston Co., Ltd., Rugby, and Miss I. Batson, only daughter of Mr. G. Batson, of London.

The marriage took place, at Tabernacle Church, Aberayron, on April 11th, of MR. ENOCH GORDON LLOYD, electrical engineer, of Charlton, London, and Miss Margaret Caroline Evans, grand-daughter of Capt. David Lewis, of Glendower, Mydrollyn.

NEW COMPANIES REGISTERED.

Park Royal Engineering Works, Ltd. [illegible] This company was registered on April 17th with a capital of [illegible] shares of £1 each and [illegible] to carry on the business of electricians, mechanical engineers, [illegible] heat, motive power or otherwise, manufacturers of [illegible] apparatus, &c., at Park Royal, Middlesex. The subscribers [illegible] preference share each are: H. H. [illegible] merchant; H. M. Bayly, 20, Addison Road, Bedford Park, [illegible] engineer. Private company. The number of directors [illegible] three or more than seven: the first are H. [illegible] and A. G. Morrish. H. H. [illegible] may, while holding [illegible] shares, [illegible] nominate a director. Qualification, 100 preference [illegible] remuneration, £100 each per annum. Registered office, [illegible] E.C.

W. T. Cornell, Ltd. (135,199).—This company was registered on April 9th, with a capital of £300 in £1 shares, to carry on the business of manufacturers of electrical and gas fittings and [illegible] external combustion engines, electrical accessories [illegible]. The subscribers are: Mrs. S. Cornell, 8, The Pavement, Northwood, [illegible]; W. Cornell, 8, The Pavement, Northwood, electrician, [illegible]; [illegible] Cornell, 8, The Pavement, Northwood, 1 share; Mrs. [illegible], The Pavement, Northwood, 1 share; A. Cornell, 15, Durban Road, [illegible] share; F. Cornell, 25, King's Terrace, Hounslow, electrician, [illegible]; H. Cornell, 27, Fame Park Road, Putney, painter. Private company. The number of directors is not to be less than two or more than [illegible]; the first are Mrs. S. Cornell and W. Cornell; qualification, five shares. Registered office, 8, The Pavement, Northwood, Middlesex.

Scottish Welding and Electrical Co., Ltd. (9,073).—The company was registered in Edinburgh on April [illegible], with a capital of £1,000 in £1 shares, to carry on the business of electrical engineers, motor and motor-car manufacturers, &c. The subscribers (with one share each) are:—J. J. Weldon, 135, Wellington Street, Glasgow, manufacturer; G. Smith, 142, Kennedy Street, Glasgow, electrician. Private company. The number of directors is not to be less than two or more than seven; the first are J. J. Weldon and G. Smith; qualification, 50 shares; remuneration £25 each per annum. Registered office, 135, Wellington Street, Glasgow.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bagdad Tramways and Electric Lighting Syndicate, Ltd.—Particulars of £15,800 debentures, created February 24th, and secured by trust deed dated April 2nd, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital and shares in a Turkish company to be formed. Trustee: H. T. Barnett, B.A.

Torquay Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £600 on February 18th, 1914, of charge dated March 18th, 1911, securing £60,000, has been filed.

Preston Portable Battery and Lamp Co., Ltd.—Debenture dated March 16th, 1914, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Morum Brothers, 18, Aldermanbury, E.C.

Electric Sign Co., Ltd. (45,610).—Capital, £5,000 in £1 shares. Return dated March 17th, 1914. 2,000 shares taken up. £1,000 paid. £1,000 considered as paid. Mortgages and charges: Nil.

Rangoon Electric Tramway and Supply Co., Ltd.—A memorandum of satisfaction to the extent of £5,196, on February 4th, and £875 on April 1st, 1914, of deb. stock dated February 1st, 1906, December 22nd, 1908, and November 5th, 1913, securing £250,000, has been filed.

Rushden and District Electric Supply Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated March 28th, 1914, to secure all moneys due, or to become due, from the company to Northamptonshire Union Bank, Ltd.

Northampton Electric Light and Power Co., Ltd.—Issue on March 14th of £250, on March 21st of £500, on March 28th of £250, and on April 1st, 1914, of £300 debs., part of a series of which particulars have already been filed.

Llangefni Electric Light and Power Co., Ltd.—Particulars of £1,200 debs., created March 27th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Freehold property known as The Mill, Llangefni. No trustees.

Boardman & Garstang, Ltd.—Debenture, dated March 1[illegible]th, 1914, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. M. J. Boardman, 109, Bold Street, Fleetwood, Lancs.

Cambridge Electric Supply Co., Ltd.—Capital, £100,000 in £10 shares. Return dated March 11th, 1914; 9,792 shares taken up; £9 per share called up; £88,128 paid. Mortgages and charges: £30,000 first debentures; also debentures with bankers to cover £15,000 (£12,000 outstanding at date of return).

Hobart Manufacturing Co. (1,350 F).—Particulars filed March 31st; capital, $1,600,000 in $100 shares; registered in Troy, U.S.A., on March 12th, 1913, to manufacture and deal in motor-driven machinery and other electrical and mechanical machinery and devices, &c. British address: Hobart House, Charterhouse Street, E.C. J. J. McIntyre, of [illegible], Birkbeck Chambers, Holborn, W.C., is authorised to accept service.

Clarke, Chapman & Co., Ltd. (39,045).—Capital, £250,000 in 18,000 ord. and 7,000 pref. shares of £10 each. Return dated March [illegible], 1914. 15,261 ord. and 6,985 pref. shares taken up. £10 per share called up on [illegible] ord., £2 10s. on 200 ord. and £10 on 4,435 pref. £[illegible] paid. £[illegible] considered as paid, being £10 per share on 11,545 ord. and 2,550 pref., and £7 10s. per share on 200 ord. Mortgages and charges: £100,000.

Gell Telegraphic Appliances Syndicate, Ltd. ([illegible]).—Capital, £40,000, in £1 shares. Return dated January [illegible], 1914. [illegible] shares taken up. 10s. per share called up on 15,000, and £1 per share on [illegible]. £15,537 10s. paid, including £337 10s. on 1,500 shares forfeited. 10s. per share considered as paid on 15,000. Mortgages and charges: £1,000.

Cambridge Electric Tramways Syndicate, Ltd. ([illegible]744).—Registered January 14th, 1914. Capital, £5,000 in £10 shares. Return dated February 21st, 1914. 107 shares taken up. £9 0s. 4½d. per share called up on 90. £10 per share on 10 and nothing on 7. £911 12s. 1d. paid. Mortgages and charges: Nil.

H. J. Cash & Co., Ltd. (79,701).—Capital, £10,000 in £1 shares. Return dated March 3rd, 1914. All shares taken up. 17s. 6d. per share called up. £8 750 paid. Mortgages and charges: Nil.

English Electrical Co., Ltd. (112 639).—Capital, £5,000 in £1 shares. Return dated March 9th, 1914, 526 shares taken up, £526 paid. Mortgages and charges £10,000.

Float Electric Co, Ltd. (107,336).—Capital, £10,000 in £1 shares. Return dated December 31st 1913 (filed February 16th, 1914), 1,005 shares taken up, £1,002 paid, leaving £3 in arrears. Mortgages and charges; £9,800.

St. James's and Pall Mall Electric Light Co., Ltd. (25,015).—Capital, £300 000 in 20,000 pref. and 40,000 ord. shares of £5 each. Return dated March 3rd. 1914. All shares taken up. £5 per share called up on 20,000 pref. and 39,650 ord. £598 250 paid. £1,750 considered as paid on 350 ord. Mortgages and charges: £150,000 3½ per cent. deb. stock and £229,300 guaranteed deb. stock of the Central Electric Supply Co., Ltd., being half the total loan capital.

Scarborough Electric Supply Co., Ltd. (37,569).—Capital, £100,000 in £10 shares. Return dated March 14th, 1914. All shares taken up. £100,000 paid. Mortgages and charges: Nil.

Electric Wiring and Fittings Co., Ltd. (29,676)—Capital, £5,000 in £1 shares. Return dated February 25th, 1914. 1,382 shares taken up. £1,375 paid, leaving £7 in arrears. Mortgages and charges: Nil.

Charing Cross, West-End and City Electric Supply Co., Ltd. (29 122).—Capital, £2,100,000 in £5 shares (180,000 pref., 180,000 ord., 80,000 City undertaking pref., and 80,000 City undertaking ord.). Return dated March 12th, 1914. 80,000 pref., 80,000 ord., 80,000 City undertaking pref., and 70,000 City undertaking ord. shares taken up. £5 per share called up on the pref., ord., and City undertaking pref. £1,200,000 paid. £350,000 considered as paid on the City undertaking ord. Mortgages and charges: £1,087,178.

Sun Electrical Co., Ltd.—A memorandum of satisfaction to the extent of £275, on March 31st, 1914, of deb. stock dated March 31st, 1911, securing £7,000, has been filed.

Hindhead and District Electric Light Co., Ltd.—Issue on March 30th, 1914, of £50 debs., part of a series of which particulars have already been filed.

CITY NOTES.

Woking Electric Supply Co., Ltd.

The directors report that the total revenue for the year ended December 31st, 1913, was £17,874, less cost of generation and distribution of electricity and management £9,752, leaving £8,122 plus £596 brought forward, and income-tax accumulations £140, making a total of £8,858. Of this sum there have been paid:—Interest on debenture stock, £2,383; interest on temporary loans, £566; dividend on 6 per cent. cumulative preference shares, £2,609; leaving £3,300. Out of this it is proposed to put to credit of depreciation and renewals fund £1,250; reduction of cost of provisional order, fire appliances, debenture issue expenses, share prospectus expenses and cost of office furniture, £168; reduction of cost of free wiring, £66; placing to a reserve account £350; paying a dividend of 4 per cent. on the ordinary shares, £843; and carrying forward £622.

	No. of consumers.	Lamps connected.	Revenue.
1911	1,628	70,710	£14,134
1912	1,761	79,717	£15 668
1913	1 901	88,143	£17,584

The directors have issued £2,470 4½ per cent. debenture stock, and £2,002 6 per cent. cumulative preference shares during the year. Owing to the continuous growth of the business, the directors are still looking towards issuing further debenture stock, and preference and ordinary shares. The expenditure on capital account at December amounted to £135,693. During 1913 2¾ miles of cable were laid. As shown above, the directors have placed £1,250 to the credit of depreciation and renewals fund account, which now stands at £13,520, and they have also opened a reserve account, to the credit of which they have placed £350 out of the year's profits.

Continental.—Norway.—It is reported that a new company is being formed to acquire the Högfossene Waterfalls situated in Treungen in Telemarken, which are estimated to yield about 25,000 H.P. when harnessed. The electrical energy will be transmitted to the town of Risör on the coast, where the promoters have an option for the purchase of large sites. suitable for building and shipping purposes. The harnessing of the waterfalls and the construction of the power station will involve a capital expenditure of more than £200,000.

It was recently reported that a Swiss company had made a contract for 10,000 E H.P. per year, which are to be supplied by the Skiensfjord Power Co., from the Aarlifos, as soon as the works with the harnessing of same are completed. A Norwegian company has now been registered in the town of Porsgrund, a few miles distant from Skien. It is said to be intended to employ the energy for steel smelting, for which purpose the necessary sites at Porsgrund for the erection of a steel works have been acquired. The capital is fixed at £14,000, and the directors are Advocat Knagenhjelm, Engineer A. Christiansen, both Norwegians, and Engineer Ullman, a Swiss citizen.

Hungary.—Messrs. Ganz & Co., of Buda-Pesth, report a profit of £34,251 for the last financial year. The dividend is being reduced from 7 to 6 per cent.

Montreal Light, Heat and Power Co.—The directors have declared a dividend of 2½ per cent., being at the rate of 10 per cent. per annum for the quarter ending 30th inst.

Weston-super-Mare and District Electric Supply Co., Ltd.

Mr. G. J Somerville (Chairman) presided on April 15th, at the offices of the Electrical Federation, Kingsway, over the 16th ordinary general meeting.

The Chairman, in moving the adoption of the report, said the year had been a good one and the dividend on the ordinary shares was an increase from 2½ per cent. to 4 per cent. The progress made during the current year was atisfactory and the three days' holiday traffic was £29 in excess of the three days of last year.

Mr. E. R. Soames seconded the motion and the report was adopted.

The directors' report showed that the total capital expenditure at 31st December amounted to £129,856. The working accounts for the year showed a credit balance of £5,142 from electricity supply, £5,264 from traction, and £54 from sundry receipts, making a total of £10,460. Deducting administration and general expenses, £1,483, debenture and other interest, £2,310, and placing £1,500 to renewals account, there was a balance of £5,167, which with £425 brought forward made a total of £5,592. The directors propose to place to reserve account £1,000, to amount written off "commission and discount on shares and debentures issued" account £390, to dividend on the 6 per cent. preference shares £2,400, to dividend at the rate of 4 per cent. on the ordinary shares £1,400, carrying forward £403.

The installations connected to the mains at 31st December, 1913 (excluding the traction section), represented the equivalent of 37,125 lamps of 8 C.P., an increase of 2,475. The number of consumers during the year increased from 456 to 505 The total revenue for the year showed an increase of £595, and the expenses an increase of £99, the net result being an improvement of £495. The gross receipts from the traction section amounted to £8,824, showing an increase of £1,597 compared with the previous year, due principally to the favourable summer weather. The expenses amounted to £3,560, leaving a balance of £5,264, an increase of £1,373 compared with 1912. The units sold were 566,270 as compared with 493,534 in 1912; and the tramway passengers carried were 1,342,753 as compared with 1,115,265, the receipts per passenger improving from 1.50d. to 1.54d. There are 12 cars and the route mileage is 2.92 m.

Taunton Electric Traction Co., Ltd.

Mr. G. J. Somerville (Chairman) presided on April 15th, at the offices of the Electrical Federation, over the eleventh ordinary general meeting, when, on the motion of the Chairman, seconded by Mr. Stagg, the following report was formally adopted:—

During the year £18 3s. 3d. has been expended on capital account which, at December, 1912, stood at £31,200. The total receipts for the year, including £32 brought forward, amounted to £2,776, and after deducting all expenses, debenture interest and a provision of £100 for renewals, there is a balance of £30 to be carried forward.

	1912	1913
Miles Open—		
Route Miles	1 66	1 66
Single Line	1 31	1 31
Double Line	0.35	0.35
Passengers carried	581,286	660,356
Average Receipts per Passenger	0.99d.	0.94d.
Average Expenditure per Passenger	0.98d.	0.90d.
Proportion of Expenses to Receipts, per cent. ...	99	96
Cars in Stock	6	6

Johnson & Phillips, Ltd.—The directors' report for the year ended December 31st, 1913, states that the profit on trading accounts, &c., after making provision for bad and doubtful debts, and after charging to revenue upwards of £7,000 for maintenance of buildings, plant, &c., amounts to £33,176 plus £3,315 brought forward. The following are to be deducted:—Remuneration of directors, auditors' and trustees' fees, £1,853; interest on debenture stock to December, 1913, £6,440; reserve *re* debenture sinking fund, £6,477; interest on second debentures to December, 1913, £2,500; depreciation on machinery and plant, &c., £6,156: interest on loan, £309; carrying forward, £12,755. The annual meeting was held yesterday.

United River Plate Telephone Co., Ltd.—The directors recommend a final dividend of 5 per cent. on the ordinary share capital, making, with the interim dividend 8 per cent. for the year, leaving to carry forward £6,357.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors have declared a dividend on the preference shares at the rate of 4 per cent. per annum for the six months ending March 31st, 1914, payable May 1st.

Rees Roturbo Manufacturing Co., Ltd.—According to a financial daily the accounts for 1913, after providing for interest on loans, show that a credit balance of £487 brought forward was increased to £2,539, which is to be carried forward

Marconi Wireless Telegraph Co., of America.

The annual meeting of this company was held in Jersey City last Monday. The balance sheet for eleven months ending December 31st, 1913, then submitted showed a surplus of $178,251. It was necessary to make very large and unusual expenditures during the year, but it is confidently expected that the extraordinary conditions which called for them will not occur again. In round figures these expenditures aggregate over $60,000. Further, a large number of orders which remained open at the end of the year could not be included in the account, because while they showed a profit this had not then been definitely ascertained. Since the close of the year the majority of the orders have been filled and profits assured for the current year. The directors state that the erection of the high-power long distance stations is progressing, and unless unforeseen circumstances arise they should be completed and open for business early in the summer. A combination of circumstances prevented earlier completion. "Entirely new construction problems had to be dealt with, new apparatus and new equipment designed and fabricated. We have been very seriously delayed by the manufacturers, who failed in some cases to furnish apparatus and equipment in time, and in other cases the machinery, etc., when completed failed utterly to stand the tests which we required, necessitating its being rebuilt. The bad weather, which prevailed throughout, also seriously interfered with the erection of steel towers; and altogether, many things conspired to retard our plans. As to the Pacific Stations, everything seems favourable to our being able to start service with Honolulu prior to June 1st. Nothing much has been done in regard to our proposed Philippine Station because of many obstacles which have been placed in the way of our securing concessions and rights from the United States and Insular Governments. A bill, however, has just been passed by the Philippine Assembly, granting us, subject to the approval of the Secretary for War, the right to erect a high-power station which will work with Honolulu, Japan and China, and we hope at an early date to receive the approval of the War and Navy Departments enabling us to proceed with the work of location and installation. The Imperial Japanese high-power station, which is being constructed to work in connection with our Honolulu high-power station, is not yet completed. . . . . Land has been purchased at Chatham and Marion, Massachusetts, the former for a transmitting station and the latter for a receiving station, for high-power work with Norway. The Norwegian Government station also is now under way. Satisfactory arrangements have been completed with the Western Union Telegraph Co. under which connection will be made between its main operating rooms in New York, San Francisco, Boston, etc., and our new high-power stations in New Jersey, California and Massachusetts. These wires will be equipped with the latest devices for direct and expeditious exchange of traffic. Inasmuch as we shall be in competition with the Western Union Telegraph Co., as well as all other cable companies, for trans-Atlantic business, it will be necessary not only for us to influence patronage in our favour in all large cities, but we shall have to keep it coming. Therefore, a business-getting organisation has been perfected and representatives will be located in New York, Chicago, New Orleans and San Francisco, who will be in charge of a capable corps of canvassers which will keep in touch at all times with the cabling public and inform them of our superior facilities and reduced rates."

"This company is arranging to construct several high-power stations along the Alaskan Coast and in the interior, and steel has already been shipped for stations to be constructed at Ketchikan and Juneau for commercial business with Seattle and Astoria, Washington. There are good prospects for good business. We are in negotiation with the Cuban Government to take over and operate on a joint basis several wireless stations which that Government has been maintaining independently."

Indo-European Telegraph Co., Ltd.

The directors report that the carrying capacity of the company's system has been materially increased by the addition of a through wire from the Russo-German frontier to Teheran. This is linked up with a new wire through Germany, connecting with a corresponding new conductor in an Anglo-German cable across the North Sea, and will shortly be connected beyond Teheran with a new wire between Teheran and Karachi, to be provided by the Indo-European Telegraph Department. The necessary agreements with the British Post Office and with the German Government dealing with the above arrangements and with other matters are not yet concluded. The total cost of the erection of the additional wire falling upon the company is £62,500; of this sum £35,000 has already been set aside, and the directors have now written off out of reserve fund the outstanding balance of £27,000. Further funds have been provided for the development of the Galletti system of wireless telegraphy and telephony. During the year 1913 these amounted to £20,360, of which sum £5,860 is represented in the balance sheet by the holding in the Galletti Co., whilst £14,500 has been treated as a cash advance against the assets of that company. The directors propose to provide out of the year's profits £30,000 which will cover not only the cash advance above mentioned, but also the further sums which have been advanced up to the date of this report, leaving a margin. The company's revenue from message account and other sources amounts to £172,532, as compared with £183,411 for 1912, showing a decrease of £10,879. The expenses are, on commercial and general account £59,268, and on maintenance account £31,173, making a total of £91,441, as against £90,974 for 1912, an increase of £467. The revenue account therefore shows a balance of £81,091, which is carried to profit and loss account 1913, and after deduction of Income tax paid is reduced to £71,902. To this is added the balance of profit for 1912 brought forward of £13,655, and £14,232 representing sundry balances which have accumulated during this and previous years and are now available, making a total of £99,789. Deducting £20,827 provided for depreciation of the company's securities to date and the interim dividend of £10,625, already paid, there remains a balance available for distribution of £68,336. The directors now propose to declare a dividend for the six months ending 31st December, 1913, of 17s. 6d. per share (making with the interim dividend already paid 6 per cent. for the year) and a bonus of 20s. per share, both free of Income Tax. They also propose to make the provision of £30,000 above referred to for the development of the Galletti wireless system, carrying forward £6,461 to the credit of 1914. They propose further to make a special distribution to the shareholders of £12,750, equivalent to 15s. per share, out of interest upon certain investments and advance accounts. This distribution also will be free of Income Tax. The directors report the death of Baron Joh. von Berenberg Gossler, of Hamburg, a director of the company for 35 years. Mr. Carl Joerger, of Messrs. Delbrück, Schickler & Co., Berlin, has joined the Board in the place of Mr. L. Delbrück of the same firm, whose death was reported last year.

Indian Electric Supply and Traction Co., Ltd.

The annual meeting was held on April 16th at the offices, Orient House, New Broad Street, Mr. J. G. B. Stone presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev., p. 627), said the gross receipts had risen from £8,499 to £10,161, and the balance carried to the balance sheet was £5,226 against £4,955 for 1912. Interest charges had risen from £2,608 to £3,600, owing to the whole of the new debenture stock now bearing interest. Since the date of the last report an additional £5,000 of debenture stock had been placed to provide further working capital, and to meet the growth of the company's business. It was anticipated that this expenditure would bring an adequate return to the company. They had practically concluded a contract with the municipality, under which they provided lamps, mains, etc., for an extended system of street lighting, and the supply of power for municipal purposes, and they waived all track rent for a period of fifteen years. Satisfactory terms had been arranged as to the revenue they were to receive from this source. During the past year the company had received no benefit from the economiser, condenser and new chimney, and consequently the consumption of coal on the existing plant had been excessive, thereby adding considerably to the cost of production. Since the accounts were closed, they had received advices from Cawnpore which already showed a considerable reduction in the amount of coal consumed per unit. The additions to the plant were now working, and they anticipated that there would be a further marked improvement in working costs resulting therefrom, apart from the ordinary expansion of the business. With regard to the short line of tramway which they worked, the position was practically unchanged, and they could see no encouragement to extend the system.

Mr. K. A. Scott Moncrieff, in seconding the motion, referring to the new plant which had been installed, said that as he anticipated would be the case when he addressed the shareholders last year, no benefit was shown in the present accounts. In fact they had been at a disadvantage because their business in Cawnpore increased so rapidly that they were compelled to work the boilers and other plant in an uneconomical fashion, and they actually did worse as regarded coal consumption in 1913 than in the previous year. From advices which they had received the result of the working of the new plant in the early part of the present year showed a marked improvement, but it would be a mistake if he were to attempt a forecast of what the actual result was likely to be for the year, because they had got to go through the hot weather, which, as regarded the condensing plant, was the most difficult time. With regard to the business in Cawnpore, he was pleased to say that it was showing a steady and regular increase. The total connections to the mains were now 57,580 30-watt lamps as compared with 45,507 for the year 1912; an increase of 26 per cent., which included an addition of 36 motors. The increase in units sold was 46 per cent., and 1912 showed a similar increase over 1911. The average price received per unit sold again showed a reduction—from 2.33d. to 2.05d.—a decline of 12 per cent., due to the increased output for power purposes compared with lighting. The result of their work in Cawnpore showed an increase in profit of 20 per cent., and there was no doubt that with the saving they expected to make in coal they ought to show an improvement on that figure for the current year.

The report was adopted.

Direct United States Cable Co., Ltd.

THE annual meeting was held at Winchester House, E.C., Sir JAMES PENDER, BART., in the chair.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., p. 667), said they had received the rents prescribed under their lease with the Western Union Co. and had paid a dividend at the rate of 4 per cent. per annum. They had suffered the misfortune of having had the main cable interrupted in deep water twice since the lease was entered into with the Western Union Co., and the cost of those repairs had amounted to a very large sum. As a result they had inserted a length of 425 miles of new cable of a much improved type, and the insertion of so long a stretch affected their reserve fund in this way—that it was possibly not so necessary to maintain the reserve fund at the same figure that they had aimed at in the past. At the same time, the directors had always held the view that it was in the best interests of the shareholders that the reserve fund should be maintained at such a figure that, should it be necessary, the main cable could be replaced at any time, and in pursuance of that policy, looking at the heavy expenditure of the last two years, they had felt it advisable to withhold the bonus that they had been able to recommend in previous years. They were hopeful that the main cable would not be again interrupted for many years to come, and that they would be able to resume payment of bonus. In the meantime he was confident that the shareholders would approve the policy of the board. The insertion of the new and better type of cable had materially improved its working capacity, and he was able to inform them that the traffic that was now being carried over the cables by the Western Union Co. was enormously in excess of that carried in previous years. Their reserve fund now stood at £451,490, of which roughly £373,000 was represented by investments and cash and £78,000 by cable on hand. The directors had thought it advisable to have a long length of cable manufactured in order that they might be prepared at any time to execute repairs that might be necessary without delay. They had an opportunity of obtaining that cable at a low price, and they believed it was their duty to put themselves in the position of being able to carry out the terms of their lease with the Western Union Co., and to effect repairs to the cables within as short a time as possible when they were interrupted. To do that they had to dispose of some of their investments, and in consequence of the depressed conditions of the markets they had to write off £5,971. As against that, however, it must not be forgotten that large sums had from time to time been credited to the company in the form of profit made on the sale of securities. Many questions had arisen between the company and the Western Union in connection with the lease, and in the autumn of last year the Secretary visited the stations and property in Newfoundland, Canada, and the United States and performed useful work in clearing [illegible] matters. Within the last few weeks they had had the pleasure of meeting Mr. Newcomb Carlton, who had just been elected President of the Western Union Co., and he was glad to be able to state that their relations with that company were of the most friendly and amicable character, and, as far as they could foresee, they had every reason to anticipate that the Western Union Co. would continue to regard their arrangement with them as being as satisfactory to the Western Union as it was to themselves.

Mr. H. C. B. UNDERDOWN seconded the motion, and the report was adopted without discussion.

Brush Electrical Engineering Co., Ltd.

MR. E. GARCKE presided at the offices of the Electrical Federation, Kingsway, on Monday, over the annual meeting.

The CHAIRMAN, in moving the adoption of the report (ELEC. REV., p. 655), said the operations of the company during the year resulted in a profit of well over £20,000 after providing for the maintenance of plant and buildings and after deducting all debenture interest. This result was due mainly to the extraordinary efforts exerted by their managing director and his able staff, and they were very grateful to him, and the shareholders were to be congratulated that after a long story of adverse fortune they had been able to produce a favourable report. The year had been a strenuous one, but they had had the satisfaction of knowing they had been on the up grade instead of the down grade, and with that incentive their efforts had been less harassing than for some years past. It was satisfactory also that the profit was not due in any way to windfalls, but had been earned in the ordinary manufacturing and trading business of the company. Happily they had been free from labour troubles in their works, although some of their neighbours had suffered from local strikes, the settlement of which they, as members of the local Engineering Employers' Association, had been able to shape. When he addressed them last year he explained that the scheme for the reduction of capital which was approved in 1912 by a committee representing the shareholders and other interests had been in abeyance, as there did not appear to be any useful purpose to be served in proceeding to give effect to the scheme until they were at least paying their way. They now proposed to proceed with the scheme and apply to the Court for the necessary sanction. The effect of that scheme, they would remember, was to reduce the preference shares to the nominal value of 7s. each and the ordinary shares to the nominal value of 5s. each, both classes of shares to rank alike and be converted into one common denomination. This would enable the amount standing to the debit of profit and loss account to be extinguished, and they would then be in a position to divide the profits which might be earned in the future. There was very little to be said on the account, and that little was satisfactory. The general charges showed a reduction from £19,470 in 1911 to about £17,000 last year—a reduction of about £2,500. In the balance sheet the only item to which he need call attention was the reduction in the amount owing to creditors which, he was glad to say, had been reduced by as much as £38,000, thus showing that not only had the company made profits, but it had strengthened its financial position. With regard to the work of the year generally, he might say that in all departments they had been fairly well occupied, and that the prices obtained for their productions had been better, although in many cases they were still too low having regard to the difficulties of the business, and the inevitable large working expense. One of their principal lines of manufacture was that of turbo-generators, and the company had received its share of orders which had been placed for this class of plant during the past year. The markets for turbines continued to develop, and the demand was likely to increase in the future. It was in anticipation of this demand that they acquired the manufacturing rights of the Ljungstrom turbine, for which they expected a ready sale in stations where economy of steam consumption was of special importance. They had made good progress in their arrangements for the manufacture of the Ljungstrom turbine, but naturally the preparations for turning out a new design embodying many special features had taken time. However, he was able to report that the first set of their own manufacture had been completed and the test showed very satisfactory results. Other sets on order were well advanced, but to enable them to develop the business in this line to the best advantage to cope with the expected demand, they would have to spend some money for special tools and also for stocking certain parts, so that reasonably early deliveries could be guaranteed. They had one or two alternative methods for dealing with the situation under consideration, one of which would no doubt provide a satisfactory solution. On the rolling stock side of their business they had been pretty busy and had carried out important contracts for railway stock for the underground railways of London, the Great India and Peninsular Railway, and other railways. They had also turned out a large number of motor omnibus bodies for the principal London and provincial companies. This was a class of work for which their long experience as builders of tramcars and horse omnibuses and similar vehicles peculiarly fitted them, and was one in which they had already established a good reputation. A gratifying feature had been the revival in the demand for electric tramcars, of which they had had a fair share of orders during the past year. With regard to the current year he was glad to say the orders on their books were well up to the average; and although there were some indications of a falling off in trade generally, he was hopeful that in their business the demand would be maintained and that they would continue to make satisfactory progress.

Mr. B. S. BROADHURST seconded the motion and the report was adopted without discussion.

Cork Electric Tramways and Lighting Co., Ltd.

THE directors' report for the year 1913 states that the receipts were £60,135 and the expenses £37,524. After adding £1,261 brought forward and deducting interest on debentures £4,600, there remains a balance of £19,273. Of this amount £6,163 was paid for the dividends on the 5 per cent. cum. pref. shares, £6,500 was added to reserve for depreciation and renewals, £1,807 written off, and there is to be paid a 3 per cent. dividend on the ordinary shares, requiring £3,450, and leaving £1,352 to carry forward. The lighting and power business again shows satisfactory progress, agreements for 136 connections being concluded during the year. The additional connections represent a total gain of 212 KW. as against 225 KW. in 1912. The lighting and power receipts were £1,894 in excess of the previous year. The traffic receipts also show an increase of £716, this being due to the exceptionally fine summer of last year. There is a small decrease in the other revenue items. The expenses were £1,928 in excess of 1912, chiefly owing to the enhanced price of coal, heavier maintenance charges for permanent way, third party accident claims, and contributions under the National Insurance Act. The capital expenditure during the year amounting to £9,150 has been mainly for house services and cables and an additional 1,000 KW. generating set required to meet the increasing demand for lighting and power. One of the original 225 KW. generating sets has been dismantled and the cost of same, together with the cost of five permanent way loops which have been dispensed with, have been written off out of the reserve for depreciation and renewals.

	Traction.					Lighting and power.	
Year.	Miles open.	Passengers carried.	Average fare.	Car-mileage.	No. of cars.	No. of customers.	8 c.p. lamps (equiv.) connected.
1911 ..	9·89	5,866,523	1·07d.	891,417	35	2,389	155,533
1912 .	9·84	5,695,103	1·06d.	898,153	35	2,539	163,771
1913 ..	9·89	5,864,339	1·06d.	893,694	35	2,665	170,926

Anglo-Argentine Tramways Co., Ltd.

The directors, in their report, give the result of the working for the year 1913 as follows :- Gross receipts, £2,963,192, less working expenses (which include various items amounting in the aggregate to £150,000 carried to depreciation renewals reserve, in addition to £347,651 expended on ordinary maintenance), £1,969,161, leaving £994,031, plus interest on investments and deposits, £20,084, transfer fees, &c., £558, and £9,254 brought forward, making £1,023,926. Interest and charges amount to £791,130, and are made up as follows :—To annuity to City of Buenos Ayres Tramways Co. (1904), Ltd., £70,660 ; 4 per cent. debenture stock interest, £174,060 ; 4½ per cent. debenture stock interest, £77,480 ; 5 per cent. debenture stock interest, £215,303 ; interest in London on temporary loans and payments received in respect of share capital before allotment, £7,103 = £473,946, less interest on works in course of construction charged to capital, £98,863, leaving £375,083 ; sinking funds for redemption of debenture and share capital (4 per cent. debenture stock, £24,295 ; 4½ per cent. debenture stock, £3,645 ; share capital first and second preference and ordinary, £3,947), £31,887 ; first preference dividend, 5½ per cent., £176,000 ; second preference dividend, 5½ per cent., £137,500 = £791,130. The interim dividend on ordinary shares for half-year ended June 30th, 1913, absorbed £100,000, leaving £132,796. Out of this balance the directors now recommend that £119,375 be paid as a final dividend for the year ending December 31st, 1913, which with the £100,000 paid as interim dividend is equal to 6¾ per cent. on the total issued ordinary share capital of £3,250,000, leaving £13,421 to be carried forward.

Subways.—The first subway line, Plaza Mayo to Plaza Once, where, at the terminus of the Buenos Ayres Western Railway, a joint underground station has been constructed, was opened to the public on December 2nd, 1913, a distance of 2 miles 820 yards. The work in connection with the construction of the extension of this line to Caballito, where it will come up to the surface, is being rapidly pushed forward, and it is hoped will be opened for traffic for the whole distance in August.

Arrangements have been made whereby 150,000 ordinary shares of £5 each have been taken up by the present owners of the ordinary share capital.

The directors have thought it desirable to charge the 12 per cent. municipal tax to the revenue of the year in which the traffics on which it is calculated are received, although the tax is payable only in the following year. As this change of method would on this occasion have the effect of debiting revenue with two years' tax, that of 1912 and 1913, the amount for 1912 has been charged to reserve, and the amount for 1913 to revenue, and the ordinary shareholders have provided the amount taken from reserve in order that the fund may not be reduced. The board have to announce the deaths of three of their colleagues, Mr. Victor Fris, president of the Société Financiare de Transports et d'Entreprises Industrielles, Brussels ; Mr. T. Frame Thomson, the deputy-chairman ; and Mr. E. A. Lazarus-Barlow, for 15 years a member of the board. These three vacancies have been filled by the election of Mr. Léon Cassel, Mr. W. F. Hamilton, K.C., and Mr. G. A. Touche, M.P.

The manager makes a full report on the work of the year, which was worse commercially than 1912.

Comparative Table.

Year.	Receipts.	Expenditure.	Passengers carried.	Miles run.	Receipts per mile run.	Expenses per mile run.	Cars in stock.
	£	£			d.	d.	
1911	2,631 836	1,728,928	299,154,835	46,019,328	13·78	8·36†	2,207
1912	2 778 302	1,824,021	316 260 097	47,765 667	13·96	8·49†	2,567
1913*	2,963,191	1,969,161	342,140,422	50,872,935	13·98	8·58†	2,555

* Includes one month's working of first section subway. † Does not include credits or debits to depreciation renewal funds.

Oldham, Ashton and Hyde Electric Tramway, Ltd.

The annual meeting was held on Friday last at Electrical Federation Offices, Kingsway.

Mr. E. Garcke presided, and moved the adoption of the report (see Electrical Review, page 668). This gave the following figures :—

	1912.	1913.
Route miles	9 m. 1 f.	9 m. 1 f.
Passengers carried	6,075,451	6,296,971
Average receipts per passenger	1·32d.	1·31d.
Average working expenditure per passenger	·84d.	·82d.
Proportion of expenses to receipts	63 %	63 %
Cars in stock	46	46

Mr. J. Vincent Kitchener seconded the motion, and the report was adopted.

Provincial Cinematograph Theatres, Ltd.—The directors' report for 1913 shows excellent progress enabling a final dividend of 7½ per cent. to be paid on the ordinary shares, making 20 per cent. for the year. It is stated that during the last three months the business has been greater than at any previous time in the company's existence.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers, during the four weeks ended February 27th, 1914, amounted to 996,753, compared with 790,198 units in the corresponding four weeks of 1913. For the four weeks ended March 27th, 1914, the figures are :—1,125,083 units, compared with 890,782 in 1914.

Launceston and District Electric Supply Co., Ltd.

The annual meeting was held on April 7th and the report (see Electrical Review, page 667) was adopted. Mr. E. B. Rogers, who presided, said that there should be a much larger balance available next year, when they would commence to build up a fund for depreciation. The capital invested in the concern was now £9,000. After the experience gained during the year 1913, with dearer coal and insurance and higher wages, they suggested that, as from midsummer, the lighting rate be raised from 5d. to 6d. per unit, the power rate remaining unaltered at 3d. With very few exceptions, 6d. was the usual rate charged in the West of England, in most of the smaller towns and some of the larger ones. The chairman spoke highly of the services of the engineer (Mr. Willey) and his staff. Mr. Willey's term of engagement came to an end next September, and they regretted that he had secured another appointment.

Mr. W. H. Symons, the vice-chairman, also referred to the proposed increase in price. He said that, on comparison, they found that every town in Devon of anything approaching the size of Launceston charged 6d. or 7d. per unit for their electric light, whilst in Cornwall there were more above than under. He found, too, that in several places in the suburbs of London, where they had populations of from 50,000 to 70,000, the price was 6d. per unit. He felt the time had come when they must, in justice to their shareholders and to others as well, work this as a commercial, and not a philanthropic undertaking, and they considered that with a judicious use of the electric light on the part of the consumers, the price would compare very favourably with the price of gas.

Oriental Telephone and Electric Co., Ltd.

The directors' report for the year ended December 31st last states that including £33,335 brought forward from December 31st, 1912, and after deducting the interim dividends, paid November 1st last, on the preference and ordinary shares, and making the necessary provision for redemption of the debenture stock and other charges, the amount to be dealt with is £65,213. The directors recommend a final dividend of 3 per cent. (less income-tax) for the year on the preference shares, requiring £1,500 ; a final dividend of 6 per cent. (free of income-tax) on the ordinary shares, making 10 per cent. for the year, requiring £10,759 ; transferring to reserve account £5,000 ; to staff pension fund £2,000 ; and carrying forward £45,954. The company's own exchanges all show increased revenues, and the number of new subscribers has reached a record during the past year ; similar increases in both subscribers and revenue have also been recorded by all the subsidiary companies. The Bombay Telephone Co., Ltd., have increased their dividend from 10 to 12 per cent., and the Bengal Telephone Co., Ltd., their dividend from 6 to 7 per cent. The Telephone Co. of Egypt, Ltd., and the China and Japan Telephone and Electric Co., Ltd., have paid their previous rates of 10 and 5 per cent. respectively. To meet increasing business, considerable extension and reconstruction work is in progress at Singapore, the effect of which will, it is hoped, show an important improvement in the revenue at that branch during the current year. The new premises of the company in Fort Louis, Mauritius, are approaching completion ; subscribers continue to join the Central Exchange in good numbers, and a small sub-exchange has been opened at Rose Hill. The directors have purchased during the year £7,930 of Consols, bringing the holding up to £20,000.

Willans & Robinson, Ltd.—For the year ended December 31st, 1913, the directors report a net profit of £8,782, after payment of debenture interest, provision for depreciation of stocks, and the proper upkeep of Queen's Ferry Works. Warrants are being issued on 30th inst. in respect of the dividends on the "A" and "B" preference stocks, and also in respect of the interest on the outstanding funding certificates. A dividend at the rate of 10 per cent. per annum is recommended on the ordinary shares, leaving a balance of £1,679. In view of the large amount by which the Rugby plant and premises were depreciated during the year under review in connection with the share capital reduction, the directors consider no need exists for further provision in these accounts. The year's operations were adversely affected by a strike in the foundry, which, in itself, covered a period of some three months. Important contracts for both steam turbine installations and Diesel oil engines were concluded during the year, and the business in hand for these classes of machinery and in other lines is promising. The meeting will be held at Rugby on April 30th.

Ramsgate and District Electric Supply Co., Ltd.—The directors' report for 1913 shows that including £762 brought forward the gross profit amounts to £4,454, and after allowing for interest at the rate of 5 per cent. per annum on outstanding accounts due to the contractors, there is a balance of £3,034. After declaring a dividend of 5 per cent., and placing £1,000 to the reserve account, £1,034 remained to be carried forward. During the year 3,916 ordinary shares were issued and fully paid up.

Telephone Co. of Egypt, Ltd.—The directors recommend a dividend of 6 per cent. (6s. per share), free of income-tax, on the preferred and deferred shares for the half-year to December 31st, making 10 per cent. for the year. £142,242 is to be carried forward.

Bromley Electric Light and Power Co., Ltd.—Mr. F. E. Gripper presided at the annual meeting held recently. He said that the company was making steady progress. The lamp connections had increased by nearly 8,000, which was 7 per cent. Sale of current increased by £450 or 3 per cent. Costs advanced by £366. They had reduced the price of current for heating and cooking to 1½d. per unit, and a demonstration given two or three months ago had produced very satisfactory results. Their shares in the Chislehurst Co. only paid them 3 per cent. this year as compared with 4½ per cent. last year, this being caused by lessened consumption in large houses which now used the metal-filament lamp. They were able to recommend 7 per cent. dividend, an increase on the figure which they had paid for many years, namely, 6 per cent. They had set aside to general reserve £4,000, making that fund £42,000, or over 30 per cent. of the entire capital.

City Electric Light Co. (Brisbane), Ltd.—In their report for the year ended January 31st, 1914, the directors state that after making additions to the franchise and purchase sinking fund, accident insurance fund, and renewals, replacements and contingencies account, and also writing off £3,000 from the Ann Street station, there remains a credit balance £18,994, plus the balance brought forward making £20 447. An interim dividend was paid in September amounting to £9,342, and further dividends were payable on March 18th of 3 per cent. on the preference shares and 6¼ per cent. on the fully paid ordinary shares, and 6¼ per cent. on the contributing shares. The balance remaining to be carried forward is £1,268. Although the capital expenditure has increased during the year by about £30,000 for additional plant, no return has been yet received from it. As this plant is almost completed the directors expect to receive the full benefit in the near future.

Bell Telephone Co. of Canada.—The gross earnings for 1913 amounted to 8,850,400 dols., an increase of 1,212,100 dols. After deducting expenses and writing off 1,680.000 dols. against depreciation there remains a net revenue balance of 2,215.300 dols., an improvement of 335,100 dols. The dividends, amounting to 8 per cent. require 1,289.800 dols., leaving a surplus of 503,700 dols.; 49,100 dols. has been transferred to reserve, and 454,600 dols. added to surplus brought forward from 1912, gives a total of 907.800 dols. to be transferred to the 1914 account. 30,918 subscribers have been added during the year, the total number of telephones now in use being 223,666. 7,977 miles of wire were added to the long-distance system in 1913.

Isle of Wight Electric Light and Power Co., Ltd.—The annual meeting was held recently at Ryde. Mr. F. E. Gripper presiding. The chairman said that 8,000 33-watt lamps had been added, and the receipts from sale of energy had advanced by £452, which was less than they might have expected from the increase in lamp connections—the metal-filament lamp was the cause. The coal bill alone was £478 more than for the previous year, and the result was £179 less profit. After paying debenture interest, &c., they had £1,128 more than last year to deal with, and recommended a dividend of 2½ per cent., as against 2 per cent. a year ago. A steady improvement in the business was in prospect.

Birkdale District Electric Supply Co., Ltd.—The directors' report for 1913 states that the capital expenditure account has been increased by £3,209 to £45,049. The revenue was £6,475, an increase of £154. The directors recommend a dividend of 9 per cent. on the ordinary shares, carrying forward £315. A new 350-KW. steam-driven set has been installed, and a new boiler is on order.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. on the ordinary capital stock.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange seems destined to misfortune, and one thing after another dogs the footsteps of business to such an extent that confidence is waylaid, hope frustrated, and cheerfulness well-nigh pulverised.

On this evening of writing it is Mexico which is playing the part of bad fairy to the markets at large, the Stock Exchange straining its ear to catch the first sound of fighting between that country and the United States. The life of the Austrian Emperor, too, is declared to be hanging in the balance; and though he is an old, old man, the actual event itself would probably disturb European politics to a mild extent. These are two of the principal considerations weighing down markets, prices and bullishness. Fortunately, they have only slightly affected the departments with which these notes deal in particular, Mexican issues excepted. Most Mexican securities are flat.

To hands more clever and technical must be left the analysis of the report presented to the London County Council by Messrs. Merz and McLellan on the subject of London's electricity supply. It is only with the influence upon the Stock Exchange market that this column is concerned, and this can be stated as favourable. There is diversity of opinion as to whether, after all, the existing state of affairs were not better left undisturbed, but the principal consensus of opinion certainly appears to lie with those who claim that London ought to be supplied with its electric power through the agency of one central undertaking or body, which ought to be some other than the London County Council. That something will be done is accepted as manifest, and this is hailed as a bull point for the market, since any arrangement at all is expected to advantage the companies. Prices of the shares, therefore, keep firm, City and County Ordinary showing small losses. The depression, in markets all round, passes over electric lighting quotations, and once again the sellers are in the position, in many cases, of being able to obtain something better than the middle prices if they wish to realise.

The Home Railway market has been glum. Prices having gone done on the trouble which broke out on the South Yorkshire coalfields, not only failed to recover when that difficulty was settled, but receded still further, the depression in Consols being the principal contributory factor. Metropolitans and Districts weakened, and Underground Electric issues lost a little of their previous sharp rises. The Income Debentures are 1½ down.

Rumours, as curious as they are vague, are in quiet circulation to account for the recent pronounced strength in the shares of the Underground Electric Railways Company. The London General Omnibus Company, it is patent to all Londoners, is doing a magnificent business, but the traffic receipts, good as they are, scarcely appear to be so remarkable as might be expected. It would be possible, of course, for the company to work some of the most paying routes by means of the 'buses of concerns allied to it, thereby in some degree disguising the full measure of its own prosperity; though probably this theory would not have been put forward at all had it not been for the fact that the 'bus company's receipts do not seem as imposing as might have been supposed. Apparently there is a strong party accumulating the £10 shares; and while the offering of advice as to such speculative things as these shares lies outside the province prescribed here, it may perhaps be no offence to suggest that holders of these shares should by all means keep them, since in days to come they may do better out of them than they can at present. By the same token, London and Suburban should benefit indirectly; in fact, the whole of the group might be expected to share to a larger or smaller extent in the abounding prosperity of one of its members. The Central London Assented stocks have each gained a point. London United Tramways Debenture stock, however, weakened to 60, and Metropolitan Electric Trams First Debenture stock is a little easier.

Brazilian and Canadian conditions remain none too happy, and they are reflected in falls in such things as Shawinigan Water, Canadian Generals, Montreal Light and Power, Rio Tramway bonds, and so on. Montreal shares stand at a figure at which it requires little demand or supply to move the price five points at a time. This week it is Supply that has been the more prominent. Adelaide Supply Preference shares are better, rising ⅛ to 5¼. No change has occurred in the nominal quotation of Vera Cruz Debenture stock, although, of course, it is doubtful whether any reasonable amount could be sold at the existing quotation. Anglo-Argentine Tramway Debenture stocks are good on a report showing further remarkable progress.

The Telephone group is quietly firm, with small rises in Eastern Ordinary, Eastern Extension shares and Anglo-American Telegraph Preferred. Marconi's, however, developed fresh flatness, following upon the fall brought about by the unsatisfactory results achieved by the American Company. Stale bulls have been getting out, but observers notice that, even so, the market seems to be none too well supplied with shares. West India and Panama fell 3/16, which raises the return on the money to 5⅛ per cent. Globes are a little easier. The Indo-European Company has declared its regular dividend, making 13 per cent. for the year; this rate has been maintained since 1904, and the distributions are made free of income-tax. The shares rose 10s. Oriental Telephones are unaltered on the dividend declaration, making 10 per cent. for the year. Some people looked for more.

Brush Debentures are still one of the principal features of strength in the manufacturing group. The Firsts have risen 4 points, the Seconds 2—the demand is due, of course, to the progressive report, upon which comment was made last week. At the meeting, the chairman spoke hopefully of a new turbine. The disappointment felt with the Babcock & Wilcox dividend of 16 per cent., instead of the 20 per cent. which optimists had hoped for, is now subsiding, and the price has recovered about 2s. a share. The company occupies a splendid financial position, and the board earns commendation from the most austere critic by virtue of its policy of fortifying reserve funds and the like.

Small falls occurred in British Aluminium Preference and Dick, Kerr Preference. General Electric Debenture stock hardened to 87 on the heavy over-subscription for the Company's new issue of shares; the Ordinary have risen to 22s. 6d. premium, the Preference are about 2s. 6d. premium. An issue of Hendon Electric shares was placed, semi-privately, with no difficulty at all, and the price has been steadily creeping up. The new South London Preference can be sold about 6s. premium, or more, and other new issues in this market are holding their premiums robustly enough. The rise in the price of raw rubber to 3s. a pound attracted a little academic attention, but the Stock Exchange market was none too certain of the reason for this advance, and prices in the share market have moved only languidly. In the Armament section, the allotments of the new Vickers shares are now out, and the price for the letters of allotment is 5s. for cash.

The heaviest fall in Mexicans has occurred in the Light and Power issues, the Common shedding 2, the Preferred 5½, and the bonds 3 and 2 points for firsts and seconds respectively. Mexico Trams dropped 4, Monterey's 2, and so on. With the crisis more acute than ever, prices in the very nature of things have become almost nominal.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations April 21st.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	5/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	15½ — 17½	..	..
Do. Do. Deferred ..	100	..	..	6½ — 8½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	3	..	56 — 59	..	5 1 8
Do. 5 % Perp. Deb. ..	100	5	5	93 — 95	..	5 1 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	79 — 82	..	5 9 9
Central London Railway, Ord. ..	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	+1	4 15 3
Do. Pref.	100	4	4	68 — 73	.	5 9 7
Do. Gtd. Assented	100	..	4	83 — 85	+1	4 14 8
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	+1	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1903	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	73 — 78	+2	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord. ..	1	..	..	3/32 — 3/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	13/32 — 23/32	..	6 19 0
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	78 — 83	..	5 8 5

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations April 21st.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	58 — 62	—1	6 9 0
Metropolitan Railway Consol. ..	100	1⅝	1⅝	41¾ — 42¼	—1	3 17 0
Do. Surplus Lands	100	2¾	2¾	63 — 65	..	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	..	4 5 4
Metropolitan District Ord. ..	100	Nil	..	28½ — 29	— ¾	Nil
Do. 6 % Deb.	100	6	6	138 — 141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	84 — 87	..	5 3 6
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	88 — 91	—1	4 17 9
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 13 0
Potteries, Ord.	1	3½	..	⅜ — ½	..	..
Do. 5 % Pref.	1	5	5	19/32 — 21/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	8¼ — 8½	— ⅛	Nil
Do. "A"	1/-	..	..	7/16 — ½	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	114 — 116	+ 2	5 3 5
Do. 4½ % Bonds	100	4½	4½	99½ — 101½	..	4 8 8
Do. 6 % Income	100	6	6	90 — 91	—1½	6 11 10
Yorkshire (West Riding). Ord. ..	5	Nil	..	5/16 — 9/16	..	Nil
Do. 6 % Pref.	5	3	4	4¼ — 4¾	+ ¼	4 4 3
Do. 4½ % Deb.	100	4½	4½	83 — 86	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅝ — 4⅞	..	5 12 10
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 9/16	..	6 0 7
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	98 — 101	+1	4 9 0
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 — 106	..	4 14 3
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 — 100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	83 — 85	..	7 1 2
Brisbane Trams Invt., Ord. ..	5	8	8	7½ — 8	..	5 0 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 — 101	..	4 9 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	117 — 121	..	6 12 4
Do. Pref. Ord.	100	6	6	105 — 109	..	5 10 1
Do. 5 % Pref.	100	5	5	103 — 105	..	4 15 2
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	96 — 99 xd	..	4 11 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	93½ — 95½	..	4 9 1
Calcutta Trams, Ord.	5	7½	9½	7 — 7½	..	6 6 8
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	97 — 100	+1	4 10 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	N	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord. ..	1	..	..	¼ — ½	..	..
Do. Pref.	1	4⅜d.	6	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	95 — 100	+4	5 0 0
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
" Elec. Tr. (1904), Deb. ..	100	5	5	101 — 103	..	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ — 100½	..	4 19 6
Mexico Trams Com	$100	7	7	67 — 70	—4	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	75 — 79	—4	6 6 6
Do. 6 % Bonds	100	6	6	78 — 83	..	7 4 7
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	3⅞ — 4⅜	..	11 8 6
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	89 — 92	..	5 8 8
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97 — 99	..	5 1 0
Do. 5 % Mort. Bonds	100	5	5	89½ — 91½	—½	5 9 3
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	98 — 101	..	4 19 0
Singapore Trams, 5 % Deb. ..	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	95 — 98	..	5 2 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord. ..	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10¼ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 9
Brompton & Kensington, Ord. ..	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91½ — 94½	..	4 4 8
Charing Cross, West End & City	5	6	6	4⅞ — 5⅜	.	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5	+ 1/16	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4½	+ 1/16	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10	16½ — 17½	— ½	5 14 3
Do. 6 % Cum. Pref.	10	6	6	12¾ — 13¾	..	4 7 3
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 7 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 — 103	..	4 8 1
County of London, Ord.	10	6	7	11¾ — 12¼	— ½	5 14 3
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	.	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	103 — 106	+ ½	4 5 8
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 — 103	..	4 7 5
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅜ — 4⅞	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4¼ — 4¾	..	5 5 3
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9

Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 8	..	5 12
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅝ — 1¾	..	5 2 7
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 17 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	92 — 95	..	4 4 1
Metropolitan	5	4½	4½	3⅝ — 3⅞	..	5 16 3
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 — 101 xd	..	4 19 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford..	5	7	7	5 13/16 — 6 5/16	..	5 11
St. James' and Pall Mall, Ord. ..	5	10	12	9¼ — 9¾	..	6 3 1
Do. 7 % Pref	5	7	7	6⅝ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2¾ — 3⅛	..	6 10 4
Do. 5 % First Mort. Deb. ..	100	5	5	98 — 101	..	4 19 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock ..	100	4½	4½	94½ — 97½	..	4 12 4
Urban, Ord.	£3	Nil	..	⅜ — ⅝	..	..
Do. 5 % Cum Pref.	5	3‡	4	2½ — 3 xd	..	6 13 4
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 12 3
Westminster, Ord.	5	10	10	8½ — 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	5 1/16 — 5 5/16	..	4 4 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 21st.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5⅛ – 5⅜	+ ⅛	5 11 7
Calcutta, Ord.	5	8½	5†	7⅞ – 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5 – 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	90½ – 92½	..	5 8 0
Canadian Gen. El. Com.	$100	7	8	109 – 113	–2	7 1 7
Do. 7 % Pref.	$100	7	7	118 – 123	–1	5 13 10
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 – ⅝	..	7 12 0
Do. 5 % Deb.	100	5	5	87 – 90	..	5 11 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87 – 89	..	6 14 10
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 – 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ – 95½	..	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 – 3/32	..	Nil
Do. 6 % Pref.	1	6	6†	13/32 – 17/32	..	10 11 10
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 – 104	..	4 16 2
Madras, Ord.	5	Nil	..	1¼ – 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103½ – 106½	..	4 14 0
Mexican El. Lt., 5 % 1st M. Bds.		5	5	63 – 68	–2	7 7 1
Mexican Lt. & Power, Common	$100	4	4†	36 – 41	– 2	..
Do. 7 % Cum. Pref.	$100	7	7	70 – 74	– 5½	9 9 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	75 – 80	–3	6 5 0
Do. 5 % 2nd Mort. Bonds	100	5	5	63 – 67	–2	7 9 3

NAME.	Stock or Share.	Dividends for		Closing Quotations April 21st.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	52 – 57	–2	..
Montreal, Lt., H. and Power	$100	9	10†	223 – 228	–5	4 7 9
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 – 20	..	..
River Plate, Ord.	Stock	10	..	245 – 255	..	3 18 5
Do. 6 % Non-Cum. Pref.	Do.	6	6	103 – 108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 – 103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 – 102	..	4 8 3
Shawinigan Water, Capital	$100	5½	6	133 – 137	–3	4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 – 109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	101½ – 103½	+ ½	4 7 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	95½ – 97½	+ ½	4 12 4
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 – 89	..	5 12 4
Victoria Falls Power, Pref.	1	6	6	23/32 – 25/32	..	7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	102 – 104	..	5 15 5

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 21st.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	25/32 – 27/32	..	8 5 0
Do. 6 % Pref.	1	6	6	¾ – ⅞	..	6 17 2
Babcock & Wilcox	1	16	16	3 1/32 – 3 5/32	+ 3/32	5 1 5
Do. Pref.	1	6	6	1 5/16 – 1 11/32	..	4 8 6
British Aluminium, Ord.	1	..	5	31/32 – 1 3/32 xd	..	4 11 4
Do. 6 % Cum. Pref.	1	6	6	13/16 – 15/16 xd	– 1/32	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	96 – 99	..	5 1 0
Do. Deb. Stk.	100	5	5	88 – 93	..	5 7 6
B.I. & Helsby Cables	5	10	13	9¼ – 9¾	..	6 13 4
Do. Pref.	5	6	6	5⅞ – 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	101 – 104	..	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 – 94	..	4 15 9
British Westinghouse, Pref.	2	Nil	5	1 5/16 – 1½	..	6 13 4
Do. Deb.	100	4	4	73 – 75	..	5 6 8
Do. 6 % Prior Lien	100	6	6	100 – 103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- – 3/-	..	Nil
Do. Pref.	1	..	..	8/- – 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 – ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 – 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	46 – 50	+ 4	9 0 0
Do. 4½ % Second Deb.	100	4½	4½	28 – 32	+2	14 1 4
Callender's Cable	5	15	5†	11¾ – 12½	..	6 0 0
Do. Pref.	5	5	5	5 – 5¼	..	4 16 5
Do. Deb.	100	4½	4½	97 – 100	..	4 10 0
Castner-Kellner	1	20	22½	2⅝ – 2⅞	..	..
Do. Deb.	100	4½	4½	104 – 107	..	4 4 1

NAME.	Stock or Share.	Dividends for		Closing Quotations April 21st.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	83 – 85	..	5 17 8
Dick, Kerr	1	Nil	..	⅜ – ⅝	..	..
Do. Pref.	1	6	6	23/32 – 25/32	– 1/32	7 13 4
Edison & Swan, A, £2 paid	5	Nil	..	0 – ⅛	..	Nil
Do. fully paid	5	Nil	..	1 – 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 – 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	62 – 67	..	7 9 1
Electric Construction	1	5	..	17/32 – 21/32	..	7 12 6
Do. Pref.	1	7	7	15/16 – 1 1/16	..	6 11 7
Greenwood & Batley, Pref.	10	7	7	6¾ – 7¼	..	9 13 2
Do. Deb.	100	5	5	[illegible] – 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10¼ – 10½	..	5 14 3
Do. Deb.	100	4	4	85 – 89	+1	4 10 0
Henley's, Ord.	5	15	20	13½ – 14½	..	6 17 11
Do. Pref.	5	4½	4½	4 13/16 – 5 1/16	..	4 9 0
Do. Deb.	100	4½	4½	101 – 103	..	4 7 5
India-Rubber, G. & T.	10	7½	7½	10½ – 11½	..	6 10 5
Do. Pref.	10	5	5	8¾ – 9½	..	5 5 3
Telegraph Construction	12	20	20	36 – 38	..	6 6 7
Do. Deb.	100	4	4	98 – 100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	64 – 68	..	5 17 8
Do. B 4 % Cum. Pref.	100	..	..	50 – 55	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 21st.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾ – 6¼	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	94 – 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 – 126		6 7 0
Do. Collat. Trust	$1000	4	4	92 – 95	+1	4 4 3
Anglo-American Telegraph	Stock	3	3	64 – 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	109½ – 110½	+ ½	5 8 7
Do. Def.	Do.	30/-	30/-	23¾ – 24¼	..	6 3 9
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 – 104	..	4 16 2
Chili Telephone	5	8	..	7⅜ – 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80 – 82	– ½	4 17 7
Cuba Telegraph	10	6	6†	8⅞ – 9⅜	..	6 8 1
Do. 10 % Pref.	10	10	10	15¾ – 16¾	..	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3¾ – 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7½ – 8	..	6 5 0
Direct United States Cable	10	4	4	6⅞ – 7⅛	..	5 12 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 – 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	133 – 136	+1	5 3 0
Do. 3½ % Pref. Stock	Do.	3½	3½	77½ – 79½	..	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	96 – 98	..	4 1 8
Eastern Extension	10	7	7	12½ – 13	+ ⅛	5 7 9
Do. 4 % Deb.	Stock	4	4	94½ – 96½	..	4 3 0
Globe Telegraph and Trust	10	6	6†	11 – 11½	– ⅛	5 4 4
Do. 6 % Pref.	10	6	6	12½ – 13	..	4 12 4
Great Northern Telegraph	10	20	20	32 – 34	..	5 17 8
Indo European Telegraph	25	13	13	58½ – 60½	+ ½	5 7 4
Mackay Companies Common	$100	5	5	85 – 88	..	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	70 – 73	..	5 9 7

NAME.	Stock or Share.	Dividends for		Closing Quotations April 21st.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph	1	20	20	3¼ – 3⅜	– 1/16	5 18 4
Do. 7 % Cum. Partic. Pref.	1	17	..	2⅝ – 2⅞	– 1/16	5 18 3
Monte Video Telephone, Ord.	1	6	6	13/16 – 15/16	..	6 8 0
Do. 5 % Pref.	1	5	5	¾ – ⅞	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 – 101	..	4 9 0
Oriental Telep. and Elec.	1	10	10	2⅛ – 2⅜	..	4 4 3
Do. 6 % Cum. Pref.	1	6	6	1 3/16 – 1 5/16	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	87½ – 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 – 100	..	4 0 0
Reuter's	10	10	10†	8 – 9	.	11 2 2
Submarine Cables Trust	Cert.	6	6	125 – 128 xd	+1	4 13 9
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 – 100	..	4 10 0
United River Plate Telephone	5	8	6†	6⅜ – 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5⅜ – 5⅝	..	4 9 0
West Coast of America	2½	2½	..	1 3/16 – 1 7/16	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 – 99	..	4 0 10
West India and Panama Teleg.	10	1¼	1¼	2 3/16 – 2 7/16	– 3/16	5 2 7
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞ – 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref	10	6	6	8⅞ – 9⅜	– ⅛	6 8 0
Do. 5 % Debs.	100	5	5	96 – 99	..	5 1 0
Western Telegraph, Ltd.	10	7	7	13⅜ – 13⅞	+ ⅛	5 1 11
Do. 4 % Debs.	Stock	4	4	95½ – 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	95 – 98 xd	+1	4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

New Vapour Lamps.—According to the *Times*, a vapour lamp, prepared with fairly pure helium, will, under certain conditions, give a white light much resembling daylight, and the character of the illumination can be controlled when used on alternating-current circuits so as to become bright yellow or even violet. These remarkable results would, it is claimed, enable varying colour effects to be produced for stage illumination by merely controlling the electric current exciting the tubes. Another new vapour lamp has been produced by Herr Greinacher, in which a spark discharge takes place between platinum electrodes; a lamp of 90 C.P. has been constructed by him, running at 500 volts. By using potassium electrodes and making the discharge take place in helium gas, it is thought that these lamps may be run on the low voltages ordinarily used for lighting.

Electrically-treated Milk.—Four reports from experts on the electrical treatment of milk have been received by the Liverpool Health Committee, and they show that the keeping properties of the electrically-treated milk are increased; there is a great reduction in the total number of bacteria of all kinds; and the bacillus coli and its allies are absent. Consequently the reports confirmed the results of the observations by the local health department. The Liverpool bacteriologist (Dr. J. M. Beattie) stated that a very considerable advance had been made in rendering milk free from disease-producing bacteria without at the same time impairing the chemical constitution of the milk, but absolute sterilisation had not been generally accomplished. He was convinced that the bacteria which remained, both from their number and from their nature, were not harmful.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MARCH, 1914.

The returns of electrical business during March show increased totals both in the export and import sections; in the case of the former the value increased from £139 241 in February to £198,145 in the month in question, while the imports reached a total of £292,559, as compared with £270,032 in the previous month. The re-exports, on the other hand, with a total of £24,810, showed a decrease of nearly £500.

Excluding telegraphic exports, the general export business reached a total well above last year's monthly average, and this applies also to the imports as a whole, for which last year's monthly average was £245,000.

Of the individual items in the exports, machinery accounted for some £210,000; cable exports reached a satisfactory figure, but there was a falling off in the telephonic and lamp sections. In the imports the machinery, telegraphic and telephonic, and lamp sections show higher values as compared with the previous month. Our best customer during the month was India with a total purchase of £77,000, which was slightly more than in the previous month; business with Argentina, Japan, and our Australian colonies also reached satisfactory dimensions. German imports were on a greater scale than in February, otherwise the import values show no particular change.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephone cable and apparatus, and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,515	125	142	69	2,344	496	7,611	201	381	140	275	5,39	18,690
Germany	1,050	1,579	24	40	466	...	2,440	3(	182	107	54	98	6 070
Netherlands, Java and Dutch Indies ...	944	1,055	318	...	42	126	916	...	119	91	96	2,626	6.333
Belgium	1,393	309	101	...	39	83	2,175	...	150	...	1,512	67	5,829
France	968	67	3,210	97	12	...	9 366	118	...	289	133	3,708	17,968
Portugal	127	20	...	10	...	...	1,166	359	19	9	56	2.115	3,881
Spain, Canary Isles and Spanish N Africa...	604	76	14	68	...	95	11,617	...	58	239	389	323	13,483
Switzerland, Italy and Austria-Hungary ...	938	56	136	...	14	...	2,963	24	34	681	75	509	5,430
Greece, Roumania and Turkey	335	14	151	33	...	...	1,141	...	40	...	41	190	1,945
Channel Isles, Gibraltar, Malta and Cyprus...	78	...	78	52	...	19	206	...	2	...	8	4,583	5,026
U.S.A., Philippines and Cuba	535	2,944	...	100	61	405	1,174	...	...	...	...	1,235	6,454
Canada and Newfoundland	1,129	1,915	774	807	...	1,147	9,198	208	568	64	2,931	1,911	20,652
British West Indies and British Guiana ...	108	...	8	156	36	...	171	...	59	...	195	32	765
Mexico and Central America	10	...	85	32	10	...	1,193	526	11	...	...	17	1,884
Peru and Uruguay	232	...	...	14	...	...	57	312	...	...	585	...	1,200
Chile	505	35	43	...	...	156	1,488	...	606	43	134	396	3,406
Brazil	1,722	1,686	415	48	...	71	10,642	8,347	10	...	2.341	266	25,518
Argentina	4 344	14,594	392	1,899	432	883	19,413	1,763	332	24	3,283	5,019	52.378
Colombia, Venezuela, Ecuador and Bolivia...	380	...	20	...	41	...	1,270	...	16	14	273	191	2,205
Egypt, Tunis and Morocco	63	45	531	74	28	6	3,570	25	83	...	101	770	5,296
British West Africa	138	98	...	33	...	63	563	...	2	...	245	237	1,379
Rhodesia, O.R.C. and Transvaal	1,562	179	132	1,101	31	65	2,308	...	96	...	7	77	5,558
Cape of Good Hope	1,737	3.016	722	492	10	5,780	88	862	196	10	596	1,022	14,531
Natal	1,046	3,959	145	480	33	21	1,071	...	50	38	219	739	7,801
Zanzibar, Brit. E. Africa, Mauritius & Aden	696	172	192	34	...	33	529	99	163	10	41	317	2.286
Azores, Madeira and Portuguese Africa ...	105	623	91	90	...	212	2,008	...	18	...	...	161	3,308
French African Colonies and Madagascar...	58	...	...	...	...	...	170	...	...	...	...	...	228
China and Siam	1,441	10,817	651	298	...	256	2,150	511	536	...	...	13	16,673
Japan and Korea	5,019	56	449	...	10	773	32,424	4,433	19	2	382	...	43 567
India	6,417	9,263	3,830	1,948	49	707	38,653	4,094	5,131	410	1,120	5,555	77,177
Ceylon	323	381	290	23	14	61	74	...	94	...	142	78	1,480
Straits Settlements, Fed. Malay States and Sarawak	346	709	326	75	219	25	7,439	539	208	57	333	1,214	11,490
Hong Kong	605	803	268	38	...	247	1,377	26	93	10	24	257	3,748
West Australia	344	853	109	252	...	352	386	410	238	...	...	...	2,944
South Australia	432	800	297	...	...	743	3,245	...	1	...	675	436	6,629
Victoria	1,460	7.978	624	666	881	1,271	12.040	625	603	...	1.935	894	28.977
New South Wales	1,958	5,387	821	1,096	307	1,641	13,822	1,930	739	64	8,844	2,985	39,594
Queensland	223	1,974	15	208	...	325	1,976	270	219	...	822	135	6,167
Tasmania	...	115	14	...	...	...	18	...	...	35	32	...	214
New Zealand and Fiji Islands	1,355	1,082	561	615	69	832	6,062	150	1,013	48	7,222	942	19,951
Total, £	42,245	72,785	15,979	10,948	5,148	16,894	214,180	25,862	12,089	2,385	35,121	44,509	498,145

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephone cable and apparatus, and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	878	...	...	133	...	...	4,438	125	708	...	9,739		16,021
Germany	8,216	25,605	1,682	14,425	7,032	3,249	91,358	2,866	2,678	11,457	12,953		181,521
Holland	...	388	...	3,118	580	...	300	15	...	74	...		4,475
Belgium	902	5,138	39	262	15	17	7,074	...	624	490	6,467		21,028
France	530	...	453	2,359	131	1,955	1,042	...	1,620	3,707	525		12 322
Switzerland	377	1,895	...	11	...	1,436	3,945	...	...	214	14		7,892
Italy	...	5,425	...	...	45	...	34	...	...	...	34		5,538
Austria-Hungary	...	1,242	28	252	26	...	118	...	95	...	...		1,761
United States	10,825	158	409	...	413	82	11,998	13,513	1,097	53	2.249		40,797
Total, £	21,728	39,851	2,611	20,560	8,242	6,739	120,307	16,519	6.822	15,995	31,981		291,355

Additional imports: Spain, wires and cables, £55; carbons, £733; Japan, wireless apparatus, £200; Victoria, electrical fittings, £50; Canada, electrical goods, £166.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephone cable and apparatus, and electric bells.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above... ...	14,040	703	...	3,112	468	...	4,658	...	531	882	416		24,810

Total Exports: £498,145 Total Re-Exports: £24,810 Total Imports: £292,559

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE PASSENGER TRANSPORTATION PROBLEM.

Report to the Special Sub-Committee of the Manchester Tramways Department, by J. M. McELROY, *General Manager.*

LIKE other large cities, Manchester finds itself faced with the problem of moving an increasing proportion of its population between their homes, their business, and their pleasure; is finding difficulty in meeting present requirements; and sees the necessity of providing betimes means to cope with those of the future. A special sub-committee of the Tramways Committee, appointed to study the position in November, 1911, presented an interim report in January, 1913, showing the magnitude and importance of the problem, and recommending that Mr. McElroy and Mr. Mattinson, general manager and permanent way engineer respectively of the Manchester Tramways, should make a journey of investigation at home and abroad, and report fully thereon for the further guidance of the sub-committee.

This they have done, and the book containing Mr. McElroy's account of the investigation, and recommendations that certain things shall be done, and other things considered and prepared for, in Manchester, as lessons derived therefrom and applied to the special conditions of Manchester, is now before us.

The book can be treated as divided into three main parts: the first descriptive of what has been done, and is being done, in fourteen large cities; the second (Parts II. and III.) lessons drawn from the investigation, and their applications to Manchester; the third (Parts IV., V. and VI.), definite proposals for street and tramway improvements in Manchester, with a discussion of the financial questions involved, the scope of the improvements as regards provision for the future, and suggestions as to further provision when rapid transit will have to be added to tramway and other street facilities.

The descriptive part of the book covers the passenger transport systems in existence, and in course of development, in New York, Philadelphia, Boston, Chicago, Pittsburg, Paris, Berlin, Vienna, Hamburg, London, and Glasgow, and is illustrated by city and district maps, plans of terminals, drawings and photographs of subways, elevated railways, stations, and vehicles, as well as by tables of statistics, giving, in 82 pages, 42 maps and diagrams, a concentrated statement of "the resources of civilisation" already applied to the transport of passengers in large cities, and the trend of development in the different places, as well as some statistical indications of the capacity, cost, and earning power of each. Highly valuable as this is, recorded by men who know what to look for, and how to state what they saw in concise and clear language, perhaps the most valuable information for general use is that describing the various forms of traffic organisation and control in the different foreign communities visited.

Criticism of this descriptive work is hardly called for; so far as it is possible to check it, accuracy is a distinctive note, and it is of later date than most of the records with which it could be compared. There is a little historical hiatus on page 63, where the wording suggests that the Metropolitan and Metropolitan District lines in London were originally constructed as the "Inner Circle," which it would be well to correct in any subsequent use of the Report for the sake of accuracy—it is not pertinent to the argument.

The illustrations of tramway and rapid transit railway terminal loops and stations in New York, Boston, and Paris, are lessons in the tackling of terminal problems well worthy of study by British tramway and railway engineers, who have not, as a body, realised the value of, or at least have not often put into practice, terminal arrangements of the loop or roundabout character, avoiding reversals and shunting of cars. Mr. McElroy, it will be seen, has learnt this lesson—as well as others. A notable and highly efficient example of this type of terminal (not mentioned in the Report) is that at the New York end of the Brooklyn Bridge, where the up and down tracks on the bridge are joined by a set of loops with ample standing space between them, so that cars, loading and unloading in "parallel," can arrive and be got away in a continuous stream on the bridge lines. The Victoria Embankment line of the L.C.C. tramways is a kind of terminal loop, but it lacks the parallel loading features essential to highest efficiency.

The principal lessons drawn from the investigation are summarised under six heads of very general application, of which the following is the most important:—

"(3). It is essential that every city should have a permanent authority directing the *initiation* and carrying-out of all schemes for new transit facilities in order that there may be continuity of policy, and that future needs of the city and the surrounding districts over a wide area are properly looked after. It is also desirable that all the means of passenger transportation—both surface and rapid transit—should be centralised under one management. If the management is not that of the city itself, then it should be subject to control and regulation by a permanent authority appointed by the city."

A Royal Commission on London Traffic said something very much like this nine or ten years ago, and it is still true, even for London.

There is a tacit assumption underlying the paragraph quoted, and indeed the whole of the applications of the Report, that an efficient solution of the passenger transportation problem in great cities is a vital public interest, a branch of that "good order and government" which all civic administration is intended to ensure and encourage. In describing the attitude of the New York city authorities to the provision of transit facilities (p. 13) we are told, in reference to the new rapid transit lines which are estimated to cost about £68,000,000, of which the city and the operating companies will find about equal shares: "the possibility of any ultimate profits to the city is remote. But the city authorities are not looking for profits. They are determined to provide adequate travelling facilities—and so important a duty on the part of the municipality do they consider this, that they have made up their minds to do it properly, even if it entails a charge upon the rates of the city." It is difficult not to suspect the author of some sympathy with this attitude, but it would be strong meat to put to a British municipality, much more to a Parliamentary Committee, and in his concrete recommendations the author discusses the financial results of his proposals upon the basis of what is usually called "sound finance." No other basis can be used here with any hope of success, and yet one thinks that it should be possible by this time to make an estimate of the social, industrial, and commercial value of good transport facilities in a great city, not altogether incommensurable with some expenditures from public sources. A study of transport achievements from this point of view is wanted, and has not yet been attempted, it is one of the few aspects of the subject on which the author maintains silence, advisedly, no doubt, for his immediate purpose; it is perhaps a part of the tacit assumption underlying the report, which he knows it is superfluous to express to the Manchester City Councillors. Doubtless he thinks that they will agree with the Bostonians, who (p. 35) "state that the time-saving effected by the rapid transit lines if reduced to a cash basis would represent a considerable amount of money."

The growth of the "Riding Habit" is a statistical subject of much importance and interest which the author discusses by the assembly of a considerable mass of statistics on pp. 88-97. From a sufficient amount of statistics some generalisations can be drawn, such as, *e.g.*, the proposition that the number of journeys per head of population tends to increase as the square of the population. This conclusion is quoted (but not accepted) by Mr. McElroy as having been derived from statistics of certain German cities, and the curves of number of journeys per head, and of population increases, given for some cities, correspond fairly with the statement. This is the case with Greater New York and Boston, but in Manchester and District, and Greater London, the number of journeys per head has increased much more rapidly than the square of the population, and other places could certainly be found showing a lower rate. Obviously, no useful conclusion can be drawn which does not take into account the periods at which additional travelling facilities were given, and no experience from any place, or group of places, can be applied to another place without very careful consideration of the local conditions, selection of similar places, and weighting of the resemblances and differences.

Mr. McElroy has an easier task; the growth of population, of traffic, and of the riding habit, in Manchester, in relation to the development of the tramway system, are at his fingers' ends, and to project the curve forward for 20 years demands an extrapolation in which there should be little risk of serious error. He has in diagram No. 43 plotted his estimate of future tramway "passengers carried" on the Manchester and Salford tramways, as a straight line through the years 1904 and 1914, although the curve for the last six years is concave upwards, *i.e.*, it is getting steeper. Nevertheless, even the cotton trade fluctuates, and if the increase is much more rapid than calculated, some form of "Rapid Transit" must come to the rescue all the sooner. At any rate, the curve attains the respectable figure of 450 million passengers in 1934, starting from about 258 millions in 1914.

The difficulties already experienced on the Manchester tramway system are those of congestion on certain routes at the morning and evening rush hours. Piccadilly, London Road, Oxford Street, Market Street, Cross Street, and the Rochdale, Cheetham Hill, Stockport and Oxford Roads are, as shown by diagram No. 51, carrying a large number of cars per hour. None of the streets in the central area lend themselves to the purposes of a tramway terminal—Manchester has nothing corresponding to Liverpool's Pier Head—and the immediate problem is therefore to relieve this central congestion.

The proposals put forward to this end are bold, and will be effective if they are carried out. What to do with the old Infirmary site has been a Manchester problem ever since the old Infirmary was vacated. Mr. McElroy says: make a tramway terminal and an open space of the bulk of it; build a fine and commodious Tramway Department office on the rest. These are good ideas. But a tramway terminal requires outlets and inlets; especially will the Infirmary terminal require additional connections on the east. So it is proposed to extend Aytoun Street into London Road, joining it near the crossing of Fairfield Street, with a new street branching from Auburn Street into Whitworth Road, opposite Temple Street, so relieving London Road and Piccadilly of a large part of the tramway traffic. Of slightly less magnitude is the proposal to lay out Albert Square as a terminal roundabout, and to cut a new street from Albert Square into Oxford Street, lining up with that street. This will be recognised as a great improvement in the chief tramway route from the southern districts. It is further proposed to lay out terminal loops in Corporation Street, Marsden Square and Stevenson Square, to accommodate the traffic from the north. With these bold improvements carried out, the carrying capacity of the tramways will be very greatly increased, the central loading and unloading accommodation should by these means equal as many cars per hour as the lines can reasonably carry, and the effective speed of the cars in the central area will be appreciably increased. Other traffic will naturally benefit by the transfer of the loading and unloading places to definite positions off the main lines of thoroughfare, and there should be fewer accidents to passengers. It may be that passengers will sufficiently appreciate the convenience and safety of such terminals as to tolerate fewer stopping places in the streets near them—this result has occurred in some foreign towns—which will further improve speed conditions in the central streets for all classes of traffic.

Various street widenings are proposed, and special emphasis is laid on the necessity of providing for the large increase of population which is in progress and in prospect on the south side of the city, as well as providing better north and south routes across the centre. The desirability of more complete coordination between the Manchester and the Salford tramways is also suggested, and it is obvious that such arrangements ought to be possible and ought to be made, as will give to the public of Manchester and Salford facilities as good as if the two systems were under one management.

The report points out, quite correctly, that with the improved central terminals the arrangement of routes terminating in the centre, and of routes running across or through the centre, can be settled on consideration of the traffic requirements only, whereas at present through routes are in many cases run to avoid the troubles of "dead-ends" in the central streets, but result in a lessened effective use of the rolling stock.

Some investigations into the "loading characteristics" on certain Manchester routes, and on cars running throughout the day, are of more than local interest, and provide an effective negative to the suggestions which have been put forward in certain quarters recently, that vehicles of much smaller carrying capacity are capable of superseding the tramcar vehicle-mile for vehicle-mile. They are used in the Report to show what volume of traffic has to be provided for now, and inferentially that the routes must be improved and supplemented to keep pace with its future growth.

Then come the crucial questions: What will all this cost? and how is the cost to be met?

To the first question, what will it cost? the Report offers no answer. It is easy to understand Mr. McElroy's reluctance to enter on estimates which involve valuations of a large amount of property, as well as the construction of new streets and all their paraphernalia, and such matters as betterment; and perhaps, what is the most difficult and momentous point of all—how the cost is to be allocated—and he has no doubt wisely confined himself to showing what amount of net revenue may be available from the Tramways Department, if it is kept abreast of the requirements by the improvements proposed. The net result is that—provided the contribution in relief of rates is restricted to £100,000 per annum, that no drastic reduction of fares takes place, and that the work is spread over a series of years—the tramway revenue can bear an expenditure of £1,000,000 on this object. This seems the sensible way of facing the matter, for it is indisputable that the city will benefit in many other ways, and to a very considerable money value, so that it is better to put on the tramways what they can bear, than to charge them with an excessive amount, or to reject the whole scheme because it cannot be shown that the tramway revenue can carry the whole cost. To show that there are other benefits to the Municipal funds from similar improvements, Mr. McElroy cites the case of a street improvement which cost £147,000, and resulted in an increase of rateable value from £16,663 to £57,594, so that whilst the interest and sinking fund amount to £6,000, the increase in the rates received is about £16,000 per annum; a very heartening example, which shows incidentally that the owners of the sites and buildings must also be getting greatly increased revenues.

These questions involve social and political issues which, unfortunately, elicit keen differences of point of view, which will have to be fought out in the Manchester City Council, and in Parliamentary Committee Rooms, when the schemes get that far, as it may be hoped they will. It is very unfortunate that in this country we cannot follow the procedure of New York and Boston in getting these matters settled by an *ad hoc* expert body, who regard only the public interest; and that here every kind of private interest can oppose and delay. The private interest ought to be fully heard and fairly dealt with in respect to compensation, but never permitted to obstruct.

No community suffers more from our unfortunate procedure than London. Not only private interest, but party political spirit, has blocked the adoption of any of the recommendations of the Royal Commission on London Traffic, with the result that although the London Transport systems have grown enormously in extent, in capacity, and in public utility during the last decade, it is obvious that the money spent has been largely wasted, that it has neither provided the facilities which—under proper co-ordination—it could have done, nor is it yielding the profit which capital laid out in public utilities may fairly look for.

Mr. McElroy emphasises the lessons from foreign cities already quoted, and also the necessity of protecting the tramway revenue in Manchester from such unregulated competition as has occurred in London.

Whilst the development of the tramway system is the immediate solution to the Manchester problem suggested by the Report, other means of transport are not ignored. The motor omnibus and the trackless trolley are seen to have very useful and important functions to fulfil in a complete system, and the promise is made of concrete proposals for their use in Manchester. This is obviously the sane and balanced view to take, and it must be admitted that an important compensation for the disadvantages of the London traffic position (only the compensation and the disadvantages are not realised by the same people in an equitable degree) has been the development of the motor omnibus, which can now be reckoned with on definite estimates of earning powers, cost, and reliability.

Finally, the Report suggests, Rapid Transit routes to supplement the tramways will become necessary in order to reduce the time of transit, and also to deal with traffic diversities beyond the capacity of any surface methods.

Strong preferences are exhibited for the shallow subway, and if cost is unimportant, there can be little doubt of the force of the reasoning, backed by the experience of such places as New York, Boston, and Paris. But expenditures of £500,000 to £700,000 per mile of route require a great deal of justification in the shape of traffic prospects, and it may be some time before any British municipality proposes such a scheme. The author recalls the fact that two underground schemes for Manchester have been privately promoted within recent years, and expresses the opinion that neither of them was on a proper route. He does not, however, adumbrate definite proposals of this kind, reserving their consideration for the future.

In conclusion, this Report can be recommended as a careful study of a problem which faces every large city in the country, as a concise statement of what has been done in other places, and with what measure of success, and of an application of the general lessons and general principles to a particular case, and as an indication of certain changes in our Municipal and Parliamentary procedure needed in order to facilitate the solution of the problem on rational lines.

The Manchester Council is to be congratulated on having obtained such useful guidance for its own future course, and Mr. McElroy on having shown his ability in assimilating what he has seen, and applying it with such concise cogency to the conditions which it has been his business to study and to meet. The best wish one can make for him is that he will be permitted to carry out his plans with the minimum delay, and with the minimum interference from extraneous influences.

THE BOKSBURG (TRANSVAAL) RAILLESS TRACTION SYSTEM.

By R. TURNBULL MAWDESLEY.

The town of Boksburg is situated on the Witwatersrand, about 16 miles east of Johannesburg. It is one of the most important gold-mining centres on the East Rand, with a white population of about twelve thousand.

The native population is much larger, and fluctuates a great deal; at the present moment, the number borders upon 40,000, mostly Zulus and Shangaans, who are recruited from the outlying districts and employed by the various mining companies. Notwithstanding this host of semi-civilized Kaffirs, there is a great shortage of native labour, brought about by the recent Labour troubles, which affected this particular part of the Reef to a great extent; this means in its turn that not so many white miners are employed.

The town has long been without means of transportation within its borders, if we except some ancient mule-drawn vehicles, which plied between the various mines on the borders, and the shopping district of the town.

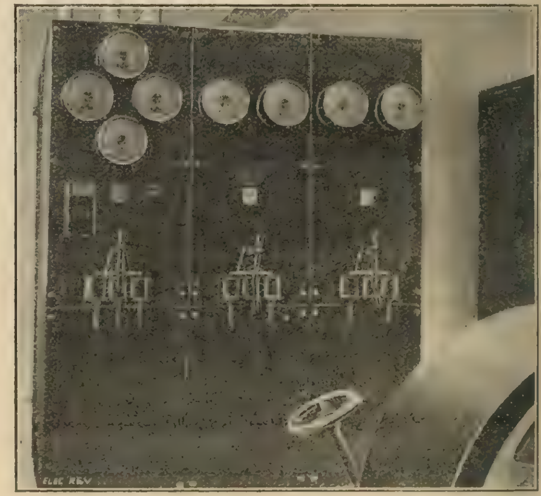


Fig. 1.—High-Pressure Switchboard.

The East Rand Proprietary Mines, Ltd. (the moving spirit in which is Sir Geo. Farrar) own a vast amount of mining rights in this area; their employés form the major portion of the population, both white and coloured, and it will be readily understood that the town's prosperity depends wholly upon mining activities.

After discussions in the Town Council, which lasted some two or three years, it was decided that a system of railless traction should be adopted, and finally preference was given to the R.E.T. Co's. system. An order was therefore placed with this company to supply the first six cars, and these were erected at Boksburg under the supervision of Mr. Jeffs (who came out for the R.E.T. Co.), in conjunction with the South African agent.

Exhaustive trial runs of all the cars have been made, and the motor-men, who are all, of course, new to this system, have been given ample opportunities for practice driving, and for familiarising themselves with the various routes. The trials have given complete satisfaction to the authorities in regard to the chassis and equipments, and the maximum speed of 20 miles per hour has been attained, though this high speed will not be reached in ordinary service.

The municipal authorities are not sanguine about the present profits from the undertaking, but the tradespeople are wholly optimistic, and foresee an increased business in the town when the cars commence to run. The general business of the town has lately been somewhat somnolent, owing to the shutting down of one of the principal mines—the Cinderella.

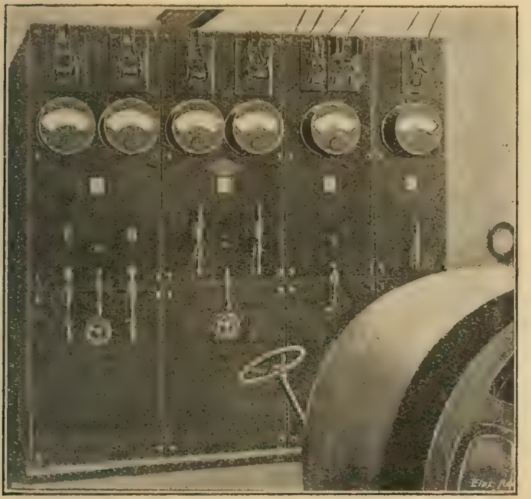


Fig. 2.—D.C. Switchboard.

The municipal authorities, in consequence, recently found it necesary to retrench the town clerk and the town engineer, and the work of the latter's department has fallen upon the shoulders of the electrical engineer.

Boksburg is one of the principal pleasure resorts on this part of the Witwatersrand, and possesses one of the few sheets of water which can truthfully be called a lake, where the only boating accommodation on the Rand can be obtained, and it is fondly hoped that the somewhat decaying business of the town may be revived by the advent of the cars.

This is the first railless traction system to be seen in South Africa——though the neighbouring town of Germiston is proceeding with a railless equipment of somewhat different construction.

The plant is, of course, necessarily quite small, and only six cars are to be put in service at present; but for this reason alone, the adoption of a railless system proves interesting.

The Brakpan Power Station of the Victoria Falls and Transvaal Power Co. is in the immediate neighbourhood, and a 10,000-volt 3-phase line supplies a transformer sub-station at Boksburg—from which sub-station a 2,100-volt supply is taken for the lighting of the town. There are some nine transformers distributed throughout the town, fed by the above 2,100-volt supply, and from these a 230 volt 3-phase supply at 50 cycles is taken for lighting and power.

A 2,100 volt 3 phase feeder cable runs from the Power Co's. transformer sub station to the Boksburg Municipal Tramways sub-station, which contains two Bruce Peebles motor converters, of the standard two bearing type, each of 150 kw. capacity, and running at 750 r.p.m.

The converters deliver direct current for the cars at 500/575 volts, and synchronising is very easily accomplished by a variable resistance in the rotor circuit. The whole of the switchgear is exceedingly simple.

In addition to the converting plant, Messrs. Bruce Peebles obtained the contract for the switchgear, which was sub-let to Messrs. A. Reyrolle and Co. The H.T. gear consists of one feeder panel and two converter panels, with oil switches and the necessary overload attachments, and is placed on a slightly raised platform facing the converters.

The direct-current gear consists of two generator panels, two feeder panels and two circuit-breakers coupled direct to the D.C. bus-cars, for supplying the car sheds.

This gear was erected by the South African representative of Messrs. Bruce Peebles, who, of course, carried out the erection of the motor-converters.

The severe lightning storms which are encountered in this country have made it necessary to install a fairly large number of lightning arresters on the trolley lines, and all frames of switchgear and converters are "earthed" by copper conductors.

The overhead equipment is of the ordinary double trolley wire construction, on span wires, and there are some four miles of this already completed; a further two miles of single track construction on side arms is being carried out by the electrical engineer.

There is no protection against lightning upon the cars themselves, the protection on the trolley lines being considered sufficient to safeguard the cars—but the passengers' grab-handles are effectively insulated from earth.

For the present it is proposed to run only two shifts at the sub-station, and the operating staff consists of a skilled man on each shift, with an unskilled helper.

The cars themselves are of the single-deck type, with one front entrance, and will be operated by a driver only on the "Pay-as-you-enter" system, much in vogue in Canada and the States, but it is the writer's opinion that the driver's time will be fully occupied in steering and avoiding obstacles, and in stopping and starting on picking up passengers. The "Pay-as-you-enter" system would appear to work satisfactorily when applied to railed cars, where no effort of the driver is needed to steer, but it remains to be seen if this system will be satisfactory on railless cars.

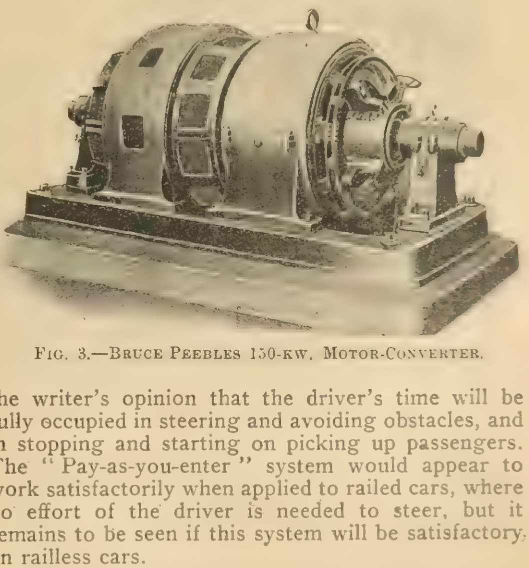


Fig. 3.—Bruce Peebles 150-kw. Motor-Converter.

The car bodies were built by Messrs. Milnes, Voss and Co.; the electrical equipment is by Messrs.

Siemens, and consists of two motors, with the usual forward and reverse series-parallel control.

The field current of the motors is shunted when the controller handle is on the last notch which gives acceleration to the car, but this gives the unnecessary speed of 20 m.p.h. which will not ordinarily be reached.

The seating capacity is 28, apart from the driver, and no natives will be allowed to ride, unless they are servants accompanied by their employers. There was a proposal to attach trailers for native passengers, but this is in abeyance.

The cars will at present serve the districts of Vogelfontein, Boksburg North, the East Rand Mines, Married Quarters, and Main Reef Road, connecting these districts with Boksburg Central Town.

The total cost of the undertaking has bordered upon £26,000, which amount was raised by the sale of municipal lands, and the work has been carried out by Mr. W. S. Guilford, the town electrical engineer.

The chief lack of the Council, and one which has every indication of being remedied, is a municipal power station. As previously mentioned, the present supply, both for traction and lighting, is taken from the V.F.P. Co.; their charges certainly border upon the high side, and are considered exorbitant by the Boksburg authorities. The cost per unit for power purposes in Johannesburg is three-halfpence, but the V.F.P. charge, in this case, no less than 2.85 pence delivered at the Council's sub-station. Therefore the cost per unit to the Council, after the substation maintenance and operation charges, is certainly high, and it is considered that the V.F.P. Co. should modify their rates.

The writer's thanks are due to Mr. W. S. Guilford, the electrical engineer, for facilities granted in the taking of the views, and for details embodied in this article.

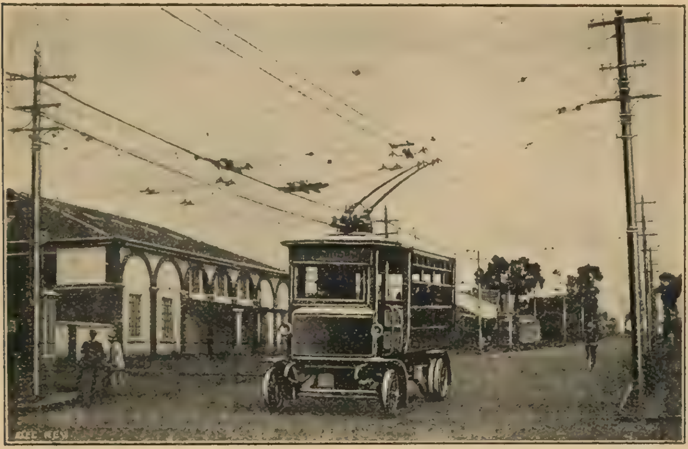


Fig. 4.—Car and Overhead Equipment; Car-Sheds on the left.

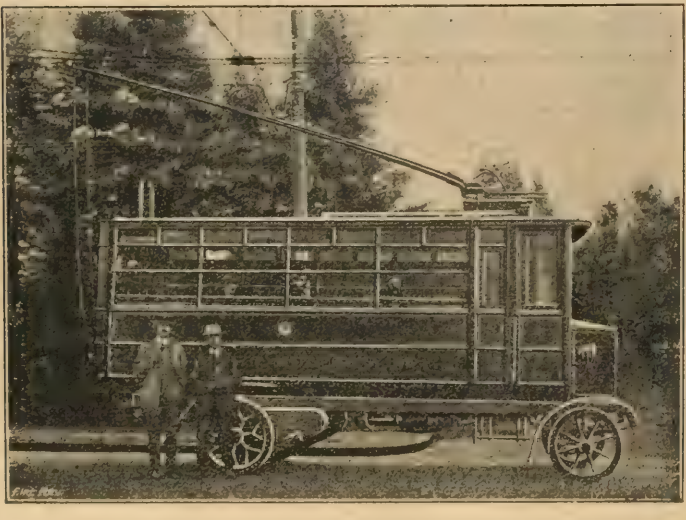


Fig. 5.—View of Car, showing length of Trolley Pole.

THE ENERGY OF X-RAYS.

The energy of the X-ray formed the subject of a paper read by Mr. A. T. Beatty, B.E., D.Sc., at the meeting of the Rontgen Society on April 7th. Dr. Beatty, who has been conducting some researches upon the transformations which take place during the handing-on of energy from the cathode rays to the X-rays, said that as anti-cathode for the X-ray tube copper was three times as efficient a radiator as aluminium. This relation, however, only applied when the cathode rays were of a low speed; when cathode rays of a higher speed were driven through the tube a new phenomenon came into play in the shape of the characteristic copper radiation, or the fluorescent radiation, as it was called. When this fluorescent effect was observed, the copper anti-cathode gave off a still more powerful stream of X-radiation as compared with the aluminium. If, in the path of this copper radiation, a sheet of aluminium were placed, the fluorescent part would be cut down to a greater extent than the general radiation, the result being that the copper became relatively less efficient than before. With the use of sheets of aluminium of a certain thickness, the fluorescent element could be cut off almost entirely, and when this was done it was found that the efficiency of the copper reverted to the same relation as before, namely, three times that of the aluminium. It might be said, therefore, that copper was always three times as good a radiator as aluminium, but superposed upon this greater efficiency was the fluorescent effect due to secondary radiation from the copper itself. This fluorescent radiation was not obtained at the expense of the general X-ray radiation, but was an effect entirely superposed. Coming to the second part of his subject, Dr. Beatty described his attempts to measure the actual amount of energy transformed from the cathode beam into X-radiation. By a device comprising an electroscope and resistances, he was able to balance the cathode current against an ionisation current, and make a number of interesting measurements. In the result, using a platinum anti-cathode, Dr. Beatty estimated that for every thousand units of energy in the cathode-ray stream, five units were obtained in the X-rays. With only five parts utilised in X-radiation, the rest must go to produce ions in the metal of the anti-cathode itself.

In the subsequent discussion, Dr. G. W. C. Kaye pointed out that Dr. Beatty's interesting conclusions were based upon the assumption that if one took the trouble to absorb the X-ray completely, the ionisation effect thus obtained was a total one, and was a direct measure of the energy of the X-ray passing through the gas which acted as the ionisation medium. The work of some recent experimenters, however, was rather against this supposition, and he thought that the assumption that the total ionisation was a measure proportional to the X-ray was a very questionable one to make. Asked by another speaker as to the relative values of a tungsten and of a platinum anti-cathode for the X-ray tube, Dr. Beatty said that, supposing no fluorescent radiation was produced, the effect would be directly proportional to the atomic weights of platinum and tungsten respectively, namely, 195 and 184. But then the characteristic radiation of the metals themselves would come in, and the greater the atomic weight of the element the greater would be the fluorescent radiation. On the whole, on theoretical grounds, he thought platinum the more efficient.

LEGAL.

Potter & Co. v. Berg & Co.

In the Shoreditch County Court, before his Honour Judge Smyley, K.C., recently, Messrs. F. W. Potter & Co., of Phipp Street, E.C., electrical motor manufacturers, sued Messrs. J. Berg & Co., of 169, City Road, E.C., to recover £5 17s., being the balance of an account for a ½-H.P. electric motor supplied. It appeared that the plaintiffs supplied four motors, three of which should have had grease lubrication and one oil. The three that were run with the grease correctly had turned out to be perfect, but the fourth had been lubricated with grease, which had spoilt the running. It was returned to them in a dirty condition, and they were willing to allow £2 for it. They, therefore, asked for the balance due for the cost of the motor as supplied new, less the £2 they were willing to allow on it.

Mr. Henry Francis Joel said it was clear that the motor could not have been looked after worse. They had had about 5,000 of them through their hands, and had never had a complaint before. He admitted that a new armature had to be put on, but that was caused through grease being used for the lubrication instead of oil; it had nothing to do with the manufacture.

For the defence, Mr. Berg gave evidence, and said he was an electrical and mechanical engineer, with 20 years' experience. He had had dealings with the plaintiffs before, and on this occasion ordered four motors. He had spent a great deal of time in trying to get this to go right, but it would not. He lubricated it with petroleum grease, but that, he thought, had nothing to do with the bad working, and he ascribed it to it being badly put together.

Mr. A. E. Robinson appearing for the plaintiffs, pointed out that the motor was specially constructed to be lubricated with oil, and for that purpose were provided with an oil pot. He had an expert present who would say that a machine built to be run with oil, could not be called faulty if run with grease. The other three which had been run with grease, which they were built for, had turned out perfect. So far as using grease on the fourth one was concerned, they might just as well have used sawdust.

Defendant: It did not go with either grease or oil. Defendant went on to say that they used petroleum grease, very fine, like vaseline, specially made for fine lubrication.

Judge Smyley said this motor seemed never to have been treated with proper lubrication, as it was built for oil, and grease had been used. There would be judgment for the plaintiffs with costs.

Reduced Tramway Profits.—Motor-Omnibus Competition and Rates.

In the Court of Appeal, on the 8th inst., composed of Lords Justices Vaughan Williams, Kennedy and Swinfen Eady, judgment was delivered upon an appeal by the Islington Assessment Committee from a decision of a Divisional Court (Mr. Justice Bray and Mr. Justice Lush) making absolute a *rule nisi* which had been obtained at the instance of the London County Council for a mandamus addressed to the appellants, calling upon them, under Sec. 47 of the Valuation (Metropolis) Act, 1869, to appoint a valuer to make a provisional valuation list showing the reduction in the rateable value of the County Council electric tramways situate in the Borough of Islington, arising, it was claimed, from the competition of motor-omnibuses. In 1912 and 1913 the gross receipts from the tramways fell from 11·42d. per car-mile to 9·05d., and a requisition was, on April 4th, 1913, served by the L.C.C. on the Islington Borough Council, as overseers of the parish, requiring them to send to the Assessment Committee a provisional valuation list showing the reduction in the rateable value of the tramways, on the ground that they had been reduced in value within the meaning of the section. The Borough Council refused to accede to the requisition, and, on an application by the L.C.C. to the Assessment Committee, that body came to the conclusion that there was no *primâ facie* evidence of such a reduction as was contemplated by the section, and they therefore declined to appoint a valuer. The Divisional Court, however, ordered that the mandamus should issue directing the Assessment Committee to appoint a valuer. The Assessment Committee appealed, contending that in order to justify the making of a provisional list on such a ground as competition of motor-omnibuses, there must be such a "continuous" reduction in value as to show that the letting value of the hereditament had been lowered, and no such continuous reduction in value had been shown in this case. Next, an alteration in value within Sec. 47 must be something special to the hereditament in question, or to the particular locality, whereas here the alleged cause of alteration in value was a cause operating throughout the whole of the metropolitan area. Further, it was said the Divisional Court were wrong in holding that the reduction contemplated by the section was a reduction in the value for the year in which the requisition was made, as compared with the value in the preceding year of the quinquennial period. The comparison, it was argued, ought to be with the value in the year in respect of which the quinquennial valuation was made.

Sir Robert Finlay, K.C., Mr. Ernest Charles, K.C., and Mr. Arthur Page appeared for the appellants; and Mr. Ryde, K.C., and Mr. E. M. Konstam for the respondents.

The judgment of Lord Justice Vaughan Williams (absent through indisposition), who dissented from the other members of the Court, was read by Lord Justice Kennedy. The effect of the refusal of the overseers to send in a provisional valuation list was, said Lord Justice Vaughan Williams, to bring into play sub-Sec. 2 of Sec. 47 of the Act of 1869—that was to say, to cast upon the Assessment Committee the duty to "appoint a person to make such provisional list in the same manner as in this Act provided in the case of overseers failing to transmit a valuation list." The Assessment Committee contended that this duty arose only on the happening of a condition precedent—viz., if the Assessment Committee were satisfied that in the course of the year the rated hereditaments had been reduced in value by some cause of a permanent kind; and that if the Assessment Committee had come to the conclusion that no reduction had been shown in this case by the L.C.C., the rule for a mandamus ought to be discharged. He, however, preferred to follow cases in which it had been laid down that, if the requisition stated a *prima facie* case, that was a sufficient compliance with the condition precedent contained in the preliminary words of Sec. 47:—"If in the course of any year the value of any hereditament . . . is from any cause increased or reduced in value." A *prima facie* case meant, in his opinion, a case in which the evidence given was such as to raise a presumption of proof unless qualified or contradicted by other evidence. In his view all evidence of values in the different years of the quinquennial period before or after the date of the suggested alteration was admissible upon the question whether the alteration under discussion was an alteration affecting the value of the hereditament or a mere temporary trade fluctuation. It seemed to him that the Assessment Committee did not in fact deal with the question whether the acquisition disclosed a *primâ facie* case of alteration in value, but rather whether the conclusion of one rating expert or the other was to be preferred. That to his mind was a question to be decided not by the Assessment Committee or the arguments of experts on the figures, but by the valuer whom the Assessment Committee were bound to appoint if the requisition on its face made a *primâ facie* case of alteration in value. The Divisional Court had found that a *primâ facie* case was made out. He thought that that finding was correct, and that it was a finding in law. In his opinion, therefore, the appeal should be dismissed.

Lord Justice Kennedy said he had come to the conclusion that the appeal should be allowed. He thought that under Sec. 47 the Assessment Committee were not only entitled but bound before appointing a person to make a provisional list upon the requisition of a ratepayer, who alleged a reduction in value as the ground of his requisition, to see that there was a *primâ facie* case for the existence of such a reduction in value as the statute prescribed as a condition. If a person was appointed by the Assessment Committee to make a provisional list, his function was simply to make a provisional list, upon the assumption that an increase or a reduction (as the case might be) in value from a cause within the meaning of the first words of Sec. 47 had been shown, to the extent of a *primâ facie* case, to the satisfaction of the Assessment Committee who appointed him. Unless there was proof of error of some sort or degree, the Court ought not to interfere with the conclusions of the Assessment Committee upon matters of pure fact. Where the rateable value of a hereditament was based upon the power to earn profits, an increase or a decrease in the capacity of the hereditament for earning profit was sufficient to constitute an alteration in value within Sec. 47, provided it was due to a cause which directly affected the assessable value of the particular hereditament, and was not of a merely temporary nature. But an increase or decrease in receipts was not sufficient evidence of an alteration in value if it was indicative only of a fluctuation. He thought that in the present case the appellants rightly came to the conclusion, whether it were treated as one of law or of fact, to refuse to appoint a person to make a provisional list. Having referred to the figures, his Lordship said that in his opinion the appellants were right in coming to the conclusion that the respondents had failed to make out a *primâ facie* case of a reduction in value resulting from a cause of a permanent nature, or in terms applicable to the circumstances of this particular hereditament, that they had failed to show that the proper inference from the alleged diminution of earnings in the year 1912-13, as compared with the earnings of the year 1911-12, was such a regular falling-off in the receipts owing to the competition of motor-omnibuses, as would render it unreasonable to suppose that a yearly tenant would give the same rent for the property, taking one year with another. The thing to be shown by an applicant asserting a diminution of value was that within the preceding 12 months an alteration had taken place which rendered the quinquennial valuation of the hereditament, made, say, three years before, an excessive valuation. If the applicant succeeded in showing this, he became entitled to have a provisional list made which fixed a valuation altered to the extent to which he showed that the value had been altered by something which had diminished the value of the hereditament during the preceding twelvemonth. He was not at liberty to bring into the assessment any earlier alteration which might have occurred. He could not be heard to say that the quinquennial whatever was incorrect at the commencement of the 12 months' period. The figures only showed a trade fluctuation which to some extent perhaps was to be accounted for by the electrification that had been going on and the dislocation of traffic in consequence. The ultimate result, however, might be to increase the earning power of the tramways. He considered that the appellants were justified in coming to the conclusion that no permanent reduction had been made out such as would warrant the appointment of a valuer.

Lord Justice Swinfen Eady agreed with Lord Justice Kennedy.

By a majority, therefore, the appeal was allowed with costs, and the rule discharged.

It was intimated that the case would probably be carried to the House of Lords.

War Office v. Kirkland & Capper and J. H. T. Woodd.

(Continued from page 653.)

Mr. Thomas Kirkland, continuing his evidence, said he had no doubt at all that under the specification he was working under, he was authorised to put in the installation in the method in which it was put in. On January 2nd, 1906, he recollected an interview with Mr. Woodd, at which he told him that the method of wiring in the tender that the War Office had accepted was by means of vulcanised india-rubber wire in folded tube on the surface, and Mr. Woodd said this would be of no use in the building. Mr Woodd said: "What can you do for me?" and witness said, "The only thing I can do for you is to put lead-covered wire in on the same lines as at Guy's, and, I believe, as far as my reading of this somewhat complicated specification goes, that I am perfectly entitled to do it." Thereupon he wrote a letter to Messrs. Boldings accordingly. Witness said he examined the wire when it arrived in May, and it was satisfactory as far as he could see by testing. The method of fixing adopted was that of fastening with lead clips on the surface. In regard to the boxes, the specification defined that they were to be standard boxes of iron, and he had these specially got. He got a standard box, and he made them put a piece of mica at the bottom as insulator, and on the top of that he had an insulator of porcelain, and then on the casing of that he had another piece of mica. When the wires were laid from box to box every section was tested before the plaster was put on. He gave instructions as to the use during the plastering of means for detecting any severance of the wires taking place. After plastering, tests were made of each individual section, and he personally tested at the end of the work. When wires were carried round corners, he instructed that the radius of the bend was to be as large as possible, and that they were to see that there were no rough edges against which the wire could be rubbed. These instructions were given to Messrs. Bolding's foreman. He gave instructions to the clerk of the works in effect that he should see that the wires came in, that they were not damaged, that damaged wires were not laid, and that the laying was proper in regard to the plastering. He constantly attended without notice on the works to see that his instructions were being carried out, and he had not spared himself in the slightest regard. After the installation was in, he tested it before the electric light company connected their mains in May, 1907. When he made his tests all the circuits had been put right. After his tests, the Westminster Electric Co. made tests, and these showed that the installation was in complete order at that time, viz., May 27th. He had no intimation that the system as passed by him and by the electricity company was wrong till August, 1907, when it was found that an entrance light was wrong, and Messrs. Boldings had it put right. He heard nothing more till about the end of the maintenance year. Subsequently, when he passed the final certificate for payment, he was of opinion that the work included in the contract had fulfilled all the specified requirements.

In your view, is the system that you have adopted of earthing wires by copping wire lightly wound round them one that is capable of, and proper for, earthing the lead wiring?—In my opinion it is so. He had found no disadvantage from not having glands at the boxes. He considered that none of the alleged defects found were to be attributable to the system that he installed. After an inspection of the whole, and after ascertaining the results of all the tests, he arrived at the conclusion that while the system was not then satisfactory in many respects, he could find no reason for holding himself responsible in any degree for its present condition.

Cross-examined further, Witness said it was more expensive to use lead in plaster than the system of folded pipe on the surface. He had heard that the War Office effected alterations during the year of maintenance, but he was not called in to advise or to take any part in regard thereto.

Cross-examined by Mr. Gordon Hewart: His attitude was that in putting in the lead-covered wires in the way that he did, he was doing what was allowable under the contract, and was really carrying out the contract as it was allowed by the specification.

Do you contend that the lead-covered wires buried beneath plaster were accessible:—Yes; in the technical sense most distinctly.

The Judge: Let me understand. If you have the conductor carried in a metal tube, if your installation fails, and there is a fault half-way along the tube, how do you get at that fault?—You pull the wire out.

Then the wire is accessible?—So is this.

Counsel: How would you get to the wire here?—First of all for accessibility you must be able to get at the ends to test.

I am speaking of the length of the wire. Having got at the ends, we will assume you find a defective wire?—What you do is to cut the ends off, then you simply make a small chase in the plaster from one end to the other. You lay a new wire in and make good.

Is that what you mean by accessible?—Yes, it conforms to accessibility.

You leave your original wire derelict in the wall, having cut off each end of it; you cut up your wall and make a new chase, put in a new wire, and then make good?—Yes.

The Judge: Do you say that is a conductor being accessible?—I do. I consider that is very good accessibility.

Further cross-examined, witness said that at Guy's Hospital half the work was in conduit casing or other method than lead-covered wiring. At the time the lead-covered wires were put in they did not put them in connection with iron boxes. The covering of the connector boxes was in wood; in regard to the insulated part, porcelain was used. He was not aware that the lead-covered wires at Guy's had caused great trouble.

Counsel suggested that in one case, from the fuseboard to the first connecting box in the corridor, the approximate length of the lead-covered wire was 80 ft., and witness said he would accept that statement. He would not dispute that there might be lengths of 60, 70 or 80 ft. of lead-covered wire buried in plaster.

What was the nature of the protection you provided for these conductors so that they might resist nails?—It was that they were put in places where this risk did not arise. And also to protect them with plaster. In certain cases he put them into folded tube down to the plugs.

Mr Gordon Hewart suggested that the connector boxes used in this were not proper boxes for lead-covered wire, and witness expressed the view that they were very satisfactory. He discarded some, and had these got ready for him with proper insulated bases before he approved of them. The boxes might have been designed to receive conduits, but they were quite applicable to receive lead-covered wires as well.

In regard to the Frazzi blocks, Counsel suggested that if they left out ceilings and regarded walls only, there were only 85 points in the whole work where the Frazzi blocks in any way interfered.—Witness said he could not speak of his own knowledge of this, but he agreed if this was the case that as far as walls were concerned, Frazzi affected about 10 per cent. of the total number of wiring points.

Counsel proceeded to deal at length with the letters, and suggested that when the Treasury counsel wrote to say that the ground of the War Office claim was substantially that the defendants allowed lead-covered wire to be laid direct in the plaster contrary to the contract, and that that constituted gross negligence on the part of a firm of electrical engineers whose duty it was to protect the interests of the War Department, the defendants did not reply that the work was in accordance with the contract and did not answer the question put to them as to who suggested the lead-covered wires.—Witness said the matter was in the hands of his solicitors and he accepted their advice as to what was to be done. He kept himself acquainted with the successive wiring rules of the Institution of Electrical Engineers, and was aware of the rules that read: "Unenclosed lead-covered conductors must be supported continuously or at intervals sufficiently frequent to prevent perceptible sagging, and must not come into contact with damp or new brickwork or plaster." On his experience of lead-covered wiring, he did not agree with that rule; it should be altered to allow of lead-covered wiring being buried in plaster.

Re-examined by Mr. Walter, Witness expressed the view that it was not desirable to draw lead-covered wire more than necessary into tubing. In regard to the boxes, he did not think from his experience there was any necessity for filling-up the holes in the box round the lead wire. The small amount of damp that could get in in that way was negligible where india-rubber-covered wire was used.

Mr. Francis Henry Nicholson, A.I.E.E., resident engineer at the King's College Hospital, Denmark Hill, said he was formerly with Kirkland & Capper, and in February, 1910, he was instructed by the firm to attend with Mr. Kirk and make complete tests of the whole of this installation. The tests took about four weeks. After giving detailed evidence at great length, Witness said that he traced down the defects in every case except as to two, to sections of wires that ended in flexible or wall plugs.

Mr. Walter: In your experience, is it at one or other of the points that you have indicated that faults nearly always originate?—Yes, it is very liable to be so where fittings of that kind are used, as they are handled by everybody.

With the fuses that you saw in position on those boards, in your view could the insulation be injured by over-heating?—Yes. My opinion was that those fuses gradually warmed up the lead-covered wire, and it was a question of time, not necessarily of the actual fault itself, that damaged those wires. If those actual faults had been repaired at the time they first occurred, those wires would never have been damaged.

In the course of subsequent detailed evidence, Witness said that in properly supervised installations, long before a fault had developed, one made periodic tests on each of the circuits at intervals to see what the insulation of the circuits was.

Is there anything in this that led you to the conclusion that the defects in this system were due to the installation of lead-covered wire?—No, it led to the very reverse. If the lead-covered wire had gone by abrasion, as they said, he should have found the defects shown in both buildings and in both parts of the lead-covered system—that was to say, between the boards and the first connector box as well as between the point and the last connector box, but he did not. He found nothing to cause those defects except the bad maintenance, and that was proved by the fact that it came down to practically flexible fittings and over-fusing. He never saw, the whole time he was there, any abrasion of any lead-covered wire at all.

The Solicitor-General: Do I understand that you suggest that what caused this lead-covered conductor to give was the fact that the wires got overheated through too strong a fuse being put in?—Yes.

From the connector box to the flex if the insulation of the lead-covered conductor was going to be affected by excess current, it would affect it through its whole length equally unless there was some defect in the insulating surface?—Certainly.

Unless the insulation had perished its whole length there would be no fault in the lead-covered conductor?—That is so.

Referred to the two pieces that were cut out on the Saturday from the circuits where faults were found, witness said the rubber showed signs of overheating, but he could not say if that overheating had perished the insulation without testing the wire. Witness agreed with Mr. Patchell that the signs of overheating were signs in one wire alone of the two. If that was so it was clear that there had been a dead earth on the circuit, and therefore the fault was one that would have been extremely unlikely to have been found in the flex. It would be found behind the plug point, and if not there, it must have occurred in the lead-covered conductor, but not necessarily buried in the plaster.

After a long cross-examination on these points, Witness agreed that on the lead-covered conductor that he tested there had been a leak to earth. He first formed the view that the mischief in the system was due to overfusing when he saw the heavy fuses, because when one began to see overfusing in any building one ought to begin to look for trouble. He did not suggest that 7-ampere fuses would have caused the insulation of the circuit to breakdown.

Mr. James Swinburne, F.R.S., next gave evidence regarding the properties of rubber and the functions of the lead covering.

Counsel: If wires are put in lead buried in plaster, when is the period when you would expect to find difficulties, if any, in connection with the insulation, the beginning or at a later period?—I should not expect from burying wire in plaster to have any trouble with insulation at all, if the plaster is going to be dry within a reasonable time—we will say a few months. It is known that mortar, that is to say, lime plaster, if wet, will eat gradually into lead, but it will take a long time to eat through a lead covering, and will only do it while it is wet. Once it is dry there is an end of it.

Assume any action on the lead with the system of insulated wires that you have here with rubber insulation, is there going to be any action on the rubber there?—No, if the lead was eaten through by continually damp mortar, and then the rubber was left long enough for it to perish, when the rubber perished you would get trouble, but I see no reason to expect trouble until that happened, and it would be a matter of years; it would not be an immediate matter. In all cases defects were in the last sections between the lighting point and wherever the previous opening was. The fact that the defects were found there showed that the probability was that it was not in the buried wire at all that the leaks occurred, but in the connections.

Witness, in subsequent evidence as to the fuses being heavier than the circuit was normally supposed to carry, said that the large fuses did not cause faults or tend to cause faults at all. They permitted leaks to go on that should be stopped and remedied. Where a normal fuse went, that showed there was something wrong, and it was the business of the man in charge then not to put in a larger fuse, but to find out what was wrong and remedy it. Installations might be completely ruined, although perfect in the first instance, by negligent supervision. If an installation was perfect, you could put in enormous fuses and no harm would ever happen, but no installation was perfect, and the fuses were put there in order that if a fault did develop anywhere they might know it was there and put it right.

Mr. Walter: Do you find in the reports, and the evidence that you have heard, any proof relative in this case that the system as nstalled failed by reason of lead being put under plaster?—No. I have not found that. I think the trouble must have arisen from points where you are making connections with the wires. I can see no reason why the lead buried in plaster so far as that goes should not be absolutely satisfactory.

The Judge: You now assume a perfect piece of lead-covered wire put properly into plaster, you say when once that is dry you see no reason why it should not work properly?—I go a little further than that; the lead ought to be perfect, but if a crack or something of that sort occurs in the lead, and it is rubber covered nside, I do not see that that is going to do any harm; with paper nsulation it is different.

Asked to define the object of accessibility of wires, witness said what one wanted to be able to do was to test the wire, and if by any chance the wire had gone wrong one wanted to be able to replace it; one did not want to get at the wire to repair it, one never repaired wire of that sort at all. If the wire was wrong, one took t out and put in another. Enclosing wires in metal conduit always led to damp inside the conduit. The question of getting n new wires simply depended on the length and the number of curves.

Mr. Walter proceeded to ask Mr. Swinburne if, in his view, there was anything in the War Office specification to prevent the use of lead-covered wire.

The Solicitor-General objected, as this (he contended) was a question for the Judge.

The Judge said he could not see that Mr. Walter could put the question he had asked, as he was throwing the specification at Mr. Swinburne's head, and asking him to find his (the Judge's) judgment for him.

Mr. Walter: It is exactly the point I think your Lordship has ot to find.

The Judge ultimately rejected the evidence as to Mr. Swinburne's interpretation of the contract.

Mr. Swinburne, further examined, said he would not think of having Frazzi chased.

Cross-examined by the Solicitor-General: It would be correct to say that this system was in a measure restricted and prohibited by the Institution rules. These restrictions would be due o the fact that people had found trouble with the system, and the character of the trouble generally, he would say, would be corrosion f the lead. He agreed that one should not put lead-covered cables ike these in plaster in places where people would be likely to rive in nails.

Subsequently, in the cross-examination, Witness was handed a le and asked to chase a Frazzi block, and he did so, admitting that the file acted quickly, and that it was not so tedious as he thought.

Eventually Mr. Swinburne gave evidence at great length on the question of accessibility and other matters.

The next witness was Mr. Ralph Gooch Tyler, M.I.E.E. In 1897 he brought out as a trade system the twin lead covered cable insulated with india-rubber. He induced Henley's Telegraph Works to produce it. They wanted something to get rid of wood casing and corrosion from the action of the plaster. The system had been used in increasing quantity from that date. A list he had prepared of 142 of his more important installations showed four in 1898, four in 1899, seven in 1900, and so on up to 13 in 1913, and he now had nine contracts in hand. They buried the cables where necessary, and it was always necessary in dropping the wires down to a switch or brackets in the wall. The floors they generally escaped by putting them immediately out of the floor boards and simply notching the joists. They always had to go through walls, and they were mortared in or plastered in, and according to his view there was no bare metal that would stand plaster except lead. In ornamental work where such cable had to be run, and where one could not have anything on the surface, it had been his practice during all these years to bury it in plaster. They had had great success with it, and Messrs. Henley's had now brought it out as a complete system for the general trade. Witness said the system had been used for every kind of building that he knew of. He had done Peak Frean's in 1900, and recently they had ordered him to do their new factory at Bedford on the same system. The laying needed care and the method of fastening with lead clips was correct.

Cross-examined: He knew that the Rules of the Institution said that conductors buried in cement or plaster must be provided with sufficient protection to resist a nail. To comply with that rule he had got out a steel channel to place over it where there was obvious danger. It was not the general rule to run the system from the terminal boxes to the lighting points with lead-covered conductors buried in new plaster for the reason that solid ceilings were not the general rule. He thought it was as wise to bury it in the ceiling as in the wall. With regard to the breaking down of the system, the fittings would be by far the weaker point.

Mr. Campbell Swinton, M.I.E.E., said that he introduced lead-covered wiring at Armstrong, Whitworth's for wiring warships over 20 years ago, and it had been adopted throughout the British service and throughout most foreign services, and also generally in the mercantile marine. It was run on the surface as a rule without any protection. There was no difficulty in putting the conductors round bends, &c., and the lead was unprotected, although the insulation depended on the lead being kept uninjured. The lead wire was used by the Post Office for their telephone wires in houses. There was an installation of electric light at the City Corporation lunatic asylum at Dartford, which contained about 1,200 lights, and was entirely wired in lead-covered wire. In regard to the installation at Millbank, he thought it was allowed to get into a bad condition. It was never tested, and when faults occurred no attempt was made to remedy them. The brutal system of increasing the size of fuses was used till they stood, and the result was that the insulation of many of the circuits was damaged Installations could be readily destroyed if faults were not located and the fuses were increased. Witness thought that no other system than the one installed at Millbank could have met the case —that is, at the time in question.

In cross-examination, witness pointed out that his specification had covered lead-covered wires, not twin, but that was the only point.

Mr. Alfred Herbert Dykes, M.I.E.E., said he was authorised by the Committee of the Association of Consulting Engineers, to give evidence on their behalf. Assuming that he was told there were only ⅜ in. of plaster above something that could not be chased and that the system had to be under the surface, in 1905 there was only the lead-covered conductor system that could be used. You could have twin lead covered, or two single wires; twin lead-covered would be the more suitable. It should have given no trouble. He was now carrying out an installation where the wires were buried on blocks similar to the Frazzi blocks, and he used metal-covered wire buried direct in plaster. A few years ago he would have used lead-covered wire. He now used copper-covered wire; this was a modern development, but the system of using was similar. Once the plaster was dry, he had never known any wire to fail through plaster in any case where he had used lead-covered wire. There had been failures in certain cases with certain kinds of plaster, and under certain conditions, but these did not occur where the plaster was either the ordinary lime plaster that was used here, or Keen's cement. Witness said that in any system he should be sorry if the fact that faults occurred in a large electric light system within a year or two after it was finished was taken to indicate that the system was at fault. One always got defects in any large system, and if they were allowed to run on, they developed into larger defects. Witness thought if the trouble was due to the lead-covered wiring being faulty, or a faulty system, he saw no reason why there should not be faults between the fuseboard and the first connector box.

The last witness was Mr. Owen David Lucas, who agreed with the view of the previous witness that the system used at Millbank was the correct one under all the circumstances. It could not have been done in any form of armoured cable. He thought the connector boxes were satisfactory for this sort of installation. He believed there was no special box made at the date of 1905 for lead-covered wire.

This concluded the evidence in the case, and subsequently counsel on each side addressed Mr. Justice Lawrence in summary of the whole evidence.

On Monday, April 6th, Mr. Justice Lawrence was to have heard legal arguments, but his Lordship was unable to take his seat owing to a cold, and the case was adjourned till the next legal term, which began on April 21st.

THE UTILISATION OF SOLAR ENERGY.

By A. S. E. ACKERMANN, B.Sc. (Eng.), A.M.Inst.C.E.

A paper on the above subject was read before the Society of Engineers (Incorporated), on the 6th inst., by Mr. A. S. E. Ackermann, who has been associated with the work (as joint consulting engineer with Mr. C. T. Walrond, to the Sun Power Co. and the Shuman Engine Syndicate) for nearly four years. The paper is the first of its kind, and deals with the whole of the experiments which have been made during that period, and which have cost about £30,000.

After naming the principal workers in this field, the author gives determinations of the solar constant and deals fully with the varying percentages of this quantity that are available throughout the day for power purposes. He then describes four types of Shuman sun heat absorbers and gives in great detail the results of his trials of these apparatus. The results of these types of absorbers are compared by means of tables and curves, and from these the author has constructed a formula by means of which it is easy to calculate for a given type and size of absorber the total output of steam per hour if three things are known :—(1) The time of day ; (2) the humidity, and (3) the steam pressure. It has been known that humidity adversely affects the quantity of solar radiation arriving at the earth's solid surface, but this is the first time that its effect on solar steam production has been quantitatively determined.

In order to utilise the low-pressure steam economically, Mr. Frank Shuman designed a special engine, which has also gone through several stages. This engine is fully described, with drawings, and the author gives the results of his trials of the several engines and compares their results with those of exhaust steam turbines and the low-pressure cylinders of compound and triple-expansion engines, showing that the Shuman engine is the more economical. The steam consumption of one of these engines was only 22·1 lb. per B.H.P.-hour, when the output was 94·5 B.H.P., and the steam pressure only 16·2 lb. per sq. in. abs.

In the earlier experiments (1907 and 1910) Mr. Shuman employed the direct rays of the sun without any reflecting surfaces ; in 1911 reflectors were used to supplement the direct rays, increasing the heat received in the ratio of 2 to 1. The boiler in this case consisted of a number of flat cells of tin-plate, each about 3 ft. square and ½-in. thick, aggregating 26 sections of 22 cells each, a total area of 5,148 sq. ft., receiving the radiation falling upon an area of 10,296 sq. ft. The area of land occupied was 126 × 142 ft., rather less than 0·4 acre. Steam was generated at or near atmospheric pressure, the maximum output being over 800 lb. of steam per hour, equivalent to nearly 27 B.H.P., and a rate of absorption of useful heat of 88 B TH.U. per hour per sq. ft. of solar radiation. This was the first absorber constructed on commercial lines.

In 1913 a larger plant was erected at Meadi, near Cairo, Egypt, in which improvements suggested by Prof. C. V. Boys were embodied. In this case the dimensions of the boiler were reduced, and the radiation from a large area was concentrated upon it by means of trough-like reflectors of parabolic section, with their axes north and south. The construction of the reflector is shown in section in fig. 1 ; it consists of thin glass mirrors carried in a light steel framework, which is rotated so as to receive the solar radiation always at the best angle, under the control of an ingenious electrical automatic heliostat.

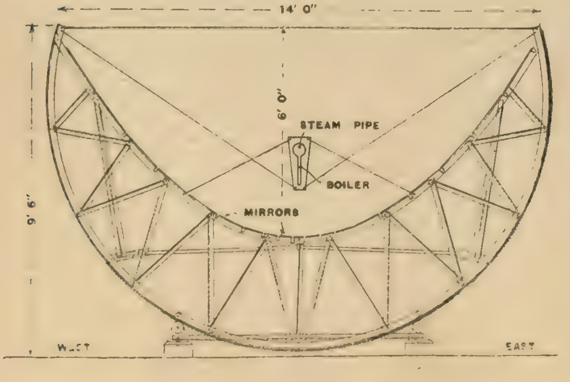


Fig. 1.—Crescent Frame of Shuman-Boys Absorber.

A section of the boiler is given in fig. 2 ; it is made in 4-ft. sections of cast-iron, bolted together in lengths of 205 ft., the dimensions of the water space being ¾ in. × 11 in. × 205 ft. The boiler is encased, as shown, with glass plates, which enclose an air space round it to prevent loss of heat by conduction and convection ; the casing was not, however, always used in the trials. There were five sections, as above described, the absorber occupying a net area of about 14,400 sq. ft., but as the sections were spaced at 40-ft. centres, the total land area occupied was about ⅞ acre. This might be greatly reduced. The total area of sunshine collected was 13,752 sq. ft., and the net concentration was in the ratio 4·6 : 1.

The amount of steam produced per hour per sq. ft. of solar radiation was 0·12 lb., as compared with 0·09 lb. in the 1911 experiments. The maximum absorption observed was 116 B.TH U. per hour per sq. ft. of radiation collected (compared with 88 in 1911), and the maximum output of steam was 1,442 lb. per hour, at 15·8 lb. per sq. in., on August 22nd, 1913. Allowing for a consumption of 26 lb. per B H.P.-hour, the plant could have developed 55·5 B.H.P. Owing to mechanical defects in the engine and pumps employed, however, the actual output bore no relation to the steam production.

The experiments showed that the production of power by direct utilisation of the sun's radiation was not only practicable, but commercially feasible. In the course of the discussion which followed the reading of the paper, a representative of the Sun Power Co., Ltd., stated that the cost of the absorbing plant was £1,560, or about twice that of ordinary steam-raising plant ; if coal cost 9s. 8d. per ton, the total inclusive running costs would be about equal, but as coal in the tropics costs about 60s. per ton, the sun plant has a very marked advantage. As a result of the experiments the Egyptian Government has ordered a 100-H.P. plant for the Soudan. Seeing that this was the first plant of its kind (with parabolic reflectors), the success achieved is highly satisfactory. Unfortunately such a plant could not be used for electric lighting without complete storage, but it could be used for the supply of electric power in tropical countries under suitable conditions.

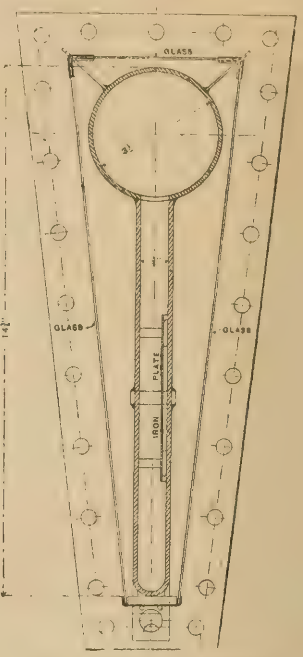


Fig. 2.—Section of Boiler.

Switching Competitions.—On previous occasions we have drawn attention to the electric light switching examinations initiated by Messrs. A. P. Lundberg & Sons, who, as the inventors and makers of a great variety of tumbler switches, are in a exceptional position to deal with the subject of tumbler-switch controls. The operation of switching a lamp on or off seems simple enough ; there is "nothing in it," yet, we understand, there are no fewer than a dozen or more types of tumbler switch available for use in connection with incandescent lamps. Many engineers would be somewhat puzzled if suddenly called upon to enumerate the conditions calling for the use of each of these types. It is, however, one of the most admirable qualities of the electric light that it lends itself to niceties of distant control that are absolutely unique, and it would be a pity to neglect this valuable feature of the system simply to save a little trouble and thought. Messrs. Lundberg, therefore, are to be congratulated upon their enterprise in instituting examinations for the purpose of developing the knowledge of this subject and educating electrical men to realisation of its possibilities, whereby they are also benefiting the electrical industry as a whole. The results of their latest competition are set forth in our advertisement pages to-day, and it will be noticed that the most successful competitor, appropriately enough is a member of the Illuminating Engineering Society.

WAGES OF WIREMEN IN THE MANCHESTER DISTRICT.

THE MANCHESTER, SALFORD AND DISTRICT BUILDING TRADES' EMPLOYERS' ASSOCIATION.

Working Rules for Electrical Wiremen and Cable Jointers for Manchester, Salford and District.

1. *Wages.*—The minimum rate of wages for qualified electrical viremen and cable jointers shall be 9½d. per hour. Any extra for harge-hands to be mutually arranged between employer and harge-hand.

2. *Hours of Labour.*—The ordinary working week shall not xceed 52 hours; 9½ hours to constitute a maximum day for the irst five days of the week, and 4½ on Saturdays.

3. *Overtime.*—Overtime rates not to count until full time for the lay has been made, this provision not to apply unless the loss of ime is through the workman's own fault. Payments for overime to be as follows:—First two hours, time and a quarter; econd two hours, time and a half; afterwards, until starting time ext morning, double time. When overtime is required, the uestion of taking meals to be arranged between employer and vorkman. Ordinary meal times to be deducted. Overtime in all ases to commence at the usual times for ceasing work. Sundays, hristmas Day and Good Friday also double time.

4. *Night Gangs.*—Men employed on night gangs to be paid at he rate of time and a quarter between the hours of 6 p.m. and a.m.

Meal times for night gangs to be arranged between employer nd workman, and ordinary meal times to be deducted.

5. *Boundary.*—The boundary shall be a radius of one mile from he Manchester Town Hall (main entrance). All men when workng within the boundary shall commence and finish work at the sual times. When required by the employer or his representative o travel between the shop and the job, or *vice versa*, men shall be aid travelling time and fares. This provision also to apply to ule 6.

6. *Travelling Expenses.*—All men working beyond the boundary nentioned in Rule 5, but within a radius of 5 miles, shall be paid ravelling expenses at the undermentioned rates in lieu of ravelling time and fares:—1 to 2 miles from Town Hall, 3d. per ay; 2 to 3 miles from Town Hall, 5d. per day; 3 to 4 miles from 'own Hall, 8d. per day; 4 to 5 miles from Town Hall, 10d. per ay. All men, when paid travelling expenses, to be on the job at he usual starting and stopping times.

7. *Country Work.*—All men sent from this district beyond the istances stated in Rule 6, to be paid travelling time each way at he ordinary rates and railway fares.

When required to lodge away from home, an addition of 1s. 6d. er night to be allowed for lodgings (Sundays included).

Return railway fares only to be allowed every two weeks when vorking within 20 miles; over 20 miles and up to 50 miles, every nonth; over 50 miles, every three months.

In exceptional cases, such as breakdowns, &c., men required by he employer to travel outside the ordinary working hours shall be aid railway fares and travelling time at the rate of time and a uarter.

8. *Apprentices.*—No employer shall engage additional apprenices whilst the total number shall exceed one-third of the journeynen employed by him, taking an average over three years.

9. *Discharge.*—Should an employer require to discharge a worknan, or a workman desire to leave his employment, one hour's otice shall be given on either side, or one hour's pay in lieu of uch notice (except in cases of misdemeanour), which shall be added o or deducted from the workman's wages at the time of payment.

10. *Society or Non-Society Men.*—Whilst agreeing not to place ny obstacle in the way of men joining the Union, employers do ot agree to employ Union men only.

11. *Tools.*—Each qualified workman to have a full kit of tools, omprising:—Pair cutting pliers; pair gas pliers; heavy and ght hammers; two gimlets; ratchet brace and four shall and two wist bits; 2-ft. rule; four Firmer chisels; tenon saw; 2-lb. oldering iron; half-round file; large, medium and small screwrivers; two plugging chisels; two bradawls; square; plumb bob nd line; small plane; key-hole saw; gouge; small footprint.

12. *Dirty Work.*—That extra payment be made to men when ngaged on work, as follows:—(*a*) Mines, pits and old ship epairs (except oil vessels after carrying oil), 6d. per day; (*b*) hemical works, accumulator works, paint works, riverside prenises and docks, where the conditions are abnormal, 6d. per day;) oil vessels after carrying oil, cleaning out or repairing old ccumulators, 1s. per day.

13 *Disputes.*—No strike or lock-out to take place under any ircumstances until the matter in dispute has first been referred to joint committee of employers and operatives, who shall meet rithin six days and endeavour to settle. Should they fail, the ame shall be referred to an umpire to be mutually agreed upon by e said committee. Wherever practicable, current conditions to revail pending reference to the committee or umpire.

14. *Definition.*—A qualified electrical wireman and cable jointer nust be over 21 years of age, able to produce indentures of pprenticeship or references proving not less than five years' emloyment in general electric contracting work, or, alternatively, nust produce a certificate from some recognised authority.

15. *Alterations to Rules.*—No alteration shall be made in these les, either by employers or workmen, without giving six months' notice in writing, such notice to expire on the 1st day of May in any year.

When notice for alteration is received by either side, 14 days shall be allowed after the receipt of such notice in which to submit counter proposals, if necessary, which shall be accepted as being in order.

We, the representatives of the Manchester, Salford and District Building Trades Employers' Association on the one hand, and the Electrical Trades Union on the other, pledge our respective societies to maintain and carry out the aforesaid joint rules in each of our respective associations and societies.

Signed this 9th day of April, 1914.

On behalf of the Manchester, Salford and District Building Trades Employers' Association (Electrical Branch).
JOHN LIGHTFOOT, Chairman.
L. E. WILSON, Vice-Chairman.
JAMES DENVER, Secretary.

On behalf of the Electrical Trades Union.
WILLIAM C. MCKAY, Chairman, District Committee.
J. ROWAN, General Secretary.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

8,620. "Sparking plugs for internal combustion engines." T. MCCLEMENTS. April 6th.

8,629. "Process for the electrodeposition of iron." S. O. COWPER-COLES. April 6th.

8,630. "Driving band for projectiles." S. O. COWPER-COLES. April 6th.

8,631. "Process and apparatus for polishing metal sheets, plates and the like." S. O. COWPER-COLES. April 6th.

8,671. "Apparatus for lighting and extinguishing lamps at a predetermined time." A. C. A. BOUCHARD. April 6th. (Convention date April 4th, 1913. Belgium.) (Complete.)

8,683. "Method of repairing the hub of a broken electric incandescent lamp. ELECTRIC UTILITY CO., LTD. and R. W. LONG. April 6th.

8,684. "Manufacture of incandescent electric lamps." ELECTRIC UTILITY CO., LTD. and R. W. LONG. April 6th.

8,695. "Electrical connections." SOC. ANON. LE CARBONE. April 6th. (Convention date, April 7th, 1913, France.) (Complete.)

8,699. "Electro-dynamic apparatus for driving machines." B. GRAEMIGER. April 6th. (Convention date, May 26th, 1913, Switzerland.) (Complete.)

8,700. "Electro-dynamic apparatus for driving machines." B. GRAEMIGER. April 6th. (Convention date, January 10th, 1914, Switzerland.) (Complete.)

8,717. "Electric regulating devices." BRITISH THOMSON-HOUSTON CO., LTD. and D. E. JEWITT. April 6th.

8,718. "Electric switches." BRITISH THOMSON-HOUSTON CO., LTD. and G. J. RALPH. April 6th.

8,719. "Electric heating and cooking devices." R. SPRENGER. April 6th. (Convention date, April 7th, 1913, Germany.) (Complete.)

8,757. "Plugs and switches for electric current." R. M. H. RANDELL and L. G. LANE. April 7th.

8,789. "Electro-deposition of metals." S. O. COWPER-COLES. April 7th.

8,790. "Electro-deposition of iron." S. O. COWPER-COLES. April 7th.

8,794. "Duplex connection for two telephone lines connected with a relay for reinforcing telephone currents." P. L. M. DRUMAUX. April 7th. (Convention date, October 23rd, 1913, Belgium.) (Complete.)

8,795. "Projectile and process of manufacturing the same." S. O. COWPER-COLES. April 7th. (Complete.)

8,798. "Electrical machines." D. F. JUAN. April 7th.

8,800. "Circuit arrangements for telephone systems." SIEMENS & HALSKE AKT-GES. April 7th. (Convention date, April 7th, 1913, Germany.) (Complete.)

8,804. "Electric welding." E. H. JONES and LIGHT STEEL TUBULAR WHEELS, LTD. April 7th.

8,806. "Holders for electric glow lamps." C. A. SCHAEFER. April 7th. (Convention date, April 15th, 1913, Germany.) (Complete.)

8,807. "Holders for electric lamps." C. A. SCHAEFER. April 7th. (Convention date, January 2nd, 1914, Germany.) (Complete.)

8,814. "Electrically heated instruments." J. A. CHAPMAN. April 7th. Convention date, May 6th, 1913, United States.) (Complete.)

8,821. "Electric cut-outs." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) April 7th.

8,828. "Electric cables." J. F. WATSON and CALLENDER'S CABLE & CONSTRUCTION CO., LTD. April 7th.

8,831. "Telephonic systems." E. A. GRAHAM and E. A. SANFTLEBEN. April 7th. (Addition to 767/14.) (Complete.)

8,841. "Electric cables." J. F. WATSON and CALLENDER'S CABLE & CONSTRUCTION CO., LTD. April 7th.

8,842. "Electric cables." W. F. PRICE and CALLENDER'S CABLE & CONSTRUCTION CO., LTD. April 7th.

8,855. "Electric lighting systems of motor-cars." B. BROOKS and W. HOLT. April 8th.

8,880. "Road vehicle electric lamps." J. LAWRENCE and HOWES & BURLEY, LTD. April 8th.

8,881. "Microphones and the like." E. B. BADCOCK. April 8th.

8,889. "Motor-starting switches, rheostats, and the like." SIEMENS BROS. DYNAMO WORKS, LTD. & E. SCHUPP. April 8th. (Complete.)

8,904. "Electro-mechanical movements." W. M. MORDEY. April 8th.

8,906. "Telephonic systems." E. A GRAHAM, W. J. RICKETS and E. A. SANFTLEBEN. April 8th. (Addition to 6,356/14.) (Complete.)

8,916. "Electrical regulation devices." R. BOSCH (Firm of) and G. HONOLD. April 8th. (Addition to 27,961/12.) (Complete.)

8,931. "Magnetos and other electric generators." A. KELLER-DORIAN. April 8th. (Convention date, April 14th, 1913, France.) (Complete.)

8,943. "Apparatus for indicating the lighting and extinguishing of electric lamps." F. O. SCHROEDER. April 8th.

8,946. "Automatic or semi-automatic telephone systems." G. A. BETULANDER, N. G. PALMGREN and O. GRAHN. April 8th. (Complete.)

8,947. "Resistance elements applicable to electric lamps, electric heaters, and other purposes." J. R. QUAIN. April 8th.

8,957. "Controlling devices for alternating current circuits." Igranic Electric Co., Ltd. (Cutler Hammer Mfg. Co., United States.) April 9th. (Complete.)

8,973. "Electric filament lamps." S. Johnson. April 9th.

8,982. "Electrical wiring installations." Concordia Elektrizitats Akt-Ges. April 9th (Convention date, April 12th, 1913, Germany.) (Complete.)

8,985. "Alternating-current motors." J. Lecoche. April 9th.

8,990. "Galvanometer for detecting and measuring physiological, geological, aerial and other electric currents." W. H. Meredith. April 9th.

9,021. "Automatic electric signs." R. Grose. April 9th.

9,030. "Electrical machines." Don F. Juan. April 9th.

9,035. "Electric switches." J. H. Tucker and J. A. Crabtree. April 9th.

9,054. "Self-luminous electric switch button and the like." W. Springmann. April 9th.

9,056. "Methods of and apparatus for shaping filaments." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) (April 9th.)

9,065. "Method and means for protecting apparatus on alternating-current systems." A. G. Collis and Crompton & Co., Ltd. April 9th.

9,092. "Electric relay systems." H. de Forest Arnold. April 9th. (Addition to 29,384/12.) (Complete.)

9,093. "Alternating-current electromagnets." R. Waygood & Co., Ltd., H. P. Amphlett and H. C. Walker. April 9th.

9,103. "Circuit arrangements for telephone systems." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt-Ges, Germany.) April 9th. (Addition to 22,013/10.) (Complete.)

9,104. "Magnetos for motor-cycles." A. Garelli. April 9th. (Complete.)

9,105. "Telephone exchange circuits." Siemens Bros. & Co., Ltd. (Siemens and Halske Akt-Ges, Germany.) April 9th. (Addition to 4,698/12.) (Complete.)

9,109. "Electrical distributing switches." F. S. Gauntlett. April 9th.

9,110. "Incandescent electric lamps." C. Gladitz. April 9th.

9,123. "Joints for metallic conduits for electric cables." Simplex Conduits, Ltd. and L. M. Waterhouse. April 11th. (Complete.)

9,134. "Electrically controlled block systems for railways." J. Sayers, W. C. Achfield, G. Salt, and B. W. Cooke. April 11th.

9,175. "Apparatus for controlling the lighting power of an electric lighting plant." Soc. Anon. des Automobiles et Cycles Peugeot. April 11th. (Convention date, April 10th, 1913, France.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

29,057. Printing Telegraphs. E. C. R. Marks (General Engineering & Construction Co.). December 17th.

1913.

1,505. Electrically Operated Steering-gear. British Thomson-Houston Co. (General Electric Co.). January 18th.

4,635. Advertising Devices and the like. H. K. Harris. February 24th. (Patent of addition not granted.)

4,779. Receiving-apparatus for Wireless Telegraphy. F. J. Chambers. February 25th.

6,122. Interrupters for Electric Circuits. A. Pollak. March 12th. (March 20th, 1912.)

6,371. Electric Regulating Switches. L. Miller & L. Boothman. March 14th.

6,421. Means for Operating upon Earthenware, Chiefly in the Production of Electric Insulators and the like. H. L. Doulton & H. Morris. March 15th.

6,799. Electric Transformer Arrangements. British Electric Transformer Co. & R. Crosbie-Hill. March 19th.

6,817. Electric Cables. A. T. Mirza. March 19th.

6,873. Electrical Switches. British L.M. Ericsson Manufacturing Co. and A. G. Rogers. March 20th.

6,887. Automatic Morse-recorder. W. B. Good & Rebesi, Ltd. March 20th.

6,900. Means for Protecting Direct-current Working Electrical Instruments from being Operated by Extraneous or Unauthorized Currents which may reach the line to the instrument by accident or design. R. Dormer. March 20th.

6,950. Electric Dry Batteries. C. Stern. (Hubert.) March 20th.

7,125. Test Circuit Arrangements for Telephone Systems. Siemens Bros. & Co. & W. H. Grinstead. March 25th.

7,127. Circuit Arrangements for Telephone Exchanges with Automatic Selecting Devices. Siemens Bros. & Co., and T. Pettigrew. March 25th.

7,156. Dynamo Regulators. W. J. Mellersh-Jackson. (Egyuem.) March 25th.

7,211. Motor-car Lamps. R. H. Matzke. March 26th.

7,244. Supports for Electric Lamps. H. Wade. (Schneider & Naujoks Elektrizitâts Ges.) March 26th.

7,246. Electric Lamp Fittings. H. Wade. (Schneider & Naujoks Elektrizitâts Ges.) March 26th.

7,282. Engine Starting Devices. S. I. Prescott. March 27th.

7,305. Overhead Conductors for Electric Traction Systems. K. D. Bowen & Cedes Electric Traction, Ltd. March 27th.

7,369. Switches for Electrically Operating Planing Machines and the like. Lancashire Dynamo & Motor Co. & W. Hargreaves. March 28th.

7,411. Flame Arc Lamps. G. E. Tate & F. O. Monkhouse. March 28th.

7,396 Self-inductances or Tuning Coils. Graham & Latham, Ltd., and B. F. Sobotka. March 28th.

7,592. Lamp Covers W. S. Sholl. March 31st.

7,600. Dynamo-electric Machines. British Thomson-Houston Co., F. H. Clough, and L. Dunker. March 31st.

7,610. Transmitting Apparatus for Use in Wireless Telegraphy and Telephony. G. Marconi and C. S. Franklin. March 31st.

7,977. Detectors for Use in Wireless Telegraphy. Graham & Latham, Ltd., and L. J. Graham and B. F. Sobotka. April 4th.

9,144 Fuses or Cut-outs for Electric Circuits. C. W. Cox. April 18th.

9,166. Observation Circuits of Telephone Systems. Siemens Bros. & Co., and D. A. Christian. April 18th.

9,449. X-Ray Tubes and the like and the Manufacture thereof. C. E. Friedrich. April 22nd.

10,004. Electric Incandescent Lamp Holders. H. T. Wilkinson. April 29th.

10,036. Apparatus for the Direct Conversion of Heat into Electricity. J. Gyuris & Allois Schlesinger (Firm of). April 29th.

10,252. Substitution Resistances for Electric Lamps. W. Heins. May 1st. (March 11th, 1913. Addition to 9,530/13.)

10,685. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt.-Ges. May 6th. (May 6th, 1912.)

10,304. Electric Arc Lamps. British Thomson-Houston Co. (General Electric Co.). May 1st.

11,057. Electric Time Switches. H. F.-J. Thompson & J. H. Bowden. May 10th.

11,755. Electric Ceiling Roses. G. Markt. May 20th. (Cognate Application, No. 24,586/13.)

12,404. Means for Securing Shades, Reflectors, or other Attachments to Electric Lamp Holders and the like. G. St. J. Day. May 28th.

12,651. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt.-Ges. May 30th. (July 8, 1912.)

12,839. Indicating Appliances for Electric and other Measuring Instruments. British Thomson Houston Co. and F. Holden. June 2nd.

13,023. Form of Electric Dimming Switch. L. Hulbert. June 5th.

13,249. Electric Light Fittings. G. Vale and R. H. Best. June 7th.

13,587. Automatic Adjustable Electrical Overload Circuit Breakers. H. T. Holmes & J. Kemp-Welch. June 12.

13,656. Systems of Electric Distribution. British Thomson-Houston Co. (General Electric Co.) June 12th.

13,684. Magnetic Compasses for Ships' Boats or the like. C. A. Bartlett & T. W. Bruce. June 13th.

14,071. Electric Arc Lamps. A. H. Railing and A. E. Angold. June 18th.

14,083. Magnetic Compasses and like Instruments. E. W. Barker. June 18th.

14,384. Apparatus for Indicating the Approach of Trains. T. Gibson, G. A. Farmer & E. Read. June 21st.

15,086. Connections for Electric Tariff Meters. C. G. Lundgren. June 30th.

15,148. Securing of Windings in Dynamo-electric Machines. Siemens Bros. Dynamo Works, Ltd., C. A. B. D. Koettgen and E. O. Kieffer. July 1st.

15,293. Apparatus for Producing Sulphuric Acid. British Thomson-Houston Co. (General Electric Co.). July 2nd.

15,327. Lead Accumulators. G. C. Dymond. (Marquise des Ligneris.) July 3rd.

16,467. Miners' Safety Lamp. F. Faerber. July 17th.

16,691. Electric Water-gauges. J. Rajczy. July 21st.

16,985. Apparatus for Uniformly Heating Interior Cavaties of a Living Body by Electro-diathermic Treatment. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). July 24th.

17,268. High Speed Rotors for High-frequency Multipolar Electrical Machinery. R. Goldschmidt. July 28th. (Addition to 10,507/12.)

17,490. Process for Heating Articles in Electric Furnaces. F. Fischer. July 30th. (November 5th, 1912.)

17,584. Vents for Electric Accumulator Cases and Other Receptacles. H Lucas & O. Lucas. July 31st.

17,607. Spark Discharges for the Ignition Systems of Internal-Combustion Engines and for Other Purposes. R. Varley. July 31st.

18,160. Telephone Locking System. W. A. Morse & A. M. Morse. August 9th.

19,212. Multiple-way Insulating-Sleeve as Separator between Conductors on Cable Joints. R. B. Mitchell & F. J. Cooper. August 25th.

19,743. Apparatus for Controlling from a Distance and for Regulating the Speed of the Propelling Turbines of a Ship. Soc. Anon. Italiana Gio. Ansaldo & Co. September 1st. (October 10th, 1912.)

19,916. Electric Lamp Sockets. E. P. Le Compte and C. W. Hodgson. September 3rd.

20,195. Bonding Clamp for Metal-Sheathed Electric Wires and Cables. W. T. Henley's Telegraph Works Co. & W. F. Bishop. September 6th.

20,300. Method of Packing the Joints of Metal Vapour, Alternating Current Rectifiers and other Vacuum Apparatus. E. Hartmann. September 8th. (September 21st, 1912.)

20,577. Trough or Channel Reflector Electric Light Devices. J. P. Child. September 11th.

23,013. Fume-Condensing Attachment for Arc Lamps. H. G. Dyer & C. S. Adams. October 11th.

23,321. Theatrical or Stage Illusion. L. McCormick. October 15th.

24,017. Electric Driving Mechanism for Rotary Printing Presses and Paper Calendering Machines. Siemens-Schuckertwerke Ges. October 23rd (October 23rd, 1912.)

24,777. Connections and Fittings for Electric Conduits. C. Birch. October 31st.

25,465. Colletor Brushes for Electrical Apparatus. W. Christie (Galvanische Metall-Papier Fabrik Act.-Ges.). November 7th.

25,586. Electrical Candle Lamps. A. E. Watson & Veritys, Ltd. November 8th.

25,666. Electric Light Pendants. F. Dehler. November 10th. (February 15th, 1913.)

25,975. Method of and Means for the Electric Transmission of Signals and Speech in Mines. R. Haddon (Reineke.) November 12th.

26,060. Electrical Devices for Operating Door-sashes of Automobiles and other Vehicles. J. F. P. De La Riboisiere. November 13th. (December 21st, 1912, Addition to 15,648/13.)

27,543. Arrangements for the Conversion of a Periodically Variable Movement of Small Energy into a Movement of Great Energy Taking Place According to a Similar Law. Fried. Krupp Akt-Ges. November 29th. (January 2nd, 1913.)

27,875. Electricity Meters. Korting & Mathieson Akt-Ges. December 4th (May 16th, 1913.

28,734. Galvanic Cells. J. Zaruba & Co. December 12th. (December 13th, 1912.)

30,082. Accumulators and Electrodes Therefor. Svenska Ackumulator Arktiebolaget Jungner. December 31st. (December 31st, 1912.)

1914.

945. Electric Time Switches. J. E. H. Beraud. January 13th. (January 23rd, 1913.)

1,119. Electrical Accumulators. C. De Sedneff. January 15th. (Divided application on 1,066/13. January 14th.)

5,414. Electrode-Holders for Electric Furnaces. Fried. Krupp Akt.-Ges. March 3rd. (December 13th, 1913.)

5,501. Means for Operating upon Earthenware, Chiefly in the Production of Electric Insulators and the like. H. L. Doulton & H. Morris. March 4th. (Divided Application on 6,421/13. March 15th.)

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VOL. LXXIV. MAY 1, 1914. No. 1,901.

ELECTRICAL REVIEW.

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SENGHENYDD EXPLOSION.

TOWARDS the end of last week the Home Office issued a Blue Book containing the reports of Mr. Redmayne, H.M. Chief Inspector of Mines, and the assessors, Mr. Evan Williams (chairman of the South Wales and Monmouthshire Coalowners' Association) and Mr. Robert Smillie (president of the Miners' Federation of Great Britain), on the causes and circumstances attending the explosion which occurred at the Senghenydd Colliery last October. This disaster resulted in a loss of 440 lives, including the death of one man the day after the explosion, consequent upon a fall of stone whilst he was engaged in rescue operations.

In Mr. Redmayne's summary of his report he says:—

> After carefully weighing the facts revealed by the evidence of the various witnesses and from my own personal investigations underground . . . . . I have come to the conclusion that there is strong probability of the explosion having originated on the Mafeking incline, and that it was preceded by an occurrence similar to that which took place further outbye in the Mafeking return in October, 1910, namely, by heavy falls liberating a large volume of gas. These heavy falls exposed seams of coal and beds of hard rock, and an outburst of gas may have come away at one of them. The only apparent means of ignition would be sparks from the *electric signalling apparatus*, or from rocks brought down from the fall, and we know that explosions have been originated by both these causes. The only other possible means of ignition were safety lamps or matches. The difficulty in regard to the former is that no lamp was found in the place, and even were a broken lamp found under a fall, there would be the inference that it may have been broken by the fall. There were, however, lamps lower down the heading, but there is no evidence pointing to any of them having been the igniting cause of the explosion. In respect of matches. . . . a rigorous search of the persons descending the mine was being carried out daily, and the possibility of a match being the igniting cause is, in my opinion, remote.

The italics are ours, and in view of the fact that we have on previous occasions expressed the opinion that the signalling apparatus did not originate the explosion, the expression of opinion by Mr. Redmayne to the opposite effect is a little disconcerting; frankly, we are both surprised and disappointed, as the bulk of the evidence given at the inquiry seemed to show that the explosion originated at an open lamp at the lamp station. We do not by any means wish to assert that sparks from signalling wires will not ignite mine gas—far from it—as experiments have been carried out which prove that it will do so, but in this particular case we maintain that this was not the cause. The view expressed in Mr. Redmayne's report is really the theory of Dr. Atkinson, H.M. Divisional Inspector for South Wales, who said:—

> If the explosion originated on Mafeking Incline, the question is how it was caused. There were very heavy falls of road, exposing seams of coal and beds of hard rock, and an outburst of gas may have come away with one of these falls. If this occurred, the only apparent means of ignition would be by a spark from the electric signal wires or sparks from rocks brought down by the fall.
>
> This theory is not advanced as a positive conclusion. Neither sparks from signal wires nor sparks from falling stones are very probable means of ignition, although I have no doubt that some explosions have been initiated by both these causes; and if the explosion commenced on Mafeking Incline, these are the only means of ignition I can suggest.
>
> Although the experiments with electric signal wires did not prove that sparks at the voltage said to be in use on the incline would ignite firedamp, the margin is too small to convince me that it is impossible.

Mr. Redmayne then somewhat adversely criticises "the rescue operations," "the state of the mine prior to the explosion," "fireman's reports and fireman's districts," and alleges several breaches of the Mines Act, 1911, and regulations under the Act, of which we may have something to say on another occasion when we deal more fully with the report, but Mr. Evan Williams, who presents a somewhat lengthy report, says :—" I regret I am unable to subscribe to Mr. Redmayne's report owing to my differing from him in greater or less degree upon several material points," and on the question as to the origin of the explosion he says :—

> The only two places suggested as possible seats of origin of the explosion are the Mafeking hard heading and that portion of the Main Lancaster Level between the No. 1 North and the lamp station. Wherever it took place, there must have been an outburst of gas which came in contact with a flame, large, like that of a lamp, or small such as a spark, but containing sufficient heat energy to ignite it, bringing about a gas explosion.
>
> To my mind the evidence is quite conclusive that the characteristics of the installation were such that no spark capable of igniting gas could have been produced. There is another point which seems to me to bear upon this question, as far as the signalling apparatus . . . is concerned. From my own observations underground, as well as from the evidence, I am satisfied that the positions of the journeys at the top and bottom of the incline were such that *no signalling could have been going on* when the explosion occurred.

In conclusion, Mr. Williams says :—

> Believing as I do that the explosion was caused by an open lamp in the lamp cabin, I think that the new lesson to be learnt from this disaster is that in mines which are dry and dusty and liable to . . . . . outbursts of gas, no open light and no unlocking or opening of safety lamps should be permitted underground.

In assigning the value of a report one must have regard to the position and experience of the author, and in Mr. Williams we have an experienced mining engineer, not only conversant with all the local difficulties and conditions affecting that particular coalfield, but who has also the responsibility of carrying on mining operations from the financial point of view, and whose interest in mining is, therefore, more than merely academical ; for these reasons we are inclined to regard Mr. Williams's views as being much more reasonable and practical.

With regard to Mr. Smillie's report, he, in the main, agrees with Mr. Redmayne, but disagrees with both Mr. Redmayne and Mr. Williams on the question of reversal of the air current, supports the evidence of a witness named Thornton, a collier, who evidently made some rash statements, says the hours of the fan enginemen—who, as a rule, have nothing whatever to do—were too long, and asserts that the districts in charge of the fireman were too large. It is really very difficult to see how Mr. Smillie's position as an assessor on an important technical inquiry like this is justified.

Returning for the moment to signalling with bare wires, we may point out that this system was used in mines all over the country for years before the general introduction of electricity for lighting and power purposes, and it seems strange that its liability to cause an explosion has never been seriously thought of until now ; even with the experiments carried out during this inquiry, the question is still so undecided that Mr. Williams suggests " that the Government should at once carry out an exhaustive series of tests with a view to determining what may and may not be permitted to be used in mines liable to outbursts of gas," and " this system of electric signalling with bare wires possesses, in its simplicity, ease and quickness of manipulation, and its reliability, so many practical advantages over all others, that its prohibition would, I am convinced, lead to a big increase of accidents upon haulage roads, and the objection to visible sparks incapable of igniting gas is sentimental only."

We agree with Mr. Williams, and trust that the outcome of this inquiry will not be some Home Office panic regulation relating to electrical signalling in mines with bare wires, but we certainly think that it would be to the advantage of both owners and workmen if the oil lamp could be dispensed with as far as possible, and electric lamps substituted in their place for carrying on the work of the mine, limiting the oil safety lamps to officials whose duty it is to test for gas. Then we may hear less of electricity being the cause of explosions, for the very simple reason that the likeliest cause of all explosions is the so-called " safety " lamp.

On Travelling at Home and Abroad.

A short time ago some correspondence appeared in these pages concerning the place filled by the commercial traveller in modern industry. The discussion was started by one who thought that travellers of the usual kind were a needless burden in the case of so complex and specialised an industry as electrical engineering ; the writer seemed to see merely the need for technical men and principals, and was shocked at the cost of competing firms keeping innumerable travellers on the run after contracts that were known to be going. But, interesting as all this may be for the purposes of discussion, it weighs but little in the estimation of firms engaged in practical business, who know well enough that the race is not to him who falls out of the running, and that out of sight may also mean out of mind. Correspondence, advertising, periodical visits of principals, all of these are essential means of keeping one's business up to that standard of efficiency and in that state of activity that will maintain a desirable reputation. Firms have we known who fell into disfavour because they failed to attend properly to correspondence ; others through a persistent non-advertising fit or policy have led to questionings as to whether they were still in business ; and yet others have stood far lower in the industrial scale than they need have done because their principals or managers have not felt inclined to leave things to associates or subordinates the while they themselves were handshaking with possible clients or studying the markets of the world. But not all of these means combined can enable average businesses to dispense with the work of the plodding commercial traveller. We know that he is often looked down upon, but often enough he " makes good " better than the scorner, and he is an essential part of our industry. If he be entirely non-electrical he has many pitfalls awaiting both himself and his firm, but we do not believe that in the electrical industry to-day there are very many men of this stamp " on the road." The opportunities for securing enough electrical knowledge to make him more " fit " as an electrical commercial traveller are varied and numerous, and he does well to avail himself of them sufficiently to over-pass that line where " a little learning is a dangerous thing." But the man who has set out at the beginning to secure an electrical training has, in many cases, found it attractive to turn his thoughts to commerce and industry, and he requires to add business knowledge and ability to his technical attainments at a certain stage, just as the " commercial " must, to some extent, qualify electrically in order to reach the standard of efficiency required for securing a successful career.

Sir Horace Marshall, at the annual dinner of the Commercial Travellers' Benevolent Institution held last week, said a good word for the class of men concerned in that organisation. " The place of the commercial traveller in the great scheme of commerce was the place of the shuttle in the loom, whose journeys to and fro built up the useful fabric. He was indispensable. 'The Romance of Business' was a common phrase to-day ; but that romance did not take the stage unless the commercial traveller was busy behind the scenes." " It was certain that most people who were enjoying success in commercial life had found a commercial traveller necessary to that success."—(*Times.*) Of course results vary largely according to your man, personality and courteous and timely persistency counting for a great deal. Many great commercial schemes have been planned around one man because of his sterling qualities ; but for the man there would have been no scheme.

In these days, when the electrical industry is so largely concerned with foreign trade connections, the dispatch of highly-qualified ambassadors is a matter of supreme importance. A few years ago, as a result of a newly-aroused interest in foreign trade, for which we were in some part responsible, many leaders in British electrical and engineering industries saw the wisdom of personally visiting Colonial and foreign markets. Some of them came back laden like Caleb and Joshua with the grapes, and thought the risks of meeting giants, in the shape of international commercial rivals, should not suffice to lead us to limit our efforts to home.

It occurs to us that the time is now ripe for more of these visits in the interests of British electrical trade ;

every experienced foreign trader knows the importance of re-visiting a market with reasonable frequency in order to keep his memory green. Some of our works are chock-a-block with work for a year or two to come, but others are not, and whether there is or is not any reason to fear a slump in general trade we do well to be active and alert in those parts of the world where business is going. In this connection we would draw our readers' attention to Blue Book Cd. 7,031 [9d.], just issued by the Government Stationery Office, wherein are given particulars of the regulations in force in the various Colonial and foreign countries with regard to British commercial travellers. To every firm doing business abroad and sending out travellers the information given herein is of great reference value.

Wanted: A Sign.

The old saying about undue familiarity breeding contempt has been again and again exemplified among workers engaged in the neighbourhood of live electrical apparatus. The word "Danger," and the representation of a skull and cross bones, answer for a time, but the emphasis which they bring to the mind when new does not continue; sometimes, unfortunately, a new meaning seems to be given to the warning after there has been an accident, but reports of inquests and inquiries show how easy it is to become heedless of dangerous surroundings, to neglect facilities provided for one's protection, and to run unnecessary risks due, probably, to absent-mindedness, thoughtlessness, or a prepossession with the piece of work in hand. It matters little what regulations we may impose or what warnings or signs we display, these weaknesses like the poor, will be always with us, but that does not relieve us of the duty of conceiving and adopting the most reasonable and efficient measures for ensuring safety. We have been asked by a correspondent who is thoroughly conversant with the conditions obtaining in electrically-equipped collieries and industrial works whether we can suggest other signs or mottoes besides the skull and bones and the word "Danger." It occurs to us that a number of our readers might be able to offer from their practical experience suggestions which would be of value. What is wanted is something which, while it will not put the worker into a morbid frame of mind, will occasionally give him a shudder or a cold shiver down his back—to how many men does the skull and cross-bones do that after a few days' familiarity?

We have no doubt that many other warning mottoes and signs are in use, and while some of them may possess a value more local than general, it would be interesting to hear of them and to record the experiences of workers who have observed their effects either upon themselves or upon their *confrères*.

Rubber.

The rubber auctions last week, at which about 1,350 tons of plantation grades were offered for sale, opened with a firm tone, and the best sorts marked an advance during the earlier proceedings, finest crepes showing an advance of 2d. to 2½d. a lb., and smoked sheets a gain of 1½d. to 2d. a lb., with a pretty brisk demand, but on the second and third days there was a very sharp reaction, trade buying falling off notably, and the easier tone was assisted by reports as to impending very large arrivals. As a result the greater part of the initial advance was lost as regards fine crepes, which sold down to 2s. 6¼d. a lb., compared with 2s. 10¾d. on April 21st, closing at about 2s. 7½d. There has lately been some scarcity of the fine crepe descriptions, and, in consequence, prices of this variety have been exceptionally well maintained at an unusually good premium, the production of this sort having been comparatively neglected in favour of smoked sheets. Something like a moderate degree of scarcity thus became developed in the former, and there had been some speculative selling a time ago, which sales had eventually to be covered, all of which helped the price upwards. The quantities of plantation rubber generally coming to hand have been liberal, but have also been very well taken up by the trade, while, as a rule, consumers have not been buying in anticipation of requirements, limiting their purchases to the supply of near needs. Their unfortunate experiences of the boom year have effectually stifled any disposition to buy largely for forward delivery, unless there are clear indications that things are improving as regards trade, and this cannot be said to be the case at the present time. At present there is a pretty good opinion held as to the prospects, especially from the point of view of the cheaper producers, and those which are capitalised at a reasonable figure per acre.

A correspondent of the *Times* recently wrote at length upon this matter, asserting that "it is somewhat curious that there is still a wide-spread belief in the danger of the production of plantation rubber outstripping consumers' demands. There seems to be in reality no such danger, at least until the present planted area has been largely increased, and the increased area brought into bearing." It is probably true that no extended planting programmes are likely to be formulated for a good while to come, and meantime there is a steady reduction in the tonnage of wild rubber being harvested. Last year, certainly, the consumption of rubber generally was in excess of the output, but in considering the position at present it must be remembered that this year trade in all directions shows evidences of reaction, and this introduces a new factor which is bound to tell, though how far it is impossible at present to see.

Official information is to the effect that the exports of plantation rubber from the Federated Malay States during March were 2,418 tons, compared with 2,364 tons in February, and 2,542 tons in January, the total for the three months 7,324 tons, comparing with 6,525 tons for 1913, and 3,809 tons for 1912. The exports for February from the Amazon basin were 5,120 tons, against 4,500 tons in February, 1913. It is a matter of considerable interest to users of rubber to know that the Rubber Research Committee of Ceylon, in co-operation with the Ceylon Department of Agriculture, have made arrangements with the Imperial Institute to conduct a series of investigations which are expected to afford definite knowledge as to the effect of different methods of preparation on the quality of plantation rubber. With this purpose in view, a laboratory has been installed at the Imperial Institute, and the work taken in hand in a thorough way. A further rather interesting matter is that the question of the standardisation of rubber is said to have been solved by the forwarding to Great Britain of latex direct from the trees for coagulation and treatment generally, an evenness of grade and quality being thereby procured, so it is claimed, which are unattainable by any other process.

Some Rules for Arbitrators.

At the conclusion of a paper on "The Arbitration Clause," which he read before the Society of Architects on April 16th, Mr. W. Valentine Ball enumerated a few maxims which, he thought, might be of practical use. They were embodied in a series of "Don'ts," which we venture to reproduce, as they may be of service as reminders to those of our readers who are called upon to act as arbitrators:—

Don't have lunch with one party only during the course of an arbitration.

Don't have any communication, written or verbal, with either party without the knowledge of the other.

Don't forget that patience is a branch of justice.

Don't blame the advocate for being too long-winded, it is a way he has; and very often counsel gets it hot from his client if he does not follow every point to the bitter end.

Don't forget to procure a Testament wherewith to swear the witnesses.

Don't talk more than is absolutely necessary.

Don't place much reliance upon the evidence of a witness who is too glib.

Don't forget that you have power to state a case on a point of law for the opinion of the Court.

Don't forget the important item of costs when making your award. Very often the costs incurred far exceed the sum in dispute.

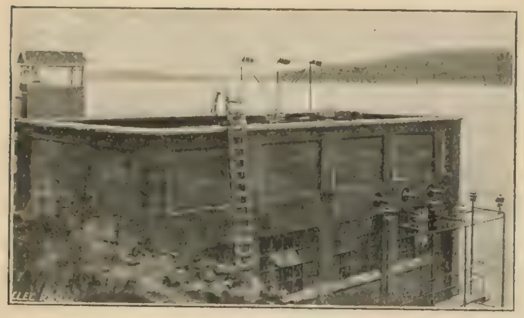
Don't divulge to either party the effect of your award unless, and until, your fees are paid in full.

Very often the "lay" arbitrator is wholly unaccustomed to the forms of law, and, in his ignorance, is apt to pay no heed to the most elementary rules by which a legal tribunal is unconsciously bound. No doubt it is one of the objects of a reference to arbitration to avoid technicality as much as possible; but the arbitrator should never allow his "Court" to become quite so informal as that of the proverbial "Cadi under the palm tree."

THE BAMBERTON CEMENT WORKS.

A most interesting cement-making plant is that which has recently been put to work on the Saanich Inlet, about 20 miles from the City of Victoria, in Vancouver Island, B.C. The constructional work has been carried out entirely by the engineering department of the Associated Portland Cement Manufacturers, Ltd., whose headquarters are at Gravesend, England, for the Associated Cement Co. (Canada), Ltd. The works are situated in a hitherto undeveloped part of Vancouver Island, and it was consequently necessary to erect a village for the accommodation of the staff and workmen.

It must be satisfactory to British engineers to know that throughout the new works, with quite minor exceptions, British plant has been employed; it is also of interest to note that with the exception of one or two steam pumps, electricity is used for power and lighting purposes throughout; other interesting features are the use of oil fuel for firing the rotary kilns, and of "Cascade" motors without slip-rings throughout for electrical driving.

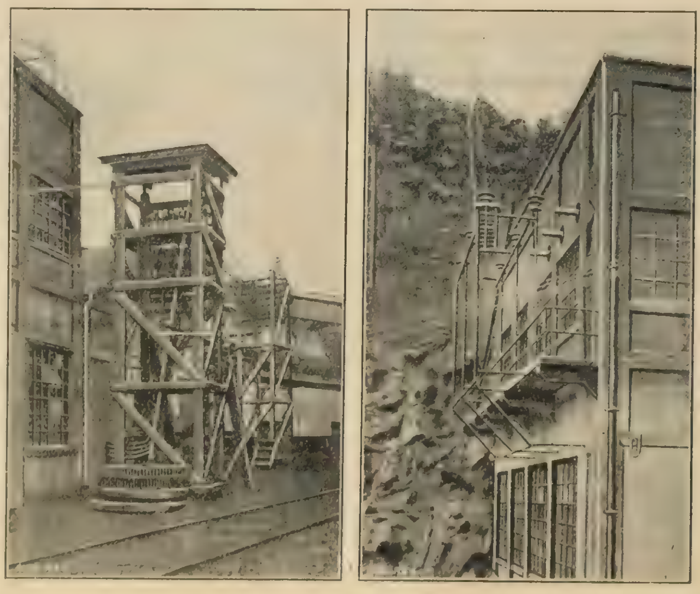


Exterior of Sub-Station, showing 60,000-volt Leading-in Wires.

A brief outline of the processes employed will be of interest. The limestone, which is quarried close to the works, is hauled up an incline and tipped direct into a No. 8 Gates crusher, from which it passes through two No. 5 crushers, which reduce it to a maximum size of about 2 in., and is then taken on belt conveyors to the limestone hoppers.

The shale is quarried some five miles further up the Saanich Inlet, and is brought to the works in scows, being unloaded into a No. 5 Gates crusher, from which it is elevated and conveyed to a series of shale hoppers, alongside those for the limestone. The two sets of hoppers contain all the raw materials for the plant.

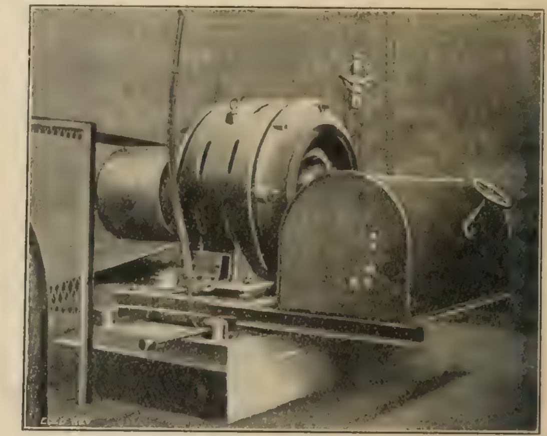
From them the raw materials are fed direct into the wet grinding plant, consisting of five ball mills and five tube mills, each unit being driven by a 160-h.p. motor; the resulting slurry is pumped through a 6-in. main to four mixing tanks, which together hold a week's supply of material, and from them it is pumped direct into the rotary kilns.



Works Sub-Station, showing L.T. Transmission Tower and Platform for Charging Lightning Arresters, H.T. side.

The burning is carried out by means of oil, which is pumped direct from the tank steamer into four storage tanks, each holding 15,000 barrels, whence it is discharged as required into a small tank close to the kilns. It is delivered to the kilns by steam pumps, and before entering the burners is passed through tubular steam heaters. The blast to the burners is supplied by Roots blowers, driven by 60-h.p. motors.

The red-hot clinker from the kilns passes into rotary coolers, giving up its heat to the air blast for the kilns; it is then discharged into a ferro-concrete silo of large capacity, immediately over the dry grinding plant, which consists of four ball mills and four tube mills, each of these again being driven by one 160-h.p. motor. The cement is afterwards passed through coolers, which reduce it to atmospheric temperature, and delivered by worm conveyors to the silos, from which it is transferred to the packing plant for delivery.



160-h.p. "Cascade" Motor driving Tube Mill in Dry Grinding Mill.

It will be noticed that from the point where the slurry enters the kilns to that at which the cement is extracted from the silo, the process is entirely on the gravity principle. This is quite unusual for a cement plant, and has the advantage of eliminating all elevators.

The arrangement was, of course, possible owing to the nature of the site.

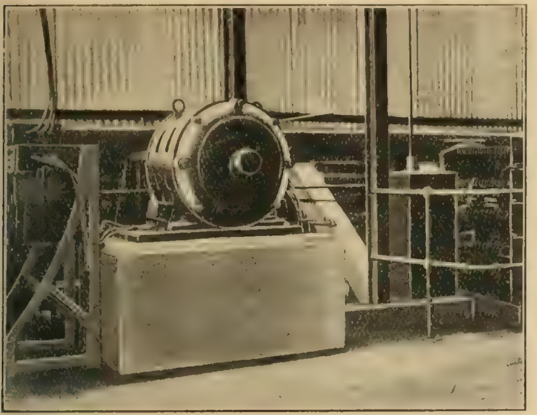
The cement is packed with Bates's patent machines, driven by 15-h.p. motors, and the bags are delivered direct from the packing machines to the ship by belt conveyors.

Water for the plant is obtained from reservoirs constructed on the high ground above the works, but in order to reduce the draw on this source during the dry season, which lasts about four months, two centrifugal pumps have been erected in a chamber on the shore for delivering salt water when necessary.

The situation of the works was determined by the adjacent supply of almost pure limestone which could be handled by gravity. Heavy reinforced concrete construction was employed in the buildings; the cement silo has 28 bins and measures 70 ft. × 120 ft. × 70 ft. high.

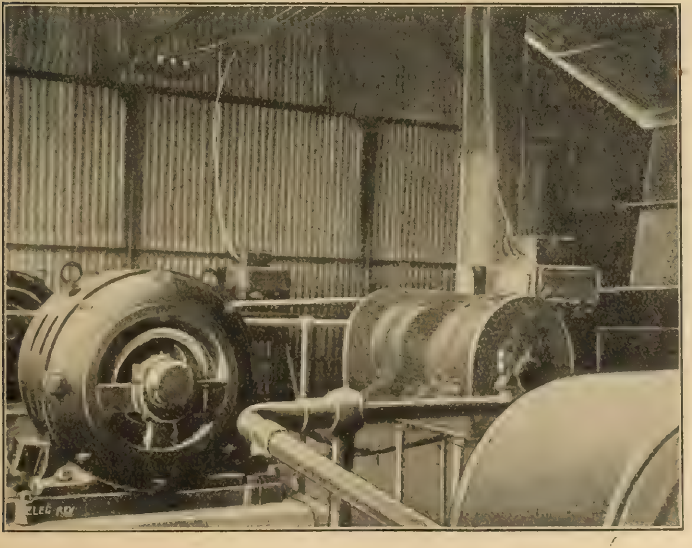
The whole of the electrical energy required is purchased from the Jordan River hydro-electric plant of the B.C. Electric Railway Co., being delivered as three-phase current at 60 cycles, over its 60,000-volt lines to a sub-station at the works containing four 1,000-KW. transformers, wound for 34,600/575 volts, one of which is held in reserve.

These transformers deliver energy at 550 volts between phases to the works switchboard, for motor supply; a further reduction in pressure to 110 volts single-phase is made for lighting purposes.



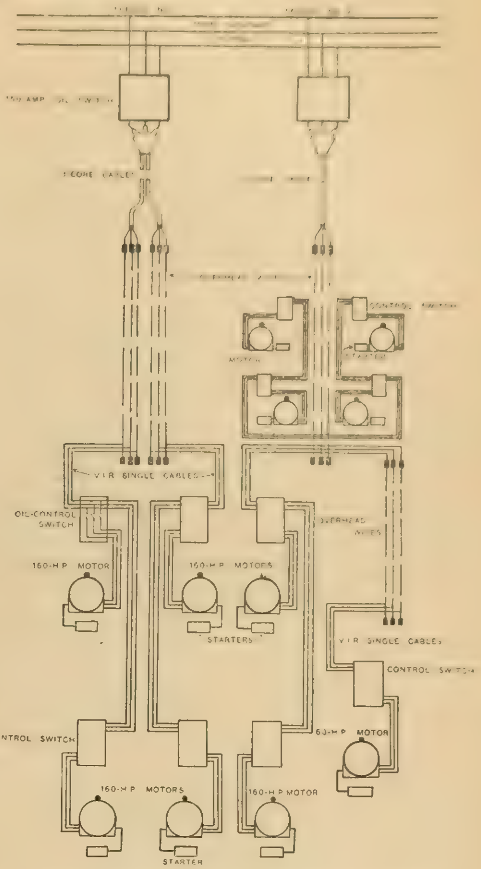
60-h.p. Cascade Motor Driving Rotary Kiln.

The main switchboard was supplied by Messrs. Reyrolle and Co., and is of their well-known ironclad type; it includes a series of panels, the first of which is equipped with the supply company's graphic-recording and integrating wattmeters for 3,000 KW.; a second contains the main three-pole oil switch for 3,500 amperes per phase, fitted with overload trips on two phases and no-voltage release; the third and fourth are the Cement Co.'s meter panels, the third being equipped with a Westinghouse graphic-recording wattmeter for unbalanced loads up to 3,000 KW., with a 31 days' chart, and a Chamberlain & Hookham integrating wattmeter for up to 3,000 KW. and 1 million units, while the fourth contains the main voltmeter and phase ammeters, a 3,000-KW. indicating wattmeter, also power factor, leakage and frequency indicators.



60-h.p. Motor Driving Roots Blower.

There are also 10 feeder panels, each equipped with a three-pole oil switch fitted with overload trips in two phases and an induction type ammeter. All the trip coils are fitted with adjustable time limits. One of the feeder panels is a spare and another feeds the transformers for the works and village lighting.



Typical Feeder Layouts, Bamberton Works.

The motors supplied number 71 in all, including spares, and are of the Sandycroft Co.'s "Cascade" type throughout.

Of the above number, 20, including one spare, are of 160 H.P. each; one drives three Gates limestone crushers, 10 drive ball and tube mills for wet grinding, and eight similar mills employed in dry grinding.

These machines are of the three-bearing open frame type, without slip rings, and will give twice full-load torque at starting with 2·1 times full-load current. The normal speed is 590 R.P.M., efficiency on full load 91·5 per cent., and power factor ·90.

The motors operate in conjunction with worm-geared liquid starters of the Wooliscroft pattern, which are electrically interlocked with the motor controllers through the no-volt release coils of the latter, in such a way that the handle of the starter must be in the "off" position before the control switch can be closed. The controllers are pedestal type ironclad three-phase oil switches; they are of the loose-handle type, each provided with an ammeter, and fitted with two overload trip coils and a no-volt release.

There are also 10 60-H.P. cascade motors of the open two-bearing type, speed 575 R.P.M., with a full load efficiency of 87 per cent. and power factor ·87; these are driving a shale crusher, two air compressors, a haulage, three blowers and two rotary kilns, one motor being held in reserve.

Special metallic starters, combined and interlocked with controllers of the drum type, to give a considerable speed range, are fitted to the kiln motors, while in the case of the haulage a reversible drum type controller is fitted.

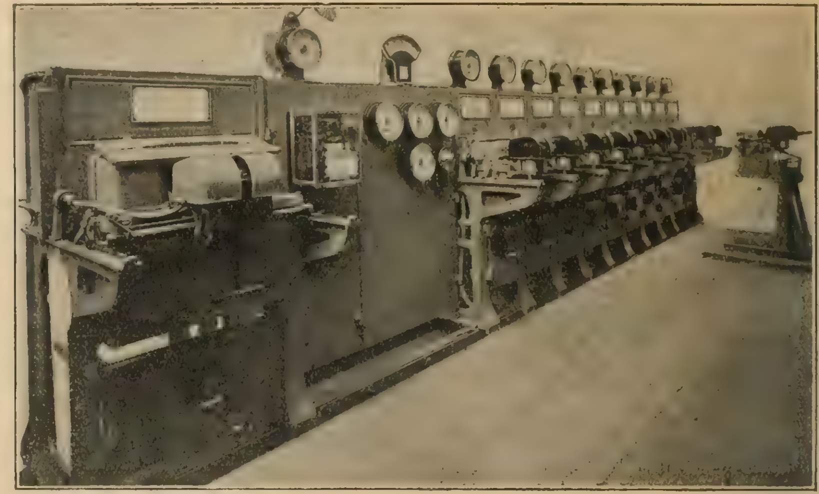
In addition to the above, there are 34 15-H.P. cascade motors, for driving mixers, slurry pumps and conveyors, and the automatic packing plant, the mixer motors being worked with metallic starters, giving two speed stops. These motors have a normal full-load speed of 575 R.P.M., and efficiency of 84·5 per cent. In addition to the above, there are a few small motors, but it will be noticed that three standard sizes of motor have been adopted practically throughout, this with a view to reducing spares to the smallest amount possible. Although large motors are employed, there is not a slip-ring in the place; with unimportant exceptions the motors all drive through belting. Five of the feeder panels are equipped with 750-ampere oil switches, and the other five with similar 400-ampere switches.

The switch panels are coupled up by three-core cables (mostly 37/12s.), to the terminals of the bare overhead wiring used in the works, the motor-control panels being connected to the latter by three single V.I.R. cables.

One of the feeders supplies a transformer sub-station, equipped with one 60-KW. and one 30-KW. transformer for supplying the works lighting, also two 30-KW. transformers for the village supply, the lighting being on 110 volts. The transformers were supplied by the British Electric Transformer Co., and the sub-station switchgear by Messrs. Ferranti.

All the smaller accessories used were in accordance with the American Fire Underwriters' requirements, the switches and ceiling roses having special clamping-type terminals, the lampholders and lamps being of the Edison screw type, fitted with special Canadian screw caps, and the cluster fittings, &c., being all screwed to the standard American pipe thread, so as to be, as far as possible, interchangeable with the apparatus used in Canada.

The whole of the plant has been constructed under the supervision of Mr. H. K. G. Bamber, the designs and specifications being prepared under Mr. C. Percy Taylor, chief engineer to the Associated Portland Cement Manufacturers (1900), Ltd.; Mr. Henry Anderson, formerly engineer at the company's Swanscombe Works, acted as resident engineer and is now in charge of the works.



L.T. Ironclad Switchboard, Bamberton Cement Works.

THE GOLDSCHMIDT TONE-WHEEL DETECTOR FOR WIRELESS TELEGRAPHY.

By S. M. POWELL.

There is little difficulty in building a D.C. galvanometer to measure, say, one-hundredth of a microampere, since a reasonable torque can be obtained, despite the minuteness of the current, by employing a very powerful magnetic field. This method is inapplicable to the measurement of the feeble currents received in wireless antennæ, owing to the practical impossibility of establishing a powerful alternating field of, say, 30 kilocycles frequency and maintaining synchronism between this and the current to be measured. A similar difficulty arises in electrostatic instruments.

Fessenden was the first to employ a high frequency generated at the receiving station for purposes of reception. In his heterodyne system, he uses a current the frequency of which is a few per cent. higher or lower than that of the currents to be received; for example, if the "arriving" frequency F_1 be 50 kilocycles, F_2 may be 49 kilocycles per second. By exciting galvanometer magnets or the plates of a static instrument by the F_2 current and the moving system by the F_1 current, the moving system is vibrated at 1 kilocycle per second, and such oscillations must be recorded oscillographically. By substituting an electrostatic or electrodynamic telephone for the galvanometer a tone of 1 kilocycle per second frequency would be heard were the telephone of sufficient delicacy. Actually, Fessenden employs a rectifying detector, and mixes the undamped 50-kilocycle current received with the 49-kilocycle current generated at the receiving station. Beats are thus obtained which are audible as a 1-kilocycle frequency note in an ordinary telephone.

Goldschmidt has sought to solve the problem of reception by using an asynchronous frequency transformer, and has experimented with his high-frequency generator in this connection (see *E.T.Z.*, 1911, page 54; 1914, page 93). By reversing the action of this machine, feeding it with high-frequency current, and running it asynchronously, low-frequency A.C. becomes available (at the terminals to which D.C. was formerly supplied), and the frequency of this current depends only on the degree of asynchronism. Remanent magnetism produces a continuous noise in the receiving telephone in such a case, but there is a clear underlying tone, and it should be possible to eliminate the effect of remanent magnetism by suitable opposite excitation.

A better and simpler alternator is, however, given by a modification of Leblanc's A.C.-D.C. commutator (which is usually supplied from transformer tappings, and then rectifies by simple commutation). In wireless work, this commutator can be used without the least trace of that sparking trouble which limits its application in heavy current engineering. To adapt it to frequencies reckoned in kilocycles, the Leblanc commutator is reduced to the form of a toothed wheel, and instead of actually commutating the high-frequency current, it makes contact only during alternate half waves (thus acting on the vibrating-rectifier principle). It is not then difficult to obtain the desired frequency of interruption—for example, 40 kilocycles per second requires a peripheral speed of 40 m. per second (8,000 ft. per minute), assuming 1 mm. tooth pitch on the "tone wheel" as the apparatus is now called. Since it is practically impossible to rotate the wheel in exact synchronism, the frequency of interruption is deliberately made 39 or 41 kcy. in the case of 40-kcy. current. The "commutated" current has then the wave form shown in fig. 1, *i.e.*, a "toothed" A.C. of 1 kcy. frequency. It suffices to rotate the tone wheel at any uneven fraction of the synchronous speed. On supplying A.C. of any frequency to the brushes and running the wheel up from rest, the tone heard in the receiver runs through the whole scale. A sustained twittering is heard up to about one-third synchronous speed: then a long pause ensues till synchronism is approached. At even fractions of synchronous speed, the tone phenomenon arises if the brushes are wide. In order that the periods of contact and interruption may be equal, $\beta + 2b = a - 2b$, where b = brush width ; β = tooth width ; and a = gap width. If b is too great, the secondary current wave is as in fig 2 ; but if the above equation is satisfied, the secondary current is as in fig. 3, *i.e.*, it has no D.C. component at half synchronous speed.

As now built by the C. Lorenz A.G., the Goldschmidt tone wheel is direct coupled to an electric motor fitted with an automatic centrifugal contact speed regulator and eddy-current brake as artificial load. The brushes used are of copper wire or sheet embedded in insulating material, which wears with the copper (at about 0·5 mm. per hour), and damps vibration. To eliminate continuous noise due to creep-leakage from the motor side of the set, current is led through the tone wheel as near as possible to the make and break brushes, and very liberal insulation is provided.

Fig. 1.

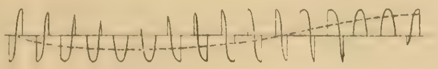


Fig. 2.

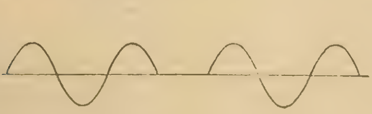
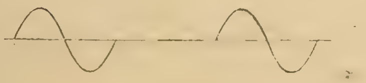


Fig. 3.



Experience so far obtained shows that the tone wheel is at least as sensitive as any other type of detector. It has given satisfactory results in trans-Atlantic service between Eilvese and Tuckerton. Its chief advantages may be thus summarised :—(1) Damped waves (from spark stations) are not received as a pure tone ; (2) signals received from stations with slightly different wave lengths are audible as very different tones, since the latter depend on the differences between the frequencies received and that of the tone wheel ; (3) the tones received are easily distinguished from atmospherics ; (4) every telephone responds best to a certain frequency, and the latter can now be secured by varying the tone-wheel frequency. The loudness of reception can be thus increased approximately in the ratio 1 : 10. If a reflecting galvanometer be used in conjunction with a tone wheel, records may be obtained in ordinary Morse characters. The frequency of mirror vibration is far too high to produce visible effects on the recording strip, hence the black line produced when the mirror is at rest is interrupted by white dashes or dots when the mirror is vibrating.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Joint-Box Compound.

A report made in August last by the National Physical Laboratory on "Trinidite" joint-box compound, supplied by the **Dussek Bitumen Co.**, of Deptford, S.E, to meet Admiralty requirements, shows that a 6-in. cube of the material placed in a metal box partially immersed in boiling water for half an hour did not alter by as much as 1 in a side through softening Tested for di-electric strength, the material, cold, withstood a pressure of 2,000 volts between electrodes $\frac{3}{16}$ in. apart, and a box containing the compound immersed in boiling water for half an hour withstood the same pressure for this period. Tested for absorption of water, two 2-in. cubes immersed in distilled and sea water for a week increased in weight by ·016 per cent. and ·024 per cent. respectively, the specification calling for not more than ·5 per cent.

A Faraday House test showed that an average thickness of the compound of ·076 cm. withstood 13,300 volts (50 cycles, A.C.) for half an hour without the insulation breaking down.

Soutterware Heating Apparatus.

In their newly equipped showrooms at 5, Chapel Walks, Cross Street, Manchester, **Messrs. Eckstein, Heap & Co., Ltd.**, exhibit a line of "Soutterware" electric kettles and other water heaters, toasters, &c., the firm being agents for Messrs Wm. Soutter and Sons, Ltd., of Birmingham. In these kettles, of which we illustrate an example ("The Indian"), made in either brass or nickel plate, the unit is so arranged as to be entirely surrounded by water. The better class kettles are provided with two heats and are all tested to boil two pints of water in 13 minutes. In the event of failure the unit is easily replaced, but strength of construction has been made a special feature. We also illustrate a "Soutterware" toaster (nickel-plate on brass), which will toast bread in four minutes on both sides. Ebony feet are used to insulate these articles from the table. A twelve months' guarantee of quality and workmanship is given. A number of other designs of kettles, besides that shown, also jugs, brass water heaters, coffee percolators, and sideboard heaters, are included in the Soutterware catalogue.

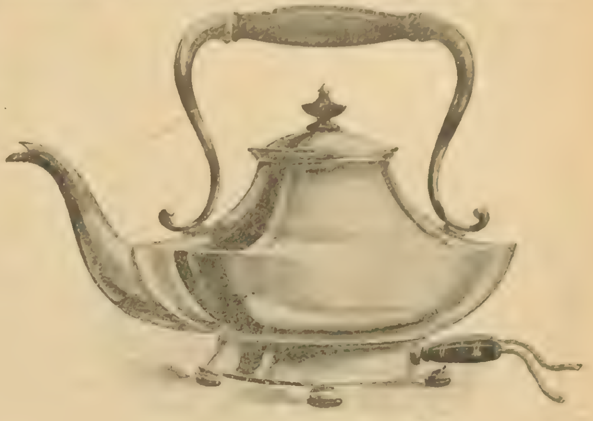


Fig. 1.—"Soutterware" Electric Kettle.

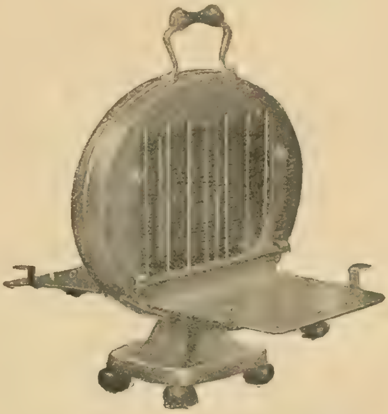


Fig. 2.—"Soutterware" Electric Toaster.

A New Lathe Tool.

The Motogear Engineering Co., of Brandon Grove, Ilford Hill, Essex, have recently introduced a patent self-contained lathe cutting-off tool, for cutting off tube, rod, &c., in the lathe.

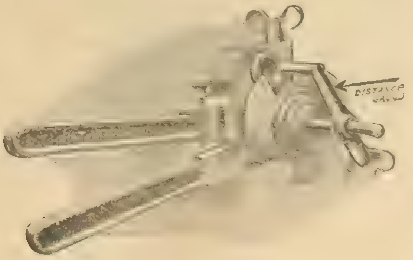


Fig. 3.—The "Eldick" Lathe Cutting-off Tool.

We illustrate this tool in fig. 3 ; as it is self-contained, it is not necessary to remove the tool from the slide rest, and a distance gauge gives exact reproduction for length. It is fitted with a blade having three cutting edges, any of which can be put into operation by loosening the nut. The work being supported right to the cutting edge, all chatter is eliminated, thus keeping the cutting edge much longer than an ordinary tool.

The tool is designed to deal with diameters from ¼ to ⅜ in., and has found favour with many manufacturers of repetition work.

Switchboard for Messrs. Vickers' Canadian Works.

Messrs. Ferguson, Palin & Co., of Higher Openshaw, Manchester, have recently completed a new switchboard for Messrs. Vickers' new works at Montreal. This is constructed of slate panels, and includes three 650-kw. 460-volt three-wire rotary converter panels, fitted with circuit breakers, moving-coil ammeters, field regulating gear, &c., and isolating links at the back; a mid-wire panel with leakage indicator, automatic short-circuiting switch, &c.; and three 1,000-ampere and five 600-ampere feeder panels, each with circuit breakers, moving-coil ammeters, intergrating wattmeters, &c., and isolating links at the back of the board.

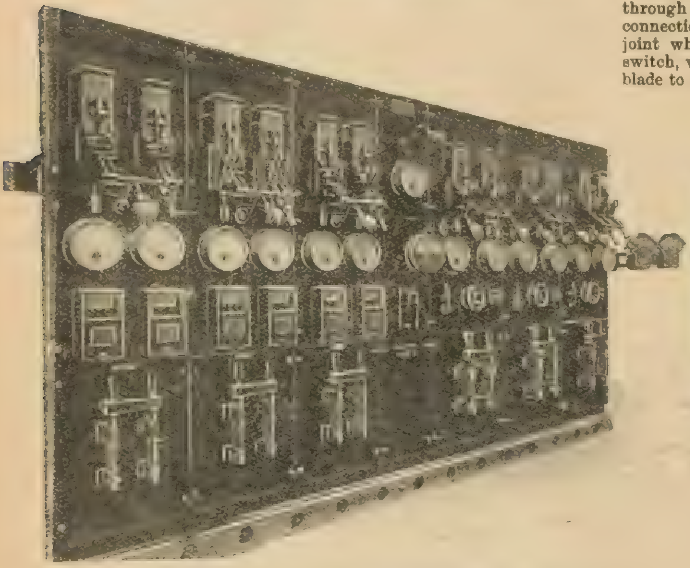


Fig. 4.—Switchboard Constructed by Messrs. Ferguson, Palin & Co.

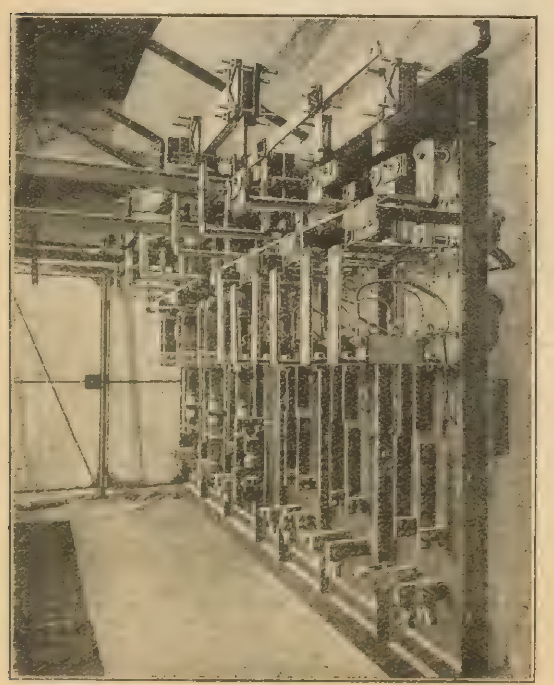


Fig. 5.—View Behind Board, Showing Isolating Links, &c.

A special feature is the provision of isolating links. These are seldom fitted on D.C. switchboards, and the reason they have not been more generally adopted, is probably due to the fact that an ordinary isolating switch of the "knife contact" type takes up considerable room. If, however, the links are made an integral part of the connections, as on this switchboard, no extra space is required. The isolating links are very useful, as if it is desired to work on a circuit-breaker, or any other piece of apparatus, it can be done without any danger; the tightening bolts come away with the links, the connections being slotted to allow of this, which means that the bolts need not be withdrawn, and pins are provided to prevent the nuts being unscrewed too far. Insulators are provided for supporting the connections, to make them stable after the isolating links have been opened.

The knife switches are of a unique design, which decreases the number of contacts the current has to pass through. The strips which engage with the blades on the front of the panel pass through to the back of the panel, and are drilled to take the strip connection or cable sockets as desired; there is no intermediate joint whatsoever. This is a marked advance on the stem type switch, which has two or three intermediate contacts from the blade to the connections at the back.

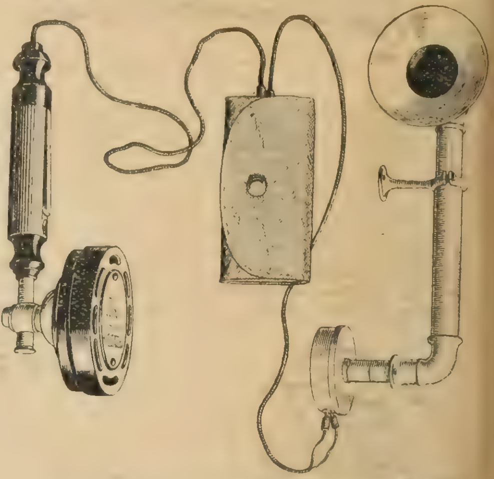


Fig. 6.—The Motor-Dictograph.

The bus-bars are of aluminium, insulated with mica and slate, and are laminated so as to give a maximum cooling effect. The outer bars at present have a sectional area of 7½ sq. in., and arrangements are made so that this can ultimately be increased to 15 sq. in. The bus-bars are not drilled excepting where they are coupled up to adjacent bars, all the circuit connections being clamped.

The shunts are mounted horizontally, so that a draught of air can pass between the strips to keep the shunt cool. The instrument fuses are brought well out from the back of the switchboard, so that it will be possible to withdraw them without any danger of coming in contact with live connections; the instrument wiring is of fire-proof wire, and is clamped with porcelain insulators.

The outer cables are led away at the bottom of the board so that there are no long straggling cables which so often are a source of danger. The neutral connections which have no switchgear apart from the isolating links, have porcelain cleats provided for them at the sides of the panels.

The design and workmanship of the board are excellent, and the back connections are neat and symmetrical.

The day we visited the works a large amount of work was in progress, including 11,000-volt and 420-volt switchgear for the Manchester Corporation; 6,500-volt and 420-volt switchgear for Salford; 6,000-volt and 400-volt switchgear for Bury; 2,000-volt and 200-volt switchgear for Blackpool; 6,600-volt switchgear for Stockport; 6,500-volt switchgear for the Stalybridge, Hyde, Mossley and Dukinfield Tramways; 6,000-volt switchgear for the Leigh U.D.C.; and 22,500-volt switchgear for Messrs. Bruce Peebles and Co. for a Canadian works.

A Motor-Car Telephone.

The General Acoustic and Dictograph Co., Ltd., of 193, Regent Street, W., have sent us particulars of the "Motor-Dictograph," a telephone specially designed for use in automobiles. It consists of a hand-transmitter, battery and loud-speaking receiver, as shown in fig. 6. With this device instructions can be given to the driver without raising the voice, and will be clearly heard by him. The battery consists only of a small dry cell, which can be dropped into one of the side pockets, and can easily be renewed. Conversation inside the car cannot be overheard unless the contact-bar in the handle of the transmitter is depressed. The apparatus can easily be installed without skilled labour.

New Water Heater.

Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, have recently introduced an electric water heater intended to give a continuous supply of hot water for domestic purposes, public lavatories, &c. We illustrate in fig. 7 the 10-gallon size; through the open door can be seen the heater, a a small pocket or circulator, fitted with low-loaded elements mounted on either side (some 300 watts for a 10-15-gallon tank).

The water connection to the tank is through the stop cocks shown, which can be shut off and the circulator removed bodily without interfering with the tank or pipes.

An inner copper tank contains the water, and is heavily lagged to prevent loss of heat.

The apparatus is intended to remain in circuit all day, and to be switched off at night; the fall in temperature during the night, from 20° to 40°, is quickly made up in the morning.

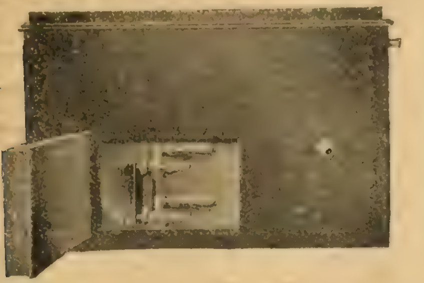
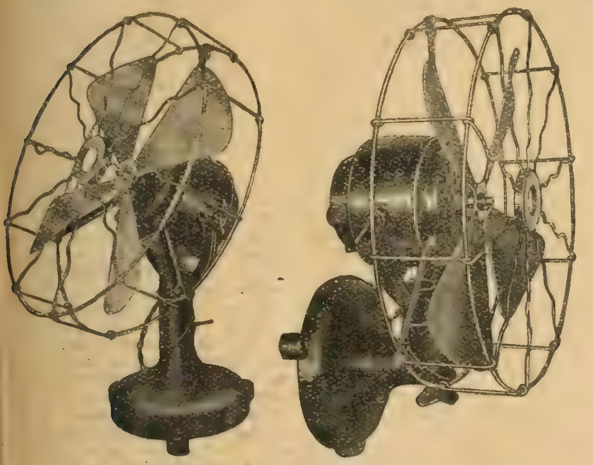


Fig. 7.—Plexsim Water Heater.

The tank always remains about half full of hot water, and as it is fitted with a ball valve feed, it is found that no great cooling of the water occurs in practice.

Ediswan Convertible Fans.

The Edison & Swan Co., of Ponder's End, Middlesex, have this season slightly altered the design of their convertible table-bracket fan. The illustration show the improved shape base. It will be seen that it is smooth, which allows a good space for high-class finishing, giving a superior, artistic appearance and reducing the dust-collecting problem to a minimum. Every part is get-at-able and easily cleaned.



Figs. 8 and 9.—Ediswan Convertible Fan in Two Positions.

The fan is easily converted from a table fan into a bracket fan, as illustrated; one of its best features is the fact that it is both noiseless and sparkless.

When fixed in position no live parts are accessible, which ensures perfect safety. The blades are heavy brass, guarded by a ring wire guard.

The "Ediswan" convertible fan can be run at three distinct speeds, unlike many other similar articles on the market—and it is British made at the company's works in Middlesex.

Commercial Development.—A "special offer" is being made to all the consumers on the books of the Marylebone Electric Supply, in the form of a leaflet bearing the announcement:—"Upon receipt of your instructions we will send you an electric iron, toaster or kettle, as illustrated herein, and add 5s. to your account for electricity each quarter until the amount is paid off. No separate account. No charge for interest on amount outstanding." The result of this attractive proposition will be awaited with interest. There is no doubt, for experience has proved it a fact, that a practical trial in a small way of electrical aids to housekeeping very often induces a desire for more, and leads to gratifying developments. In this case the Council appears to incur no risk to speak of, and the consumer will not feel the burden of cost when paying by small instalments. It is a simple idea, but well worth imitation.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Meetings of the I.E.E.

There seems to be a fairly general opinion among members that there is something lacking in the Institution of Electrical Engineers; most people seem to find the proceedings dull and depressing, and this cannot surely be due to the nature or quality of the papers, but must in some way be due to the way in which the meetings are organised, or, perhaps, the *extent* to which they are organised.

The method by which the author is compelled to give a more or less garbled version of his paper, and by which the discussion is carried on only by those who have carefully prepared their remarks, is calculated to produce a result lacking in spontaneity and freshness, and as the closure is ruthlessly applied, whether the subject is thrashed out or not, there is at the end a feeling of incompleteness, and the usefulness of the discussion is much impaired.

The remedy is possibly difficult to find, but if not found the meetings will cease to attract, except as opportunities for social intercourse, and it is in this light that they are already regarded by many of those who attend them.

Another sign of decay is surely the mildness of the protests against the recent alterations in the form of the *Journal*, the method of packing it for the post, and the abandoning of the postcards announcing each meeting.

No one likes these things, but very few take the trouble to protest, unless, of course, the protests have been made, and ignored.

It is significant that there was a large falling-off in the numbers attending the last meeting, and it seems not unlikely that this decrease may be due to the fact that members are forgetting the dates of the meetings.

Finally, why is the annual general meeting held in the afternoon, when it is impossible for most members to attend? Surely it should be a matter of importance to get as many together as possible on that occasion.

This letter is written in the belief that many are in general agreement with the opinions expressed, and in the hope that it may stimulate a discussion that will bear fruit in future sessions.

E. S. Shoults,
Associate Member.

Finchley, *April 24th*, 1914.

Protection or Tyranny?

It would appear that Mr. Bruce Anderson desires to vindicate the honour of the B.E.A.M.A. (*i.e.*, of its corporate members). Very well, one does not envy him the task! At present do not let us be confused by "form." Mr. Fletcher put his case quite plainly, and suggested that our electrical companies (including, I suppose, the firm for which Mr. Anderson is responsible), have definite arrangements with other firms, or other members of the B.E.A.M.A., for the prevention of interchange of staff. And that is quite a fact. Say an engineer applies for a position with the firm mentioned. At first he may not mention the name of the firm he is with. He is interviewed and almost engaged. But naturally the name of his employer must come out, when the firm "wish to consider the matter further," and the applicant hears soon that they do not require his services "at present." Indeed such cases are now quite common, and Mr. Anderson surely knows it, even when for reasons of policy he apparently attempts to deny it; whilst the position is also known by many staff engineers who are in responsible positions with industrial firms, and who often deal with these "private and confidential" matters.

It is generally known now that competitive electrical firms have their "arrangements" like other firms, and for many of them, despite the assertions of Mr. Purse and others, they are fully justified. But it does not seem to be understood that they wish to eliminate internal competition as much as possible, to their mutual advantage all round.

And that is where, I take it, the interchange of staff has of necessity to be taken into account, since when engineers go from one competitive firm to another they obviously give the former an advantage over the latter, so that "the balance of internal competition" is affected.

The amazing thing is that employed engineers will not see the deep seriousness of the position. One imagines if they did, that if the full facts could be published or proved, the Staff Engineers' Association would become one of our strongest institutions, instead of drifting as it seems to do. Of course one must not suggest that Mr. Fletcher has not done his best at a thankless task, for which he deserves full credit.

Herbert Wilson.

Manchester, *April 27th.*

[Our correspondent has apparently misplaced the words "former" and "latter."—Eds. Elec. Rev.]

ELECTRICITY IN MINING.

At a meeting of the Mining Institute of Scotland, held on April 11th, Mr. Archibald M. Russell read a paper on "The Sinking and Equipment of Blairhall Colliery, Fife." As the equipment has been recently fitted out, the following notes on the electrical plant, taken from the paper, will be found of interest:—The generating plant consists of two Willans mixed-pressure turbines of the disk-and-drum type coupled to Brown-Boveri three-phase generators, capable of giving an output of 500 kw. at 550 volts, 50 periods per second, at 3,000 r.p.m. The condensing plant is of the vacuum-augmentor type; it is capable of dealing with the whole of the steam from one of the turbines, and is supplied with cooling water from a Balcke cooling-tower.

The exhaust steam from the winding and fan-engines is delivered to a Rateau steam accumulator capable of dealing with 20,000 pounds of exhaust steam per hour and bridging over stops of 60 seconds.

The switchboard is of the mechanical remote-control type, arranged with the oil switches and bus-bars in cubicles. The wiring at the back of the board is carried out with asbestos-braided cable run on porcelain cleats. The generators are protected by time-limit overload relays and reverse-power relays. A Brown-Boveri regulator is fitted to control the supply pressure. The lighting of the colliery is taken from two 25-kw. three-phase transformers, either of which is capable of doing the work.

Three-core double-armoured vulcanised-bitumen cables are led into a brick-lined trench roofed with fire-clay covers, leaving room for future requirements. This trench passes the washer and the screens on the way to the shaft.

Two cables were taken down the shaft, each capable of supplying half the requirements. In addition, these cables are sectionalised at each pump-room. The cable is of the solid vulcanised-bitumen three-core double-wire armoured type, and for the suspension of the cables in the shaft, hard-wood cleats 5 ft. long were used at intervals of 150 ft., with intermediate cleats 2 ft. long arranged at distances of 30 ft. between the others. The reason for using long cleats of this description was that very little pressure between the halves of the cleats is necessary to hold the cable in place. With short cleats, on the other hand, it is necessary to put considerable pressure on the cable; if this be not done carefully, and if the cleats are not a true fit for the cables, there is risk of damage to them.

The earthing arrangements for the pit were carefully considered, in view of the fact that the new Home Office Rules were under consideration at the time when the installation was being erected, and a solid copper bus-bar is provided in the power house, also at each of the pump rooms, to which all armouring, motor-frames, &c., are carefully bonded. A cast-iron, heavily ribbed earth-plate is attached to the main earth-bar at the power station; another earth-plate is placed near the shaft top; and earth-plates are connected with the earth-bars in each pump chamber and immersed in the sumps, as it was found that, owing to difficulties in connection with the ground at the surface, this was necessary in order to secure an efficient earth. Tests taken after the earthing was completed proved the efficiency of the system.

An overhead line is taken to the river, from which is drawn the water supply for the boilers and for the cooling tower. Another overhead line is taken from the power station to Blairhall village for the purpose of lighting.

The whole plant has been designed to deal with an output of 1,500 tons per eight-hour day.

At a meeting of the Mining Institute of Scotland held in Glasgow, Mr Willoughby M. Dunn replied to the discussion which had previously taken place on his paper, "Electric Winding Plant at South Kenmuir Colliery." Referring to observations made regarding the failure of supply, Mr. Dunn said the plant had been running continuously for the last four years, and during that time not a single moment had been lost because of the supply failing. He could endorse all that had been mentioned regarding the reliability of power supply from the Clyde Valley Power Co. The escape shaft for South Kenmuir Colliery was half-a-mile distant at another of their pits, which had a steam equipment, and this had some bearing on their deciding to adopt winding by electricity. With, however, the experience of the past four years behind him as to the reliability of the power supply, he would have no hesitation in equipping both shafts with electrical winding gear. Regarding the question of wear and tear to winding ropes owing to the small diameter of the drum, he found that their life was considerably greater on the electric winder as compared with any of their steam winding engines, with cylindrical drums varying from 8 ft. to 11½ ft. in diameter. This he believed to be due to the steady and regular acceleration of the load by the electric winder, as compared with the more or less erratic and jerking start given to a steam engine by a large number of enginemen.

At the annual meeting of the West of Scotland Branch of the Association of Mining Electrical Engineers, a paper was read from Mr. J. A. Kerr, Natal, on "Hints for Colliery Electrical Plant." He was in favour of armouring and earthing if it were properly carried out and maintained, but in certain cases this was impracticable. Indeed, the time and money spent in efforts in this direction would be better utilised in making the insulation proof against the occurrence of faults, and in providing extra copper at lower pressures. In some districts it was difficult to get men at a reasonable rate sufficiently skilled to do this work properly. As a rule, it would be much safer on small installations if earthing were not resorted to until it was found possible to get a sufficient difference of potential between each piece of apparatus and earth to cause danger. This would help to raise the standard of insulation. There must be two faults on an insulated system to get a shock to earth. It would not be hard to find places on such a system where a person might come against live metal with one hand and the case of a switch or motor with the other and not receive a shock, whereas if the case was earthed and a fault occurred on another part of the system, or there were a number of small leakages, the result might be serious. Mining practice in Natal, till within a few years ago, confirmed this view. Bare wires were run along the sides of the roads; this practice was very properly stopped by the Mines Department, the pressure being 250 volts. The coolies and natives worked barefoot and almost naked. Earth wires were unknown. Contact with live wires and apparatus must have been of daily occurrence, yet with the exception of one doubtful case, there was no record of any fatality. In many mines in the West of Scotland much could be said for the unarmoured unearthed system. Other industries offered attractions and less onerous conditions to skilled electricians, with the result that men competent to keep the earthing right were hard to retain.

Far too much had been made of the risk of fire on unarmoured systems through defective jointing. If the resistance of a joint was high enough to cause heating and ignition of the insulation, it would be detected in the working of the apparatus it had to supply. With large strand-filled cables there was difficulty in getting the joints properly sweated, but a stepped mechanical joint would overcome this. Theoretically, in a long cable the copper should become longer than the iron-wire armour with a rise in temperature. In one instance a three-core, 0·25-sq. in. double-wire armoured bitumen cable went to earth about 600 ft. down a shaft where the temperature varied from 70° to over 100° F. It was found on cutting out the fault that the cores were badly decentralised. The makers could find no fault with the method of fixing, which was done with cleats 3 ft. long fixed to the buntons. The cable had never been worked at a greater density than 700 amperes per sq. in., and it was probable that the unequal expansion and contraction of the copper and iron caused the trouble. This cable subsequently decentralised at various places and had to be taken out. It was not advisable to attempt to locate a fault in bitumen cables by burning out, as the current might be sufficient to decentralise the cores.

It was high time, continued the writer, that slate switchboard, were done away with for anything over low pressures. Unless substantially bushed and faced with mica for underground worsk the insulation was not reliable. He thought the members of the Association should form a committee to pass and approve such apparatus. The joint experience of a number of members would ensure a sound verdict, and would benefit both the buyer and the manufacturer, as the latter would have defects and objectionable features pointed out to him, while the former could safely accept what had been approved by the inspection committee of the Association. A system of file cards was of great value, and should be in use wherever electrical plant was operated. Each motor should have a card bearing the following particulars:—Name of maker, date of delivery, date when put to work, number, voltage, current, horse-power, speed, size of fuse wire or current at which circuit-breaker would operate, where situated, date and nature of repairs and by whom repaired, material used for repair, stores allowed, &c. Wherever possible, machines, motors and switchgear should be standardised, thus enabling spares to be stocked and allowing repairs to be quickly carried out. Such a system had the advantage that, having the characteristics of fewer pieces of apparatus to study, men could more quickly locate and repair faults, put parts together again, and better guard against the possibility of breakdown occurring. Some men at present seemed to think that the colliery was run for the electrical installation, and not *vice versâ*. This attitude did an immense amount of harm, and it behoved those who were operating and maintaining plant, to exercise the strictest economy consistent with safety, not only for their own good, but for the welfare of the mining and electrical industries.

Strike.—There has been a strike of carpenters at the Woolwich Works of Messrs. Siemens Bros. & Co., Ltd., "as a protest against labourers being compelled to do joiners' work."

COMPARATIVE ECONOMICS OF TRAMWAYS AND RAILLESS ELECTRIC TRACTION.

In a paper on this subject, read before the Institution of Civil Engineers by Mr. T. S. Gribble, on March 25th, the author endeavoured to arrive at a definition of the sphere of usefulness open to the railless system. He submitted evidence that for urban and suburban transportation, track-laying had been carried far enough, and in many cases too far, maintaining that wherever overhead wires could be employed, railless electric traction afforded the best means of extending the tramways. The development of the railways had brought about over-centralisation of the population, necessitating the adoption of means for decentralisation, such as electric traction, without the heavy burden of permanent way; at the same time this would enable a supply of electricity to be given to sections of the population which at present lacked that advantage.

Comparing railless with tramway traction, the main distinction commercially was that with the former the capital expenditure on permanent way was saved, and the cost of maintenance of rubber tires was added. Other expenses might, for practical purposes, be taken as equal in the two cases. The railless cars at present in use were single-decked, with a seating capacity for 28 passengers, but double-decked cars with 38 seats would probably come into use. As the average number of passengers carried on British tramways did not exceed 13, and might be taken as 9 for traffic of average density, the single-decked railless car could cope with such traffic. The use of trailers, which was general on the Continent, would much enlarge the capacity of railless electric traction for handling special traffic, and would permit the weight of the power-car to be reduced, with advantage to the maintenance of the roads.

An analysis of the capital expenditure on British tramways, embodied by the author in curves, illustrates the remarkable variations between the different undertakings; but by taking into consideration as far as possible the effect of local conditions, the author has endeavoured to arrive at normal figures. For redemption of capital a period of 30 years is allowed, and the rate of interest at which the undertaking can be described as remunerative is put at 5 per cent. The author thus obtains the results shown in fig 1. By an analysis of the working expenses of 47 British tramways he finds the working expenses amount to 6.47d. per car-mile, on the average; but thirteen tramways, of which the working expenses exceed 7.5d. per car-mile, give an average of 7.82d., and 17 below 5.5d. give an average of 5.26d. per car-mile. Power expenses range from 0.767d. to 2.212d. in these cases, with a general average of 1.282d. per car-mile. For railless electric traction the working expenses average 6.75d. per car-mile, including 0.765d. for power and 1.5d. for rubber tires, the latter item comparing with 0.421d. for permanent way in the case of the tramways.

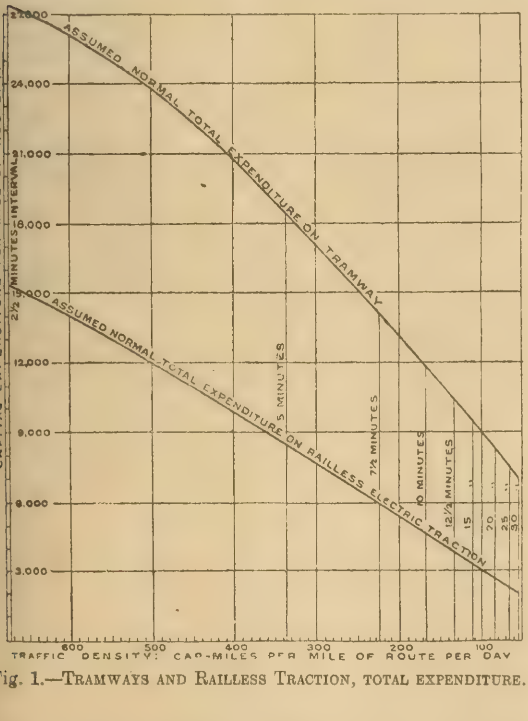


Fig. 1.—Tramways and Railless Traction, total expenditure.

The cost of energy is in most cases the principal cause of abnormal results, and the author points out that in many cases tramways which purchase energy could make a great saving by putting down their own plant.

The cost of construction of a railless system has been taken as equal to that of a tramway, including the power station, but minus the track. Experiments made by the author on various occasions show for a car weighing 5 tons loaded, on a macadamised road covered with snow, a consumption of energy varying from 0.9 KW.-hour per car-mile on the level to 1.075 on a 5 per cent. gradient, at a schedule speed of eight miles per hour. On gradients from 6 to 9 per cent., at a schedule speed of seven miles per hour (maximum ten) the energy ranged from 1.085 to 1.45 units per car-mile. For power station plant the author allows 25 KW. per car in service, including reserve. The figure chosen for maintenance of rubber tires (1.5d. per car-mile) depends upon the price of rubber, the condition of the road surface, etc. Contracts have been made at 1d.

Regarding the wear of the highways, the author points out the difficulty of apportioning responsibility at a time when the world is passing through a revolution in highway transportation, and the fact that roads are maintained by local authorities, though used largely by the inhabitants of other districts. He considers special legislation necessary, and he points out that the railless car is at present handicapped as compared with the motor omnibus in that overhead wires can only be erected under a costly special Act of Parliament, and that the 'bus makes no contribution to road maintenance. Uusually the railless service is called upon to pay up to ⅜d. per car-mile towards the cost of maintenance, at which rate a 2½-minute service would contribute nearly £400 per mile of road per car per annum.

The author's final comparisons are shown in fig. 2. He finds:—(1) That with a traffic-density represented by a 2½-minute service, the cost of working is still in favour of railless electric traction, although only to the extent of about 7 per cent. The cost of construction is, however, about 44 per cent. less.

(2) That the saving increases inversely with the traffic-density, so that with a time-interval of 30 minutes the cost of operation is about 36 per cent. less, and that of construction about 70 per cent less.

The opinion that the economy of the "trolley-bus" ceases at a service frequency of about 10 minutes, is, in the author's opinion, quite unfounded.

The tramway cannot serve the public as comprehensively as the "trolley-bus." In order to serve the city best, the aim should be to reach the farthest suburb, and to supply the greater frequency of service in the centre of the city by means of overlapping services radiating to the suburbs, precisely as is done by the London General Omnibus Company.

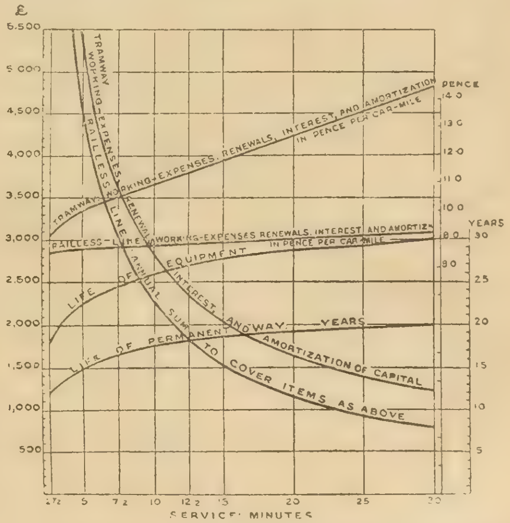


Fig 2.—Comparative Economics of Tramways and Railless Electric Traction.

The cost of tramway-construction sets a limit to suburban extension which is not set by railless-electric traction.

The curves in fig. 2 are based upon the following assumptions: Length of route, 1 mile; Length of traffic-day, 14 hours. Scheduled speed 7½ M.P.H. No. of cars in service, car-mileage per day ÷ 105. No. of cars in stock, car-mileage per day ÷ 70. Power-house capacity, 25 KW. × No. of cars in service. Cost of power-house with plant, £500 × No. of cars in service; rolling stock, £750 × No. of cars in stock; land and car-sheds, £200 × No. of cars in stock. Cost of electrical equipment, from £3,000 to £1,000, and of track from £12,000 to £5,000 per mile of route, depending upon the traffic-density.

CURRENT-LIMITING REACTANCES ON LARGE POWER SYSTEMS.

(*For abstract of paper read by* Messrs. K. M. Faye-Hansen *and* J. S. Peck *before the* Institution of Electrical Engineers, *see* Elec. Rev., *p.* 609).

Discussion at Manchester.

Mr. McKenzie said it was now generally recognised that reactances in some part of a large generating station were highly desirable as a means of reducing the disastrous effects due to short circuits on feeders and busbars. In laying out a new system most engineers would agree that correct place for reactance was in the busbar sections, because the feeders and generators should be so arranged that there was very little interchange of power between the different sections. In the case of extensions having taken place over many years and larger units added, it was a difficult matter to decide where reactances should be placed, as under certain conditions great interchange of power might take place. He was of opinion that it was best in such circumstances to place the reactances in the generator leads to limit the short-circuit current on the generators to 7 or 8 times the normal. Care had to be taken, however, to ensure that the rotor windings would withstand the overload necessary to compensate for the drop in pressure across the reactances. He thought the authors had rather magnified the effects of short circuits on feeders. During the last ten years at Stuart Street, Manchester, 90 per cent. of the faults on the system had originated in one phase. If proper balanced protection was fitted to each of the feeders, then in nearly every case the feeders would be brought out without much damage. Faults such as these seldom developed into shorts between phases, the neutral being earthed through a resistance. The same remarks applied to generators with balanced protective gear. In the case of a new system, it seemed desirable to build generators and transformers to have the necessary reactance in themselves instead of a separate piece of plant.

Mr. S. J. Watson said it did not seem right to run plant with an output of 80,000 to 100,000 kw. on one set of busbars, as even with reactances certain conditions might be set up which would result in disaster. Higher reactance in the generators themselves could be obtained at the expense of regulation, and the prime cost was lower.

Mr. W. Tallent Bateman said reactances should be considered more from the point of view of switchgear protection, since a switch might be called upon to interrupt the current from several generators in parallel. The largest type of oil switch was not capable of dealing with a greater momentary short-circuit capacity than about 250,000 kw., so that when this figure was exceeded reactance was essential. A type of reactance switch used successfully by the American Westinghouse Co. consisted virtually of two oil switches, one of which had a reactance in series, coupled in parallel. The single switch operated first, leaving the second switch and reactance in series, and finally the second switch operated, thus keeping the current within the limit of circuit-breaker design.

Mr. H. A. Ratcliff thought that in the future design of generators and transformers it would be found desirable and even necessary to introduce internal reactance for their own protection. The principal use of external reactances would be in sectionalising busbars and protecting switchgear. One great advantage of external reactance coils was that under abnormal conditions the mechanical and electrical strains in a circuit were presumably greatest where the reactance was greatest, and reactance coils could be more easily constructed to withstand these strains than generators. The possibility of varying the reactance of external coils was also an advantage. The modern H.T. oil switch could deal better with pressure rises than heavy current rushes.

Dr. G. W. Worrall said that whilst reactances in the generator circuit would certainly limit the rise of current at the source, there would be a danger of reduced busbar pressure. Busbar reactance gave rise to errors in the switchboard instruments, unless the Continental practice of having the instruments on another floor of the building were adopted. The most serious objection to the use of these reactances was the introduction of another link into the existing chain of weaknesses.

Mr. Blackmore said he had experienced a great deal of trouble due to short circuits on mains and generators, and all the devices tried hitherto had introduced more trouble instead of avoiding it. In addition to end-connection trouble in turbo-generators, he had encountered breakdowns due to local heating of the laminations during short circuit. The two-circuit-breaker method, which introduced a reactance after the first breaker had operated, was unsatisfactory, as the initial rush was not met by the reactance, and damage ensued. He appealed for a device which would save switchgear and mains, and not introduce more trouble.

Mr. D. B. Mellis said that a reactance coil to be efficient should have practically constant induction for all values of current passing. When iron was employed within the coil it would soon become saturated, and the induction density would fail to be proportional to the applied ampere turns. Armature reaction was not of value for keeping back instantaneous short circuits, only armature self induction, which was controlled by the induction density possible in the iron within the windings. For this reason it appeared that in no case could safety be ensured without external reactance, the coils of which should be as free from iron as possible. The use of reactance coils normally short-circuited was not to be advocated.

Mr. Eustace Thomas said the principal importance of the use of reactances arose from the following:—(1) That machines were not safe against the stresses of short circuit; (2) that oil switches as now made were not safe protectors of the plant installed under emergency conditions; (3) that by limiting the amount of current that could flow if a feeder or generator broke down, a shut-down might be avoided. The paper was a manufacturer's paper, and as the design and construction of machines and oil switches had been entirely in the hands of manufacturers, this admission of weakness would be felt by users of large electrical plant to be most serious. Regulation was recognised as now no difficulty, and it was agreed that higher internal reactances must again be employed. In the same way still better clamping and support for the end connections of armature coils were required and perfectly possible. The lack of safety in modern oil switches was a much more serious matter, and it appeared that manufacturers were trying how small they could make the appliances upon which the ultimate safety of plant costing hundreds of thousands of pounds depended. Bad shorts in the station itself could be almost eliminated by adopting certain simple precautions. The reactances would have to be well built and have the phases well separated, otherwise they would introduce more risk in themselves than the damage which they protected against.

Mr. S. Ferguson considered that reactances should be placed directly in the generator leads. Two miles of .15 sq. in. cable was as effective in limiting the current on a 6,000-volt system as a 3 per cent. reactance coil. Feeder reactances were certainly useful in preventing the fall of busbar pressure in the event of a short on a feeder, but the cost was scarcely warranted in view of the rare occurrence of feeder shorts. Generator reactances also reduced the strain on the switchgear of the whole system.

Dr. E. Rosenberg said that in the early days of electrical engineering there was no need for artificial reactance. For the present no doubt these additional reactance coils were necessary in order to limit the effects of short circuits, but they had not come to stay. Generators were now built which could withstand the effects of short circuit (not necessarily any number of shorts). The cumulative effect would arise not only on the end connections, but under certain conditions in the rotor, especially if excited from busbars with considerable resistance in series. Transformers were now designed to stand dead short circuits. The extremely close regulation had been done away with by increasing the internal impedance from 1 per cent. to about 4 per cent., and the short-circuit current had consequently been reduced from about 100 times to 25 times normal. Additional reactance in the line was necessary because present-day cables had such an extremely low reactance; the possibility remained of getting a feeder with a moderate amount of inherent reactance by using either single-core cable throughout or a combination of single and three-core. Of course, iron armouring in the manner adopted for D.C. single-core cables would not be used, but the problem of effective sheathing could be solved. A natural reactance would then be obtained, also increased safety between phases.

The Authors, in reply, agreed with Mr. McKenzie, that it was very difficult in the case of extensions to decide where reactances should be placed, and also how to arrange them. This was one reason why care had been taken in the paper to avoid laying down rigid rules regarding the position of reactances. Whilst feeders and generators usually broke down first to earth, it was to be remembered that a good number of faults were due to mechanical damage. Subsidence of soil, for example, might produce heavy shorts between phases; no protective gear yet devised was quick enough in operation to deal with such a case, and reactance in the circuit had to be resorted to. Where transformers were used in series with generators, it was satisfactory to good practice to put the necessary reactance in the transformers. The tendency at present was to build large stations and connect to the same busbars; there were good economical reasons for this tendency, and the authors believed that the capacity of generating stations would get larger and larger. Regarding the size of reactance coils, the 720-k.v.a. reactance coil mentioned would correspond to a 20,000-k.v.a. alternator. The cost was certainly a serious matter, on account of the necessity for dealing with the k.v.a. on short circuit. Taking the k.v.a. rating of such a reactance coil, the cost would be in the neighbourhood of that of a transformer of 5 to 10 times the capacity. The losses in reactance coils were very small indeed. It was true that a cheaper generator, and also one with higher efficiency could be built where regulation was not so important. The two-breaker method limited the current, but the same result could be obtained by using one switch with auxiliary contacts. The breaking capacity could be brought up to anything at present required, but it involved expensive switchgear, and the reactance coil had not only to protect the switches, but also to keep up the voltage on the other parts of the system during the fault. Reactance coils were in use by the London Electric Supply Corporation, the London County Council, and on the North-East Coast. The probability of resonance was not increased by the introduction of reactance coils. The authors did not agree that no iron should be used in these reactances; if the iron was kept well away from saturation it would behave as well under short circuit as under normal conditions. It was certainly advisable to have very ample oil switches, and this with the generator strengthened would reduce the number of places where reactance coils were required. It would not be wise to design a big station without reactance coils unless it could be laid out with transformers designed to give the necessary reactance. Regarding the capacity of switches, probably the best way would be to state the K.V.A. which could be broken without rendering the breaker unfit for service.

LEGAL.

Marx v. Electric Utility Co., Ltd.

Question of an Assigned Debt.

In the King's Bench Division on Wednesday, April 22nd, Mr. Justice Atkin sitting without a jury, had before him this action, in which the plaintiff, Mr. Carl Marx, residing at Lauderdale Mansions, Maida Vale, London, W., proceeded against the Electric Utility Co., Ltd., of 35, King Street, Cheapside, E.C., to recover £300, which it was said represented a debt due from the defendants' predecessors, the Electric Lamp Regenerators, Ltd., to a Dr. Seigbert Bloch, of Berlin, which debt was assigned to the plaintiff by a deed of September 24th, 1913. The defendant company, it was said, had taken over all the assets and liabilities of the old company, the Electric Lamp Regenerators, Ltd., and had assumed responsibility for the payment of the debt to the plaintiff or Dr. Bloch's assignee. The defendants denied that they ever acknowledged responsibility for the debt as affecting the plaintiff, and they said that the old company agreed to pay Dr. Bloch £300 out of the first moneys accruing through the sale of certain South African patent rights, and that, in fact, no money had so accrued.

Mr. J. B. Matthews, K.C., and Mr. Romer Macklin appeared for the plaintiff, and Mr. Hollis Walker and Mr. Morris represented the defendant company.

Counsel addressed the Court at great length, and his Lordship gave judgment for the defendants, with costs.

Osram Lamp Works, Ltd., v. The Austrolite Co.

On April 24th this case was mentioned to Mr. Justice Joyce upon a motion by the plaintiffs for an interim injunction.

Mr. Walter, K.C., for the plaintiffs, said the action was in respect of two patents for the manufacture of metal filaments, the validity of which had been certified after a long contest. This motion came before the Court in October last, but stood over with a view to settlement. The negotiations had, however, come to nothing.

Mr. Newbolt, for the defendant company, said his clients were only the retailers of the article in question, and had an indemnity from their vendors in Vienna. The negotiations had been between the plaintiffs and the vendor. Defendants did not know whether the articles in question were infringements. But they could not afford to fight a patent action. Again and again they had asked their vendors to undertake the defence, but that had not yet been done.

His Lordship: Why don't you undertake not to infringe without prejudice to any question?

Mr. Newbolt: Perhaps that would be the best thing to do.

His Lordship: If I were in your position I would do so, and then give notice to your vendors that you are not going to defend.

An undertaking was accordingly given until the trial.

Bailey and Others v. The Manchester Corporation.

New Trial Ordered.

In the Court of Appeal on the 23rd inst., Lords Justices Buckley and Kennedy, and Mr. Justice Scrutton, disposed of this case, on an application by the plaintiffs, asking for a new trial, the action having originally been heard at the Manchester Assizes, before Mr. Justice Lush and a special jury. Mrs. Annie Bailey brought the action on behalf of herself and her seven infant children, claiming damages for the loss of her husband, John Bailey, a hansom-cab driver, who was killed in a collision with a Corporation electric tramcar. The accident occurred when the deceased was in the act of turning his cab into Queen's Road from Park View, Manchester, and plaintiffs alleged that it was due solely to the negligence of the driver of the tramcar. The defendants denied negligence, and pleaded contributory negligence. At the trial, the jury found for the defendants, and judgment was entered accordingly. The ground of the appeal was alleged misdirection of the jury by Mr. Justice Lush "in directing them that only in the event of their finding that deceased was not guilty of any negligence, were plaintiffs entitled to recover."

Lord Justice Buckley, giving judgment, said that the point of misdirection alleged, was that Mr. Justice Lush had not put before the jury that which, in the words of the late Lord Penzance, was expressed thus:—"Though the plaintiff may have been guilty of negligence, and although that negligence may, in fact, have contributed to the accident, yet, if the defendant could in the result, by the exercise of ordinary care and diligence, have avoided the mischief that happened, the plaintiff's negligence will not excuse him." It was necessary to look at the summing up to see whether in this case the learned Judge brought to the minds of the jury that point of law for their consideration, whether, in other words, he directed them that supposing they found that the cab driver hesitated, or pursued an erratic course, yet, nevertheless, if they found that the tramcar driver could, by reasonable care, have avoided the accident, then the plaintiffs were entitled to a verdict. Having referred to the summing up, Lord Justice Buckley said that, in his opinion, the jury's attention was not called to the relevant and material question indicated, on which the action ought to have been decided. Therefore, though with regret, he came to the conclusion that there had been misdirection and consequently, there must be a new trial.

Lord Justice Kennedy, concurring, said he shared the regret expressed by Lord Justice Buckley, but he thought that justice required that there should be a new trial.

Mr. Justice Scrutton took the same view.

Plaintiffs were given the costs of the appeal, the costs of the first trial to abide the result of the re-hearing.

Breach of Regulations.

At South Shields Police Court, on April 23rd, Messrs. Pyman, Bell & Co., Ltd., were summoned under the Factory and Workshop Act, on a charge of having failed to cover certain overhead wires with insulating material, or so to place and safeguard them as to prevent danger so far as was reasonably practicable. Mr. W. B. Lauder, Inspector of Factories, prosecuted, and Mr. F. Kidd defended.

Mr. Lauder, in explaining the facts of the case, said the defendants occupied a portion of ground at Tyne Dock, and there they stored pit-props. There were five circular saws driven by electricity, which were used to cut the props into the requisite sizes. For the purpose of conveying the current to the electric motors which drove the saws, there were three electric overhead wires, 22 ft. from the ground, and they were supported on wooden poles. On March 12th, a man named Samuel Beck, who was employed by the defendants, was engaged on the stack of pit-props 17 ft. high, and was throwing down the props to other workmen who were loading the wagons. While the work was in progress, one of the men noticed that there was something wrong with Beck, and on climbing to the top of the stack, he found him in a state of collapse. The three wires had sagged down, one being under Beck, another across his chest, and a third gripped in his right hand. At once the current was cut off, but the man was already dead, having received an electric shock. It was not definitely known how the accident had occurred, but at the inquest the opinion was expressed by the engineer and the foreman that Beck had probably slipped on the round props, and, in trying to recover his balance, had grasped the electric wires in his hand, and pulled them down on top of the stack. At the time of the accident two layers of props had been removed, and that left a space of 6 ft. between the top of the stack and the wires. The breach of the regulations was that the defendants had failed either to limit the height of the stacks or to insulate the wires so as to protect the workmen from possible danger.

Mr. Kidd admitted the facts, and the breach of the regulations, but pointed out that two of the workmen who gave evidence at the inquest said that it would have been impossible for the deceased to have taken hold of the wires. It was one of those accidents that it was impossible to foresee, and his clients were exceedingly sorry for what had occurred. They had voluntarily paid the funeral expenses of the dead man, and they were prepared to carry out any suggestions that might be made by the factory inspector. He added that the wires were at the usual height, and it was not necessary for the men to get on to the stacks to remove the props.

The Magistrates imposed a fine of £5 and costs.

Factory Acts Prosecution.

At the Durham County Petty Sessions, on April 22nd, the Coal Distillation Co., the occupiers of by-product works at Littleburn Colliery, were charged under the Factory and Workshops Act with having neglected to have certain electric wires covered with insulating material or otherwise protected, as a result of which a fitter's assistant named Joseph Edward Blackburn was killed in February.

Mr. W. B. Lauder, Factory Inspector, stated that the electric wires, which were entirely bare, were situated 44 in. above the steam valves, and anyone wishing to operate the valves must of necessity be in close proximity to the wires. On February 4th last Blackburn and another workman were busy connecting certain steam pipes, and evidently Blackburn came into contact with the live wire, while he had been attempting to open a steam valve. Nobody actually saw the accident, but he was found immediately below the wires unconscious, and died despite resort to artificial respiration.

Mr. Turnbull, for the defendants, admitted that Blackman died from electric shock. The works were constructed by tender, in which it was plainly stated that they had to be erected in full compliance with the Board of Trade regulations. His (Mr. Turnbull's) clients had already done their duty so far as the relatives were concerned, the sum of £228 having been paid in compensation. He mentioned that Blackman really went into danger by walking along the pipes instead of moving the ladder to a suitable position.

The Chairman said there had been a technical offence, and the magistrates would impose a nominal fine of £10, and costs

Mackie *v.* Geo. Bland and The London Hydraulic Power Co.

This case was mentioned to Mr. Justice Joyce, in the Chancery Division on April 24th, upon a motion by the plaintiff to restrain the defendants from interfering with a private roadway from the plaintiff's premises to Old Street, E.C.

Mr. Erington, for the plaintiffs, said that his clients were electrical engineers, with large contracts with the Marconi Co. and other people, which had to be completed within a certain time under heavy penalties. Thus it was essential that the roadway should not be disturbed, in order that the machinery might be delivered. Plaintiff was the lessee of the premises in question.

Mr. Barber, for the defendants, said the London Hydraulic Power Co. were in the position of contractors who had an order from the plaintiff's dead lessor to lay certain hydraulic mains. The work would be finished by Tuesday, and the administrator of the lessor's estate would give an undertaking in damages.

On this footing the motion stood over.

Biggs *v.* Anderson.

At Liverpool Assizes, on Friday, Charles Arnold Biggs (15) brought an action against Messrs. Thos. Anderson, Ltd., electrical engineers, for damages for personal injuries. Mr. Gordon Hewart was for the plaintiff, and Mr. Greer for the defendants. The case for plaintiff was that whilst in the employ of the defendants, he was instructed to attend to some dangerous machinery—a motor disintegrator—in which a wheel revolved at a rate of 220 miles per hour. The plaintiff was told to shovel into the machine some blocks of compo taken from the outside of the boilers. While doing this, a piece of metal which had got into the disintegrator, flew out and struck him in the left eye, which was so badly injured that it had to be removed. Mr. Greer admitted that the defendants were obliged to compensate under the Workmen's Compensation Act, but for the purposes of the present action, the jury had only to consider his claim in common law. He held that the machine was not dangerous, and was as securely fenced at the time of the accident as it possibly could be. The jury found for the plaintiff, awarding £250 damages.

War Office *v.* Kirkland & Capper and J. H. T. Woodd.

On Tuesday, April 21st, the first day of the Easter legal sittings, Mr. Justice Lawrence resumed in the King's Bench Division the hearing of this action. At the conclusion of the last sittings the evidence in the case had been completed, and his Lordship now proceeded to hear the addresses of counsel in the case in summary of the evidence.

Mr. Montague Shearman, K.C., first addressed his Lordship on behalf of the architect, Mr. Woodd. He contended that no case was made out against his client. Upon the construction of the contract, he argued Mr. Woodd was to be remunerated at the rate of 5 per cent. on the cost of the works completed under his direction, and that did not include the electrical work. The contract as between Mr. Woodd and the War Office contained a provision that there should be a responsible expert for the electric lighting.

Mr. Justice Lawrence said it seemed to him that the suggestion of the War Office was that Mr. Woodd interfered and said "you must put in this system."

Mr. Shearman, K.C., said that upon the documents Mr. Woodd could not be held responsible, as it was not correct to say that he "gave directions."

Mr. Walter, K.C., addressed the Judge at length for the defence of Messrs. Kirkland & Capper. After submitting that no case of professional negligence could lie upon the documents against Messrs. Kirkland & Capper, counsel referred satirically to the adverse comment made by the War Office against the lead-covered system buried in plaster. It was provided by the specification that the conductors could be run in plaster in short lengths, and who was to judge what was a short length if the supervising engineers were not to do so? No single instance of a defect could be pointed out as being attributable to any lack of protection. He submitted that upon the terms of the specification Messrs. Kirkland & Capper were authorised to do just what they did, the system broke down not by reason of the lead-covered wire system that Messrs. Kirkland & Capper installed, not through any lack of supervision, but because of the absolute ineptitude of those who meddled with the system after it was installed, and the negligence of those who had charge of it. The whole action was founded on prejudice by the War Office against this lead-covered system. Counsel proceeded to submit that it was clear upon the evidence that every fault occurred at used points. There was no case proved where the fault originated in the lead-covered cable.

The Solicitor-General addressed his Lordship on behalf of the War Office. There was the plainest intimation in the specification, he said, that the conductors were not to be run for long lengths in plaster. It was provided that there should be accessibility; it was suggested by the defendants that this meant that the two ends were accessible. Accessibility meant that you could get at the wire if you so wished, take the wire out, examine it to see what was wrong and put it back. The language of the contract was reasonably clear that these lead-covered conductors were not to be run through plaster indiscriminately, and yet they had the spectacle of Mr. Woodd arranging with Mr. Kirkland for the specification to be departed from because Mr. Woodd had never taken the trouble to look at the specification to see if the system was allowed. Mr. Woodd's duty was to control the electric lighting specification, and the fact that he did not trouble to inquire into it was an act of negligence. It could not be said that the system was a better one; the system stood condemned by electrical engineers. It had not been established by the defence that the lead-covered wire failed because it was over fused. There was no accessibility because you could not get at the wires without cutting the place to pieces.

At the conclusion of the Solicitor-General's speech Mr. Justice Lawrence reserved his judgment.

Goodbody *v.* Poplar Borough Council.

In the Bow County Court on Monday, before his Honour Judge Bray and a jury, Christopher Goodbody, a bricklaying contractor, sued the Poplar Borough Council for damages for personal injuries.

Mr. Clements, barrister, appeared for the plaintiff, and Mr. Harris was counsel for the defence.

Plaintiff's case was that as he was walking along Bow Common Lane the cover of an electric chamber on the pavement blew off through an explosion, knocking him violently up against a public house. He saw blue flame, water and steam come out. He was unconscious for over half an hour, and afterwards thought he would be bound to lose his sight. He had been earning £3 to £5 a week up to the time of the accident. He was attended by doctors afterwards for seven months for a nervous breakdown, from which he had not even recovered now.

Dr. Power, for the defence, said all plaintiff was suffering from was disuse of the muscles.

Mr. Ingle, of the electricity department of the Poplar Borough Council, said fusing was a protective measure. No explosion such as had been described could have occurred, as there was no water in the box. He thought it extremely probable that the spark that always came at the severance of the fuse would get out through the joints of the cover, no matter how tightly they were sealed. That spark would be quite sufficient to explode an accumulation of coal gas, and that would lift a pavement cover if there was a sufficient accumulation. It was impossible to prevent gas getting into the chambers, and it was a source of very great trouble to them and to all electrical supply concerns at all times. The gas companies were always informed of an accumulation of gas when it was discovered. Round this particular box there were a large number of gas mains, which would be, of course, a source of danger.

Mr. Beauchamp, of the East Ham Corporation electricity department, said the greatest care was exercised to prevent the accumulation of gas and air, without which such an explosion would be impossible. It could have nothing to do with the electricity alone.

The question left for the jury to decide was as to whether this chamber was a nuisance on the highway. They decided it was neither a nuisance nor a danger, and Judge Bray said that entirely disposed of the case so far as the jury were concerned. If counsel desired to have any legal arguments as to the matter they could arrange a day, otherwise the verdict was for the defendants.

The Statute of Limitations.

At Blackburn County Court on Monday, Judge Sturges gave a decision of considerable importance to tradesmen. A claim was brought against a debtor, and as the debt was contracted 13 years ago, the debtor's solicitor raised the Statute of Limitations as his defence. The debtor himself, upon being called in regard to another part of the amount alleged to be owing, admitted the old debt, whereupon Judge Sturges ruled that he had thus destroyed the protection afforded him by the statute. In the opinion of the judge, such an admission as the debtor had made on oath amounted to the withdrawal of the plea that the debt was statute barred, and he therefore gave judgment for the plaintiff for the whole amount. Judge Sturges added that, in view of the importance of the matter, he would give leave to appeal.

Stephenson *v.* Colne and Trawden Light Railway Co.

At Colne County Court on April 28th Judge Graham, K.C., gave an important judgment bearing on the position between master and servant. It was a case in which John Edward Stephenson, formerly tram conductor in the service of the Colne and Trawden Light Railway, sued the company for £2 14s. 6d., which the plaintiff claimed he was entitled to in respect of wages and alleged illegal deductions.

According to plaintiff's story he lost 500 1d. tram tickets, and the company deducted the face value of them from his wages, although it was contended the actual damage was purely a nominal one. On October 17th plaintiff's wages were as low as 1s 8d. for the whole week.

The defence was that the money was stopped from Stephenson's wages from July 1st last for shortages in his cash.

His Honour, in delivering judgment for the plaintiff, said the law enacted that the employer shall at the time of working a contract give a fair copy of it to the workman or a notice containing its terms. There must be judgment for the plaintiff for the sum claimed with costs, although he thought that plaintiff's conduct had been such that he might very properly have not allowed any costs.

BUSINESS NOTES.

Consular Notes.—JAPAN.—The American Consul at Yokohama reports that with the remarkably rapid expansion of electrical projects in Japan, there has been a still more remarkable advance in the practical proficiency of the plants that manufacture electrical appliances. At first the electrical business was confined to providing light and power for electric street car lines, but now the electrical manufacturing companies in Japan are becoming very prominent, as well as good dividend-payers in many instances. Two companies of the latter class that attract much attention are the Shibaura Engineering Works at Tokio, and the Tokio Electric Co., Ltd., having extensive and up-to-date electric lamp manufacturing works at Kawasaki, located in the steam and electric railway lines between Tokio and Yokohama. The General Electric Co. of the United States owns 50 per cent. of the lamp works, and nearly a one-third interest in the Shibaura plant, which has a paid-up capital of £278,000. The lamp company's capital is now about £270,000. The lamp plant is credited with turning out the great bulk of all the electric lamps used in Japan, while the Shibaura works manufacture machinery up to from 3,000 to 4,000 KW. size in generators, transformers, motors, &c. Notwithstanding this, about 80 per cent. of all electric motors are still imported, including those of from 500 to 1,000-KW. power. Needless to say, both of these companies have had valuable assistance in the way of technical details and engineering guidance from the American company which is heavily interested in them, and with further advances in proficiency of production the Japanese hope to approach the high standards of the foreign manufacturers of electrical supplies. The hydro-electric companies still buy their heavy machinery abroad. Water-pipes of unusually large size are also purchased abroad, but, on the other hand, Japanese manufacturers in these lines go on cheerfully aspiring to supply their own demands in due course. The business of furnishing electrical power for manufacturing plants in Japan is also comparatively new. It is now roughly estimated that the electrical plants of all kinds in Japan represent about £56,000,000, including capital stock. The paid-up capital stock, compared with the total capital stock, of the following enterprises, is estimated as follows:—

	Stock.	*Paid up.*
Electric lighting companies	£14,000,000	£10,000,000
Electric lighting and railway companies ...	16,000,000	14,000,000
Electric railway companies...	2,000,000	1,400,000

Ten years ago the electrical properties of Japan were estimated to represent only about £2,800,000. During the above period the kilowatt power produced in Japan advanced from less than 45,000 to over 345,000, the number of miles of electric wire from less than 10,000 to over 35,000, and electric railway mileage from less than 100 to over 700.

INDIA.—The German Consul in Bombay reports that in the year 1912 electrical machines were imported into India to the value of 3,613,000 rupees. As far as power machinery is concerned, electrical machinery for use in connection with water-power plants has the best future. There are at present in the country two large works of this nature, the one on the Cauvery Falls, in the Southern province of Mysore, from which transmissions have been carried to the Kolar goldfields and the towns of Mysore and Bangalore, and the Tata hydro-electric works in Lanauli, near Bombay, which is to supply power for 900,000 spindles and 7,500 looms in Bombay. The total number of electric plants in India is already large, and is increasing. All the larger towns either already possess electrical works for lighting and tramways, or are in train to establish such. Consequently the use of electricity may fairly be said to be only in its initial stage, and one may therefore confidently anticipate a gradually increasing market for electrical machinery. There is no Indian machinery industry, and everything that works require of this character must be imported. The greater part of the trade—in fact, about 90 per cent.—is now supplied from the United Kingdom, whilst Germany and the United States follow a long way in the rear. The reasons for this are said by the Consul to be various. On the one hand, the machinery import trade is almost exclusively in the hands of British houses, who naturally maintain their connection with the United Kingdom. On the other hand, many machines are not bought in India, through the British merchant houses, owners of factories journeying themselves to Europe and giving orders at the works. As the English in India, as well as the natives, rarely know any other European language than English, however, it naturally follows that they most frequently place their orders in Great Britain. Moreover, habit is a powerful factor. Machinery and appliances have for so long been procured in England, that buyers are difficult to convert to the opinion that, in the view of the German Consul, they can buy just as well, and just as cheaply, in Germany. The chief reason for the meagre German business in machinery in India is that German firms have taken little trouble to push their goods in the market. The handing over of representation to any importing house is not sufficient. The cultivation of the demand for any particular firm's machinery requires much work which an importing firm is, as a rule, neither willing nor energetic enough to undertake. Moreover, the occasional visit of a commercial traveller will not suffice, as the connection which he may establish with the importers can neither be strong enough, nor of a lasting description. More success will attend the system of attaching to the importing house to which representation may be given a technical agent from the works, who will have nothing else to do but nurse the market, while the importer does the shipping and financial part of the business. The impression seems to prevail that the Indian manufacturer will be prepared to purchase machinery from a catalogue or description, whereas, in fact, he is much more likely to do so if it is possible for him to see the machine itself, or better, to have an opportunity of seeing it in working. English firms with this end in view have in some instances established warehouses in India, with technical men at their head. This procedure is naturally expensive, but it is found in time to repay the cost. Up to the present, however, German firms have not followed this example, which they might well take into consideration.

SOUTH-EAST ASIA.—The American Consul at Hong-Kong reports that development of wireless telegraph communication along the South-East Coast of Asia is slowly proceeding, though it is far from being as advanced and as satisfactory as has been expected. Early in December the wireless installation under construction in British North Borneo was put into operation to some extent, and communication was established with the Philippines. At present the service lies between Sandakan and Malabang, where a de Forest installation has been in operation for about seven years. The communication from Malabang to Manila is by landlines. The second station in North Borneo was being completed, at the time of writing, at Jesselton, the two stations named being stations in a complete system which is being established by the British North Borneo Co. Wireless installation in Hong Kong has not yet materialised despite the fact that the acturial budgets for 1912 and for 1913 each appropriated about £10,000 therefor, and this, too, independently of the plans of the British Government for a comprehensive system of wireless communication for the Colonies. The actual purchase and installation of the proposed low power plant, according to information given by the Colonial Government, lies with the Crown Agents in London. Questions of defence and military exigency are mixed up with other elements in the situation, so that it is not easy to give any date for the installation of a wireless service, though the business community of this, the largest commercial port in the East, and especially the shipping interests in this great shipping port, are insistently demanding wireless service. In China wireless telegraphy is receiving considerable attention, though, as a rule, the service given is not very satisfactory. Some 12 stations are operated, or are supposed to be operated, in various parts of the Kwangtung and Kwangsi Provinces, and the Chinese Government has planned extensions of wireless service all over the country, including a service to Tibet and the so-called New Territory. A contract was made over a year ago for establishing a complete system of high power station from Peking and Kalgan to Shanghai, Canton and all provincial capitals and also on the Pratas Island shoals about 200 miles south of Hong Kong, but for financial and other reasons the actual work has not yet been begun, and it is uncertain just when the systems will actually be established. The work of installing the powerful Telefunken stations in Siam begun a year ago has progressed satisfactorily. The principal station is at Klong Toi, near Bangkok, where a most substantial installation has been made for the maintenance of a day and night service with Singora and points as far as Sabang.

For Sale.—At Manchester on May 7th, Messrs. Percy Huddleston & Co. will sell, by public auction, a large quantity of electrical apparatus, &c., particulars of which are given in our advertisement pages.

Catalogues and Lists.—The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Eight-page price list of special types of Osram drawn-wire lamps for medical and scientific purposes.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Publication No. 766, giving illustrations and fully tabulated prices of "Aston" knife switches, circuit breakers, fuses and distribution boards.

Messrs. Sloan Electrical Co., Ltd., 12, Golden Lane, London, E.C.—Folder card, giving particulars and prices of Conradty's carbon brushes.

The Hart Manufacturing Co., 76 and 77, Rochester Row, Westminster, London, S.W.—Eight-page list, containing a full description of their "Diamond H" remote-control switches; wiring diagrams, mounting and drilling dimensions, and prices are given.

Messrs. Drake & Gorham, Ltd., 1, Felix Street, Westminster Bridge Road, London, S.E.—Illustrated and priced pamphlet No. 22, showing their electric cooker and stove, and a few of its uses.

Messrs. Richard Johnson & Nephew, Ltd., Bradford Ironworks, Manchester.—Pamphlet of about 50 pages entitled "Wire: A useful handbook for buyers and users," giving very full information respecting their telegraph and telephone wires—galvanised iron and steel—fencing and barb and other wires. A number of handy wire gauge, breaking strain, and other tables are included.

Messrs. Benjamin Electric, Ltd., 1a, Rosebery Avenue, London, E.C.—Section lists Nos. 55 and 56, giving illustrated and price information respecting the Dean design battery horn which they are putting on the market for motor-car and motor-cycle service. The motor-car horns are made in four models operating on from 5 to 10 volts; model "C" for motor-cycle use operates on 4 to 6 volts. We understand that these horns have already been standardised for 17 different makes of light motor-cars in America.

The British Thomson-Houston Co., Ltd., Rugby.—Price list No. 2,220 (eight pages) contains an illustrated description of the firm's battery charging generators (0·22-2·52 KW.), with tables of prices, &c., for 50-70 volts and 100-140 volts.

ALLGEMEINE ELEKTRICITATS-GESELLSCHAFT, Berlin.—Brochure describing insulation resistance measuring instruments for use with alternating current.

THE WESTINGHOUSE BRAKE CO., LTD., 82, York Road, King's Cross, London, N.—Publication No. M414 of 64 pages, excellently illustrated, containing very full information describing their silent rocker-joint chain drives, their design, cost, installation and maintenance.

THE ST. HELENS CABLE AND RUBBER CO, LTD, Warrington.—Booklet dealing with "cab tire sheathed" cables for wiring work. This type of cable has been adopted for electric vehicles by the I.M.E.A. Committee, and is here put forward for use in general installation work; the wires may be run on or under plaster, and it is claimed that the wiring is cheap, gives no trouble, and is practically everlasting. Ordinary fittings may be used with it, and single, twin (round or flat), and three-core flat cables are listed, as well as small flexible cords for portable lamps, &c. A special corrosion-proof junction-box for use in corrosive surroundings has been devised for use with C.T.S. wire.

Bankruptcy Proceedings.—TOM MURRAY WOODCOCK, electrical engineer, 64, Holly Street, Sheffield, York.—The public examination of this debtor was held last week at the County Court Hall, Bank Street, Sheffield. It appeared that he commenced business in February, 1913, having no capital. Debtor admitted that he had lost about £3 weekly, but stated that he was not aware of this whilst he was trading. His turnover for the 12 months was about £370, and his deficiency was estimated at £153. The failure was attributed to inability to buy cheaply on account of lack of capital, losses on contracts and heavy business expenses. Debtor commenced to trade with the General Electric Supply Co. in October last, and he now owed them £74. He had not paid this company anything in respect of the goods which they had supplied. In reply to further questions, debtor said he had tried to find out his position, but had been unable to do so. The case was declared closed.

W. H. PEASE, electrical engineer, residing at 19, Princess Royal Terrace, Scarborough, lately carrying on business at Royal Hotel Shops, Scarborough, and at Doncaster.—A statement of affairs has been issued in the above-mentioned case, which discloses liabilities to unsecured creditors amounting to £771, and to secured creditors £5, making a total of £776. The assets are estimated to produce £256, and there is a deficiency of £525. The debtor, who is 23 years of age, was engaged as an electrical engineer for 12 months prior to January, 1912, when he commenced business on his own account. He had a capital of £21, and worked under contract. In March, 1914, he opened out at Harcourt Place, Scarborough, taking with him from Doncaster about £100 worth of stock. At that time he was being pressed by creditors, and, in order to meet his payments, he resorted to borrowing money from relatives and friends, and had also obtained £56 from money-lenders. He attributed his failure to bad health and loss on contracts. The first meeting of creditors was held at Sheffield on Tuesday. The Official Receiver remains trustee.

Dissolutions and Liquidations. — THE CANADIAN POWER TRAMWAYS CONSTRUCTION SYNDICATE, LTD.—A meeting will be held at 3, Princes Street, E.C., on May 29th, to hear an account of the winding up from the liquidator, Mr. H. G. Clarke.

TELEPHOS, LTD.—A meeting will be held at Gresham House, E.C., on May 26th, to hear an account of the winding up from the liquidator, Mr. M. A. Carson.

TRICKET & CO., electrical and general engineers, gas fitters and garage keepers, Norwood, S.E.—Messrs. F. J. Tricket and C. G. Stevens have dissolved partnership. Mr. Tricket will attend to debts.

THE STEAM FITTINGS CO., LTD.—This company is winding up voluntarily with Mr. W. Jaegermann, of 3, Melbourne Avenue, Ealing, as liquidator. A meeting of creditors is called for May 11th; claims must be sent to the liquidator by May 30th.

VESEY BROWN & HALL, consulting electrical engineers, Milburn House, Newcastle-on-Tyne.—Messrs. C. S. Vesey Brown and W. Hall have dissolved partnership as from December 31st, 1912.

THE UNIVERSAL CABLE CODE (PARENT) CO., LTD., 22, Henrietta Street, W.C.—First meetings of creditors and contributories May 12th at 33, Carey Street, W.C.

Fire.—Early on Monday morning a disastrous fire broke out at the works of Messrs. Hurst, Nelson & Co., at Motherwell. In addition to damage to the works building, throwing 300 men out of work, 25 tramcars and a number of railway coaches were destroyed. It is said that the loss is £100,000.

Book Notices.—"Advertising and Progress." By E. S. Hole and John Hart. London: *Review of Reviews* Office. Price 5s. net.

"An Elementary Treatise on the Calculus for Engineering Students." By John Graham. London: E. & F. N. Spon, Ltd. Price 5s. net.

"*Proceedings* of the Physical Society of London." Vol. XXVI, Part III. April. London: *Electrician* Printing and Publishing Co., Ltd. Price 4s. net.

"*Journal* of the Western Society of Engineers." Vol. XIX, No. 2. February. Chicago: The Society. Price 50 cents.

"*Giornale* ed Atti della Associazione Elettrotecnica Italiana." Vol. I, No. 9. April 25th. Milan: The Association. Price L. 1.

Trade Announcements. — THE LANGDON-DAVIES MOTOR CO. announce that their new telephone number is "City 2744" (two lines); their works telephone is unaltered.

MESSRS. E. G. APPLEBY & CO. have removed to more extensive premises at 12, The Broadway, Westminster, S.W. New Telephone No. "Victoria 6503."

MESSRS. NALDER BROS. & THOMPSON, LTD., have recently removed to larger premises at 97A, Dalston Lane, N.E. (telephone Nos, Dalston 2365 and 2366; telegraphic address, "Occlude Kinland London"). The works are five minutes' walk distant from Dalston Junction and Hackney Downs stations. The City office and showroom at 34, Queen Street, is being retained, with a private telephone extension line connection to the works. The "parts" works premises at Kingsland Green are likewise connected by a private extension line. The extended works and additional manufacturing facilities now available will enable the firm to give more expeditious execution of contracts.

LIGHTING and POWER NOTES.

Accrington.—L.G.B. INQUIRY.—On Wednesday last week Mr. H. R. Hooper held an unopposed inquiry into the application of the T.C. to borrow £33,530 for extensions to its E.L. undertaking, including £28,000 for plant and £5,000 for buildings.

Armagh.—PROPOSED E.L.—The U.D.C. is considering the question of lighting the town with electricity.

Bexhill.—The Corporation has decided to extend the feeder cables, to lay distributor cables, and to install a booster at the electricity works for the purpose of increasing the pressure of supply at Little Common and Cooden Beach. The estimated cost is £2,500, and the scheme will defer the erection of a sub-station for three or four years.

Blackburn.—YEAR'S WORKING.—For the past year the T.C. electricity department has yielded a net profit of £5,000, of which £4,410 has been placed to the renewals and extensions fund. The income was £48,400, and the expenditure £24,217.

Blackpool.—YEAR'S WORKING.—The income of the electricity department for the past year amounted to £44,997, against £40,333 in the previous year. The expenditure was £23,562, against £20,928, and the gross balance is £21,435, of which £13,972 is absorbed by interest and sinking fund charges. The net surplus is £7,463, against £6,226. £4,000 has been placed to the relief of rates and £3,500 to the renewals fund.

The Corporation has decided that electrical illuminations shall form a special feature of the next autumn season, and, in order to obtain ideas, a Corporation official was to visit Paris last week.

Bristol.—EXHIBITION LIGHTING SCHEME.—In connection with the Bristol International Exhibition, which opens on May 28th, an extensive scheme of electric lighting has been devised. The Corporation electricity department is laying 6,000-volt cables over the 2½ miles between its power station and Ashton Gate, to feed a sub-station in which will be installed nine static transformers, giving a supply at 365 volts for power and 210 volts for lighting. The Exhibition supply will permanently benefit a large section of the city supply; the authorities have guaranteed to use some £6,000 worth of energy, and the electricity department is spending about £8,000 in cables, &c. The illumination scheme includes the outlining of the various pavilions, the lighting of the grounds, and various spectacular features.

Castlerea (Co. Mayo).—PROPOSED E.L.—The D.C. has applied to the L.G.B. for sanction to a loan of £1,263 for the installation of an E.L. plant at Ballaghaderreen town.

Chester.—STREET LIGHTING AND NEW MAINS.—The Electricity Committee has recommended that the 103 remaining arc lamps, and 20 incandescent lamps be replaced by metal-filament lamps, at an estimated cost of £545; it was stated that the current consumption would be about halved. The Committee also recommended that new cables be laid, at an estimated cost of £3,282, to be charged to the reserve fund and spread over three years.

Clogheen (Munster).—PROPOSED WORKHOUSE LIGHTING.—In connection with the proposed E.L. scheme, the B. of G. has appointed a committee to consider the E.L. of the workhouse, at a cost of about £150.

Clonmel (Co. Tipperary).—ASYLUM LIGHTING.—At a meeting of the Committee of the Clonmel District Lunatic Asylum, the medical superintendent stated that with the new E.L. plant the cost per light worked out at 9s. 5d., whereas gas cost 18s. 10d. per light; they also obtained three times as much light with electricity, and other advantages were the absence of the blackening of walls and coolness in summer.

Continental Notes.—GERMANY.—Last autumn a new municipal dock was opened in Berlin, and already the very complete modern electrical equipment has attracted such a large volume of new traffic that extensions of the silos and cranes are proposed.

The Waldeck Dam, which is being built by the Prussian Government, will probably be opened this year by the Emperor. As it will hold 202 million cb. m. of water, and will be 42 m. high, it will be the largest dam in Europe, though not in the world. Its primary purpose is the regulation of rivers, but the power will be utilised on a large scale. The plant will be coupled electrically with the water-power stations at the Diemeltal and Münden Dams, and will distribute energy over a wide area.

The issue of bonds to the amount of £250,000 by the Stade Elektrizitäts Verband for the construction of a network of high-pressure electrical mains has received Ministerial sanction.

A co-operative electric supply association has been formed at Felstedt, Schleswig-Holstein, to provide that town and the neighbouring districts with electricity.

The Landtag of Pomerania has approved of the expenditure of £250,000 for the construction of a bulk electric supply station at Stettin.

The A.E.G., of Berlin, intends to construct a station at Kalau, in Brandenberg, for the supply of electricity in bulk to the districts of Spremberg, Kalau and Luckau.

SPAIN.—A correspondent of the *Financial Times* writing on the subject of hydro-electric power developments in the neighbourhood of Barcelona, points out that at Pobla a 4,000-H.P plant has been completed; nearby, at Talarn, the development of 96,000 H.P. is being carried out, and should be completed this year. At Lerida another 56,000-H.P. plant is practically completed. To the south of Seros a scheme is in hand for developing 300,000 H.P. on the Ebro, and a contract is stated to have been entered into with a Swedish Co. to supply 75,000 KW. to a nitrogen extraction works, from this source. All these concerns are controlled by the Barcelona Traction Co. (a Canadian concern), and it is stated that the company has never yet been able to overtake the demands of its customers. The company controls the 65,000-H.P. steam plant of the Barcelona Electricity Co., which it is intended to hold as a stand-by, when hydro-electric energy is available. The company has in hand some 50,000 contracts for 103,000 H.P., and it is estimated that a further 50,000 H.P. can be contracted for when power is available, while other contracts in view comprise 32,000 H.P. The power is mostly used in the cotton and worsted industries, and the company has an arrangement with its only serious competitor, the Electric Energy Co., of Catalonia.

NORWAY.—It is reported from Stavenger that the A/S Sandefaldene has entered into a contract with the Union Carbide Co., of New York, to supply the latter with 40,000 H.P. within four years from 1916, and with additional power after if required. The Carbide Co. already operates four American works, and it is anticipated that the carbide products from the new factory will be shipped to America. The Orsten (Romsdal) and the Arkedalin municipal authorities are both embarking on small hydro-electric schemes.

BULGARIA.—A scheme for establishing a central station for the electric lighting of the towns of Kritschin and Philipopolis is under consideration.

SWITZERLAND.—The Grand Council of Zurich has sanctioned a credit of £49,200 for the construction of an electric lighting and transformer station in that city.

Coventry.—PROPOSED MAINS EXTENSIONS.—The E.L. Committee is considering the question of extending the E.L. mains to Stoke Church.

Dalbeattie.—PROPOSED E.L.—The T.C. has received a communication from an Edinburgh firm on the subject of an E.L. scheme for the town; the letter has been remitted to the Lighting Committee for report.

Dalkey.—E.L. BILL.—The U.D.C. has appointed a Committee to oppose the Gas Co.'s Electric Supply Bill.

Dunoon.—NEW E.L. PLANT.—The T.C. has decided to install new plant, at a cost of £444, to provide for the E.L. of the pier, pavilion and Castle Gardens.

Flint.—E.L. SCHEME.—The T.C. has decided to undertake an E.L. scheme, the cost of which is estimated at £6,000.

Golcar.—PROPOSED BULK SUPPLY.—In response to a letter from the U.D.C., the Huddersfield Electricity Committee is considering the question of supplying electricity in bulk to the area controlled by the U.D.C.

Gravesend.—LOAN SANCTION.—The T.C. has received sanction to a loan of £13,150 for electricity purposes.

Haltwhistle (Northumberland).—PROPOSED E.L.—The P.C. has adopted a resolution requesting it to purchase a refuse destructor plant and electrical equipment for electric lighting in the district.

Ilkley.—L.G.B. INQUIRY.—An inquiry was held on Tuesday, by Mr. T. C. Ekin, into the application by the U.D.C. for sanction to borrow £18,000 for electricity purposes in Ilkley and Myddleton, including the erection of a generating station at Ilkley. A number of property owners objected to the site of the generating station.

India.—The Dewan has directed that, as from the 1st inst., the charges in the assigned tract (civil and military station), Bangalore, are to be on exactly the same basis as in the city, which will represent a cheapening all round in the station by as much as 25 per cent. It is also understood that these rates will be still further reduced next year.

Inverurie.—PROPOSED E L.—The T.C. has appointed Messrs. James E. Sayers & Caldwell, of Glasgow, to report on the various E.L. schemes for the town.

Keighley.—EXTENSION OF SUPPLY AREA.—In connection with the proposed supply of electricity by the T.C. to Morton, the Council suggested that inquiries should be made at East Morton, and asked the Keighley R D.C. whether it would approve of the T.C. seeking powers to supply electricity in Steeton-with-Eastburn and Sutton. The R D.C. has consented to the T.C. making inquiries at Morton Banks, further consideration of the matter being deferred for one month.

Longhrea (Co. Galway).—The Town Commissioners have accepted the offer of the local E.L. Co. for electric lighting in the town.

Lytham.—BULK SUPPLY.—The terms to which the U.D.C. has agreed for the supply of electricity in bulk from the St. Anne's U.D.C. are as follow:—Up to 100 KW., £5 per KW.; between 100 and 200 KW., £4 per KW.; between 200 and 300 KW., £3 10s. per KW.; between 300 and 400 KW., £3 per KW.; plus ½d. per unit up to 200,000 units and ¼d. over 200,000 units. The St. Anne's Council is to pay Lytham 10 per cent. of the gross receipts from the Tramway Co. for the supply of current in Lytham after June 1st, 1917. The agreement is to be for 10 years, and the above charges are subject to revision at the end of five years. The St. Anne's Council is to withdraw its opposition to Clause 41 of the St. Anne's Improvement Bill.

The application of the U.D.C. for sanction to borrow £23,700 for electricity purposes formed the subject of an inquiry last week.

Manchester.—YEAR'S WORKING.—The income of the electricity department for the past year increased by £36,125 over the previous year, and the net surplus increased from £28,331 to £36,370. The units sold increased from 104 millions to 117 millions.

For the forthcoming year the Committee estimates for the sale of 130 million units, an income of £552,800, and a surplus of £30,500, of which £30,000 is earmarked for the relief of rates, according to arrangement.

Middlesbrough.—NEW MAINS.—The Electricity Committee has decided to expend £3,250 on new electric cables.

Preston.—PROPOSED NEW PLANT.—The T.C. has appointed a Committee to consider the necessity for provision being made for an increased output of electricity.

Rawtenstall.—YEAR'S WORKING.—The accounts of the Electricity Department for the past year show that the income increased by £2 915 compared with the previous year, and the surplus is £2,481. The output increased by nearly a million units. The total cost of production was ·64d. per unit. The new turbo-alternator is expected to be ready this month, and further extensions are contemplated.

Ripley.—PROV. ORDER.—The B. of T. has refused the application of the U.D.C. that the maximum charge named in the prov. order applied for by the E.L. Co. should be under 6d. per unit. The clause empowering the company to supply fittings has been deleted, and the Council has now dropped its opposition to the order.

Roundhay.—The B. of T. has authorised the Leeds T.C. to supply electricity in Roundhay.

Skipton.—It has been reported to the U.D.C. that the electricity plant is insufficient to supply the Co-operative Society's new premises in Swadford Street, and the matter is to be considered next month.

Southend-on-Sea.—STREET LIGHTING.—The T.C. proposes to light the new promenade, from the Palmeria Arches to the Pier, with 20 2,600-C.P. arc lamps, at a charge of £13 14s. each per annum, and to light the Broadway with 10 new arc lamps of a total capacity of 32,500 C.P.

Wallsend. — An extensive electrification scheme is being carried out at the Wallsend and Hebburn mines of the Wallsend and Hebburn Coal Co., at a total cost of about £200,000, under the superintendence of Mr. C. A. Nelson, formerly of the Silkstone Collieries, Yorkshire. The whole of the steam plant has been removed and modern electrical plant has been installed by the British Westinghouse Co. Two years ago 3,000 men and boys were employed by the company, but when all the pits are in full working order it is estimated that about 7,500 will be employed.

West Ham.—STREET LIGHTING.—The Highways Committee has recommended that the tender of the electrical engineer be accepted for alterations and improvements to the street lighting on tramway routes, as follows:—Replacement of present arc lamps with 200-watt incandescent lamps on each pole, including lighting and maintenance, at £3 10s. per lamp per annum, and with lanterns containing four 100-watt lamps, at £7 per lantern per annum; the installation of modern swan-neck fittings, with 100-C.P. lamps, in place of existing electric lamps, including lighting and maintenance, at £2 12s. 6d. per lamp per annum; and the conversion of about 200 gas lamps to 100-C.P. incandescent electric lamps, at £2 12s. 6d. per lamp per annum.

TRAMWAY and RAILWAY NOTES.

Barnes.—ELECTRIC VEHICLES.—The surveyor to the U.D.C. has reported to the Council in favour of displacing horse-drawn vehicles for refuse collection by battery-driven vehicles, carrying a ton of refuse, and costing £520 each. He estimates that five such vehicles would replace 10 horsed vans, with a saving of £200 per annum. Consideration of the matter is being delayed until the Committee can see a vehicle of the kind in use.

Blackburn.—Year's Working.—The T.C. tramways undertaking shows a profit for the past year of £4,011, compared with £3,870 in the previous year; the receipts were £71,338, and the working expenses were £24,168.

Blackpool.—Year's Working.—The income of the T.C. tramways for the past year was £84,797, as against £74,166 in the previous year. The gross profit was £41,310, compared with £34,484, and the disposable surplus is £24,522, as against £18,331 last year; £12,000 is to go to the relief of the rates, and the balance to the renewals fund.

Birmingham.—Electrical Vehicles.—According to the *Surveyor*, the electricity department has undertaken to supply the Refuse Disposal Committee with two battery-driven vans for removing street refuse, at a cost of £550 each.

Castleford.—The Yorkshire (W.R.) Tramways Co. proposes to double the tramway track in Cambridge Street.

Continental Notes.—Germany.—The rolling stock design for the Berlin railways is being very carefully investigated, and a number of experimental trains are being tried. For the new municipal underground railway the London and Paris types of coach are being copied, and separate entrances and exits will be provided.

The Prussian State Railways has ordered experimental rolling stock for the City and Ring Railway from the Maffet-Schwartzkopffwerke, Siemens-Schuckert, A.E.G., Bergmann and Brown-Boveri firms, and has commenced trials of one complete train on its Dessau-Bitterfeld line. This train of 12 coaches can be split into two sections, and is stated to have only two four-wheel motor-bogies; separate compartments, with a narrow side corridor, are likely to be adhered to.

The Göttingen T.C. has decided to construct a tramway system.

The Rhenische Schuckert Gesellschaft has been granted a concession for the construction of an electric railway between Bensheim and Lindenfels, in Hesse.

Sweden.—The Mellerster Oester-Gottland Railway Co. has decided to electrify its system to the west of Linkoping, the current to be supplied from the Naas power station on the River Motala.

France.—A new company has been formed at Douai, with a capital of £20,000, entitled La Compagnie du Tramway Electrique à Voie Etroite de Douai a Lallaing, to construct and work an electric tramway between the two towns named.

Dundee.—Railless Traction.—The Tramways Committee has agreed to discontinue the railless traction system in Clepington Road.

Golcar (near Huddersfield).—The question of a motor-'bus service having again been introduced, the U.D.C. has appointed a sub-committee to consider the provision of some means of passenger transit for the district.

Halifax. — Proposed Extensions.—The Tramways Committee is to hold a special meeting to consider the suggested tramway extensions from Brighouse to Rastrick and on to the Huddersfield boundary, and from Halifax to Elland.

Rawtenstall.—During the past year £1,500 has been taken from the rates for the relief of the tramways undertaking, £622 of which was placed to the credit of the renewals fund, and £878 to balance of loss on the year's working.

Stirling.—Proposed Tramways.—The T.C. has agreed to hold a conference with representatives of the County Council, the Bridge of Allan T.C., and the Stirling and Bridge of Allan Tramways Co., to consider a proposal for electric tramways.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Post and Telegraph Department has drawn up a plan of work to be carried out during the next three years, involving an expenditure on telephone equipment of about £4,000,000, of which Sydney will receive about 1½ millions and Melbourne £600,000. Three automatic telephone exchanges have been erected in Sydney, and none in Melbourne.

Imperial Wireless System.—The Select Committee of the House of Lords, which has been inquiring into the charges against Lord Murray, has this week been discussing the chairman's draft report in private.

Morocco.—Notice is given in the *London Gazette* of new rates for telegrams to Morocco, ranging from 3d. to 6½d., according to destination.

Post Office Employés.—A return has been issued showing the changes in the wages and conditions of service of Post Office employés in connection with the reports of the Select Committees on Post Office Servants, 1907 and 1913.

Strike.—A number of labourers employed in the extension of the underground telegraph cables in Dublin went on strike on Saturday last, because their demand for an additional ½d. per hour in wages was refused.

Telegraph Conference.—An International Conference of Telegraph Engineers is to be held in Berne from September 14th to 20th next. Among the subjects to be discussed are: "The Prospects of Telephony over Longer Distances," "The Protection of Telegraph and Telephone Wires from other Electrical Conductors," and "How Far Automatic Apparatus in Telephone Exchange Working is Desirable."

The Telephone Service.—Captain Norton furnished the following information in reply to a question in the House of Commons:—

Total new telephones provided during the year 1913:—

London	31,000	Edinburgh	1,818
Birmingham	3,161	Belfast	981
Liverpool	3,057	Dublin	1,267
Manchester	4,131		
Glasgow...	3,033	Total	48,448

Applications in hand:—

—	One month old or less.	Over 1 but not more than 3 months old.	More than three months old.	Total.
London ...	1,105	322	223	1.650
Birmingham ...	208	151	246	605
Liverpool ...	94	20	35	149
Manchester ...	166	90	86	342
Glasgow ...	122	41	3	166
Edinburgh ...	69	16	93	178
Belfast ...	49	32	52	133
Dublin... ...	34	54	62	150
	1,847	726	800	3,373

Reasons for applications delayed over three months:—Subscribers not yet ready for work to be proceeded with, 104; cases in which wayleave difficulties have arisen, 99; applications in connection with new exchanges not yet opened, 136; waiting for the extension of underground and other main plant, 273; long lines in ordinary course of completion, 93; various other causes of delay, 95; total, 800.

At the annual meeting of the London Chamber of Commerce last week, Lord Southwark said that a special Telephone Committee had been formed on which that Chamber, the L.C.C., the City Corporation, the Port of London Authority, the Home and Foreign Produce Exchange and other bodies were represented, to deal with telephone matters.

Messrs. Johnson & Phillips, Ltd., who secured the order for manufacturing and laying a new trunk telephone cable between Swansea and Llanelly, will shortly commence the work of drawing-in.

Time-Signals for Explorers.—The German Orinoco Expedition will carry wireless receivers to detect the time signals from the stations on the Amazon and in North America. These will serve to correct the chronometers.

Wireless Telegraphy.—Duke Ernst II., of Sachsen-Altenburg, has for years taken a great interest in wireless telegraphy, and is having an installation erected on his Castle in Altenburg for communication with air-craft. On April 4th he caused a lecture to be delivered there before a large company of persons interested in the subject. The lecturer was Herr Bredow director of the Telefunken Co., and by the aid of an experimental installation, he read messages of greeting from Norddeich and Nauen. Those from Norddeich were in Morse code, but those from Nauen were telephonic, *i.e.*, the words were spoken and not telegraphed.

CONTRACTS OPEN and CLOSED.

OPEN.

Ashton-in-Makerfield.—May 11th. D.C. overhead transmission line, with switchboards and internal wiring for power and lighting, for the sewage disposal works. Messrs. Banks, Fairclough & Stephen, civil engineers, Leigh.

Australia. — May 26th. Adelaide Tramways Trust. Overhead tramway equipment and construction. Board of Trade Commercial Intelligence Department in London.

May 20th. Victorian Railways Commissioners. One three-phase slip-ring electric motor and accessories. Deposit £1. Local representation. A specification can be seen at the B. of T. Commercial Intelligence Department in London.

Sydney.—July 20th. Box compound, meters, maximum-demand indicators, arc lamp carbons, and straight-stem insulators, for the Council. Specifications for each section 10s. 6d., from City Electrical Engineer, Town Hall.

Melbourne.—May 20th. 1,132,000 arc lamp carbons, for City Council. See "Official Notices" to-day.

Belgium.—May 9th. The municipal authorities of Montegnée (Province of Liége) are inviting offers for the concession for the electric lighting of, and power supply in, the town. The contract is being offered in two ways, one of which provides for the establishment of a central station, as well as a network of distribution mains in the town, and the other for the mains only, the current being supplied from an already existing power station.

Brussels.—May 6th. Tenders for the supply and erection of telephone and telegraph cables. Deposit, 10,000 fr. Cahier des Charges Spécial No. 217. Salle de la Madeleine, Brussels.

Bridgend.—May 6th. Glamorgan County Asylum. Electrically-driven lift for cold store. See "Official Notices" April 24th.

Buxton.—Electric wiring work, Grosvenor Private Hotel. Mr. P. J. Maddock, Newlyn, Moreton (Cheshire).

Derby.—Corporation. Twelve months' supply of steam coal, for the electricity department. Particulars from the Borough Electrical Engineer.

Devonport.—May 12th. Steam coal (5,000 tons) for a year, and general engine-room stores, for the Corporation Electricity Department. Mr. J. W. Spark, Borough Electrical Engineer, Newport Street, East Stonehouse.

Dundalk.—May 11th. U.D.C. Diesel generating plant, balancer and booster, motor generator, switchboards, battery, mains, crane, oil pipe line and storage tank. See "Official Notices" April 24th.

Edinburgh.—May 6th. Corporation. Twelve months' supply of lead-covered, paper-insulated cables, for the Electricity Department. Specification from Mr. F. A. Newington, Engineer, Electricity Supply Station, Dewar Place.

Germany.—May 13th. The Lighting and Water authorities of the City of Bremen are inviting tenders for a 40-KW. asynchronous transformer for converting alternating to continuous current.

Hoylake and West Kirby.—May 8th. Coal for a year for the U.D.C. E.L. works (about 3,500 tons washed peas). Mr. Chas. J. Turner, Electrical Engineer, Hoylake.

May 11th. U.D.C. Ornamental iron transformer station. See "Official Notices" to-day.

Ilkley.—May 11th. U.D.C. Electricity generating station buildings. See "Official Notices" April 17th.

Leeds.—May 11th. Corporation. Steam turbine, three-phase alternator and exciter, 12,000 KW., 1,000 to 1,500 R.P.M., and condensing plant. See "Official Notices" April 3rd.

London.—May 6th. Metropolitan Asylums Board. (1) Electric light installation at Grove Fever Hospital; (2) rewiring fire alarm and telephones, &c., at Southern (Lower) Fever Hospital; (3) milk Pasteurising and motor-driven plant for Eastern Fever Hospital. See two "Official Notices" April 24th.

Manchester.—May 13th. Corporation. 5,000-KW. turbo-alternator complete. See "Official Notices" April 17th.

Oldham.—May 4th. Electricity Committee. Steam coal for six months, commencing May. Mr. S. W. Newington, Electricity Offices.

Sheffield.—May 2nd. B. of G. Installation of telephone and fire-alarm system at the Workhouse, for the Guardians, Ecclesall Bierlow Union. Specification from the Clerk, Union Offices, The Edge, Sheffield.

South Shields.—May 9th. Stores, &c., Tramways Department for 12 months. Mr. W. T. Robson, Tramways Manager, Dean Road.

Spain.—May 15th. The Tarragona Provincial Tramways Co., of Tarragona, is inviting tenders for the construction of an electric tramway between Reuss and Tarragona.

Swansea.—May 4th. Electric lighting, new building, Rhyddings Congregational Church. Specifications from the Clerk of Works on the site.

Warrington.—May 12th. Extra-high and medium-pressure paper cables, for electricity department. See "Official Notices" April 24th.

West Ham.—May 16th. Corporation. For 15 double-deck bogie tramcars and one four-wheel single-truck double-deck tramcar. Specifications from Mr. J. S. D. Moffet, Tramways Manager, Greengate Street, Plaistow, E.

Wolverhampton.—May 12th. E.L. installation, Walsall Street Schools, for the T.C. Secretary, Education Offices, Town Hall.

York.—May 12th. Feeder cables for electricity department. See "Official Notices" April 24th.

CLOSED.

Arbroath.—The tender of Messrs. Underhill & Ritchie, Glasgow, has been accepted for the electric lighting of the Parish Church.

Bristol.—The reference in our last issue to a contract for Siemens lamps given out at Bristol was incorrect. For *Bristol* read *Belfast*.

Bury St. Edmunds.—The T.C. has accepted the tender of the D.P. Battery Co., Ltd., for the supply of a storage battery of 252 L21 type cells, complete, for £840, and also their offer to maintain the battery for 10 years (after one year free) for the sum of £83 per annum.

Doncaster.—The Corporation Tramways Committee has provisionally accepted the tender of Messrs. Walter Scott, of Leeds, for the supply of rails for tramway extensions to Warmsworth, for £8,312.

East Ham.—Wiring work. The Town Council proposes to accept the tender of the Ray Electric Co., at £35, for wiring the Boleyn convenience.

Huddersfield.—The T.C. has accepted the tender of the United Electric Car Co. for the supply of 14 new top covers for tramcars.

London.—Stepney.—The B.C. Electricity Committee recommends the acceptance of the offer of Messrs. Harrisons (London), Ltd., for a barge-load (175 tons) of Lanark prime quality washed peas, at 13s. 6d. per ton, for trial purposes. For the provision of the steelwork for the foundations for machinery to be installed at the Limehouse station the following tenders were received:—

Dorman Long & Co., Ltd. .. .. (recommended)	£372
Redpath, Brown & Co., Ltd.	383
E. Wood & Co., Ltd.	410
J. Westwood & Co., Ltd.	415

Southwark.—The tender of the General Electric Co., Ltd., is recommended to the Borough Council for acceptance for the supply of four switchboard meters, at £21 each.

Maidstone.—The Kent Insurance Committee has accepted the tender of Messrs. Haynes Bros., Ltd., of Maidstone, for installing the E.L. at new offices in the town, at £25, and for internal telephones, at £46.

Peterborough.—Messrs. Ashton, Frost & Co. have received the contract, at £129, for piping required in connection with the new generating set at the Electricity Works.

Pontypridd.—The following firms have received contracts for the supply of various items to the Electric Light and Tramways Department in the current year:—

Overhead equipment.—Brecknell, Munro & Rogers, Ltd.; Imeson, Finch and Co. (1912), Ltd.; Fleming, Birkby & Goodall, Ltd.; Haslam and Schontheil, Ltd.; Watlington & Co., Ltd.; W. F. Dennis & Co.; B.I. and Helsby Cables, Ltd.

Joint boxes and service boxes.—B.I. & Helsby Cables, Ltd.; W. Lucy and Co., Ltd.; Sykes & Sugden, Ltd.

Insulating material.—L. Andrew & Co.; Baxendale Bros.; British Thomson-Houston Co.; Micanite and Insulators Co., Ltd.; Siemens Bros. & Co., Ltd.; I.R., G.P. and Telegraph Works Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.

Installation stores.—Edison & Swan U.E. Light Co., Ltd.; Veritys, Ltd.; Siemens Bros. Dynamo Works, Ltd.; S. Marsel Jones; Berry, Skinner and Co.; General Electric Co., Ltd.; Baxendale Bros.; Drake and Gorham, Ltd.; British Thomson-Houston Co., Ltd.; I.R., G.P. and T. Works Co., Ltd.; Wandsworth Electrical Manufacturing Co., Ltd.; Accles & Pollock, Ltd.; British Thomson-Houston Co.; Siemens Bros. Dynamo Works, Ltd.; General Electric Co., Ltd.; Cryselco, Ltd.; H. A. Jackson & Co.

Meters, Glass and Globes.—To be purchased by quotation as required.

Cables.—Schedule 1:—Mackintosh Cable Co., Ltd. (subject to satisfactory test. Manager instructed to visit company's works for the purpose.)

Schedules 2 and 3 (Association Cables):—To be purchased by quotation as required.

Schedule 3 (Flexibles):—Callender's Cable Co., Ltd.

Schedule 4:—Liverpool Electric Cable Co.

Insulating material.—Armorduct Manufacturing Co., Ltd.; Brecknell, Munro & Rogers, Ltd.; and British Westinghouse Co., Ltd.

Tramcar equipment.—P. R. Jackson & Co., Ltd.; British Thomson-Houston Co., Ltd.; Morgan Crucible Co., Ltd.; Millar & Co.; British Hele-Shaw Patent Clutch Co., Ltd.; Anti-Attrition Metal Co., Ltd.; Haslam & Schontheil, Ltd.; Fleming, Birkby & Goodall, Ltd.; Equipment and Engineering Co.; and Siemens Bros. & Co., Ltd.

Installation stores.—H. H. Jackson & Co.; E. Dewhurst; Ward & Goldstone; and Metallic Seamless Tube Co., Ltd.

Portugal.—The tenders invited by the General Direction of Public Works and Mines, at Lisbon, for the concession and working of a 12-kilometre electric tramway at Lamego (reported in our "Contracts" column last week), are, it is stated, subject, so far as foreign tenderers are concerned, to the condition that they submit to Portuguese law. A declaration to this effect must be made by them before, and signed by, a Portuguese Consul, and forwarded to the Portuguese Ministry of Foreign Affairs, at Lisbon, for legalisation.

Preston.—The Electrical Apparatus Co., Ltd., has received the contract for the year's supply of D.C. starters to the National Electric Supply Co., of Preston.

Rawtenstall.—The T.C. has accepted the tender of the executors of the late Mr. Joseph Birtwistle, of Waterfoot, for installing the E.L. in connection with the library extensions.

South Africa.—The following tenders have been received in connection with the Ermelo electric light and water schemes for machinery, pumping plant, poles and overhead system :—

Hubert Davies & Co.	£7,750
S. Sykes & Co.	£7,314
Siemens, Ltd.	£7 048
German General Electric Co.	£6,305
British G.E. Co. .. .. (recommended)	£5,961

and the following have been accepted :—

Pipes, £3 000.—Andrew & Thienhaus.

Special castings, valves and fittings, £585.—Stewarts & Lloyds.

Locomobile engine three-throw pumps, poles and cross-arms (manufactured by Stewarts & Lloyds), £6,541.—British General Electric Co.—*South African Mining Journal.*

Southend-on-Sea.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for two 180-KW. generators for sub-stations at Leigh and Thorpe Bay, at £752.

Southport.—The Tramways Committee recommends that the Tramway Manager be instructed to purchase three toast-rack tramcar bodies from the United Electric Car Co., for £220 each.

West Ham.—The Corporation has accepted the tender of Messrs. Gillespie & Beales for a supply of electrical conduits.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, May 1st. At 8 p.m. At 39, Victoria Street. Paper on "The Control and Organisation of the Engineering Profession," by Mr. S. T. Robson.

Salford Technical and Engineering Association.—Saturday, May 2nd. Visit to Park Works, Newton Heath.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, May 4th. At 7.30 p m. At Armstrong College. Paper on "Electric Heating and Cooking," by Mr. W. A. Gillott.

Society of Engineers.—Monday, May 4th. At 7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Ordinary Meeting.

Royal Institution of Great Britain.—Monday, May 4th. At 5 p.m. At Albemarle Street, Piccadilly, W. General Meeting.

Rontgen Society.—Tuesday, May 5th. At 8.15 p.m. At Institution of Electrical Engineers. Paper on "X-Rays and Crystals," by Mr. L. W. Bragg.

Institution of Civil Engineers of Ireland.—Wednesday, May 6th. At 8 p m. At 35, Dawson Street, Dublin. Ordinary meeting.

Chemical Society.—Thursday, May 7th. At 8.30 p.m. At Burlington House, Piccadilly, W. Ordinary meeting.

Iron and Steel Institute.—Thursday and Friday, May 7th and 8th. At Institution of Civil Engineers, Great George Street, S.W. Annual Meeting. Thursday, May 7th. At Connaught Rooms, Great Queen Street, W.C. Annual Dinner.

Physical Society of London.—Friday, May 8th. At 8 p.m. At Imperial College of Science, S.W. Paper on "Gyrostatic Devices for the Control of Moving Bodies," by Dr. J. G. Gray.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued :—

Friday, May 8th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Saturday, May 9th.—Headquarters will be open for regimental purposes only from 10 a.m. to 12 noon.

Monday, May 11th.—"A" Company. Supper at St. James' Tavern, St. James' Park Station, at 7 p.m.

Tuesday, May 12th.—"B" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Wednesday, May 13th.—Rating examination, all companies.

Thursday, May 14th.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Friday, May 15th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Saturday, May 16th.—Musketry practice at Purfleet Rifle Range, at 1 p.m. to dusk.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

A Gyroscopic Motor-Car.—Dr. Pierre Schilowsky has applied the gyroscopic principle to a petrol-driven motor-car, which runs on two wheels, and has been exhibited in London this week. A gyroscope weighing 7 cwt. is used to stabilise the car.

EXPORTS STATISTICS OF SWITZERLAND.

The following figures showing the exports of electrical and similar machinery from Switzerland in 1912 are taken from the recently issued official trade statistics; the particulars for 1911 are added for purposes of comparison and notes of any increases or decreases are given :—

Dynamo-electric machines and electric transformers of all kinds.—

	1911. Francs.	1912. Francs.	Inc. or Dec. Francs.
To Germany	2,742,000	2,837,000	+ 95,000
,, Austria	767,000	1,093,000	+ 326,000
,, France	4,675,000	3,756,000	— 919,000
,, Italy	1,298,000	901,000	— 397,000
,, Belgium	1,036,000	914,000	— 122,000
,, Great Britain ...	1,374,000	822,000	— 552,000
,, Russia	1,306,000	1,805,000	+ 499,000
,, Spain	1,319,000	1,410,000	+ 91,000
,, British India ...	253,000	280,000	+ 27,000
,, Mexico	156,000	24,000	— 132,000
,, Brazil	627,000	757,000	+ 130,000
,, Argentina	730,000	968,000	+ 238,000
,, Other countries ...	1,765,000	1,459,000	— 306,000
Total ...	18,048,000	17,026,000	—1,022,000

Hydraulic and wind motors.—

	1911. Francs.	1912. Francs.	Inc. or Dec. Francs.
To Germany	1,342,000	1,223,000	— 119,000
,, France	999,000	818,000	— 151,000
,, Italy	549,000	500,000	— 49,000
,, Great Britain ...	352,000	480,000	+ 128,000
,, Russia	263,000	279,000	+ 16,000
,, Spain	385,000	468,000	+ 83,000
,, Japan	937,000	1,413,000	+ 476,000
,, Canada	566,000	81,000	— 485,000
,, Mexico	180,000	435,000	+ 255,000
,, Brazil	362,000	558,000	+ 196,000
,, Argentina	168,000	148,000	— 20,000
,, Other countries ...	1,060,000	1,566,000	+ 506,000
Total ...	7,163,000	7,999,000	+ 836,000

Steam engines, cranes, pumps, turbines, &c.—

	1911. Francs.	1912. Francs.	Inc. or Dec. Francs.
To Germany	1,873,000	1,743,000	— 130,000
,, France	1,214,000	638,000	— 576,000
,, Belgium	1,280,000	1,249,000	— 31,000
,, Russia	1,428,000	1,549,000	+ 121,000
,, British India ...	441,000	203,000	— 238,000
,, Japan	183,000	269,000	+ 86,000
,, Canada	100,000	—	— 100,000
,, Other countries ...	1,164,000	2,589,000	+1,425,000
Total ...	7,683,000	8,240,000	+ 557,000

Gas, petrol, benzine, hot air, &c., motors.—

	1911. Francs.	1912. Francs.	Inc. or Dec. Francs.
To France	1,884,000	2,406,000	+ 522,000
,, Italy	1,425,000	1,979,000	+ 554,000
,, Great Britain ...	1,151,000	770,000	— 381,000
,, Russia	1,132.000	862,000	— 270,000
,, Roumania ...	641,000	315,000	— 326,000
,, Egypt	432,000	1,039,000	+ 607,000
,, Algeria and Tunis	281,000	458,000	+ 177,000
,, Argentina ...	168,000	374,000	+ 206,000
,, Australia ...	279,000	301,000	+ 22,000
,, Other countries ...	1,878,000	3,918,000	+2,040,000
Total ...	9,271,000	12,422,000	+3,151,000

Electric meters.—

	1911. Francs.	1912. Francs.	Inc. or Dec. Francs.
To Germany	106,000	291,000	+ 185,000
,, Austria-Hungary	131,000	150,000	+ 16,000
,, France	244,000	465,000	+ 221,000
,, Italy	207,000	198,000	— 9,000
,, Other countries ...	174,000	249,000	+ 75,000
Total ...	865,000	1,353,000	+ 488,000

Steam and electric locomotives.—

	1911. Francs.	1912. Francs.	Inc. or Dec. Francs.
To France	1,093,000	797,000	— 296,000
,, Servia	109,000	—	— 109,000
,, Dutch E. Indies ...	493,000	157,000	— 336,000
,, Argentina ...	339,000	—	— 339,000
,, Other countries ...	83,000	504,000	+ 421,000
Total ...	2,117,000	1,458,000	— 659,000

Note.—25 francs = £1.

ELECTRICAL SMELTING OF IRON ORE IN SWEDEN.

[From our Special Correspondent.]

Director E. J. Ljungberg, who formerly was the managing director of the Stora Kopparbergs Bergslags Aktiebolag in Sweden, and is still associated with this big concern as chairman of the board of directors, has recently expressed his views on the future of the electrical pig-iron industry in Sweden as far as this company is concerned, to a representative of the *Affärsvärlden*. The details given are of the greatest interest, as this company may be regarded as the pioneering company of the electrical smelting of iron ore, and the more so as they have been given by such an authority as Dr. Ljungberg, who, by the other ironmasters, has been honoured by the name of "the Grand Old Man." It will, however, first be necessary to give a brief description of the history of the electrical iron industry.

As may be known, the Swedish process of smelting iron ore direct by means of electricity was invented by the Swedish engineers Grönvall, Lindblad and Staalhane. After having demonstrated the process on a minor scale, the inventors transferred their patent rights to a company, which was formed under the name of the A/B Elektrometal, by which name the process is now generally known.

The Stora Kopparbergs A/B from the first took great interest in the invention, which finally resulted in the erection of an experimental plant at the Domnarfvets Ironworks, belonging to the company. An electrical furnace, with a capacity of about 700-800 H.P., was built at the above-mentioned works, where experiments were carried out during a period of about one year and a half with charcoal as fuel. These experiments gave such good results, that the Swedish Iron Office (Jernkontoret), which is a semi-financial and industrial institution for furthering the interests of the iron and steel industry, and the Ironmasters' Association, jointly granted the necessary capital (£14,000) for the erection of a large demonstrating plant with the view of ascertaining how the process would work on a larger scale. The chief purpose of these experiments was said to be the development of electric smelting of iron ore and placing it in such a position, that this method could be gradually introduced into the Swedish ironworks, after the private works and individuals had been given an opportunity of making the necessary tests with their own raw materials without being put to the expense and risks, which are connected with such experimental working separately. This excellent idea is only equalled by the practical manner in which the experiments have been carried out. The best engineers and the greatest experts that could be found were engaged, and nothing was neglected that could contribute to carrying the plan successfully through and to giving the results obtained the stamp of absolute trustworthiness. It was decided to erect the demonstration plant at the Trollhättan Waterfalls, where the necessary energy was available, and the work was started on November 29th, 1909. Scarcely one year after, viz., November 15th, 1910, everything was in full order, and the electrical furnace was put into operation. The furnace was designed for a consumption of 2,500 E.H.P., and estimated to be capable of producing 7,500 tons of pig-iron per year. Two transformers, each of 1,100 kilovolt-amperes, were installed for working the furnace. These are supplied with three-phase alternating current at 25 periods and a pressure of 10,000 volts, and they are coupled in Scott's connection. They yield a two-phase current with a voltage adjustable between 50 and 90 volts in eight stages, and in addition by change of connection on the secondary side, also from 100 to 180 volts.

The electrical energy is conveyed to the furnace chamber by means of four electrodes, each of which is made up by four single electrodes, with an aggregate section of 660 mm. square (26 × 26 in.) per electrode. The electrodes project through the arch of the furnace in a slanting position, forming an angle with the horizontal plane of 65°. The quadrangular electrode, when inserted in the arch, is surrounded by cooling jackets of copper, which are made tight by means of asbestos packing, in order to prevent any leakage of the furnace gases. A fan is installed for the circulation of the gas. With a gas temperature of 200° C. and a mixture of gas of equal volumes of CO and CO_2, the fan yields 70 cubic metres (2,470 cb. ft.) of gas per minute, against a 325 mm. water-pressure. This means a consumption of 8 H.P.

The furnance is encased in iron plates and measuring from the floor of the furnace to the upper edge of it, the height is 12·7 metres, and as the bottom of the furnace is 1 metre above the floor of the furnace house, it follows that the total height of the furnace from the ground is 13·7 metres.

The total volume of the furnace was 38 cubic metres, of which the melting chamber occupied 12·45 cubic metres. The total cost of the plant was £17,800, and the expenditure thus exceeded the original amount granted by about £3,800. The expenditure does not include anything for the production of the electrical energy but only for the transmission plant, as the energy was obtained from the Trollhättan power station by purchase.

Without going into details in regard to the working of the Trollhättan furnace, it is sufficient to say that the results have been very satisfactory, considering the various difficulties that have had to be overcome. One of these was, for instance, the varieties of charges employed. During the first five months the charges were continually changed, and there were no fewer than 29 charges used of varying composition, and it stands to reason that it must have been a very difficult task to make the furnace suit all kinds of ores, &c. The varying charges had naturally an unfavourable effect on the durability of the arch, but, on the whole, it must be said that the furnace stood the severe tests very well. The production of pig-iron in proportion to the consumption of energy varied considerably and was as low as 2·43 tons per H.P. per year, but it also reached 2·99 tons per H.P. per year. The results from high grade ores were generally better than those obtained from low grade ores. During the period November 16th, 1910-April 6th, 1911, the interruptions in the supply of electrical energy lasted 173 hours for phase 1 and 1,006 hours for phase 2, which was due to the fact that the transformer had to be repaired three times on account of defects.

In order to make the electrical smelting of iron ore pay, it has always been regarded as necessary by all experts to bring the production up to 3 tons of pig-iron per H.P. per year, and this result has since been achieved at the Trollhättan Works as well as at the Uddevalla Iron Works, where three furnaces of the Elektrometal type are now in operation. It must, however, be added that this furnace can only use charcoal as fuel and not coke, as the latter material has turned out to be unsuitable.

Passing now to the views expressed by Dr. Ljungberg, he says that it has now been established as a fact that the Elektrometal furnace is satisfactory in economic, as well as technical respects, and it has by this time been brought to such a degree of perfection that it is very doubtful whether the type can be improved upon, and any alterations with the view of increasing the production can scarcely come into consideration. But for the production of electrical pig-iron on a large scale, this furnace would not do, because the construction is not suitable for a higher consumption than 3,000 H.P., and in view of this the Stora Kopparbergs A/B has had to resort to another type, viz., the Helfenstein furnace, which is able to work with a load of 10,000 to 12,000 H.P. It has always been difficult to draw a comparison between the economic results from the production of pig-iron in the electrical furnace, and in the ordinary charcoal blast furnace, and up to the present it has, in fact, been quite impossible to obtain exact and reliable figures, because electrical smelting has not been carried on during a sufficiently long period to allow of such figures being given. The products have also mostly been employed at the producer's own works, which is one reason for the lack of figures that otherwise might have been available.

Electrical smelting, according to the Elektrometal process, has now arrived at a stage at which it is made to pay, and electrical pig-iron ought, as a rule, to fetch a somewhat higher price in the market than ordinary pig-iron.

As, however, the Elektrometal furnace is limited to a consumption of 3,000 H.P., the production will also be limited, and it is easy to understand that a furnace like the Helfenstein furnace, which is capable of consuming three or four times the amount of energy with a corresponding increase of the production, would have certain advantages, and ought to be a more suitable type of furnace for the production of pig-iron on a large scale, because the cost of manufacturing per ton for one large unit would, under equal conditions, be much lower than the corresponding figure for several small furnaces with less capacity.

Expenses, such as the ordinary working costs, depreciation, interests, repairs, &c., will, of course, be reduced in proportion to the production as soon as this is raised. These are the reasons why the Stora Kopparbergs A/B locked out for another type of furnace, and why the company has taken the risk of building a 12,000-H.P. Helfenstein furnace, although there was a Swedish furnace in existence that had passed the experimental stage. This furnace was completed at the beginning of last year, and experiments have since that time been carried out. They have not been altogether successful, and frequent disturbances of the work have occurred, so that the operations have repeatedly been discontinued in order to allow various alterations to be carried out.

There are still certain difficulties in the working that have not been overcome, but Dr. Ljungberg is very confident that the existing difficulties are not insurmountable, and that it is only a question of time and patience to get over the same. The company will unquestionably soon achieve the production of electrical pig-iron on a large scale.

The plans for the company's future activity during the first 10 years have already been prepared, and, according to these, it is the intention to increase the production of iron and steel gradually, so that the present annual production, which is somewhat under 100,000 tons, will be raised to about 300,000 tons per year. Out of this quantity it is the intention to produce about 200,000 tons of electrical pig-iron. This enormous increase will raise the total output of pig-iron of the whole country by about 25 per cent., and it is only natural that this activity will require a large quantity of electric energy. Provision has, however, been made for the necessary energy, which will be derived from the company's own waterfalls by a further harnessing and regulation of the same. The total amount of power required for this industry alone will be about 70,000 electrical H.P.

With reference to the raw materials needed, the company is just as self-supporting and independent as it is in the question of energy, and there is no necessity to go to the market, as the additional quantity of 500,000 tons of ore per year will be obtained from the company's own mines in Central Sweden, which are quite capable of yielding this quantity and even more for a good many years, when the mining operations are extended in accordance therewith.

It has always been a traditional policy of the company to avoid the export of raw materials, but to employ these instead for manufacturing purposes and then export the finished rolled products. The same policy will also be pursued in future, and it is the intention, apart from the export business, to lay particular stress on the supplying of the Swedish engineering workshops with cheap raw materials, and also the building and railway industries.

It will, as mentioned before, require a period of about 10 years to put all these plans into operation. In the meantime there is every reason to congratulate the nation which is capable of producing such an enterprise, and also to congratulate the electrical industry upon the progress which is foreshadowed and partly realised in connection with the electrical smelting of iron ore.

NOTES.

American Electric Vehicles.—English Agencies.—Mr. E. W. Curtis, of the General Vehicle Co., New York, is visiting England with the view of establishing a number of agencies and branches for the sale of electric vehicles.

Electric Cooking.—On Monday last, at the invitation of Mr. R. F. Venner, we had the pleasure of putting his new electrical cooking apparatus to the test which proverbially is the only reliable and convincing proof of quality—not that we ate the apparatus: that would have been too tough a proposition. The occasion was an electrical luncheon at the offices of "Venner's Electrical Appliances," Walter House, Strand. The menu comprised grilled soles and salmon, grilled kidneys and sausages, roast lamb, baked potatoes, an omelette, and coffee—all prepared entirely with the Venner apparatus in the presence of the guests, who, however, were not in the least incommoded with fumes, odours and heat such as are associated with cooking by gas. The quality of the dishes was all that could be desired, and the simplicity of the processes through which they passed was remarkable—apparently all that needed to be done was to put the raw material in or on the cooker, and remove the finished article. Brains, however, are necessary to the attainment of perfection, and we must pay a tribute of respectful admiration to the skill of the accomplished artiste, Miss Campbell, in charge of the culinary arrangements.

As regards the appliances with which such excellent results were obtained, we must defer a description of the details to our next issue; but, in the meantime, we may briefly indicate that the essential principle of the apparatus is the use of oil as the vehicle conveying the heat from the heating element to the metal surface upon which the food is cooked. Amongst other advantages, this plan ensures that the elements shall never be heated above about 450° F., and therefore are practically everlasting, while the efficiency of the transfer attains a very high value. In the case of the oven this principle is departed from, open elements being used, but there are various ingenious improvements in the design of the oven which will be found of interest.

Tangled Wires.—A correspondent in California writes:—Steel poles carrying high-voltage transmission wires were washed out by the high water along the Los Angeles River, at the Aliso Street Bridge. Three transmission lines and three trolley-wires were instantly entangled, and the ensuing fireworks were spectacular in the extreme. About 1,000 people had gathered at that point to watch the storm water cutting into the river banks, and a swift scurrying to safety followed as sparks, flames and the smell of fusing metal gave the alarm. Fortunately, no one was injured by the tangling of wires carrying 15,000 volts, but the trouble man found all the trouble he was looking for directly afterwards. For hours the electric lines were out of commission, and light and power in various parts of the city were shut off.

Collapse of a Transmission Line through Floods.

A Sign of the Times.—The accompanying view is of considerable interest, as it indicates the trend of public opinion in the matter of domestic electrical uses. The board is fixed on a block of flats in Marylebone, and our energetic friend, Mr. Seabrook, also sends us another view showing much the same thing in the case of another block of flats. In Marylebone, at least, electric heating and cooking are becoming as well known as electric lighting; and if in Marylebone, why not in other London areas with similar requirements?

All-Electrical Flats.

A Diesel Dinner.—An interesting function took place on Thursday last week at the Trocadero—namely, the first dinner of the Diesel Engine Users' Association, the youngest of the many organisations for special purposes which have sprung up in the engineering world. Mr. J. E. Edgcome, of Kingston-on-Thames, is the president, and occupied the chair at the dinner, which was attended by some 50 members and guests—mainly the latter.

After the loyal toasts, the success of the Association was proposed by the Mayor of Kingston-on-Thames, Councillor C. H. Burge, in an entertaining and discursive speech. Mr. Burge claimed for Kingston the distinction of being the first town in the kingdom which had installed Diesel engines of the horizontal type; he only regretted that they had to obtain them from Germany, which had reaped the advantage of being the birthplace of Dr. Diesel. The Association, he said, though in its infancy, was composed of veterans, and he hoped that it would grow and become more and more beneficial, not only to its own members, but also to the public in general.

Mr. Edgcome, responding to the toast, said he hoped the dinner would become an annual event. The Association was formed last year, its origin being a meeting of engineers using Diesel engines, who found that certain problems required attention, and desired to exchange experiences; the qualification for membership was "the use of Diesel engines," and the chief engineers of all large undertakings using them were eligible. The result had been satisfactory. The Diesel engine was invented no less than 21 years ago, and at present in England there were 450 engines at work, aggregating 86,000 h.p.; abroad there were 4,050, with 750,000 h.p. The members of the Association were few in number and exceedingly scattered, so that it was difficult to hold meetings that were fully representative, but when they did get together and related their experiences, the results were most important to themselves and to the whole industry of Diesel engines. Mr. Edgcome repudiated the idea that there was any antagonism whatever between the Association and the manufacturers; their interests were absolutely identical, and while the manufacturers fully and generously placed their knowledge at the service of the engineers, the experience of the latter was useful to the former. The users were constantly in touch with the engines and could point out features in which improvements could be made. The Association also could be of service in the matter of fuel oil. As long as the price of oil was kept at an abnormally high figure the general use of the engine would be retarded; 70s. to 80s. per ton delivered did not fairly represent the value of the oil. As the Association grew it would be able to exercise influence upon the people who were keeping up the price apparently for the sake of profit. Again, the Association would be useful in experimenting with different classes of fuel. At present it was practically impossible to obtain in this country a regular supply of gas tar oil, &c., of uniform quality and at a fair price. With the co-operation of the manufacturers the Association would exert a useful influence in this regard. He thanked the Association for electing him president for the first year.

Mr. W. E. Brandreth, hon. secretary, proposed the health of the guests, who were in the majority at that meeting, owing to the scattered nature of their membership. He said they wished to work in perfect harmony with the manufacturers; frequent conferences would help them to eliminate troubles incidental to the Diesel as to other engines, and to render the plant more economical and reliable. It was only by running the engines that they could learn all about them, and their reports would help the manufacturers. Thus by attaining the objects for which the Association was founded, the demand for the engines would be increased and the costs of manufacture reduced—then the members of the Association would reap their just reward. The membership was not restricted to users of electrical generating plant, it was open to chief engineers of all concerns using Diesel engines. The representatives of many manufacturers were present; manufacturers were not at the moment eligible for membership, but were well represented on the Association, as the members all stuck up for the type of engine under their control.

In response, Mr. H. S. Russell (Messrs. Mirrlees, Bickerton and Day) heartily associated himself with what the president and secretary had said regarding the relations of the Association and the manufacturers. There had been a feeling at first that the Association was formed to get better terms from the manufacturers, but they were now in full agreement, and only too glad to profit by the experience of the users of Diesel engines. Mr. Russell concluded a humorous speech with apt quotations from "Macbeth," which, he contended, showed that Shakespeare knew a good deal about the Diesel engine.

Mr. G. Heath (Consolidated Diesel Engine Manufacturers, Ltd.) and Mr. J. M. Ferguson (Willans & Robinson, Ltd.) also replied, expressing their pleasure at being present, and agreeing that the assurances given the manufacturers regarding the intentions of the Association had been fully realised.

Finally, Mr. G. Porter proposed the health of the President, who, he said, was chosen because he was the best man for the post, and Mr. Edgcome briefly replied.

A programme of music was interspersed with the speeches, and the entertainment, as a whole, was highly successful.

Institution and Lecture Notes. — INSTITUTION OF ELECTRICAL ENGINEERS.—For the annual election of ordinary members of Council, in addition to the eight names put forward by the Council for the six vacancies (which we published in our issue of April 30th), several other nominations have been made from outside the Council:—

MR. REGINALD WALLIS-JONES, consulting electrical engineer, has been nominated by 60 members, including Sir David Salomons, Capt. H. R. Sankey, Messrs. A. L. C. Fell, Justus Eck, A. T. Snell, F. H. Nalder, A. Gay, E. Garcke, E. Manville, Col. H. M. Leaf, &c.

MR. FRANK AYTON, electrical engineer to Ipswich Corporation, has been nominated by 10 members, namely, Messrs. A. C. Cramb, A. Hugh Seabrook, R. A. Chattock, H. Faraday Proctor, Thos. Roles, John Christie, S. L. Pearce, W. Wyld, J. E. Edgcome and C. S. Davidson.

MR. JOHN CHRISTIE, electrical engineer to the Brighton Corporation, has been nominated by Messrs. W. W. Lackie, Frank Ayton, C. Furness, A. S. Blackman, J. W. Beauchamp, S. J. Watson, E. E. Headley, F. M. Long, W. A. Vignoles and H. Richardson.

It is interesting, especially to members of the Incorporated Municipal Electrical Association, to note that Messrs. Ayton and Christie's supporters are drawn entirely from the ranks of the I.M.E.A., and that they include almost the whole of the engineer members of the Council of that Association. So remarkable a circumstance can hardly be of accidental origin, and, no doubt, it will have its effect upon the voting, the result of which will be interesting, as there are now 11 nominations for 6 vacancies.

DUBLIN SECTION.—A very enjoyable function took place in the Lecture Theatre, Leinster House, Dublin, on Saturday last, when the Local Section of the Institution held their annual conversazione. The Theatre, which had been kindly placed at the disposal of the Committee by the Royal Dublin Society, presented a very festive and brilliant appearance. The guests, numbering about 200, were received by the chairman, Mr. G. Marshall Harris. The gathering included representatives of the various scientific and engineering associations in the city. Amongst those present were Capt. Adcock, Mr. J. C. Cowan, Mr. W. H. Tasker, Major Harriss, Mr. G. Idle, Capt. C. Jones, Col. Macartney, Prof. Orr, Mr. A. G. Porte, Dr. Probst, Mr. Robinson, Mr. Mark Ruddle, Prof. Scott, Mr. Tomlinson (hon. sec.). and Capt. Webber. During the evening a programme of vocal and instrumental music was carried through, amongst those contributing being Miss Stanford Campbell and Messrs. W. Lewin, J. E. Payne, G. White, Wesley Guard, J. R. Morgan, and H. Baynton ('cellist); while Mrs. White acted as accompanist. Mr. Frank L. Baynton's string orchestra played a charming selection of music during the reception and the interval. The musical programme was varied by two brief but interesting lectures by Prof. G. A. J. Cole, F.G.S., and Dr. Pollock. The former dealt with scenes in some of the walled towns of Southern France and Germany; while Dr. Pollock chose as his subject a description of notable scenes in Cyprus. Both lectures were well illustrated by lantern slides, and were much appreciated by the audience.

On Tuesday last the paper on "Current Limiting Reactances on large Power Systems," by Messrs. K. M. Faye-Hansen and J. S. Peck, was submitted to the members of the SCOTTISH LOCAL SECTION at Glasgow. A discussion followed.

At the meeting of the BIRMINGHAM LOCAL SECTION, on Wednesday last, a paper was read by Mr. A. M. Taylor, at Summer Lane generating station, on "Static Transformers for the Simultaneous Changing of Frequency and Pressure of Alternating Currents," and was followed by a discussion.

ROYAL SOCIETY OF ARTS.—On Tuesday, Mr. Charles Bright, F.R.S.E., read a paper on "The Administration of Imperial Telegraphs," in which he advocated the laying of a State owned Atlantic cable and a cheap tariff for messages within the Empire, as well as a permanent central authority to control the inter-Imperial telegraphs, including the Pacific cable and the wireless chain.

ELECTRICAL CONTRACTORS' ASSOCIATION.—On Wednesday last the annual dinner of the Association was held at the Grand Hotel, Leicester; Mr. H. S. Webb, the president, occupied the chair, and some 50 members and guests were present. A report will appear in our next issue.

VEREIN DEUTSCHER ELEKTROTECHNIKER.—The annual meeting is to be held in Magdeburg, from May 24th to the 28th. Papers are to be read by Dr. F. Foerster on "Electro-Chemistry," by Dr. Ing. Guggenheim on "Electric Steel," by Prof. Dr. Dieselhorst on "Progress in Wireless Telegraphy," by Prof. Josse on "Condensing Plants," and by Herr O. Krell on "Electricity on Ship-board." A number of visits are also to be paid during the gathering, including one to the municipal central electric lighting station in the town, one to the works of Messrs. Schaffer and Budenburg, and another to the engineering establishment of Messrs, R. Wolf.

Concert.—The annual smoking concert of the electrical engineers' department of the Great Eastern Railway, held at the Cannon Street Hotel last Saturday, was a great success. The company present numbered over 600, and included Sir Ailwyn Fellowes, K.C.V.O., deputy chairman of the G.E.R., and the following officers:—Mr. Wm. C. May, chief goods manager; Mr. A. J. Hill, locomotive superintendent; Mr. S. A. Parnwell, land agent; Mr. A. E. Dolden, accountant; Commander Coysh, Marine superintendent; Mr. G. Keary, district superintendent; Mr. J. H. Wardley, engineers' department; Mr. A. O. Shave, printing works; Mr. A. P. Parker, general manager's office; Mr. E. S. Tiddeman, loco. department; Mr. G. Bird, engineers' department; Mr. W. Greenfield and Mr. C. T. Wells, superintendent's department; and Mr. Dodson, goods manager's office.

The visitors included Mr. W. Duddell, President of the Institution of Electrical Engineers; Mr. Roger T. Smith, electrical engineer, Great Western Railway; Mr. T. Stevens, consulting electrical engineer; Mr. P. V. McMahon, engineer, City and South London Railway; and Mr. Harcourt Williams, of the British Thomson-Houston Co.

Mr. Duddell proposed the toast, "The G.E.R., its Chairman, Director and Officers," and Sir Ailwyn Fellowes responded; Mr. D. James proposed "The Visitors," and Mr. Roger T. Smith replied; Mr. W. C. May proposed "The Chairman of Concert" (Mr. Frith), and Mr. Frith suitably responded. "The Committee and Hon. Secretary" was proposed by Mr. H. W. Frith, Mr. J. W. Ball, hon. secretary, replying.

The Building Trade Dispute.—The men have ballotted as follows respecting the modified disability clause and other proposals:—In favour, 2,021; against, 23,481. Majority against, 21,460.

Appointments Vacant.—The Kent Education Committee is inviting applicants for the post of head of the Engineering (Mechanical and Electrical) Department at the Technical Institute now erecting at Ashford (£150 to £180); borough electrical engineer (£450) for Greenock; draughtsman (temporary) for Newport electricity department; posts and telegraphs inspector for Gold Coast Government (£250), age 25 to 40. Particulars are given in our advertisement pages.

The Engineers of the "Titanic."—Last week a monument, erected in Southampton to the memory of the engineers of the *Titanic*, who died at the post of duty, striving to keep the vessel afloat, was unveiled by Sir Archibald Denny, and formally dedicated.

Inquiry.—A correspondent wants a simple and cheap controller for an electric launch.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At last week's meeting of the Greenock Town Council, reference was made to the resignation of MR. J. A. ROBERTSON, the borough electrical engineer, who was going to Salford. Treasurer Williamson said that he could not speak too highly of Mr. Robertson's ability and admirable service. During his 11 years at Greenock the department had progressed with great rapidity. The Electricity Committee had appointed him consulting engineer until the completion of the extension to Port Glasgow. They also intended to ask him to guide them in appointing his successor. At the closing meeting of the Scottish Local Section of the I.E.E., of which Mr. Robertson is president, he was congratulated upon his new appointment, and received a vote of thanks for his management of the Section for the past 12 months.

MR. NORMAN STANILAND, the borough electrical engineer of Hornsey, is to have his salary increased from £500 to £550 per annum.

Mr. Charles Lill, sales engineer of the electricity department of the Hackney B.C., has resigned on securing an appointment with Messrs. J. & H. Grevener as engineer in charge of their motor and dynamo department. Mr. C. J. Smith, mains prime cost clerk at Hackney, has secured an appointment under the Shanghai Municipal Council. Mr. F. G. Taylor, at present sales prime cost clerk, takes the place vacated by Mr. Smith, and Mr G. W. Dawkins, at present works general clerk, takes Mr. Taylor's former position.

Mr. Sydney Trow Smith, of Leek, has been appointed, out of 33 applicants, gas and electrical engineer to the Malvern U.D.C., at a salary of £350, rising to £400, *vice* Mr. W. H. Johns, who is proceeding to West Bromwich.

The Darwen Electricity Committee has recommended that the salary of Mr. C. Garnett, the electrical engineer, be increased by £50 a year.

Mr. H. P. Stokes, electrical engineer and tramways manager to the Bexley Urban District Council, has had his salary increased by £100 per annum.

Tramway Officials.—A serious accident happened on Friday last to Mr. Waldeman Jensen, manager of the Chatham and District Light Railway Co. He was about to enter a car at Gillingham when he was knocked down by another car, and fell between the two. He was badly crushed and sustained a serious cut on the head, necessitating his removal to the Hospital.

General.—According to the *New York Times*, Mr. Newcomb Carlton has been elected president of the Western Union Co. in the place of Mr. Vail, this step having been rendered necessary owing to the arrangement between the Attorney-General and the American Telephone and Telegraph Co. for the severance of relations with the Western Union. Messrs. C. W. E. Atkins and Belvidere Brooks have been elected vice-presidents, Mr. W. H. Baker secretary, Mr. A. R. Brewer treasurer, Mr. E. T. Gallaher controller. The executive committee is composed of Messrs. Baker, H. A. Bishop, Carlton, H. C. Davison, T. E. Hubbard, R. S. Lovett and M. L. Schiff. Mr. Carlton has returned to the United States.

Mr. E. J. Nally, vice-president and general manager of the American Marconi Co., is at present in London.

Mr. Geo. Ward, of the Commercial Cable Co., is expected in London in June next.

As a memento of Her Royal Highness's visit to the district, the inhabitants of Rhondda last Friday presented to Princess Alexander of Teck a "Ceag" electric miner's lamp in solid silver. It was an exact copy of the standard collier's "Ceag" lamp which, as our readers will remember, took the first prize in the competition of a year or two ago. The presentation lamp was supplied by the "Ceag" Electric Safety Lamp Co., Ltd., through Messrs. Haslam & Schontheil, Ltd., of Cardiff.

According to the *Financial Times* the twelfth annual dinner of the Eastern Telegraph Schools' Athletic Club was held last Friday evening, at the Holborn Restaurant. The chairman, Mr. F. A. Johnston, in proposing "The Club," referred to the retirement, after 41 years' service with the company, of Mr. T. A. Bullock. Mr. P. Burrell, president of the School, replied. A gold cigarette case, subscribed for by those present, was handed to Mr. Bullock, who, in responding, referred to the great changes that had taken place during his service with the company. Other speakers included Mr. J. C. Denison-Pender, M.P., and Mr. W. Slingo.

Mr. Roderick MacLeay, senior supervisor at the Portsmouth Dockyard electrical power station, is entering upon a commercial career at Montreal, Canada.

The marriage took place at Uley Parish Church last week of Mr. S. V. Lancey, electrical engineer, of Southampton, and formerly of the electrical staff of Mawdsleys, Ltd., of Gloucester, and Miss Rose Lusty, daughter of Mr. Lewis Lusty, of Uley.

The marriage took place at St. Paul's Church, Herne Hill, London, on April 18th, of Mr. Thomas Mountford Taylor, elder son of Mr. Thomas Taylor, J.P., of the firm of Taylor, Tunnicliffe and Co., electrical china manufacturers, Eastwood, Hanley and Longton, and Miss Dora Hair Masters, third daughter of Mr. J. John Masters, of Brent Lodge, Norwood Road, Herne Hill. They were the recipients of many valuable presents.

Obituary. — Robert Kaye Gray.—With profound feelings of regret we have to record that Mr. Robert Kaye Gray breathed his last on Tuesday afternoon at Brighton, after a long illness, in his 63rd year. In our issue of November 25th, 1904, we reproduced the most lifelike photograph obtainable of Mr. Gray, together with a brief account of his career and exceptional qualities. He was a prince among Presidents of the I.E.E., and had thousands of admirers and friends in telegraph and electrical circles in all parts of the globe who will learn with pain of his death. We shall make more extended reference to the matter next week, but for the information of those desiring to attend the funeral, we would say that the ceremony is to take place on Saturday afternoon. The remains will leave Lesseness Park, Mr. Gray's residence at Abbey Wood, at 3.45 p.m., and the interment will take place at St. Michael's Church, East Wickham, at 4 o'clock. A convenient train leaves Charing Cross Station at 2.12 o'clock, and Cannon Street at 2.20 o'clock, for Abbey Wood Station. Friends will proceed direct from the station to the Church.

The death occurred on March 15th of Mr. John Kneeshaw, tramway traffic superintendent, at Sydney, under the New South Wales Railways Commissioners. He was in his 53rd year.

Mr. A. N. Banister.—The death is announced of Mr. Alan Neville Banister, formerly for some years manager of the Norwich Electric Tramways Co. He was 54 years of age, and passed away on April 22nd at the Homestead, Gallywood, Essex.

NEW COMPANIES REGISTERED.

Setok Syndicate, Ltd. (135,394).—This company was registered on April 23rd, with a capital of £1,500 in 1,000 ordinary shares of £1 each and 10,000 deferred shares of 1s. each, to acquire and deal in land, mines, forests, minerals, railways, buildings, business concerns, stocks, shares, patents and property of all kinds, to carry on the business of an electric light company, to construct railways and other works, &c. The subscribers (with one share each) are:—B. R. Kingsford, Whiteholm, Laurel Road, Barnes, S.W.; Major M. O. Donel, 46, Bassett Road, Notting Hill, W. Private company. Table "A" mainly applies. Secretary (*pro tem.*), C. F. Mitchell. Registered office, Central House, Kingsway, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Pernambuco Tramways and Power Co., Ltd.—Issue on April 7th, 1914, of £100,000 debs., part of a series of which particulars have already been filed.

Sheerness and District Electric and Traction Co., Ltd.—Issue on March 27th, 1914, of £1,750 debs., part of a series of which particulars have already been filed.

Lamp Manufacturing Co., Ltd. (76,151).—Capital, £10,000 in £1 shares. Return dated February 3rd, 1914. 5,400 shares taken up. £5,400 paid. Mortgages and charges: £2,500 debs.

Hove Electric Lighting Co., Ltd. (36,942)—Capital, £100,000 in 15,000 ord. and 5,000 pref. shares of £5 each. Return dated March 24th, 1914; all shares taken up; £100,000 paid. Mortgages and charges: £44,600.

I. Frankenburg & Sons, Ltd.—Capital, £250,000 in £10 shares (12,500 pref.). Return dated February 23rd, 1914; 12,465 ord. and 10,120 pref. shares taken up; £10 per share called up on 2,965 ord. and 120 pref.; £30,850 paid; £195,000 considered as paid on 9,500 ord. and 10,000 pref. Mortgages and charges: Nil. (A further 105 pref. shares were allotted for cash on March 31st.)

CITY NOTES.

Evered & Co., Ltd.

The directors report that the accounts for 1913 show, after providing for debenture interest, £1,410, and income tax £418, a net profit of £1,637, making, with £4,309 brought forward and £4,000 which it is proposed to transfer from the reserve, £9,946 to be dealt with. They recommend a dividend of 4 per cent. free of income tax, absorbing £6,830, that £1,000 be written off plant, and that £2,116 be carried forward. The directors record the death of Mr. Richard George Evered, the managing director of Surrey Works, which took place in January, and which is a great loss to the company, as he was a man of great business ability, keen insight, and indefatigable perseverance.

The result for the year is disappointing. This is due partly to a falling-off in the Mediterranean export branch of trade that showed itself in the first half of the year, and partly to the dislocation of business resulting from the rearrangement of the system of distribution of goods, started in June, involving the reduction of the Drury Lane establishment, and the transfer to the works of nearly the whole of the London trade and stock. The directors are satisfied that their policy is the right one, and that it will justify itself in subsequent years by a saving of expenses more than equivalent to the trade lost; but, while the latter effect has been immediate, the reduction of the London establishment must take some twelve months to carry completely into effect. Of the Drury Lane premises rendered vacant by the change, the larger portion has already been satisfactorily disposed of, and there can be no doubt that the remaining part will very shortly be let. Another result of the transference will be that the one single stock kept in Birmingham, while more complete and of greater amount than either of the two stocks kept hitherto, will be of less value than the two combined. In addition, therefore, to the reduction in expenses, there will be an appreciable amount of capital released by this reduction in stock. Much of this capital was provided in the past by profits placed to reserve, employed in the business. In all the circumstances, therefore, they feel justified in recommending the appropriation of a comparatively small sum from the reserve, as this stands at a large amount and is an accumulation of undivided profit.

Mr. E. T. Read has been appointed to the general managership of the works. Mr. R. G. E. Freeman and Mr. Harold Evered have been elected to seats on the board.

Melbourne Electric Supply Co., Ltd.—The directors announce that, in view of the fact that the company's earnings foreshadow the maintenance of the dividend of 10 per cent. paid on the consolidated ordinary stock last year, they have decided to equalise the interim and final dividends, and have accordingly declared an interim dividend at the rate of 10 per cent. per annum, free of income-tax, payable on June 2nd in respect of the half-year to February 28th.

Auckland Electric Tramways Co., Ltd.—The directors have declared a dividend of 7d. per share for the half-year to December 31st.

Adelaide Electric Supply Co., Ltd.—The directors have declared an interim dividend of 5s. per share on the ordinary shares.

Kaministiquia Power Co.—A quarterly dividend of 1½ per cent. is announced, as compared with 1¼ per cent. a year ago.

West African Telegraph Co., Ltd.—A final dividend of 4s. per share is announced, making 4 per cent. for the year.

Anglo-Argentine Tramway Co.

Mr. J. B. Concannon presided at Winchester House, E.C., on Monday, over the annual meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 709), the Chairman referred first to the death of three members of the board. Continuing, he said, no doubt they were all aware that business in the Argentine during 1913 showed no improvement upon 1912, which was not a good year, but rather the contrary, and naturally the commerce of the City of Buenos Ayres suffered in consequence. It was all the more pleasant therefore to be able to congratulate them upon the continued progress made by the company. The total number of miles run, namely, 50,872,935, showed an increase of 6·51 per cent. over 1912, while the number of passengers carried, 342,140,422, increased by 25,880,325, or 8·18 per cent., and the total receipts were better by £208,382, or 7·56 per cent. The expenses showed an increase of £145,140, mainly under the head of wages consequent upon the additional mileage. Thanks to lower freight rates for coal and to continued economy in the consumption of current, there was an actual decrease in the costs of £5,348, as compared with 1912, although the cars ran 3,107,268 more miles. The expenditure included £347,650 spent upon overhead lines, cables, permanent way, rolling stock, and buildings, as well as £150,000 credited to the renewals fund. The latter fund was charged with £147,652 for renewals effected during the year. The net revenue account, including the balance £9,253 carried in from 1912, after providing the city company's annuity, interest on debenture stocks, interest on temporary loans, dividends on both classes of preference shares, provision for sinking funds on the 4 per cent. and the 4½ per cent. debenture stocks and the share capital, left a balance available for dividend on the ordinary shares of £232,795, an increase as compared with 1912 of £23,490. The interim dividend paid on the ordinary shares absorbed £100,000, and they now recommended a final dividend which would require £119,375, leaving a balance of £13,420 to be carried forward to the 1914 accounts. The subway construction work was making rapid progress, and they hoped by August next to complete the extension of the first section. The subway lines in operation were giving satisfactory results. The owners of the ordinary share capital had taken up 150,000 new shares at £5 5s. net to the company, and the balance of the 5 per cent. debenture stock, £1,500,000, was issued in February last, the applications for which amounted to £2,482,600. Upon the question of possible motor-omnibus competition, to which he referred at the last annual meeting, they would be interested to hear that the municipal Council had recently declined to grant any concessions therefor, upon the grounds that the tramways system was sufficient for the public needs, and that the narrow streets and the paving system would make their operation inapplicable. For the current year up to March 31st the gross receipts showed an increase of £20,814 over those of 1913. As to the prospects for the remaining months, he referred them to the last paragraph of the general manager's report. [This paragraph reads :—"I do not, therefore, consider that we should by the end of the year show any falling off in receipts on the surface lines, and the receipts of the subway's working of the extension to Caballito will probably bring the total increases up to between 6 and 7 per cent. on the receipts of 1913."] His forecasts hitherto had been on the conservative side ; let them hope that he had not been too sanguine this time.

Mr. C. R. Sanford seconded the motion.

Replying to Mr. A. F. Gurney, the Chairman said the reason for there being two sets of law charges in the accounts was because one set referred to London and the other to Buenos Ayres.

The report was adopted.

Mr. Leon Cassel, Mr. W. F. Hamilton, K.C., and Mr. G. A. Touche, M.P., were elected directors to fill the vacancies caused by death.

The Chairman proposed a hearty vote of thanks to the chairman and members of the local committee, Mr. Pedriali, the general manager, and the staff in Buenos Ayres and London.

The motion was carried.

The Chairman mentioned that there were now 26,000 debenture and shareholders connected with the company.

London Electrical Trading Co., Ltd.—The adjourned second ordinary general meeting of this company was held at 185, Wardour Street, London, W., on April 9th. In proposing the adoption of the annual report and balance-sheet for the 16 months ended at October 31st, 1913, the chairman, Dr. H. Charlton Bastian, F.R.S., stated that the turnover during that period had been more than doubled as compared with the preceding 16 months. In order to establish the position of the company in many markets, it had been necessary to accept low prices in the first instance, and, consequently, the net profits were small in proportion to the turnover. It was expected that the volume of business would be well maintained, and that better prices would be obtainable in future. The directors' recommendation that a dividend of 4 per cent. on the ordinary shares be declared, payable on July 1st, 1914, and that £255 be carried forward, was duly approved. Rear-Admiral Commendatore Persico, R.I.N., was re-elected a director.

Cork Electric Tramways and Lighting Co., Ltd.—The annual meeting was held at 83, Cannon Street, E.C., on Friday last, Mr. A. R. Monks (chairman) presiding. The proceedings were purely formal, and on the motion of the chairman, seconded by Mr. H. C. Levis, the report, as already published, was adopted.

Continental Notes.—Norway.—The annual general meeting of the A/S Norsk Elektrisk Metalindustri was held recently, and according to the directors' report, the results for the past year's working have been very satisfactory. The company was established four years ago with a capital of £11,670, and has carried on the electrical smelting and refining of zinc. The works are situated at the town of Sarpsborg, in the south-eastern part of the country.

It is reported from Trondhjem that the Meraker Co., which owns a number of pulp mills, carbide factories, &c. has lately bought some large deposits of limestone in the neighbourhood of Trondhjem, and is carrying on negotiations for the purchase of several others. The company has at the same time worked out the plans for the harnessing of several of the waterfalls belonging to it, and it is thought that the acquisition of the above-mentioned limestone deposits is closely connected with the latter scheme, and that the energy will be employed for the production of either calcium-carbide or nitrates, for both of which limestone is the raw material. The factories will be built at the port of Hommelvik, at the Trondkjemsfjord, where the company has secured large sites and to which place the transmission of energy offers no insurmountable difficulty.

Sweden.—A new company has recently been formed at Stockholm under the name of the Tungsten Wire Works, with a capital of £2,055, for the manufacture of tungsten wire.

An Italian Amalgamation.—A great financial transaction is impending in Naples, where the Società Meridionale di Elettricità is about to acquire the undertakings of the two other supply companies in Naples. These are the Società Napoletana, which has a combined share and loan capital of £420,000, and the Società Generale, whose united share and loan capital amounts to £1,000,000. At the same time, the debts of the Società Meridionale, which represent a total of nearly £600,000, and which have been chiefly contracted with the Société Financière Italo-Suisse, of Geneva, are to be converted into shares, and the share capital increased from £400,000 to £2,000,000. The other enterprises interested in the amalgamation are the Italian Meridional Railway Co. and the Banca Commerciale, and the completion of the scheme will combine all the electric lighting interests in Naples. It is next proposed to proceed with the erection of hydro-electric works in connection with the river Sangro, in the Abruzzi.

Russia.—The United Cable Works Co., of St. Petersburg, report a net profit of £147,510 for the last financial year, as compared with only £102,160 in 1912. The dividend is being increased from 8 to 10 per cent.

Germany.—The report of the Bergmann Elektricitätswerke Gesellschaft, Berlin, for the last financial year shows that after making due allowance for depreciation, the net profit amounted to £158 930, as compared with only £119,000 in 1912. A dividend of 5 per cent. is again being declared, a sum of £10,500 is also being set aside for writing off doubtful debts, leaving £16,490 to be carried forward.

The report of the Gesellschaft Mix & Genest Telephon und Telegraphenwerke, of Schoneberg, Berlin, for the last financial year, shows a net profit of £14,650, as compared with a loss of £60.118 in 1912. A dividend of 4 per cent is being declared.

Belgium.—La Société A.E.G. Union Electrique, of Brussels, the Belgian branch of the A.E.G. Co., reports a net profit of £11,890 for the last financial year.

La Société Belge d'Electricité, Eclairage, et Force Motrice, of Brussels, reports a profit of £940 for last year.

Japan.—The last Japanese mail brings the news that the Anglo-Japanese Water Power Electric Co., of Tokio, proposes to increase its capital from £120,000 to £300,000, with the object of establishing a new hydro-electric power station on the River Tomoe-gawa, at Aichi-ken. The company is at present running a power station of 3,000-H.P. capacity, and also taking current to the extent of 2,000 H.P. from the plant of the Nagoya Water Power Electric Co. The demand for a supply of electrical energy in the Hamamatsu district has, however, so greatly increased that an extension of generating plant has become necessary.

A meeting of the shareholders of the Kyushu Electric Tramway Co. is about to be held at Kobe to consider a proposal to increase the capital of the concern to £630,000.

Western Union Telegraph Co.—The *New York Journal of Commerce*, of 15th inst., states that in view of the change in classification of accounts prescribed by the Interstate Commerce Commission, effective January 1st, 1914, the directors of the Western Union Telegraph Co. have decided that future quarterly statements submitted to stockholders at the time dividend cheques are forwarded, shall show the latest available results of actual operations, and that the practice of submitting partly estimated quarterly earnings shall hereafter be discontinued. The figures published for January and February are as follows :—Total operating revenues, $6,896.202 (decrease, $141,490) ; total operating expenses and taxes, $5,654,316 (decrease, $146,940) ; net income $1,241,886 (increase, $5,450).

Victoria Falls and Transvaal Power Co.—The *Times* states that the net earnings, including those of the Rand Mines Power Supply Co., for the quarter ended March 31st, amounted to £122,319.

Anglo-American Telegraph Co., Ltd.—Interim dividends for the quarter ending March 31st : 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax.

German Electrical Companies.

The *Berlin Elevated and Underground Railway Co.* proposes to raise further capital for the purpose of meeting the monetary requirements in connection with the extensions in progress, and for extinguishing the debt to the bankers incurred on these lines. The sum to be issued is £1,000,000 in 5 per cent preference shares, and the transaction will be carried out by the Deutsche Bank and allied institutions.

The *Electricity Supply Co., of Berlin*, which is interested in a number of electricity works, has just made an issue of £500,000 in 5 per cent. obligations, which will be redeemed at par by annual drawings, commencing in 1920 and terminating in 1919. At present the company has an ordinary share capital of £1,500,000, and loans amounting to £954,000, these being all of the 4½ per cent. class.

The *Rhenish Schuckert Co.* has decided to increase its share capital by the issue of £150,000 in new shares, which have been taken over by a banking syndicate headed by the South German Discount Co. The shares are to be offered to present proprietors at the price of 123 per cent. in the proportion of one new to three existing shares. At the same time an emission of 5 per cent. bonds is to be made of the amount of £300,000, redeemable at 102 per cent. in 25 years.

The *A.E.G.* has resolved to realise a financial transaction indirectly through a subsidiary company. Although the recently formed A.E.G. Schnellbahn, which is to be constructed between Gesundbrunnen and Neukölln, has yet to be commenced, the parent company will shortly issue, through its financial syndicate, cumulative preference shares for £1,125,000, and £500,000 in ordinary shares of the new high-speed railway company. The dividend coupon on the preference shares will be guaranteed by the A.E.G. at the rate of 5 per cent. until the end of 1923, and from the beginning of 1924, when the new railway company will assume the entire responsibility, the rate will be reduced to 4½ per cent. The A.E.G. consequently assumes the difference of ½ per cent. on its own account for 10 years, or a total of 5 per cent. for the whole period, in order to secure a speedy realisation of the capital. The transaction is considered to be unusual in connection with an undertaking which is merely in an initial stage.

The *Sudsee Gesellschaft fur Drahtlose Telegraphie, of Berlin*, which was formed in 1912, for the purpose of establishing a wireless system in the South Seas, shows a loss of £740 through working expenses down to June 30th, 1913. The stations are valued at £63,000 on a paid-up share capital of £32,500, and loans of £18,000 and £16,500 have been granted by the German-Netherlands Telegraph Co., of Cologne, and the Berlin Wireless Telegraphy Co., respectively.

The *Kabelwerk Duisburg, of Duisburg*, after allotting £35,000 to depreciation in 1913, as compared with £24,000 in the preceding year, reports net profits of £48,000, as against £23,000 in 1912. It is proposed to pay a dividend of 16 per cent. on the capital of £150,000, as contrasted with 14 per cent. in 1912, and to place £24,000 to the reserve fund, this comparing with £5,700 in the previous year.

The *Treuhand Bank fur Elektrische Industrie, of Berlin*, which is a financial institution originally established by the Felten and Guilleaume Co., and now also associated with the A.E.G., reports net profits of £14,200 from interest receipts in 1913, as compared with £12,700 in 1912. It is intended to distribute 4 per cent. on the paid-up capital of £312,500 out of nominal capital of £1,250,000, this rate contrasting with 3½ per cent. in the previous year. The bank is shortly to be developed by the calling up of further capital and the acquisition of the shares held by the Felten & Guilleaume Co.

The *Norddeutsche Seekabelwerke, of Nordenham*, whose share capital of £300,000 is held in equal halves by the German-Atlantic Telegraph Co. and the Felten & Guilleaume Co., earned gross profits of £53,000 in 1913, as contrasted with £82,000 in the preceding year. After meeting general expenses and apportioning £24,000 to depreciation, as against £26,000 in 1912, the accounts exhibit net profits and balance forward amounting to £37,000, as compared with £51,000 in the preceding 12 months. It is proposed to pay a dividend of 5 per cent., as against 10 per cent. in 1912.

The *Elektrochemische Werke, of Berlin and Bitterfeld*, which belong to the group of the A.E.G. and the Zurich Bank for Electrical Enterprises, record gross profits of £84,000 for 1913 from manufacturing and dividends received, the company having a working community of interests with the Griesheim Elektron Chemical Works. The figures compare with profits of £82,000 in 1912. After defraying general expenses and setting aside £2,500 for depreciation of investments, the accounts indicate net profits of £61,000, as contrasted with £60,000 in the previous year. The directors recommend a dividend of 10 per cent. on the ordinary capital of £275,000, being the same rate as in 1912.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared a dividend for the quarter ended December 31st of 2s. 6d. per share, together with a bonus of 4s. per share (or 2 per cent.), free of income-tax, making a total of 7 per cent. for the year 1913.

River Plate Electricity Co., Ltd.—For the year 1913 the net revenue was £42,201. A dividend of 10 per cent. on the ordinary stock is announced, carrying forward £13,062.

Rangoon Electric Tramway and Supply Co., Ltd.—The directors recommend a dividend of 6 per cent. on the ordinary shares, carrying forward £1,054.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

The directors' report for the year ended December 31st, 1913, states that the result though less satisfactory than that of some previous years is, when considered in all its bearings, not unfavourable. During the year several small consumers who took power at a somewhat higher rate than the average have closed down and thus the power sales and profits show a decrease. Contracts have, however, now been entered into with new consumers which, there is good reason to believe, will restore the company's business to the previous level both in volume and profit. After providing for payment of the debenture interest and the full dividend on the preference shares, and placing £3,000 to the reserve for renewals and depreciation, there remains to the credit of profit and loss account £372 to carry forward. The small cash position shown has resulted from the heavy capital expenditure, amounting to £9,618, incurred during the past year in the installation of the 750-KW. Parsons turbo generating unit and other plant. With a view of building up the company's financial position, and to make provision for the debentures which fall due on December 31st, 1917, the directors have decided to reduce, for the present, the rate of dividend on the preference shares from 6 per cent. to 4 per cent. The dividend warrants will be posted to the shareholders on the 1st prox., together with a print of the report of the proceedings at the general meeting. The new unit, the Parsons turbine referred to above, is working satisfactorily, but as it was in operation for less than half of the year under review no important benefit was derived from it. The company has now sufficient machinery for all the business including a reliable stand-by equipment. The heavy expenditure for new plant, which during the last six years amounted to £62,120, may now be considered at an end. The plant, machinery and buildings have been maintained in first class condition; the whole of the machinery works with efficiency. The directors report the retirement from the board of Mr. R. W. Wallace, K.C., and place on record their appreciation of his services as chairman since the inception of the company. Mr. G. C. Howard, one of the largest shareholders in the company, has been elected a director. Mr. Edward Pope, who was for many years vice-chairman, has been appointed chairman.

The annual meeting was held on Wednesday.

Worcester Electric Traction Co., Ltd.—The directors report that the total revenue for the year 1913 amounted to £18,070, as compared with £15,771. After deducting all expenses chargeable to revenue, including a provision of £2,139 for renewals, there remains £4,258, plus the amount brought forward, making £4,539 available for distribution. The directors are placing to reserve £1,000; to dividend on the ordinary shares at the rate of 3½ per cent. for the year, £3,339; carrying forward £200. The net revenue for the year shows an increase of £1,633, due chiefly to the fine weather during the summer and to the operation of additional motor-omnibus services. The agreement with the Corporation of Worcester, under which the Corporation maintained the whole of the permanent way for £450 per annum, was determined on December 31st last.

Swansea Improvements and Tramways Co.—The directors report that the total revenue of the tramways undertaking for 1913 amounted to £69,683, an increase of £5,870. The traffic receipts were £67,169, an increase of £5,800. After deducting all expenses, debenture and other interest, and the amount payable to the Swansea Corporation in respect of the lines leased from the Corporation and setting aside £7,500 to the renewals fund, there remains a surplus of £14,832. The directors propose to place to reserve £4,000 and to pay a dividend on the ordinary shares at the rate of 6 per cent. for the year, carrying forward £2,185. Capital expenditure during the year amounted to £8,082. There was also expended during the year £4,023 on renewals of the permanent way, electrical equipment and plant, which is charged to renewals fund. During the year three short extensions of the lines were constructed by the Swansea Corporation.

Cuba Submarine Telegraph Co., Ltd. — The directors report that the total receipts of the 12 months ended December, 1913, were £38,491, while the expenses amounted to £15,473, leaving a balance of £23,017 plus £7,931 brought forward, giving a total of £30,949 to be dealt with. £3,500 has been placed to the pension fund, and £4,000 added to the general reserve fund, which now stands at £98,000. Interim dividends were paid on October 23rd, viz., at the rate of 10 per cent. per annum, less income tax, on the preference shares, and at the rate of 6 per cent. per annum, free of income-tax, on the ordinary shares. The above interim dividends absorbed £7,800, and leave £15,649, out of which the directors recommend the payment of final dividends at the same rates, making total dividends for the year of 10 per cent. on the preference shares, less income-tax, and 6 per cent. on the ordinary shares, free of income-tax, the balance, £7,849, being carried forward.

Tramways and Light Railways Estates Co., Ltd.—The total revenue for 1913 was £1,556. The available balance is £1,626, and it is to be appropriated as follows:—To reserve, £250; to reduction of goodwill, £100; to 5 per cent. dividend on the shares, £753; leaving to be carried forward £523.

Tramways and General Works Co., Ltd.—The *Financier* states that the directors have declared a dividend of 9d. per share of 6s. for the year

Grand Berlin Tramways Co.

The report of the *Grosse Berliner Strassenbahn A.G.* for 1913 shows a decline in the growth in the receipts as compared with the preceding year, and the dividend which has just been declared is at the rate of 8 per cent. on ordinary share capital of £5,001,000, this contrasting with 8½ per cent. in 1912. The number of passengers carried increased from 463,000,000 in 1912 to 466,000,000 last year; the number of car-miles run also advanced, and the proportion of working expenses to receipts rose from 56·66 per cent. to 58·64 per cent. in the two years respectively. A further extension of 13·60 miles in the mileage took place, bringing the total length up to 367 miles at the end of 1913. At the recent general meeting it was stated on behalf of the directors that the undertaking was exposed to considerable competition in the second half of the year from municipal tramways, the Omnibus Co., and the Underground and Elevated Electric Railway Co. Both the latter had entered the best thoroughfares for traffic, and the effects of the opening of the railway company's extension *viâ* the Alexanderplatz to the Schönhauser Allee had been specially perceptible. Despite the keenness of the rivalry, which was scarcely likely to be repeated in the future, the tramway company carried 43,000,000 more passengers last year than all the other Berlin traffic undertakings combined, and the reduction in the second half was merely a ripple on the surface. It was only necessary to proceed with the regular development of the tramway system in order to equalise the decline, but this would not take place until the general economic conditions and general building activity had improved, the latter being particularly important to the company. Apart from these matters, the tramways were superior to the electric railways and the motor-'buses in material points. The railways were exceptionally expensive to build, and would remain limited to specially remunerative routes, whilst the motor-'buses had to reckon with substantially higher working expenses than the tramways, and required specially paved roads. On the other hand, the tramways possessed the advantage of cheap fares and season tickets and the lines were being extended right into the suburbs. The fall in the receipts had not been looked upon without taking action. In the first place the company had acquired omnibus shares to the extent of £200,000; secondly, it was hoped that the transport regulation against excess passengers, which exceptionally prejudiced the company as compared with the electric railway and the City Railway, would be abolished; and, in the third place, it was proposed to construct seven new ring lines and make extensions of existing lines to the extreme limits of the suburban boundaries. The construction of the lines was as good as assured. The company did not undertake unremunerative lines, as when a surplus was not expected the local authorities gave the assurance of large contributions. Discussions had taken place in regard to the acquisition of shares in the Underground and Elevated electric railway, but these had not led to any result. As to the suggested transport service for light goods, the opinion of forwarding agents was that it would be impossible for the company to even realise a profit of 8 per cent. on the business. As this was the percentage which had to be paid to the municipal council, the company would earn nothing if the branch were undertaken. In conclusion, it was mentioned that the new order in regard to the payment of fares by passengers had been urgently needed as the directors estimated the loss through evasion of payment by "bilkers" at £10,000 per annum.

Swiss Electrical Companies.

The *Société Franco-Suisse pour l'Industrie Electrique, of Geneva*, which is an investment company, reports gross profits of £110,000 for 1913, as against £104,000 in the preceding year. After making provision for the depreciation of securities and meeting interest charges on the loans of £931,000, the accounts show net profits of £63,000, as contrasted with £56,000 in 1912. It is intended to pay a dividend of 5½ per cent. on the share capital of £1,000,000, this rate comparing with 5 per cent. in the previous year.

The *Motor, A.G. fur Angewandte Elektrizitat, of Baden*, which has an ordinary paid-up capital of £1,200,000 and loans of £1,400,000, owns various supply works in addition to being financially interested in others, the latter department occupying the predominant position. The accounts for 1913 indicate net profits of £91,000, as compared with £66,000 in the previous year, and the directors recommend a dividend of 7 per cent., as in 1912. The report refers particularly to the formation of the Columbus Co., which was constituted in 1913 by Swiss, Italian and Argentine financial circles for the promotion of electrical enterprises in transmarine countries, especially in Argentina.

The report of the *Elektrizitats Gesellschaft Alioth, of Basle*, whose share capital of £240,000 is mostly held by the firm of Brown, Boveri & Co., of Baden, states that the company's workshops in Münchenstein had been disposed of to the latter company in return for paper securities. The total securities in portfolio now represented a book value of £300,000, and the company had consequently assumed essentially the character of an investment company, although the shares chiefly concerned manufacturing companies. The accounts indicate net profits of £13,000, as compared with £18,000 in 1912, but as no provision had to be made for depreciation of plant in 1913, it is possible to increase the dividend from 4½ per cent. in 1912 to 5 per cent. for last year.

The *Aluminium Industrie A.G., of Neuhausen*, states that the accounts for 1913, after placing £111,000 to depreciation as compared with £56,000 in 1912, show net profits of £266,000, as contrasted with £183,000 in the preceding year. It is proposed to pay a dividend of 20 per cent. on the paid-up share capital, being the same rate as in 1912, and to allocate out of the remaining balance the sum of £[illegible] to the fund which was created for the purpose of gradually paying in full the uncalled capital on the ordinary shares, upon which 50 per cent. has hitherto been paid. Having made this appropriation the directors recommend that the amount of £101,000 should be transferred from this fund, which totals £109,000, for effecting a payment of 10 per cent. on the ordinary shares which will then be paid to the extent of 60 per cent. In addition it is intended to increase the share capital to £1,400,000 by the emission of further ordinary shares for £360,000, which will be offered to existing shareholders. The new capital is intended to serve the purpose in the first place of strengthening the financial position of the undertaking, and, secondly, to extend the existing plant as well as to develop the bauxite mines in the district of Bergheim, Cologne.

Berlin Elevated and Underground Railway.

The report of the *Gesellschaft für Elektrische Hoch und Untergrund Bahnen, of Berlin*, states that the length of the company's own lines increased from 11 miles in 1912 to 16·9 miles last year. If to this mileage is added that appertaining to the Schoneberg, Wilmersdorf and Dahlem railways, which are worked by the company, the total length now reaches 23·3 miles. The average receipts per passenger, which amounted to 1·52d. in 1912, advanced to 1·54d. in 1913. The accounts show the following results for the two years:—

	1912.	1913.
Ordinary share capital	£2,500,000	£3,000 000
Gross profits	319 000	355,000
Interest on loans	81,000	97,000
Railway redemption fund	7,700	9,800
Renewal fund	86,000	41,000
City taxes	8,900	9,800
Depreciation	3 600	3,600
Net profits and balance forward	176,000	184,000
Dividend percentage	6	6

The dividend is payable on share capital amounting to £2,125,000. At the recent meeting the general director stated that the organic rounding-off of the system owned and worked by the company would be completed by the supplementary line from the Gleisdreieck (Triangle) to the Wittembergplatz, which was in course of construction, and by the Frankfurter Allee line, the beginning of which depended upon the widening of the Landsberger Strasse by the Municipal Council. At the request of certain local authorities, however, the company had prepared schemes for making extensions, and negotiations were proceeding with other authorities for further developments. In addition, the company had received sanction to establish two motor-'bus services, for which 60 'buses had been ordered, and the lines would be opened in the early future. The company had acquired a large interest in the Berlin Omnibus Co. The number of passengers carried by the railway advanced from 62,730,000 in 1912 to 71,530,000 last year, whilst the level line transported 2,450,000 persons in 1913, as compared with 2,240,000 in the preceding year. The former has an equipment of 226 motor coaches and 174 trailers, and the latter has 10 motor-cars and 7 trailers.

Sunderland District Electric Tramways, Ltd.—The report states (according to the *Financier*) that during the year to October 31st a scheme providing for the reduction of the capital was approved by the shareholders, and sanctioned by the Court on March 17th last. This scheme has been given effect to in the accounts now submitted, the amount provided by the reduction of capital being utilised in writing off various items of expenditure which had accrued and which were not represented by assets. After providing for interest on the prior lien bonds and the first mortgage debentures, sinking fund instalment and balance of receivership expenses, and transferring a sum of £1,000 to reserve account for law costs, &c., there remains a net profit of £2,717. Of this the directors have transferred £2,000 to reserve account, leaving £717 to be carried forward. In order to maintain an efficient service and to meet additional traffic, 16 new cars have been purchased and put into service, whilst various other improvements have been effected which should still further increase the net revenue. The traffic receipts for the past year show an increase of £4,608 over those for 1912.

Stratford-on-Avon Electricity Co., Ltd.—Mr. G. M. Bird presided at the annual meeting held on April 21st. He said that the sales had increased by £141, but the expenditure had advanced owing to an abnormal outlay on engines and producers of £182, as against £59 in 1912. They were recommending an increased dividend, but they were carrying forward a smaller sum. The business was steadily increasing, and for the last quarter of 1913 they sold 2,326 units more than in the corresponding quarter of 1912. The new plant would, they hoped, be sufficient for the next five or six years, but he did not wish them to expect that they were going to get an increased dividend every year. They had now reached 4 per cent., and they hoped to be able to maintain it. They ought to pay attention to reserves and to preliminary expenses. Later on they proposed to somewhat increase the capital by way of debentures. They were seeking power to raise £3,000, but they would not want more than £1,000 for a considerable time to come. The report was adopted.

Chloride Electrical Storage Co., Ltd.—According to a financial paper the directors recommend an ordinary share dividend for the year of 10 per cent., plus a bonus of 10 per cent.

La Plata Electric Tramways, Ltd.

The directors in their report for the year 1913 state that the average total length of single track constructed and in operation during the year was 27½ miles. The total receipts on revenue account amounted to £62,321, and the expenditure to £45,252, leaving £17,072. After providing for debenture stock interest (£5,000) and charging £1,141, the amount payable in respect of arrears of municipal taxes in accordance with the decision of the Supreme Court of Appeal of the Province of Buenos Aires, and making further provision of £200 for bad and doubtful debts, there remains £10,732 which, with £598 brought forward, leaves a balance available of £11,330. An interim dividend of £1,000 was paid on the preference shares in October last, and the directors now recommend that there be put to reserve fund £1,000; a balance dividend on the preference shares absorbs £6,000, and there is to be carried forward £330.

Mr. W. F. Hamilton, K.C. (chairman), presided on Tuesday at Winchester House, E.C., over the annual meeting.

He said that the total receipts as compared with 1912 showed an increase of £9,145, and the expenditure an increase of £1,977, the net increase of profit being £7,168. The actual profit result had fallen short of their estimate by nearly £3,000. Unfortunately during the latter part of the year acute financial depression had prevailed in Argentina and the country generally, and La Plata in particular was experiencing a very anxious time. Last year they had every reason to expect that the proposed new shipbuilding and repairing yard would be begun at Ensenada, but no doubt owing to the state of the money market, they had been disappointed. Their prosperity depended upon that of the country, and therefore it would have been surprising if their anticipations had been realised. Their manager had done his utmost to keep down expenses, but in bad times traffics necessarily decreased. He might mention that their working expenses per car-mile run were only 6.67d., which was lower than those of any other tramway system with which he was acquainted. The current year did not up to the present shew any improvement in the financial position, but all who knew Argentina were convinced that the set-back was only temporary, the result of over-speculation in land, bad harvests, and drought, combined with a world-wide stringency of money. The chairman went on to refer to the company's share of Municipal and Government paving carried out to date. Considerable paving had been carried out, and the company's share to date might amount to some £10,000, which they would liquidate under the Paving Law of December 1909 by an annual payment of 6 per cent. for interest and amortization until the whole of the principal sum was amortized. They had registered at Somerset House the Supplementary Trust Deed for the balance (£100,000) of the authorised amount of debenture stock. They had under consideration the issue of some of this stock to provide for their requirements and pay off their existing loan. During the whole of the year they had had the Ensenada line in full electrical operation, whereas in 1912 that line only started operation on 23rd September, so that the increase in general traffic expenses and power was explained by the extra car mileage run on that line. Under Mr. Valentine Brown's able management, the cost of current in 1913 worked out, notwithstanding the increased cost of coal at 2.02d. per car mile run, as compared with 2.19d. in 1912, and he had succeeded in training the men to reduce the consumption of current by judicious handling and running of the cars. In the net revenue account there was a charge amounting to £1,141 for arrears of Municipal taxes. Their concession provided for an entire exemption from taxation whether Provincial or Municipal for a period of ten years, and when accounts were presented for taxes for street lighting, cleaning, water supply and drainage, they felt it incumbent on them to resist them. The Supreme Court of Appeal of the Province of Buenos Aires had, however, decided that these taxes were not taxes within the meaning of the exemption under their concession, but constituted payment for services which they, in common with everyone else, enjoyed. The Central Argentine Railway, the Buenos Aires Western Railway, and the Great Southern Railway had also fought these cases like themselves and lost them. They considered it would be waste of time and money to continue fighting them, and consequently they had paid up the arrears and fines amounting to this total of £1,141. With reference to their action against the late auditors, progress had been delayed by the necessity for bringing over to this side the books of accounts and other documents used in La Plata, and by the preparation of the detailed particulars required by the court. Although the present immediate prospects were not so bright as they wished them to be, he was still confident of the future of the company. Owing to the congestion of sea-borne traffic in Buenos Aires, the overflow must find its way to La Plata, whilst the available space for factories of all kinds was practically unlimited. The increase of population that this must bring would not fail to benefit the company, and all they had to do was to keep expenses at a minimum during this temporary depression. No man was more alive to this necessity than their present manager, whom they hoped to see during the coming summer.

Mr. W. T. Westley seconded the motion, and the report was carried without discussion.

Johnson & Phillips, Ltd.

Mr. Robert W. Blackwell presided over the ninth annual general meeting, held at Winchester House, E.C., on April 23rd.

In moving the adoption of the report, the Chairman said the accounts showed a further distinct improvement. The trading profit, after providing £7,311 for maintenance of plant, amounted to £33,175, which was £1,851 better than last year. Adding the balance brought forward they had a total of £36,191 to deal with. From that sum, they must deduct directors', auditors' and trustees' fees £1,835, debenture interest £8,940, debenture amortization £6,477, depreciation on machinery and plant £8,155, and interest on bank loan £309. There remained a balance, which it was proposed to carry forward, of £12,755. Their property was steadily improving in value and the business increasing on safe and conservative lines. Their turnover had largely increased. They had dropped all work which was not really productive and each department of the business showed a profit on the year's working. Their trading position was distinctly satisfactory. On the 31st December last, sundry creditors and bills stood at £94,311, against which there was owing to them £107,855. They had a stock of goods and work in progress amounting to £159,546, investments of £2,405, and cash in hand £11,310. Their valuations had been carefully and conservatively made and the stock was taken at less than market value. During the past year they spent, in addition to the manufacturing plant, £20,121, which disbursement was essential to the well-being of the business. He had repeatedly called their attention to the necessity of improving the plant and bringing it up to date. In eight years they had increased the property account by £63,000 and written off to depreciation £37,000. That meant £100,000 spent on improving the earning power of the concern. The original issue of first mortgage debentures had now been decreased by £49,541, and as they already knew, the floating debt of the company was last year converted into a 5 per cent. 20-year debenture for £50,000. He appreciated that there might be a natural disappointment that the Board had not proposed a dividend. That they were not prepared to do, but they believed that on the next occasion they met a dividend would be declared, and that, thereafter, the shareholders might expect a reasonable return upon their investment with regularity and certainty. In general, he might say that the business of their company was being well maintained. They had an ample supply of work at fair prices which should keep their shops employed for a great part of the present year.

Mr. Thomas Deuce seconded the resolution.

Mr. W. H. Morgan (shareholder) said that several companies carrying on work and business similar to that which they were doing had during the past year been very prosperous. He hoped the trading of the company in the near future would be more satisfactory to ordinary shareholders.

The Chairman said that the working capital had unquestionably been insufficient, but he thought that taking everything into consideration, those deficiencies had now been put right.

The resolution was carried, and the retiring directors were re-elected.

Chesham Electric Light & Power Co., Ltd.

The profit for 1913 after paying all charges, including interest on debentures and temporary loans, but exclusive of depreciation, amounted to £922. Depreciation £300 and opposition to gas company's bill £26, leave £595 plus £2,047 brought forward, making £2,642. A dividend at the rate of 4 per cent. per annum absorbs £600, leaving to be carried forward £2,042.

The gross earnings, exclusive of profits on wiring, show a steady increase, as follows:—1911, £3,633; 1912, £4,062; 1913, £4,436. For each of these years 4 per cent. dividend has been paid. This is very satisfactory progress, but as long as the company's operations are confined to the limited area of Chesham itself any considerable increase in these figures can hardly be expected. The company has obtained provisional orders for the rural and urban districts of Hemel Hempstead, the rural and urban districts of Berkhamsted, and the rural district of Amersham, and allusion has previously been made to the necessity of carrying out the extensions which will be required to supply these districts. The time has now arrived when it is imperative to give effect to these powers, and the directors have made arrangements for the temporary financial assistance necessary for carrying out the work. The expenditure now necessary is estimated at £10,000, which will bring the capital expenditure to approximately £41,322. A considerable portion of the capital expenditure has hitherto been represented by temporary loans, bills payable and amounts outstanding on open accounts to tradesmen and others.

In order to provide a sufficient sum to discharge these liabilities, to pay for the extensions required under the new powers, and generally to place the finances of the company on a more satisfactory footing, the directors have decided to increase the present debenture issue (now standing at £10,000) by a further amount of £15,000, making the total debenture issue £25,000 bearing interest at the rate of 5 per cent. per annum. The capital expenditure on buildings, mains, plant, etc., £41,322, will constitute an ample security for this issue.

The annual meeting was held on April 17th at Hamilton House, Victoria Embankment, E.C.

Indo-European Telegraph Co., Ltd.

The annual meeting was held on Tuesday, at 18, Old Broad Street, E.C., Sir Herbert Tritton in the chair.

In proposing the adoption of the report (see Elec. Rev. p. 707), the Chairman, after referring with regret to the loss the company had sustained through the death of Baron Joh. von Berenberg Gossler, who had been a member of the board for 35 years, proceeded to review the company's operations during the past year. They had pleasure, he said, in announcing that the additional wire throughout the company's system, *viz.*, from their London station to Teheran in Persia, was now an accomplished fact. Further, this wire would shortly be linked up with an additional wire from Teheran to Karachi (to be provided by the Indo-European Telegraph Department) by the route of the Central Persian line, and the system *via* Indo would thus receive a very important addition to its carrying capacity for all classes of traffic. The traffic receipts had fallen from the very high level touched during 1912, and this was only in accordance with anticipation. Tariffs with certain places in the Far East had been reduced, and the class of "deferred" and "Press" telegrams gave ever-increasing facilities for communication in plain language at very cheap rates. He could wish that their outpayments to governments decreased in proportion. During the year under review, the managing director made a tour of inspection of the line, and they felt much indebted to him for having undertaken this arduous task. The additional wire was in course of erection, and he was able to check the rate of progress and report upon the line as altered. The work was carried out to schedule time and a minimum of disturbance was caused to the working. Mr. Wecke, the company's chief engineer in Odessa, deserved great credit for the perfection of the arrangements—no easy task when one took into account the packing, shipping, and overland transport, the facilities for which were in many cases primitive and the labour anything but skilled. Their managing director inspected the relay- and control-stations, and found the property owned by the company to be in good repair. The new maintenance offices and quarters in Odessa were substantially built and should appreciate in value. The same applied to the office and quarters built in Suchum, where they had a relay-station. Experiments were being made with new apparatus for improved automatic transmission, and so far as the experiments had gone they had proved most satisfactory. In all probability the new through wire would be equipped with this apparatus, and if the anticipated speeding-up was realized, the system would be generally adopted. Turning to wireless telegraphy—a very absorbing subject to many of them in these days—and in particular to the Galletti system, in which they were personally interested, there was no need to remind them that the directors, when this system was first brought to their notice, felt that it would not be wise on their part to ignore it, particularly having regard to the friendly attitude adopted by the French Government towards the inventor. They decided therefore to give it a full trial by forming a private company to acquire the patent rights and to carry out the necessary experiments. This company—Galletti's Wireless Telegraph and Telephone Co., Ltd.—was controlled entirely by the Indo Company, not only in direction and management, but in respect also of the proprietorship of the shares, a majority of which were, and always would be, in the hands of the Indo Company. The primary and inherent advantage claimed by the Galletti system, working as it did with continuous current, was that electric energy could be superimposed to any desired extent in order to cope with the magnitude of the task in hand, and the directors, therefore, were encouraged to work up the system to the ultimate goal, not only of transmission across the Atlantic, but of automatic reception on slip, of messages over the same distance. This was, of course, a very arduous task, and they would bear in mind that, however promising and even perfect a system might be, its adaptation to commercial purposes was necessarily a lengthy process. The choice of a high power station for transmission was practically decided for the Galletti Company by the French Government, which showed its interest in the system by placing at the disposal of Mr. Galletti not only a site on the eastern frontier of France, but an aerial complete on an exceptionally large scale, together with facilities for a full supply of continuous current at the necessary high voltage. These facilities seemed to carry them as directors of the Galletti Company far on the way to success, but they had not yet thoroughly satisfied themselves that, with the means at their disposal, they were justified in saying that they had absolutely solved the problem of automatic wireless transmission and reception by the system on a commercial basis over so long a distance as 4,000 miles (the length of the route over which they were experimenting). They had, however, thoroughly tested the system over shorter distances up to 500 miles with success. Wireless transmission, in order to be commercially useful, must not only cover long distances, but must do so at high speed and with accuracy. Those conditions were not satisfied as to reception by the use of the telephone, nor as to speed by the existing method of hand transmission. Automatic methods must therefore be used at each end. Wireless transmission by Wheatstone, Baudot, or other automatic transmitter at high speed was not such a difficult task, but the reception on slip of a current which, as received, was infinitesimal as compared with that put into the aerial, presented serious difficulties. These difficulties had been surmounted so far as they were concerned by the employment of a very ingenious and sensitive relay, which enabled them to record on slip perfect signals with a current of exceedingly low value. The Board felt that the purchase by the Galletti Company of the world's exclusive rights over the relay referred to—the Orling relay—had given that company a valuable asset. Wireless telephony had also occupied attention, and good results over short distances had been attained by means of a microphone, over which an option for exclusive rights had been obtained. The directors must ask the shareholders to leave to their discretion the question of the provision of further sums for these experiments. Turning to the accounts, these showed no outstanding feature of any kind except the decrease of revenue from message and other sources already referred to. Depreciation on the company's investments during the year under review had, he regretted to say, absorbed £20,827. They would, however, be glad to learn that this had been wiped out again to a very considerable extent at the present time. The directors now proposed the usual final dividend absorbing £14,875, and bonus of 20s. per share, £17,000, both free of income tax. They also proposed to provide out of profit £30,000 for the further development of the Galletti system. They again recommended a special distribution out of interest upon certain investments and advance accounts of 15s. per share, free of tax, carrying forward £6,161 to the credit of 1914. They would probably expect him to say a few words with regard to the general prospects of the Indo Company during the year 1914. As he had already informed them, tariffs had been reduced in many directions, and though it was difficult to forecast for the complete twelve months, it looked as if those reductions, taken in conjunction with a reduction in the tariff to India from 2s. to 1s. 8d. per word, which would be in force from the 1st May, would be likely to lead to a decrease in their traffic receipts in the near future. In conclusion, he would point out that the directors had so husbanded the resources of the company that the assets as shown in the balance sheet, not only had suffered no shrinkage during the last few years, but, apart from the difficulty of depreciation of securities over which they had no control, actually showed an increase in value.

Sir William R. Brooke seconded the motion.

Replying to a shareholder, the Chairman said that the company would give early and careful consideration to the suggestion of splitting up the £25 shares of the company into £5 shares. When the £25 share was fixed upon the £5 share was hardly known. He must, however, remind the shareholders that the position was not quite so simple as it might appear at first sight, for they had a very unusual provision in the company of having shares to bearer, which were instituted at the formation of the company in accordance with Continental practice.

The report was adopted.

Calcutta Tramways Co., Ltd.

The annual meeting was held on April 22nd, at 1, Queen Victoria Street, E.C., Mr. E. C. Morgan presiding.

The Chairman, in proposing the adoption of the report (see Elec. Rev., p. 666) said that the year 1913 constituted a record in the history of the company. There had been added to the capital expenditure £6,239, which was represented by the cost of the freehold land at Shambazar acquired for the turning loop, new plant installed at the power house for lighting purposes, six new trailer cars, and sundry workshop plant. The traffic receipts made a fresh record, the increase over last year amounting to over £10,000, directly attributable to the continued steady growth of the Company's business. This excellent result was obtained despite the adverse effect of an abnormal rainfall in June. It must also be recollected that this was the first year to elapse since the transference of the Capital to Delhi. Taking next the expenditure, there was an aggregate decrease of £6,523 as compared with last year. This was due to reductions in power expenses under fuel, attributable to the general improvement in the condition of the Nonapookur plant, and under maintenance and repairs materials, consequent on the extraordinary expenditure incurred on the overhaul of the plant in the previous year. In consequence of the continued expansion of the company's business it became necessary to reinforce their feeding system in the city area, and with this object they had now put in hand, under a scheme proposed by their joint manager and chief engineer, Mr. Allen, the installation of a rotary converter sub-station at Dalhousie Square, and it was to provide for the expenditure in connection with this scheme that an opportunity was taken of issuing the balance of the 2,705 preference shares referred to in the report. The Calcutta Improvement Trust was still considering various schemes for the general improvement of the city, but they understood that no definite work had yet been decided upon.

Sir Henry Kimber seconded the motion and the report was adopted.

Replying to a vote of thanks, the Chairman said that the directors had considered the question of the interim dividend and they thought it best to keep it at its present rate, and so practically assure it, and to make the large payment at the final declaration.

STOCKS AND SHARES.

Tuesday Evening.

Events abroad and in the Stock Exchange move so rapidly that prices are hard put to it to keep pace with them. So that, on one day, there may be hot and cold markets, buoyancy and flatness, cheerfulness and profound despondency. Whither the Mexican maze will lead the world at large no man pretends to do more than guess. Stock Exchange prices are at the mercy of every cablegram, and in the kaleidoscope of the Mexican situation the fertile brain of the inventive journalist in New York finds abundant scope for variegated colours.

At home the gravity of the political situation was deemed to have become so much the greater, of course, in consequence of the gun-running affair at the end of last week. The Stock Exchange politically, as everybody knows, is largely Unionist; and there was much banter of the few Liberals at the way in which the Government had been outwitted. This over, it was admitted that the challenge to the Government had complicated matters even worse than before, and a sharp fall in the price of Consols, with a good deal of pressure to sell Home Railway stocks, was the consequent financial reflection of the whole business. Rumours of an early dissolution were in circulation on Tuesday, and although discredited, they had the effect of stemming the tide of realisations.

Home Railway stocks are flat, though well above the worst, because it is argued that any open rupture in the North of Ireland would spell serious loss of traffic to the great carrying lines of this country. The investor is evidently alarmed, for he has been selling his steam stocks eagerly. With them, there have gone down the prices of the Undergrounds, Districts and Metropolitans being affected with the rest, though any through connection between the Inner Circle and Ulster it would beat even a jobber to explain. Indirectly, the tension, combined with the war fears, is tending already to bring about a hardening of discount rates in the money market, which signals to holders of all securities that they must be at least prepared to see prices go lower. London and Suburban Preference fell ⅛, and London United Tramways Debenture is 2 points lower.

The falls in Mexicans progress from bad to worse. Sharp rallies occurred on Monday, upon the idea that the United States, General Huerta and the Latin-American Republics might hammer out some way of peace which could be trodden by the first two. Consideration of the position, however, persuaded men that the time for shouting had not yet come. Buyers declined to be tempted into the markets, and, accordingly, prices fell back of their own weight. It will be noticed from the pages over-leaf that the slump since last we wrote has been substantial. It may be of interest—melancholy enough, truly—to compare existing quotations with those of three months ago, since the table displays, in more graphic fashion than mere word-painting can, how great has been the shrinkage in values:—

Stocks or shares.	Price. Feb. 2nd.	Now.	Fall.
Mexico Tramways Common	77½	63½	14
do. 1st Mort. Bonds	87½	73½	14
do. 6 p.c. Mort. Bonds	87	70	17
Mexican Electric Light Bonds	72	60	12
Mexican Light and Power Common	52½	37	15½
do. Preferred	87½	65½	22
do. 1st Mort. Bonds	84½	71	13½
do. 2nd Mort. Bonds	72	61½	10½
Monterey 5 p.c. Debenture	66½	50½	16

The Mexican Northern Power Company proposes to create 3 million dollars 6 p.c. prior lien 30-year gold bonds, and the terms will have to be attractive at a time like this; the Company's 5 p.c. first mortgage bonds now stand at 20 to 25.

Brazilian Tractions dropped 6, and the Preference shares fell back to 96. Para Electric Railways are steady, but falls have occurred in the bond issues of the Rio Tramways and the Sao Paulo Tramways. Canadian General Electric have been flat, and Shawinigan Water fell 2. Vera Cruz Debenture stock is nominally unchanged at 88. Kalgoorlie Electric Preference fell $\frac{3}{32}$, on the proposal to scale down the dividend from 6 per cent. to 4 per cent., and Kalgoorlie Tramways "A" Debenture stock is a point lower. This market, like the rest, is agitated and tender. The Anglo-Argentine Tramways group keeps very steady, and the chairman, at the meeting, stated that the Buenos Ayres Municipal Council had recently declined to grant any concessions for the motor-omnibus competition that had been suggested. Gross receipts for the current year, he added, showed an increase of £20,814 up to March 31st last.

In the Electric Supply group a small demand for Folkestones raised the price 10s., and Hove shares keep steady at 8¾. The London group is uninteresting; small falls in Metropolitan St. James's and Westminster Preference, with ⅛ rise in London Preference, are the only noticeable changes. South Metropolitan Debenture stock moved up to the neighbourhood of par. Urban and Edmundson's both eased off to 8s. 9d. middle. A drop of 10s. in City of London Ordinary was due in part to sales by holders who required money to finance other obligations. The Rangoon Electric Tramway and Supply Company has raised its dividend from 5 per cent. to 6 per cent., and the Melbourne interim dividend is advanced from 4 per cent. to 5 per cent. for the half-year.

The Manufacturing list is noteworthy for a further rise in Brush Debenture stocks, the Firsts gaining 3 and the Seconds 1. On the other hand, Willans & Robinson Preference fell to 48½, a drop of 4 points, upon the issue of a report which the market regarded as unsatisfactory. Castner-Kellners are better to a slight extent, and the improvement in Babcock & Willcox is well held. Rubber shares receded still further with the price of the material, the latter going back to nearly half-a-crown per lb.

Marconis slumped to 2⅞ at one time, recovering later to 3, the selling having the character of forced realisations. The subsidiaries have receded as well, and the Preference shares show a loss of 10s. on the week. Anglo-American Telegraph Deferred lost ⅛, in spite of the declaration of the usual quarterly dividends on the other stocks; the Preferred stock is ¼ better. Eastern Extension Telegraphs are amongst the few to show a rise, having a gain of 5s. to their credit. West India and Panama Telegraphs second preference declined to 8⅞ in consequence of the American-Mexican outbreak.

American Telephone and Telegraphs weakened on sales from across the pond. Mackay Common improved a little. The Globe issues remain very steady.

We understand that an issue of £55,000 6 per cent. First Mortgage Debentures at 99 is projected by the Jersey Electric Lighting and Power Co., Ltd.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, April 29th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2⅞d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29	£1 10 dec.
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£21 15	5s. dec.
a Lead, Nitrate	„	£30 10	..
a „ White Sugar	„	£28	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	3¼d.	..
a „ Perchlorate	„	3¾d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	.
a „ Lump	„	£5 5	5s. inc.
a Soda, Caustic (white 70/72 %) ..	„	£10	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£2 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£86	..
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£107 6 8	£4 13 4 dec.
b „ Sheet, in ton lots ..	„	£112	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅛d.	⅛d. dec.
c „ Tube (brazed)	„	9⅝d.	..
c „ „ (solid drawn) ..	„	7⅞d.	⅛d. dec.
c „ Wire, basis	„	7⅛d.	¼d. dec.
c Copper Tubes (brazed)	„	9¾d.	¼d. dec.
c „ „ (solid drawn) ..	„	9¾d.	¼d. dec.
g „ Bars (best selected) ..	per ton	£80	£2 dec.
g „ Sheet	„	£80	£2 dec.
g „ Rod	„	£80	£2 dec.
d „ (Electrolytic) Bars ..	„	£66 5	£1 15 dec.
d „ „ Sheets ..	„	£84 5	£1 15 dec.
d „ „ Rods ..	„	£71 15	£1 15 dec.
d „ „ H.C. Wire	per lb.	8¾d.	⅛d. dec.
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/-	..
h India-rubber, Para fine	„	2/11½	½d. dec.
j Iron Pig (Cleveland warrants) ..	per ton	51/-	1d. inc.
„ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£19 to £19 5	10s. inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7	..
e Mica (in original cases) small ..	per lb.	6d. to 3s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/8½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10⅝d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£158 to £159	£8 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/4	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 28th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Prof. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	½ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	15½ — 17½	..	..
Do. Do. Deferred ..	100	..	..	6½ — 8½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	8	..	56 — 59	..	5 1 8
Do. 5 % Perp. Deb. ..	100	5	5	93 — 95	..	5 1 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	79 — 83	..	5 9 9
Central London Railway, Ord. ..	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	83 — 85	..	4 14 8
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord. ..	1	..	..	3/16 — 9/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	½ — ⅝	—3/32	8 0 0
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	78 — 83	..	5 8 5
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	56 — 60	2	6 13 4
Metropolitan Railway Consol. ..	100	1⅝	1⅝	39¼ — 40¼	— 2	4 0 9
Do. Surplus Lands	100	2¾	2¾	63 — 65	..	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	..	4 5 4
Metropolitan District Ord. ..	100	Nil	..	26½ — 27	- 2	Nil
Do. 6 % Deb.	100	6	6	138 — 141	..	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 8
Do. 4 % Prior Lien	100	4	4	97 — 99	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	84 — 87	..	5 3 6
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	88 — 91	..	4 17 9
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 13 0
Potteries, Ord.	1	3½	..	⅜ — ½	..	..
Do. 5 % Pref.	1	5	5	17/32 — 21/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	3 — 3¼	— ¼	Nil
Do. "A"	1/-	..	..	7/16 — ½	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	114 — 116	+ 2	5 3 5
Do. 4½ % Bonds	100	4½	4½	99½ — 101½	..	4 8 8
Do. 6 % Income	100	6	6	89 — 90	—1	6 13 4
Yorkshire (West Riding), Ord. ..	5	Nil	..	5/16 — 9/16	..	Nil
Do. 6 % Pref.	5	3	4	4⅜ — 4⅞	+ ⅛	4 2 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	+1	5 3 6

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations April 28th.	Rise + or Fall —	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅝ — 4⅞	..	5 12 10
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 9/16	..	6 0 7
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	98½ — 101½	+ ½	4 8 6
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 — 106	..	4 14 3
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 — 100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	77 — 79	—6	7 12 0
Brisbane Trams Invt., Ord. ..	5	8	8	7½ — 8	..	5 0 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 — 101	..	4 9 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	116 — 120	..	6 12 4
Do. Pref. Ord.	100	6	6	104 — 108	—1	5 11 1
Do. 5 % Pref.	100	5	5	104 — 105	..	4 15 2
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	96 — 99 xd	..	4 11 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	93½ — 95½	..	4 9 1
Calcutta Trams, Ord.	5	7½	9½	7 — 7½	..	6 6 8
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	N	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	84 — 89	—1	5 12 4
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord. ..	1	..	..	¼ — ½	..	..
Do. Pref.	1	4⅜d.	6	¾ — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1⅛ — 1⅜	..	4 7 8
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	95 — 100	..	5 0 0
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
" Elec. Tr. (1904), Deb. ..	100	5	5	101 — 103	.	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	78 — 81	—1	6 3 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ — 100½	..	4 19 6
Mexico Trams Com	$100	7	7	61 — 66	—5	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	71 — 76	—3½	6 11 7
Do. 6 % Bonds	100	6	6	67½ — 72½	—12½	8 5 6
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	3⅞ — 4⅜	..	11 8 6
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	89 — 92	..	5 8 8
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	96 — 98	— 1	5 2 0
Do. 5 % Mort. Bonds	100	5	5	89½ — 91	—½	5 10 0
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	96 — 100	—1½	5 0 0
Singapore Trams, 5 % Deb. ..	100	5	5	83 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅝ — 5¼	..	5 14 8
Do. 5 % 1st Deb.	100	5	5	95 — 98	..	5 2 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	1913.	Closing Quotations April 28th.	Rise + or Fall —	Present Yield p.c.
Bournemouth & Poole, Ord. ..	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10⅜ — 10⅞	+ ⅛	5 10 4
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 9
Brompton & Kensington, Ord. ..	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91½ — 94½	..	4 4 8
Charing Cross, West End & City	5	5	6	4⅞ — 5⅜	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10	16 — 17	— ½	5 17 8
Do. 6 % Cum. Pref.	10	6	6	12¾ — 13¾	..	4 7 3
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 7 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 — 103	..	4 8 1
County of London, Ord.	10	6	7	11¾ 12¼	..	5 14 3
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	103 — 106	..	4 5 3
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 — 103	..	4 7 5
Edmundson's, Ord.	£3	..	..	5/16 — 9/16	—1/16	Nil
Do. 6 % Cum. Pref. .. .	5	6	6	3¾ 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..		1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 87	.	5 3 6
Folkestone	5	6	6	4⅞ — 5⅜	+ ½	5 11 7
Do. 5 % Cum. Pref.	5	5	5	4¼ — 4¾	..	5 5 3
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9
Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 8	..	5 12 0
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅜ — 1¾	..	5 2 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	+ ⅛	5 14 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	92 — 95	..	4 4 1
Metropolitan	5	4½	4½	3¼ — 3¾	— ⅛	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 — 101	..	4 19 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford	5	7	7	5 13/16 — 6 5/16	..	5 11 0
St. James' and Pall Mall, Ord. ..	5	10	12	9⅛ — 9⅝	— ⅛	6 4 8
Do. 7 % Pref	5	7	7	6⅝ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2¾ 3⅛	..	6 10 4
Do. 5 % First Mort. Deb. ..	100	5	5	98 101	..	4 19 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 100	+2½	4 10 0
Urban, Ord.	£3	Nil	..	5/16 — 9/16	—1/16	
Do. 5 % Cum Pref.	5	3‡	4	2½ 3 xd	..	6 13 4
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 - 88	..	5 12 3
Westminster, Ord.	5	10	10	8½ — 8¾	.	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5¼	—1/16	4 5 9

* Unless otherwise stated all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 28th.	Rise + or Fall	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 11 7
Calcutta, Ord.	5	6½	5†	7⅞ — 8	..	5 6 8
Do. 5 % Pref.	5	5	5	$4\frac{13}{16}$ — $5\frac{3}{16}$	—$\frac{1}{16}$	4 16 3
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	5 8 0
Canadian Gen. El. Com.	$100	7	8	103 — 108	—5½	7 8 2
Do. 7 % Pref.	$100	7	7	117 — 122	—1	5 13 10
Cordoba Lt., Power and T., Ord.	1	5	..	$\frac{7}{16}$ — ⅝	..	7 12 0
Do. 5 % Deb.	100	5	5	87 — 90	..	5 11 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87 — 89	..	6 14 10
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ 95½	..	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	$\frac{1}{32}$ — $\frac{3}{32}$		Nil
Do. 6 % Pref.	1	6	6†	¼ — $\frac{7}{16}$	—$\frac{3}{32}$	..
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 — 104	..	4 16 2
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	104 — 107	+ ½	4 13 6
Mexican El. Lt., 5 % 1st M. Bds.		5	5	57½ — 62½	—5½	8 0 0
Mexican Lt. & Power, Common	$100	4	4†	35 — 39	—2	..
Do. 7 % Cum. Pref.	$100	7	7	63 — 68	—6½	10 5 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	68½ — 73½	—6½	6 16 1
Do. 5 % 2nd Mort. Bonds	100	5	5	59 — 64	—1½	7 16 4

NAME.	Stock or Share.	Dividends for		Closing Quotations April 28th.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	48 — 58	—4	..
Montreal, Lt., H. and Power	$100	9	10†	223 — 228	..	4 7 9
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	245 — 255	..	3 18 5
Do. 6 % Non-Cum. Pref.	Do.	6	6	108 — 108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 — 103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 — 102	..	4 8 8
Shawinigan Water, Capital	$100	5½	6	131 — 135	—2	4 9 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 — 109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	101½ — 103½	..	4 7 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 97	— ½	4 12 9
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 — 89	..	5 12 4
Victoria Falls Power, Pref.	1	6	6	$\frac{23}{32}$ — $\frac{25}{32}$	..	7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	102 — 104	..	5 15 5

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 28th.	Rise + or Fall	Present Yield p.c.
Aron, Ord.	1	7	..	$\frac{23}{32}$ — $\frac{27}{32}$	..	8 5 0
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	6 17 2
Babcock & Wilcox	1	16	16	$3\frac{3}{32}$ — $3\frac{5}{32}$	..	5 1 5
Do. Pref.	1	6	6	$1\frac{5}{16}$ — 1⅜	..	4 8 6
British Aluminium, Ord.	1	..	5	$\frac{31}{32}$ — $1\frac{3}{32}$	..	4 11 4
Do. 6 % Cum. Pref.	1	6	6	⅞ — $\frac{15}{16}$	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	96 — 99	..	5 1 0
Do. Deb. Stk.	100	5	5	88 — 93	..	5 7 6
B.I. & Helsby Cables	5	10	13	9¼ — 9¾	..	6 13 4
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	101 — 104	..	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	2	Nil	5	$1\frac{5}{16}$ — 1½	..	6 13 4
Do. Deb.	100	4	4	73 — 75	..	5 6 8
Do. 6 % Prior Lien	100	6	6	100 — 103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	8/- — 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	49 — 53	+3	8 10 0
Do. 4½ % Second Deb.	100	4½	4½	29 — 33	+1	13 12 8
Callender's Cable	5	15	5†	11¾ — 12½	..	6 0 0
Do. Pref.	5	5	5	5 — 5¼	..	4 16 5
Do. Deb.	100	4½	4½	97 — 100	..	4 10 0
Castner-Kellner	1	20	22½	$2\frac{23}{32}$ — $2\frac{27}{32}$	+ $\frac{1}{32}$	7 18 2
Do. Deb.	100	4½	4½	104 — 107	..	4 4 1

NAME.	Stock or Share.	Dividends for		Closing Quotations April 28th.	Rise + or Fall	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	⅜ — ⅝	..	..
Do. Pref.	1	6	6	$\frac{21}{32}$ — $\frac{25}{32}$	..	7 13 4
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	62 — 67	..	7 9 1
Electric Construction	1	5	..	$\frac{17}{32}$ — $\frac{21}{32}$	..	7 12 6
Do. Pref.	1	7	7	$\frac{15}{16}$ — $1\frac{1}{16}$	..	6 11 7
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10¼ — 10½	..	5 14 3
Do. Deb.	100	4	4	85 — 89	..	4 10 0
Henley's, Ord.	5	15	20	13½ — 14½	..	6 17 11
Do. Pref.	5	4½	4½	$4\frac{15}{16}$ — $5\frac{1}{16}$	..	4 9 0
Do. Deb.	100	4½	4½	101 — 103	..	4 7 5
India-Rubber, G. & T.	10	7½	7½	10½ — 11½	..	6 10 5
Do. Pref.	10	5	5	8¾ — 9½	..	5 5 3
Telegraph Construction	12	20	20	36 — 38	..	6 6 7
Do. Deb.	100	4	4	98 — 100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	64 — 68	..	5 17 8
Do. B 4 % Cum. Pref.	100	..	..	46 — 51	—4	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 28th.	Rise + or Fall	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾ — 6¼	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	121 — 125	—2½	6 8 0
Do. Collat. Trust	$1000	4	4	90 — 93	—2	4 6 0
Anglo-American Telegraph	Stock	3	3	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	109¾ — 110¾	+ ½	5 8 7
Do. Def.	Do.	30/-	30/-	23⅛ — 23⅝	— ⅝	6 7 9
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	— ⅝	4 16 2
Chili Telephone	5	8	..	7⅝ — 7⅞	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80 — 82	— ½	4 17 7
Cuba Telegraph	10	6	6†	8¾ — 9¾	..	6 3 1
Do. 10 % Pref.	10	10	10	15¾ — 16¾	..	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7½ — 8	..	6 5 0
Direct United States Cable	10	4	4	6⅝ — 7⅛	..	5 12 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	133 — 136	..	5 3 0
Do. 3½ % Pref. Stock	Do.	3½	3½	77½ — 79½	..	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	10	7	7	12¾ — 13¼	+ ⅛	5 5 9
Do. 4 % Deb.	Stock	4	4	94½ — 96½	..	4 3 0
Globe Telegraph and Trust	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12½ — 13	..	4 12 4
Great Northern Telegraph	10	20	20	30½ — 32½ xd	..	6 3 1
Indo European Telegraph	25	13	13	58½ — 60½	..	5 7 4
Mackay Companies Common	$100	5	5	86 — 89	+1	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7

NAME.	Stock or Share.	Dividends for		Closing Quotations April 28th.	Rise + or Fall	Present Yield p.c.
Marconi's Wireless Telegraph	1	20	20	$2\frac{15}{16}$ — $3\frac{1}{16}$	—$\frac{3}{16}$	6 10 6
Do. 7 % Cum. Partic. Pref.	1	17	..	2½ — 2¾	—⅜	6 3 8
Monte Video Telephone, Ord.	1	6	6	$\frac{13}{16}$ — $\frac{15}{16}$	..	6 8 0
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 — 101	..	4 9 0
Oriental Telep. and Elec.	1	10	10	2⅛ — 2⅜	..	4 4 3
Do. 6 % Cum. Pref.	1	6	6	$1\frac{3}{16}$ — $1\frac{5}{16}$	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	4 0 0
Reuter's	10	10	10†	8 — 9	..	11 2 2
Submarine Cables Trust	Cert.	6	6	125 — 128 xd	..	4 13 9
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 — 100	..	4 10 0
United River Plate Telephone	5	8	6†	6⅜ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅝	..	4 9 0
West Coast of America	2½	2½	..	$1\frac{3}{16}$ — $1\frac{7}{16}$	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	1¼	$2\frac{3}{16}$ — $2\frac{7}{16}$	..	5 2 7
Do. 6 % Cum. 1st Pref.	10	6	6	9⅝ — 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref.	10	6	6	8⅞ — 9⅛	— ⅛	6 11 6
Do. 5 % Debs.	100	5	5	96 — 99	..	5 1 0
Western Telegraph, Ltd.	10	7	7	13⅜ — 13⅞	..	5 1 11
Do. 4 % Debs.	Stock	4	4	95½ — 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	95 — 98 xd	..	4 11 1

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Motor-Starters.—Referring to the abstract in our issue of the 24th ult. of the paper read by Mr. E. F. Butler before the Junior Institution of Engineers, on the subject of motors and motor control, the Igranic Electric Co., Ltd., express entire agreement with his remarks on the subject of damage caused to starter contacts by the operator often moving his lever on to the first step and then drawing it back, and so causing destructive sparking. The remedy which Mr. Butler puts forward, they say, although a useful one on starters already supplied, precludes the use of an overload release, and also the arrangement is not fool-proof, it being possible for the operator to leave the lever in the lowest speed position and so burn out the resistance. The company have devoted a considerable amount of time and experiment to this particular subject, and claim that their patent arc-preventing interlock renders starting fool-proof and reliable. All circuit-making and breaking is accomplished on magnetically-operated circuit-breakers specially designed for this service, and they are enabled to use an overload release device which allows the operator to start the motor with all the advantages of a loose-handle circuit-breaker. The fact that they have a very large and increasing demand for this type of starter proves that the electrical industry is aware of the advantages offered by such a device.

THE LAND AND THE ELECTRICAL INDUSTRY.

By JOS. J. H. STANSFIELD.

At the instance of a Committee appointed by the Chancellor of the Exchequer, two volumes have been published as the result of an enquiry made in the years 1912-13 to obtain "an accurate and impartial account of the social and economic conditions in the rural parts of Great Britain," and a knowledge of the "nature and working of the existing systems of ownership, tenancy and taxation, and the rating of land and buildings in urban districts and the surrounding neighbourhoods, and their effect on industry and the conditions of life."

The object of the enquiry was confessedly of a political character, and so far as such object is concerned we have not, as persons engaged in connection with the supply of electrical energy, any direct interest, but in view of the possibility of legislation being based upon the conclusions arrived at by the Committee, it is not inopportune to consider such portions of the second volume dealing with the urban parts of Great Britain as touch upon matters of moment to the electrical industry, and endeavour to see how far any proposals made will affect the future.

The first volume treats exclusively of the rural part of Great Britain, and the evidence it contains and the conclusions arrived at are not of such great moment as those dealt with in the second volume. When we are on holiday bent the country has its attractions, but in our work-a-day times we are much more interested in mills than in hills, and generating rather than railway stations claim our closer attention.

The second volume is a book of over 700 pages, and whilst there is much that is mainly interesting to the politician and the student of social problems and conditions, there are a number of subjects dealt with that should not be overlooked whatever particular brand of politics we may affect. The most important of these to members of the electrical profession are as follows:—

The Acquisition of Land.

Part II of Volume II deals with the acquisition of land by public and quasi-public bodies in urban and rural areas, particularly where such acquisition is by virtue of compulsory powers.

A statutory body which seeks to obtain compulsory powers to acquire land for a public undertaking may proceed in several ways: (1) by Act of Parliament, (2) by Provisional Order of a Government Department (confirmable by Parliament), (3) by Provisional Order confirmable by a Government Department, and (4) by resolution of the local authority without any further confirmation being needed.

Under the Electric Lighting Acts, 1882 to 1899, the policy has been against the acquisition of land by compulsory powers, but land may be acquired by agreement in the case of companies unlimited as to quantity (except where transfer to a local authority is intended), and in the case of local authorities limited to five acres.

A Joint Committee of the two Houses of Parliament considered in 1898 whether compulsory powers should be given to electrical undertakers, but it was not until the passing of the Electric Lighting Act of 1909 that such powers could be obtained without an application to Parliament for the granting of a special Act.

Where, as in the case of Power Companies, an application to Parliament has been made, the special Act has incorporated the whole or part of the Lands Clauses Acts in respect of the sites scheduled in the Act for the erection thereon of generating stations.

The procedure almost universally employed in assessing compensation is laid down by the Lands Clauses Consolidation Act of 1845, and the Amending Acts of 1860, 1869, 1883 and 1895, and the practice that has grown up under these has been summed up by Mr. F. W. Hunt in a paper read at the Surveyors' Institution in 1912 under five heads: (1) the lands to be taken are restricted to what are actually required for the undertaking, (2) an owner is entitled to be paid the value of the property to him at the time of the enquiry, and compensation for damage due to the taking of the lands, irrespective of any benefit he may, in respect of other lands belonging to him, obtain by the execution of the works, (3) a percentage is added to the sum awarded as compensation for the value of the land taken, amounting to at least ten per cent., (4) the claimant has the right of selecting the tribunal to settle the case in the event of no agreement, including the right to a jury, which under the Act is the normal tribunal, and (5) an owner cannot be compelled to sell part of a house, manufactory or other building, if he is able and willing to sell the whole.

It is natural that there should be much difference of opinion as to whether the prices usually paid for land compulsorily acquired are reasonable or not, but the main reason for the large prices often paid appears to be due to the fact that it is the value of the land to the owner that is the subject of compensation, and not merely the market value or its value to the promoters taking it.

The tendency of later legislation has been to narrow the basis of compensation by fixing the fair market value without any addition for compulsory purchase, sometimes embodying the principle of betterment as in the Light Railways Act of 1896, where the arbitrator, in determining the amount of compensation, "shall have regard to the extent to which the remaining and contiguous lands and hereditaments belonging to the same proprietor may be benefitted by the proposed light railway."

From the statements quoted in the book there appears to be on the whole a general idea that the present methods of obtaining land are cumbrous, dilatory and expensive, and certain recommendations are made, the most important being as follows:—(1) except in cases of schemes of great magnitude or novelty recourse to Parliament should be unnecessary, (2) compensation should be paid for damage due to severance and disturbance, (3) no addition should be made for compulsory purchase, (4) the basis of compensation should be the market value if sold by a willing seller assessed on the principles laid down in the Finance (1909-10) Act, 1910, (5) no allowance should be made for injurious affection to other lands, and no deductions should be made for "betterment," (6) promoters should be able to take part only of land or buildings, (7) local authorities should be able to purchase land for future use (companies usually find no difficulty in obtaining this power), and (8) the tribunal for assessment of compensation should be a new body to be called the Judicial Land Commissioners.

Easements and Wayleaves.

During recent years considerable progress has been made in the erection of overhead lines for the purpose of distributing electrical energy, and that portion of the book dealing with easements and wayleaves is therefore of particular interest and importance.

The Committee, in reporting, say that "modern developments of the use of electricity to supply power at a distance from the spot where it is generated have given increased importance to this question. Wires have to be carried across country, and each owner whose land it is proposed to traverse is enabled to hold the scheme up by demanding an excessive price for permission to carry the wires across his land. In some cases he is enabled to prevent it altogether."

An instance of difficulty having been experienced is given where the Bury Corporation endeavoured to obtain a wayleave to carry an overhead electric wire across certain agricultural land in order to supply power to an adjoining urban district. There would have been six poles on the land, and the owner demanded an annual payment of £5 per pole, but afterwards refused to grant facilities at any price, compelling the Corporation to expend an additional £1,000 in order to get round the forbidden area.

Most of those persons who are concerned in obtaining easements and wayleaves can add instances where prohibitive prices have been quoted, and an Act dealing with those matters would undoubtedly be a boon.

Gas, water, and electrical undertakers usually have powers to break up streets, repairable by the local authority, where the laying of underground pipes or mains is desired, and electrical undertakers either schedule other streets to be broken up in the Provisional Order, or can make an application to the Board of Trade for the necessary powers where the streets are dedicated to the public.

The difficulties mainly arise where mains are to be laid in or over private property where the consent of both owner and occupier is necessary, and in the case of companies, the consent of the local authority also.

In the case of unreasonable refusal by a rural district authority to consent to overhead lines, power companies have usually an appeal to the Board of Trade, but other authorities have an absolute veto, and sometimes do not hesitate to exercise it even where no public streets would be crossed.

The Committee recommend that the Government Department authorised to sanction the Order should have the power to make an order for the compulsory acquisition of easements and wayleaves; that the terms should be fixed by the Judicial Land Commissioners, and that the consent of the local authority should be necessary in the case of boroughs and urban districts of more than 10,000 population.

With regard to the consent of the local authority being required, the writer is of opinion that the local authority should only have a reasonable veto. It is only just that the Government and quasi-public companies should be protected in case of arbitrary refusals. Little hesitation is shown in making regulations for the safety and protection of the public, and as a *quid pro quo* some slight assistance might be given to those who are legitimately carrying out duties conferred upon them by Parliament.

In several continental countries legal facilities exist by which compulsory wayleaves can be obtained where necessary, as a result of which standard prices have gradually become established, and agreements are usually arrived at without any necessity to have recourse to the officials authorised to grant compulsory powers.

Copyholds, Short Leaseholds, &c.

An instructive and interesting part of the report deals with the various current forms of tenure with their area of distribution.

From time to time it is necessary to obtain land for the erection thereon of generating and substations. It is not always possible to purchase outright, and careful consideration is necessary where a local distributive system is laid in connection with a sub-station where the lessor can sooner or later require an amendment of the conditions of a lease.

The Committee are averse to compulsory powers being granted to convert leaseholds into freeholds, except in the case of leases to religious bodies and to local authorities, their principal recommendations being:—(1) that after a certain interval all copyholds shall become freehold, (2) that "life leases" shall be prohibited, and (3) that the Judicial Land Commissioners shall be empowered to extend leases, amend their terms, and assess compensation payable in respect thereof.

Rating.

Considerable space is devoted to the question of rating, and recommendations are made in respect of amendments in both law and practice.

The present system of assessment is cumbrous, and in the case of authorities operating over large areas, often unsatisfactory. The Committee state that in the case of railways, canals, mines, tramways, docks, telephones, gas, water, and electric light works, they agree with the conclusion of the Royal Commission in their Final Report in 1901, where they recommend that an independent assessor should be appointed by the Government, who should value all such properties.

They make no recommendations as to an alteration in the method of valuing such undertakings for rating purposes, their principal suggestion being that site values should be rated, and that all future expenditure in any given rating area should be met by a rate upon site values instead of upon the value of the composite hereditament.

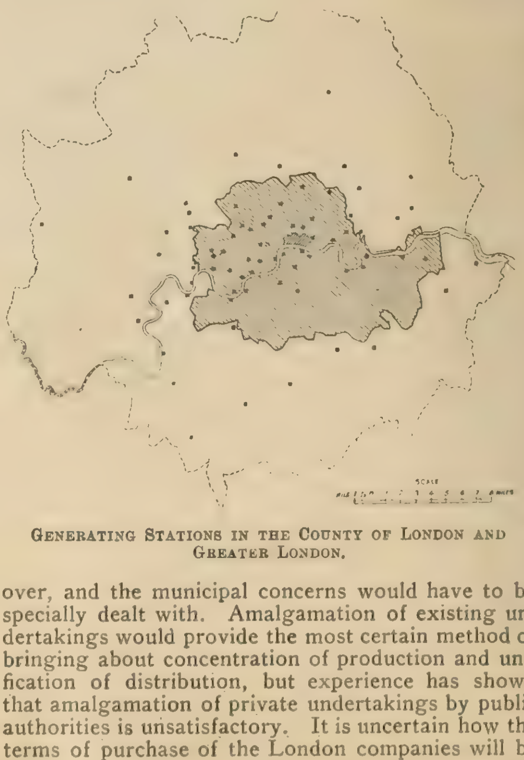
LONDON ELECTRICITY SUPPLY.

Messrs. Merz and McLellan's Report Summarised.

(*Concluded from page* 688).

As regards competition, if a new undertaking were established by public authority or company to supply in bulk for power and heating, but not for lighting, progress would be more rapid, both in districts where competition took place and indirectly; if a new and comprehensive undertaking were established covering the greater London area, with full powers of competition for all classes of supply, it is considered probable that the price of electricity would immediately fall and developments of heating and cooking follow rapidly.

Although no monopoly was granted, yet it might be necessary to postpone the date of purchase of existing companies or arrange for them to be taken over, and the municipal concerns would have to be specially dealt with. Amalgamation of existing undertakings would provide the most certain method of bringing about concentration of production and unification of distribution, but experience has shown that amalgamation of private undertakings by public authorities is unsatisfactory. It is uncertain how the terms of purchase of the London companies will be interpreted. The conclusion is that the only satisfactory solution is the establishment of a new under-



Generating Stations in the County of London and Greater London.

taking with such powers as will enable it to concentrate production, standardise and unify distribution, and bring about amalgamation of the various undertakings; this is recommended as opposed to the establishment of an undertaking prohibited from associating with or from competing against the existing undertakings, provided their co-operation can be secured. This policy does not necessarily involve any immediate interference with the Council's rights of purchase in 1931. Assuming the necessity of establishing a new undertaking, the report, from which we abstract, considers the agency by which this might be carried into effect, as follows:—

Broadly speaking, there are four different agencies by which the new undertaking might be established:—

(*a*) A combination of all the companies and local authorities in Greater London.
(*b*) A new company, formed either by the existing companies, or independently.
(*c*) A new public authority representing the County, and, possibly, certain districts outside, acting alone.
(*d*) A new public authority, of this nature, acting in co-operation with private enterprise.

(*a*) This method may be briefly dismissed. At the present time there is not sufficient cohesion among either the companies themselves or the borough councils, and still less among all the authorities in Greater London, to form even the nucleus of a central body.

(*b*) If private enterprise be the agency decided upon, a company formed under the auspices of the existing undertakings would appear more likely to succeed, and there is at present a proposal for bringing these companies together, though at present no agreement has been reached.

Before considering the other aspects of any scheme of this kind it seems to us essential that the council should satisfy itself upon certain important points, and especially:—

(1) The existence of sufficient unanimity between the various interests and sufficient driving force and financial support to carry it through energetically on the best and broadest lines.
(2) The provision for including the borough council undertakings and the important undertakings outside the county, which together supply over one-half of the total output in Greater London.

It is in these areas that power supply is growing and likely to grow more rapidly than in the London companies' areas where the revenue from lighting still predominates, and the combination of the lighting and power loads is essential to the best results and a satisfactory scheme.

If the existing companies were to form a holding company to erect one or more large stations outside London and to use such stations for the purpose of supplying undertakings both in and around London, provision would have to be made, as far as possible, for the subsequent purchase of these outside stations or as much of them as was necessary. Provision would also have to be made for ensuring that the consumer benefited from the new arrangement.

In fact, the council would also have to arrange:—

(1) Terms for taking over any new station outside the county.
(2) Maximum prices for the retail supply of electricity for power, heating and cooking to the consumer from these stations.
(3) A sliding scale of discounts and dividends paid.
(4) Provision for controlling the raising and expenditure of capital so that these safeguards became effective.

(*b*) (ii) If private enterprise be the agency decided upon and if the existing companies are not able to come to any agreement, or are otherwise unable to put forward a satisfactory proposal, the employment of some independent company, specially promoted for the purpose of establishing the new undertaking, might be considered.

Very similar considerations would apply, as regards the safeguards necessary in the interests of the consumer and public generally, as in the case of a scheme promoted by the existing companies.

(*c*) If a public authority be decided upon as the most suitable agency, the restriction of area from which municipal undertakings have suffered would not apply to a comprehensive scheme covering Greater London.

The advantages of a complete municipal undertaking for London may be stated as follows:—(1) All questions of control or repurchase of the undertaking are avoided. (2) The capital would be raised at the cheapest rate. (3) Any profits that were made would go to the consumer or ratepayer. (4) Certain municipal electric lighting undertakings are to-day showing considerable enterprise in connection with the commercial side of their business and are achieving results which compare very favourably with those of the London electric lighting companies.

The disadvantages of such a scheme may be stated as follows:—(1) Compulsory purchase of existing undertakings would probably be necessary, and this would be most expensive. (2) The encouragement or establishment of by-product developments and subsidiary industries in connection with the generation of electricity would be difficult.

(*d*) The alternatives so far considered are company ownership and operation, and municipal ownership and operation, which both have certain drawbacks and risks.

There is a third course, partial or complete municipal ownership with private operation, under strict municipal control, the bulk of the profits going to the public, whether ratepayer or consumer.

Apart from all questions of the relative efficiency of municipal and private management, the merits of such co-operative arrangements, *compared with absolute company ownership*, are that the risk of watered capital with its attendant evils are avoided. The municipality obtains a share in the profits without, or with only small, accompanying risk, and during the concession it is able to exercise closer control over the working in the public interest, and at the termination can assume possession without having to pay for wasted capital, goodwill, or prospective prospects. There is, also, little difficulty of raising capital during this period, nor the same inducement to "starve" maintenance.

As compared with municipal operation, the advantages claimed by its supporters are that commercial considerations are less likely to be violated for political ends, and that continuity of policy is more certain, while in the case of electricity supply there is the all-important advantage of greater elasticity in development, greater ease in negotiating contracts, and greater freedom in replacing antiquated plant.

In view of the marked success of these co-operative arrangements elsewhere, there would appear many advantages and no insuperable difficulty in applying the same principle to the laying down of a system of electricity supply in the London area.

Such an arrangement would involve:—

(*a*) An owning and controlling authority which would supply the bulk of the capital necessary to construct the new works.
(*b*) An operating body which would work the undertaking on behalf of the controlling authority, guarantee the interest on the capital, and gradually unify and ultimately amalgamate existing undertakings as the agent of, and under the control of the owning authority and special statutory regulations with regard to price and dividends, etc.

The operating body would preferably represent the interests of the existing London companies, though not necessarily those interests solely.

The best results would be secured if the constitution of the controlling authority were to some extent based upon the functions which it would be called upon to perform.

We therefore recommend that the London County Council should promote a bill in the next session of Parliament, empowering some central body to set up an undertaking with powers of bulk supply and the means of *gradually* acquiring and amalgamating the different undertakings on *commercial* terms. We consider that in no other way will it be possible for London to obtain the full advantages of cheap electricity, and moreover that such an undertaking if carried out on proper lines might be made self-supporting at a comparatively early stage.

SUMMARY OF CONCLUSIONS.

(1) The concentration of generating plant on sites down the river is the correct policy to begin with, both on technical and commercial grounds, deferring the question of generating part of the energy at the coalfields or elsewhere until both the load and the load factor have grown.

(2) In order to carry out this policy with the minimum waste of capital a high voltage 3-phase primary distributing system at 50 cycles per second should be standardised for London as soon as possible. In this connection a standard primary voltage should be at once adopted for all new high pressure mains.

(3) If electricity is to be supplied for power and general domestic use at the lowest possible price it is also necessary, both for economical and other reasons, that the existing low pressure distribution networks should, as a rule, not be extended but be supplemented by a new 3-phase network.

(4) The most satisfactory and economical method of achieving these results is the establishment of a new undertaking with such powers as will enable it gradually to concentrate production, standardise distribution, and bring about the amalgamation of all the various undertakings.

The latter half of the report consists of lengthy appendices summarising the technical tendencies of production and distribution; the history of electricity supply in London; and the position of electricity supply in the great cities throughout the world.

A considerable amount of data is included, together with curves and maps, one of which shows the authorized supply areas and generating stations in the Greater London area.

From appendix II., we reproduce two tables which indicate the position at the present time. The first table is taken from the Administrative County of London Electricity Supply Returns, 1911-12.

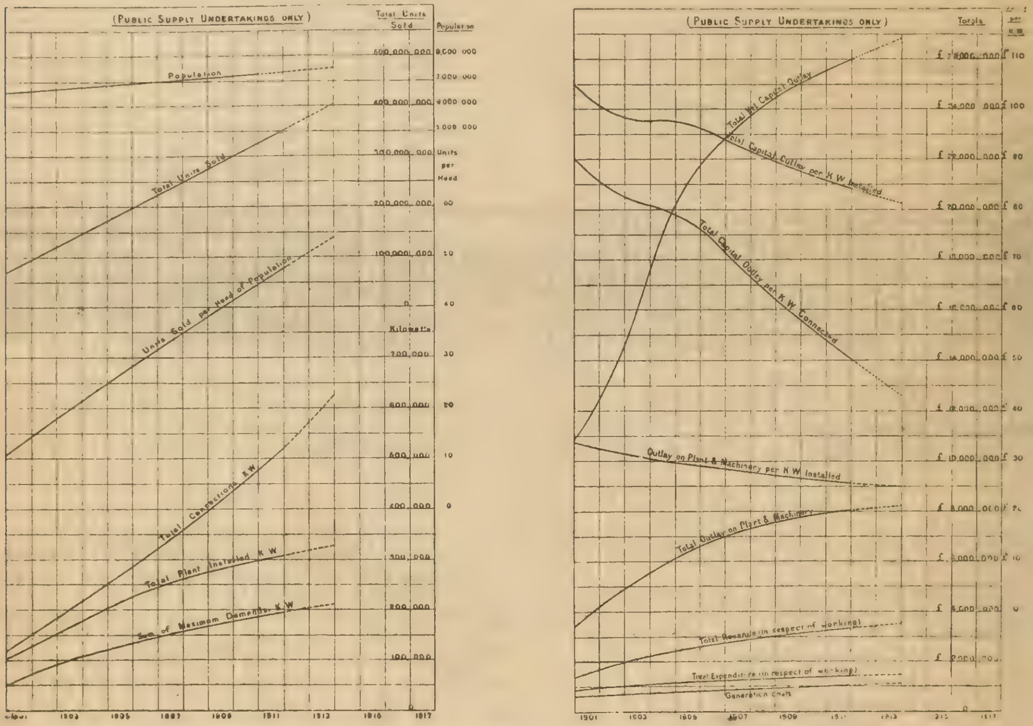
The municipal authorities have apparently repaid some 20 per cent. of their loans, while the companies appear to have sinking funds of about two millions.

It is considered that the price obtained for most of the existing plant, if sold, would be little more than "scrap" value, and that the value of the sites would be about a million sterling.

TABLE I.

Statistics of Existing Undertakings in Greater London, 1912.

	County. Local Authorities.	County. Companies.	Outer London. Local Authorities.	Outer London. Companies.	Total.
Total Capital Outlay	£6,581,198	£14,437,257	£3,267,174	£1,711,770	£25,997,399
Total Expenditure on Plant and Machinery	£1,792,700	£4,651,431	£1,115,573	£499,897	£8,059,601
Total kw. connected	137,249	266,510	96,392	23,714	523,865
Total Plant installed kw.	80,603	153,479	53,070	20,186	307,338
Sum of Maximum Demands in kw.	54,474	96,651	31,824	13,772	196,721
Units sold per head of population	21.5	35.5	24.25	11.7	48.5
kw. connected per head of population	.03	.06	.04	.01	.07
Average price obtained, all purposes	2.06d.	2.62d.	2.06d.	1.96d.	2.29d.



Curves showing the Growth of Electricity Supply in Greater London.

TABLE II.

Systems used in 1913.

	Central Area.	Greater London.
Number of generating stations	41	70
Number of Authorities	39	70
Average size of stations	7,646 kw.	5,286 kw.
Average size of units	785 kw.	632 kw.
Number of types or systems of generation	31	49
Number of frequencies	8	10
Number of voltages :—		
Generation	20	32
Distribution	21	24
Number of methods of charging & prices	Over 50	Over 70

REINFORCED-CONCRETE POLES.*

By J. G. JACKSON.

Although reinforced-concrete poles have been the subject of experiment from time to time for a great many years, it is comparatively recently, so far as the writer is aware, that they have been employed or even seriously considered. The high and increasing cost of wooden poles, their comparatively short life, with consequent prospective renewal at greater expense, as well as the public demand for the beautification of city streets, render the consideration of concrete-pole construction desirable for modern overhead systems.

Quite a number of successful installations of concrete poles have been made during the past five or six years on this continent and in Europe. Perhaps the largest single installation at present is that of 25,000 poles designed by the writer and installed in connection with the municipal street-lighting and general light and power distribution system of the Toronto Hydro-Electric System in Toronto, Canada, during 1910, 1911 and 1912.

The adoption of concrete poles for this installation was due to the necessity of supplying energy to the entire city, comprising over 400 miles of streets, from overhead lines, underground construction being in general too expensive except for the business districts, and a realization that more wooden poles and overhead construction of the usual type, added to streets already occupied by at least two such systems, would be decidedly objectionable.

It was felt that the appearance of an overhead installation could be greatly improved by employing a pole of neat and uniform construction such as could be obtained by the use of concrete. With a suitable lighting system and arrangement of overhead wiring, a pleasing, and, in fact, ornamental, effect can be secured at a cost substantially the same as when wooden poles are employed and with a prospective saving in maintenance expense. This would appear to be of especial interest to the smaller cities and residence districts of large cities, where the demand for underground construction is based mainly on aesthetic considerations but where such construction is not justified by the revenue to be obtained.

In this connection it might be noted that in the recent installation of a street-lighting system with which the writer was concerned, for a city of approximately 10,000 inhabitants, the usual practice of installing a "white way" with underground wiring in the business section and gooseneck fixtures on wooden poles in the residential district was abandoned in favour of the installation of concrete poles throughout. This arrangement resulted in a smaller cost for the entire installation, a decorative system in the residence districts and a "white way" with tungsten clusters carried by heavy cast-iron brackets of ornamental design mounted on the faces of the concrete poles. This, in the writer's opinion, was not lessened in effectiveness by the small number of wires overhead. The concrete poles also served to carry the trolley span

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*Reproduced from the *Electrical World*.

wires where necessary, so that, as in the case of steel trolley poles similarly employed, a minimum of street obstruction resulted.

In the design and construction of the poles employed in the installations referred to an effort was made to eliminate unnecessary details and to render the manufacture as simple as possible in order that poles might be turned out rapidly and at low cost. A pole of solid square cross-section with bevelled edges was adopted. The square section not only made possible a simple form of mould, but, as the strains to which a pole is subjected are ordinarily either normal to or in the direction of the line, this is obviously the most efficient arrangement of the material, especially with the longitudinal reinforcement grouped at four corners, as 50 per cent. of these members are then equally effective in tension in any direction normal to a face of the pole. As the majority of the Toronto poles were intended to carry an ornamental lighting bracket and tungsten lamp, they were provided with a ½-in. iron pipe cast in the pole with lower outlet at the lamp and upper outlet under the line wires.

The earlier poles of the Toronto installation were provided with three galvanized-steel cross-arms cast in the pole and having a hole at each end for a steel core pin. This arrangement of cross-arms was not found sufficiently flexible in obtaining clearances of the lines and was later discarded.

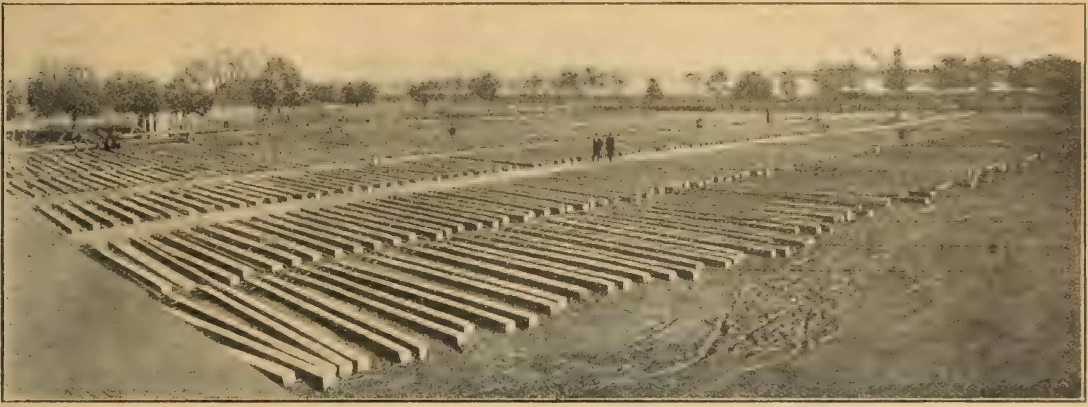


Fig. 1.—A Two-Weeks' Run in Pole Yard, 112 Poles per Day being turned out.

Holes were provided through the pole with a slot on either face so that brackets of any desired length could be bolted to the pole.

The concrete poles employed in this installation ranged from 21 ft. to 35 ft. in length, the majority being 24 ft. long. Standard poles were made with 8-in. by 8-in. base and 5-in. by 5-in top for 24-ft. poles, with 9-in. by 9-in. base and 6-in. by 6-in. top for 30-ft. poles, and with 10-in. by 10-in. base and 6½-in. by 6½-in. top for 35-ft. poles. The longitudinal reinforcement consisted of four deformed or square twisted steel bars of high elastic limit set at the corners of the pole and ½-in. from the surface. Three-eighth-inch bars were used in the 24-ft. poles and ½-in. bars in the longer poles.

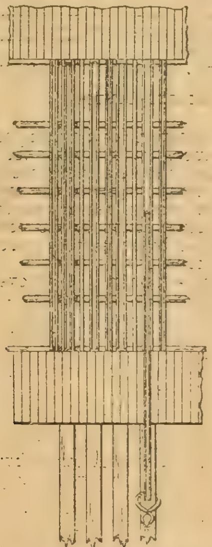


Fig. 2.—Method of Handling and Supporting Poles.

Extra reinforcement consisting of additional bars extending part way up the pole was provided where poles were expected to be subjected to considerable strain. The cross-sections of the poles were determined with regard to the resulting appearance as well as from considerations of strength and cost. As all of these poles were intended for use on city streets, wind stresses could be considered to be a minimum owing to the sheltered location. With the exception of poles on curved streets, the lateral stresses result mainly from service lines to buildings. It is probable that the greatest strain that the majority of these poles would be subjected to was that due to handling in transportation and erection. The reinforcement provided, giving an ultimate strength as measured by the horizontal pull applied at a point 2 ft. from the top ranging from approximately 500 lb. in the 24-ft. poles to 800 lb. in the larger sizes, with extra reinforcement as stated, has been found to be sufficient for the conditions obtaining in Toronto.

Poles at ends of lines or at corners were ordinarily well guyed. Insufficient guying at occasional points, however, resulted in considerable deflections of the poles concerned, with consequent easing up of strains, but in comparatively few cases did breakage of poles result.

A number of poles 21 ft. long with 7-in. by 7-in. base and 4-in. by 4-in. top provided with four ¼-in. plain square reinforcing bars were experimented with when determining the sizes of the poles to be employed. These poles were found, at thirty days or thereabouts, to be incapable of withstanding the handling and transportation. It is of interest to note that in tests made on poles thirty days old with plain square-bar reinforcement failure resulted from slipping of the reinforcement in the case of ⅜-in. and ½-in. bars. One-quarter-inch square bars broke without appreciable slipping.

The plan employed in the manufacture of these poles consisted in the main of parallel horizontal forms arranged in rows with a runway at one end of the forms for the delivery of concrete, together with concrete mixer and special wagons for placing the concrete in the poles. All forms were constructed of finished Southern pine as more satisfactory results were obtained with this wood than with the less dense and resinous Northern variety. Bases of forms were spaced 2 ft. apart with wooden rails between, one pair of sides being provided for each three bases. A very wet mixture of concrete in the proportions of one part cement to two parts of sharp sand and four parts of crushed limestone of less than ½-in. size was used. The quality of sand used was found to have an appreciable effect on the characteristics of the pole, a sharp sand, as would be expected, tending to produce the more

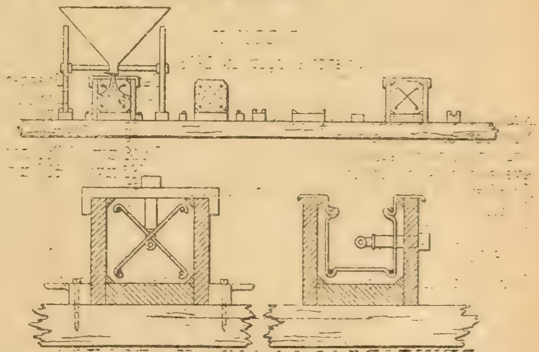


Fig. 3.—Method of Pouring Concrete and Reinforcing.

elastic concrete. Gravel instead of crushed stones was found to give satisfactory results.

A number of mixtures less rich in cement were tried but were found to give a pole somewhat inferior in strength at ages up to thirty days covered by the period of test. The surface, also, was not so good as with the richer mixture. The 1 :2 :4 mixture employed gave an excess of cement and sand beyond that required to fill the voids in the stone. The method of placing the liquid concrete by pouring from a spout in the bottom of the concrete wagon resulted in the almost complete elimination of air bubbles without special spading or working of the concrete for this purpose after placing in the forms. A small amount of troweling was necessary for the finishing of the upper surface, however. The poles made in this way, when set, presented smooth white cement surfaces showing the grain of the wood on three faces. The hand-finished upper surface was dressed by means of carborundum bricks after removal from the form.

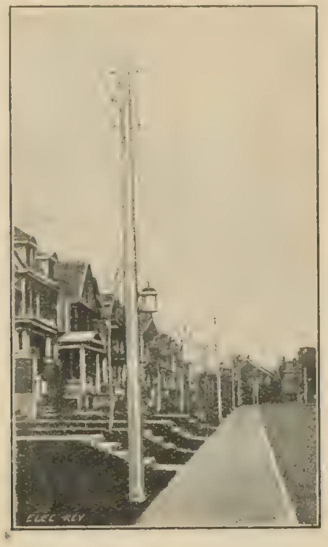


Fig. 4.—Concrete Pole in Residential Section of Toronto, Canada.

In casting the poles sides were set up and forms poured on every third base during the first day. On the following day the side walls were removed from the first poles and advanced to the second base, and the operation was repeated. On the fourth day the first poles cast were removed from the forms and the cycle of operations was started again. The removal of poles from the forms was accomplished by sliding the pole endwise from the form in stages a distance slightly greater than its length every third day, until sufficiently set for handling.

In the first stage, in order to prevent overstraining of the green poles, an extension of the base consisting of a 2-in. plank slightly wider than and equal in length to the pole was provided. The withdrawal was accomplished by gripping the base of the pole by means of a particularly robust pair of ice tongs made for the purpose, the tractive effort being supplied by a horse attached to a rope on the tongs. Poles were commonly loaded on the outgoing wagons, or piled for storage after the third stage, at approximately ten days after casting.

Vertical reinforcement was placed by laying it in the form on wire hangers suitably spaced and with open hooked portions to carry the reinforcing bars. The lateral reinforcement intended to take up the vertical shear and to prevent failure by buckling consisted of a series of short bars with hooked ends dropped diagonally across the longitudinal members at intervals and for a distance above and below the ground line proportioned to the strain to be provided for. No effort was made to bind the longitudinal reinforcement in a cage by means of the suspension wires or together by means of the cross-reinforcing bars except by hooking together as noted and depending on the setting of the concrete to complete the bond and lock the reinforcement in place.

This method of reinforcement resulted in a minimum cost both for labour and for material. Repeated inspection of poles cast in this way and afterwards broken on test or otherwise proved the method of setting the reinforcement to be sufficiently accurate and the lateral reinforcement to be capable of developing the full strength of the longitudinal steel. It is ordinarily desirable, however, that the lateral reinforcement be such that the pole will fail by crushing of the concrete rather than by breaking of the bars in tension, as in the former case a very considerable force will yet be required to bring the pole to the ground, which would seem to be an advantage in view of the weight of the pole, although the wiring carried would ordinarily prevent the falling of an overstrained pole.

In the manufacture of the Toronto poles three yards were employed during a part of the time, turning out approximately 250 poles per day. Two of these yards were adjacent and employed the same men and equipment, giving an output of 150 poles per day practically at one point. The third yard was located several miles distant in order to shorten the haul for the finished poles to the points of erection. One of the yards with forms for more than 100 poles per day was operated for three successive years and was still in fairly serviceable condition at the end of that time, notwithstanding the exposure of a part of the forms to the weather during two winters.

While the majority of these poles were cast out of doors, about 2,000 were made in a large building during the winter of 1910-11. The labour cost under these conditions was approximately double that found necessary with unrestricted space.

Delivery of poles to erection gangs was carried out by means of ordinary wagons upon which oak frames were set to provide several points of support for the poles—a load consisting of six 24-ft. poles weighing 1,100 lb. and four 30-ft. poles weighing approximately 1,600 lb. Poles were lifted on to the wagons by a loading gang without special equipment and were lowered to the ground on skids.

Ordinary labour was employed in the erection under the direction of line foremen. While three poles erected per day per man was accomplished under favourable circumstances, the average was slightly less than this. Raising pikes with a forked end were used, and poles were lifted and dropped into the holes in the same manner and with the same care as in the case of wooden poles. Twenty-four-foot poles were set 4 ft. in the ground and 30-ft. poles 5 ft. The holes were refilled with the excavated earth, no concrete bases being employed. The small sizes of the bases as compared with wooden poles resulted in a smaller cost for digging holes as a minimum diameter was excavated. While the cartage of concrete poles was comparatively expensive as a result of the weight, the cost of handling and erection was approximately the same as for wooden poles, with a possible advantage in this instance for the concrete pole as a result of the larger number erected and the fact that ordinary labour was employed for this purpose.

Notwithstanding the fact that no special precautions other than ordinary care were taken in handling the poles, the total breakage on approximately 25,000 over a period of about three years covering manufacture, erection and operation was less than 2 per cent. Failure while in service during this period was a small fraction of 1 per cent. per year and resulted mainly from collisions with heavy vehicles and obvious overstraining. While several thousand of these poles have been in service during three winters, carrying from three to six lines ranging from No. 6 to No. 2 and larger, in addition to frequent services to buildings, they appear, except in a number of cases where overstraining is apparent, to be in as good condition as when erected, and inspection of the concrete indicates the improvement which would be expected with age. With the exception of a number of poles which were frozen before the setting of the concrete, no deterioration of the concrete appears to have developed, and examination of the reinforcement of poles broken gives evidence of the preservation of the steel.

Cost of Street-Lighting Poles designed to carry six wires and ornamental tungsten-lamp bracket with conduit connection.

24-ft. Pole, 8-in. by 8-in. Base, 5-in. by 5-in. Top; Volume of Concrete, 7 cu. ft.	
Cement, at 40 cents per bag	$0.700
Stone, at $1.33 per ton	0.400
Sand, at $1.15 per yd.	0.145
⅜-in. steel reinforcing bars, at $1.95	0.889
Suspensions for reinforcing bars	0.056
Lateral reinforcing bars	0.100
½-in. pipe and fittings	0.268
Three galvanized-steel cross arms	0.262
Miscellaneous material	0.050
Depreciation of forms	0.400
Mixer and other plant	0.120
Preparing yard	0.080
Total	$3.47
Labour	1.05
Total labour and material, etc.	$4.52
Adding for engineering supervision, office expenses, 10 per cent.	0.45
Total	$4.97*

30-ft. Pole, 9-in. by 9-in. Base, 5-in. by 5-in. Top; Volume of Concrete, 12 cu. ft.	
Cement	$1.200
Stone	0.710
Sand	0.255
½-in. steel bars, at $1.85	1.893
Suspensions	0.072
Lateral reinforcing bars	0.140
½-in. pipe and fittings	0.430
Galvanized cross-arms	0.262
Miscellaneous	0.060
Forms	0.500
Mixer and other plant	0.120
Yard	0.080
Total	$5.72
Labour	1.31
Total labour and material	$7.03
Plus 10 per cent.	0.70
Total cost	$7.73

*This, of course, includes the iron conduit pipe and galvanized steel cross-arms, so that the cost of a plain 24-ft. pole would be $4.39 and that of a plain 30-ft. pole would be $6.97.

The costs of the concrete poles under the several conditions described were variable, but for a considerable part of the work approximated the figures given in the accompanying table.

It is apparent, of course, that in a comparison of costs of wooden and concrete poles the labour required in preparing the wooden poles and also the painting should be considered as a part of the cost, as the concrete pole is produced as a finished article. While concrete poles can compete, even in first cost, with wooden poles in many cases, and present decided advantages where appearance is a factor, as in the case of street-lighting systems, it is not, in the writer's opinion, probable that satisfactory or economical results will be had from the occasional manufacture of poles by inexperienced persons.

TELEPHONY IN THE UNITED STATES.

The report of the American Telephone and Telegraph Co., which has just been issued, is practically an epitome of the present position of the telephone industry in the United States. As is well known, this company owns the Bell patents, and controls the greater part of the public telephones in the country.

This report is interesting on account of the separation which was effected during the year from the Western Union Telegraph Co. For three years these companies had worked together, but objection was taken by the Government to the association of interests, and eventually an arrangement was made by which the two companies became distinct and all Western Union shares held by the Telephone Co. were sold.

The extent of the operations of the company can best be understood by an examination of the following figures, which summarise the position in different years :—

	Dec. 31, 1895.	Dec. 31, 1900.	Dec. 31, 1905.	Dec. 31, 1910.	Dec. 31, 1913.
Miles of exchange pole lines	25,330	30,451	67,698	120,175	151,497
Miles of toll pole lines	52,873	101,087	145,535	162,702	171,554
Total miles of pole lines	78,203	131,538	213,233	282,877	323,051
Miles of underground wire	184,515	705,269	2,345,742	5,992,303	8,817,815
Miles of submarine wire	2,028	4,203	9,373	24,636	31,833
Miles of aerial wire	488,872	1,252,329	3,424,803	5,625,273	7,261,363
Total miles of wire	675,415	1,961,801	5,779,918	11,642,212	16,111,011
Comprising toll wire	215,687	607,599	1,265,236	1,963,994	2,333,541
Comprising exchange wire	459,728	1,354,202	4,514,682	9,678,218	13,777,470
Total	675,415	1,961,801	5,779,918	11,642,212	16,111,011
Total exchange circuits	237,873	508,262	1,135,449	2,082,960	2,812,944
Number of Central Offices	1,613	2,775	4,532	4,933	5,245
Number of Bell stations	281,695	800,880	2,241,367	4,030,668	5,415,209
Number of Bell connected stations*	27,807	55,031	287,348	1,852,051	2,717,808
Total stations	309,502	855,911	2,582,715	5,882,719	8,133,017
Number of employés	14,517	37,067	89,661	120,311	156,928
Number of connecting companies, lines and systems				17,845	25,679
Exchange connections daily	2,351,420	5,668,986	13,543,468	21,681,471	26,431,024
Toll connections daily	51,123	148,528	368,083	602,539	806,137

*Includes private line stations

On January 1st of the present year there was one Bell telephone station to each twelve of the total population of the United States. During recent years the gross and net earnings were :—

		Gross Earnings.	Expenses.	Earnings.
1895	...	£4,978,500	£3,187,000	£1,791,500
1900	...	9,545,000	6,303,000	3,242,000
1905	...	20,060,000	13,620,000	6,440,000
1910	...	34,080,000	23,585,000	10,492,000
1913	...	44,351,000	32,275,000	12,076,000

The total assets of the company on the last day of the various years were :—1895, £24,770,000; 1900, £47,376,000; 1905, £93,376,000; 1910, £155,002,000; 1913, £201,640,000.

The report gives a number of details in regard to the working of the telephone which are very interesting. Thus at the beginning of this year there were over 12,000,000 telephone receivers and transmitters owned by the Bell Company. None of these were made before 1902, and the average age of all the instruments in use was under five years.

The company claim to have always been in the front in regard to developments in the art of telephony, and at the present they have working on telephone problems at their headquarters 550 carefully trained engineers and specialists, many of them of the highest training and repute.

Details as to the development of long-distance speaking are given. It is expected that within a comparatively short time it will be possible to speak between the Atlantic and the Pacific, and that all the principal cities in the States will be brought in direct telephonic communication with each other.

The full text is given of the arrangement with the Government whereby the separation from the Western Union Telegraph Co. was effected and undertakings were given to allow interchange service connections between subscribers to the Bell system and to independently owned telephone undertakings.

It is impossible in a short résumé of these figures to give more than a dim outline of the working of this vast corporation. It is evident that if ever the United States Government desire to follow the example of our own and to acquire the systems they will have to pay an immense sum for the undertaking, and it would seem from the arguments used that they would have to provide a more continuous policy of working to ensure success than is usual in other branches of State-operated undertakings.

EXPERIMENTS ON AIR-BLAST COOLING OF TRANSFORMERS.

By F. J. TEAGO, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Manchester, March 24th,* 1914.)

Experiments were made on one of a pair of single-phase transformers of the core type in order that accurate information might be obtained as to the relation between the "heat rating" and the quantity and condition of the air. The transformer had a rectangular core with one ventilating duct, and was designed for an output of 12 k.v.a., $\cos \phi = 0.8$, 200 volts (ratio 1 : 1), 50 cycles; the net weight of iron was 82 lb., and net weight of copper, 48 lb. The estimated amount of air for mean coil rise of 50°C., with inlet air at 15°—20° C., equals 5 cub. ft. per sec.

Fig. 1 shows the arrangement of the air-blast plant. The air enters at the fan inlet, passing through baffles in the air pipe into the air box, which is divided into two sections, the shutters A controlling the air inlet to the transformers through the openings D. The air baffles, consisting of perforated metal and wire gauze, are placed at each end of the air pipe in the joints B and B′. The baffles at the inlet end of the air pipe are two sheets of perforated metal having 165 perforations

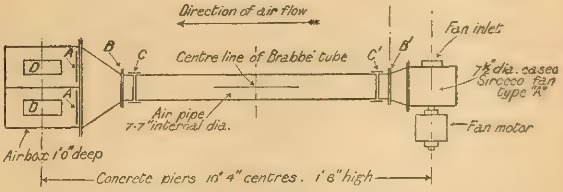
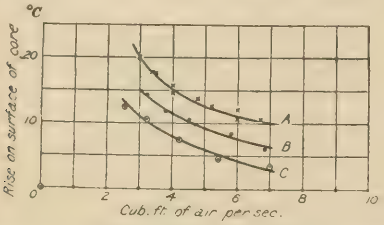

Direction of air flow
Fan inlet
B
C
Centre line of Brabbe tube
C′
B′
A
D
A
D
7½" dia. cased Sirocco fan type "A"
Air pipe 7·7" internal dia.
Fan motor
Airbox 1′0" deep
Concrete piers 10′ 4" centres. 1′ 6" high

Fig. 1.—General Arrangement of Air-Blast Plant.

(each of 0.0024 sq. in. area) per sq. in. At the outlet end of the air pipe the baffle is a sheet of wire gauze having 2,500 meshes per sq. in. In arranging the baffles, the object was to get as large a quantity of air as possible through the pipe with a distribution as nearly uniform as possible. C. and C′ are leather joints in the air pipe to prevent the transmission of vibrations which would interfere with the Brabbé tube readings.

Each transformer has a sheet-iron case, connected to an air-shoot which discharges the warm air outside the building. When the pipe is baffled the air flow is very steady, and the baffles tend to distribute the air uniformly over the cross-sectional area of the pipe. Within the limits of the velocities taken, the ratio mean velocity : velocity at centre is constant for the baffled pipe. The mean value of 0.972 was taken as being correct.

The first set of experiments was made in order to find out whether the varying humidity of the air had any effect on its cooling properties. It was not anticipated that the effect, if any, would be great since the specific heat of water vapour is only about 25 per cent. greater, for equal volumes, than that of air, and the amount of water vapour present, even when the air is saturated, is very small. It was found that in the ordinary way the differences due to humidity were too small to be detected.



Load = 80 amps., 200 volts.
Curve A, no spray; Curve B, 436 grammes of water per hour; Curve C, 914 grammes of water per hour.

Fig. 2.—Comparison between Air and "Fogged" Atmosphere as Cooling Media. (Top of ventilating duct.)

The mean temperature rise of the coil was 17 per cent. greater than the surface rise at the lowest point observed, and 10 per cent. at the highest point.

A "fogged" atmosphere has been suggested as a cooling medium for electrical machinery on a number of occasions, notably by H. M. Hobart. A number of tests were made with air rendered "fogged" by atomizing water at the inlet to the transformers, and these are compared with similar tests where the air was not "fogged."

In these experiments on the average the cooling effect of the water equals 300 and 600 watts respectively, and the heating effect of the losses equals 900 watts. One might therefore expect the temperature rise to decrease by 33 per cent. in one case, and 66 per cent. in the other. Fig. 2 shows a decrease approximately equal to that anticipated. These results justify the serious consideration of a "fogged" atmosphere as a cooling medium for electrical machinery, especially where the electrical pressure is only moderately high. In the ideal case the air would be thoroughly "fogged" so as to obtain a homogeneous mixture, the amount of water used being no greater than was necessary to ensure that the water particles were not deposited on the coils, etc., as the cooling mixture passed through. The atomizer used in these experiments does not completely fulfil these conditions.

Plant is now manufactured capable of producing very large quantities of "fogged" air eminently suitable for cooling purposes. In one type of plant the air is washed free from dust particles and cooled, and delivered with an amount of free water in suspension which varies from zero to about two or three per cent. of the total volume of the mixture according to the design. The cooling efficiency with plant of this description ought to be fairly high.

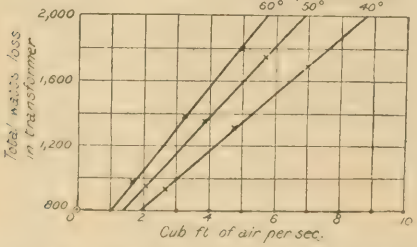


Fig. 3.—Curves showing the Connection between Total Watts Loss and Cubic Feet of Air per Second for various Mean Temperature Rises on Coils.

As regards the insulation resistance, in these experiments no injury was done to the insulation by the water. The insulation resistance was low immediately after a test, but this was due to the fact that moisture condensed on the bare ends of the windings. When these were dried, the insulation resistance was normal, namely, 10 megohms.

The next set of experiments was conducted with the object of finding the way in which the output of the transformer varied with the number of cubic feet of air supplied per second, the basis being a mean temperature rise of the coils of 50° C.

From the results the following figures are obtained, and have been plotted in fig. 3:—

Mean temp. rise of coils.	60 amperes.		73 amperes.		84 amperes.	
	Cb. ft. of air per sec.	Total watts loss.	Cb. ft. of air per sec.	Total watts loss.	Cb. ft. of air per sec.	Total watts loss.
40° C.	2·7	928	4·75	1,306	7	1,683
50° C.	2·1	955	3·9	1,348	5·7	1,738
60° C.	1·7	981	3·30	1,385	5	1,789

These figures suggest that for any particular value of the total watts loss—

cub. ft. of air per sec. × mean rise of temperature of coil = constant (K).

This should prove of value to the designer, since all the values of K can be determined, for any one type of construction, from the product (cub. ft. of air per sec. × mean rise of temperature of coil) at two different values of the watts loss, since the relation is practically a straight line (see fig. 4).

By extrapolating these curves it is found that for a load of 8 k.v.a. no air at all is required, and for 20 k.v.a. 9 cub. ft. of air per sec. is required.

In connection with these experiments the following general statements may be made:—

1. The temperature rise of the transformer is independent of the temperature of the inlet air within ordinary limits, provided that the surfaces to which the heat is radiated, that is the walls, etc., of the room, are at the air temperature.

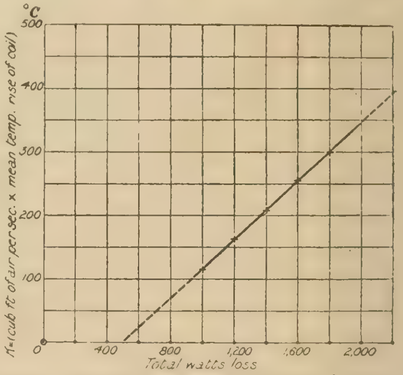


Fig. 4.—Curve showing Relation between "K" and Total Watts Lost for the Type of Transformer Described.

2. Variations in the barometric pressure only affect the temperature rise to a small extent, and the correction is negligible for the small variations in the barometric pressure from day to day.

3. The humidity of the air, up to the point of saturation, has no appreciable effect on the temperature rise.

Discussion.

Mr. J. Frith said that although air-cooled transformers were rather a thing of the past, a great deal of the information in the paper could be used for air cooling of other electrical apparatus. Commutation no longer limited the output of machines, the limit being now temperature rise. There was still a field for the suggestion of compressing the air outside and letting it expand into the case of the machine. This seemed to get the heat out in more manageable form.

Mr. W. Cramp wrote that the co-efficient ratio of mean velocity to velocity at centre which the author gave as something over 0.9 was quite in agreement with his own experience, although some authorities placed their co-efficient between 0.6 and 0.9.

Mr. H. Mawson gave test results of a 1.5 h.p. Sirocco fan running at 900 r.p.m. and discharging into a square duct 10in. by 10in. A Pitot tube similar to the author's Brabbé tube was employed, the manometer being of the sloping tube pattern using paraffin of density .823, which gave very satisfactory results with the 1/16in. bore. Arrangements had to be made to place the tube in any position over a half section of the duct. It was customary in fan experiments to separate the energy of discharge into two portions, one utilised in overcoming the static pressure head and the other used in creating velocity head, and it was for this reason that the mean velocity head was calculated. In order to get smooth curves baffles had to be applied, having 100 meshes per inch. With the fan running at the lower speeds, very smooth curves were obtained and the mean velocity of the flow was 0.92 of the velocity as measured at the centre of the duct. The mean velocity head was 0.855 of the velocity head at the centre. At the higher fan speeds, even with baffles, smooth curves could not be obtained. Fan testing did not permit of excessive baffling, and a good method was to discharge the air into a large box where its velocity would be destroyed and then allow it to flow through an orifice when at the same time the difference of pressure head on the two sides could be measured. Provided the cross section of the orifice was less than one-twentieth part of that of the box, consistent results could be obtained.

Mr. C. C. Aitchison said in connection with cooling of generating plant that in a particular case air passed through one cooler and then through a number of ducts to individual machines. The arrangement worked all right while all machines were in operation, but if one or two machines were not in service the distribution of air was not correct, and in order to overcome the trouble it had been necessary to carry division plates not only through the eliminator section, but right through the whole filter.

Dr. Worrall thought "fogged" air had a future, especially in the case of turbo-generators. There should be no loose moisture about, and the question of condensation would have to be studied. Although it was generally considered that water vapour was detrimental to windings, it was not the water so much as the chemical fumes dissolved in it. It was of the utmost importance to have air perfectly clean, as with forced ventilation the ducts were soon choked up if the air was dirty.

Mr. K. Faye-Hansen said on checking the ratio connecting centre and mean velocity he found it to be approximately 0.94 and not 0.972, which showed still more clearly the improvement due to the baffles. He did not consider that "fogging" increased cooling sufficiently to warrant its use on high-voltage machines, as an increased rating of only about 10 per cent. was obtainable, which could easily be achieved by forcing a little more air through the machine. There was also the difference in cost to be considered, and the fact that free moisture would give trouble in the windings.

Mr. A. E. McKenzie spoke strongly in favour of wet air filters, and considered that one large filter would supply a number of machines successfully, provided that portions of the filter were cut in and out with the machines in order to maintain a constant flow of air through the baffle plates. Wet air filters and dry air filters cost about the same initially, but the upkeep of the former was much the smaller.

Mr. W. A. Bristow asked for more definite information regarding the effect of initial temperature on temperature rise.

Mr. J. L. Thompson considered that a shell type transformer should have been chosen for the tests.

The Author, in reply, said the experiments were made in order to obtain more definite information concerning the relation between quantity of air supplied and consequent temperature rise, and to bring forward the value of "fogged" air as a cooling medium, rather than to justify the air cooling of transformers. No matter how carefully the atomising was carried out initially, there was always a tendency for the water particles to coalesce and be almost immediately deposited if too much water was present in a given quantity of air. The latent heat of vaporisation of the water was much more important than the specific heat of either water vapour or air, and it was doubtful if a refrigerator could compete successfully with plant designed to fog the air on the point of cost for equal effect. The author advocated the wet filter, particularly the type employed by Mr. Christie at Brighton. If "fogging" was carried out correctly no deposit of moisture would be produced, because as soon as the particles of water touched the windings they would be evaporated. The danger of moisture lay almost wholly in the impurities, and in "fogging" air impurities could easily be avoided. Regarding the temperature of the air and water before mixing, since the latent heat of vaporisation of the water was the predominant factor, any exchange of heat could have very little effect on the final result, and the whole of the cooling could be attributed to the presence of water particles. That the cooling effect of air was proportional to its velocity within wide limits was due to the air being churned, although the law held good when air was passed through narrow ducts without becoming turbulent. In view of the present-day practice relating to the computation of the amount of air required for cooling electrical machinery it was correct to assume the product cub. ft. air per sec. × mean temp. rise = constant provided the loss remained constant. It was not correct at any rate for transformers to write :—cub. ft. air per sec. × mean temp. rise ÷ kw. loss = constant. In the experiment it was only possible to observe the effect of variation of inlet air temperature on the final temperature rise within the limits 14° C. to 20° C., and over this range the correction was certainly negligible.

Italy.—The Walsall Electrical Co., Ltd., have been placed upon the Italian Admiralty list for the supply of circuit breakers, switches, ammeters, voltmeters and dynamo brushes.

A NEW MAGNIFYING RELAY.*

The long outstanding problem of the telephone relay, or device for reproducing and magnifying small rapidly-varying currents, is one still calling for a complete solution. Amongst the suggestions which have come up from time to time has been one for the employment of the variable conducting properties of the stream of electrons in a cathode tube for the purpose, but hitherto this has been without much success.

Messrs. R. von Lieben and E. Reisz have now, however, devised an arrangement on these lines which appears to overcome most of the difficulties, and which is being put on the market by the Allgemeine Elektrizitats Gesellschaft, the Siemens & Halske A.G., the Felten and Guilleaume A.G. and the Gesellschaft für Drahtlose Telegraphie acting in conjunction.

The principle on which the new relay depends is the rapid variation of discharge current with voltage between the electrodes in an exhausted tube at and about a particular value of the current (the saturation current).

In order to utilise this effect to the best advantage, a third electrode of perforated metal is introduced in the tube between the main cathode and anode to act as an auxiliary anode.

Thus, in fig. 1, K is the main cathode, A the main anode, and H the auxiliary anode. When a discharge takes place between A and K, the stream of current-carrying electrons passes at high speed from the cathode towards the anode A, and some of them pass through the openings in H, while a large part of them will come into contact with H, and be absorbed by it. This absorption raises the (negative) potential of H, and thus gradually reduces the fall of potential between K and H, and so reduces the speed of the main stream of electrons below K and H, and of those few electrons which pass through the gaps to the anode.

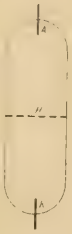


Fig. 1.

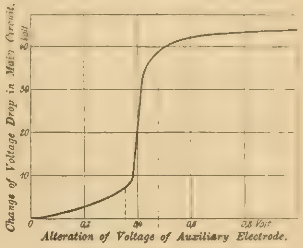


Fig. 2.

This reduced speed further reduces the ionisation produced between the auxiliary electrode and the anode. Both these effects of (1) reduced speed of the original electrons, and (2) reduced ionising power, acting together lead to a marked increase in effective resistance of the tube between the main cathode and anode and a corresponding fall in current.

The very marked effect of a small difference in the voltage applied to the auxiliary electrode on the voltage drop between the main electrodes is shown by the curve of fig. 2. It is this sensitiveness which is made use of in constructing the new relay. The voltage variations of the primary circuit which are to be magnified are superposed on the voltage between the auxiliary electrode and the cathode, either directly or inductively, the initial voltage having first been adjusted to the most sensitive conditions, as shown at c, fig. 2. The arrangement suggested is shown in fig. 3.

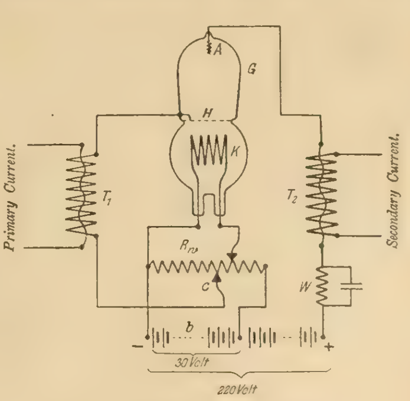


Fig. 3.—Connections of Relay.

G is the partially-exhausted glass vessel containing the three electrodes (cathode K, anode A and auxiliary electrode H). The cathode K is of a type due to Wehnelt, and consists of a platinum strip coated thinly with barium oxide and calcium oxide and wound on a glass support. This strip is maintained at a bright red heat (about 1,000° C.) by the battery b of 30 volts.

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* From a paper read before the Elektrotechnischer Verein by E. Reisz. *E.T.Z.*, November 27th, 1913.

The adjustment of the potential difference between the cathode K and the auxiliary electrode H is effected by the slider C, moving over the resistance R_w connected across the battery *b*. The primary currents act inductively on this voltage by means of the transformer T_1. The secondary (magnified) currents are obtained from the secondary of the second transformer T_2. This transformer is not essential, but is a convenient means of keeping the main supply voltage of 200 to 250 volts away from the apparatus in the secondary circuit. The resistance W is for the purpose of limiting the current through the tube to a reasonable value. In order to avoid weakening the alternating currents, however, this resistance is bridged by a suitable condenser.

With such an arrangement the main current variations of the anode are indicated visually by the fluctuations of the height of the dark space above the auxiliary electrode, so that if, for instance, the primary of T_1 is connected to a battery and microphone, and the latter is spoken into, the glow discharge about the anode can be seen expanding and contracting in unison with the speech waves.

The pressure of the gas in the tube has an important effect on the behaviour of the relay, and experiment showed that if mercury vapour was present, not only was the constancy of the pressure greater, but the discharge voltage was also considerably reduced. The effect is not quite the same as in the ordinary mercury vapour lamp, for in the latter the current carriers are the mercury vapour ions produced by using a high current density at the cathode, whilst in the relay the mercury vapour is independently ionised by the action of the oxide-coated cathode, and then carries the greater part of the current. It is found that under these conditions very little occlusion of the gas molecules in the tube occurs during action, and an average working life of 1,000 hours has thus been reached, whilst some tubes have shown as much as a 3,600-hour life.

If mercury vapour and a little liquid mercury are used in the tube the pressure inside is fairly constant, but is still affected by room temperature variations, and it has been found better to replace the pure liquid mercury by an amalgam.

The actual type of construction adopted by the A.E.G. is shown in fig. 4 ; *g* is the glass vessel, A is the anode composed of a spiral of 2 mm. diam. aluminium wire, H is the auxiliary electrode of sheet aluminium—perforated all over its surface with 3·5 mm. diam. openings. The cathode K consists of a platinum strip about 1 metre long, 1 mm. wide, and ·02 mm. thick, coated thinly with a mixture of calcium oxide and barium oxide. The connections to the supply are made by a plug contact at the base of the lamp, which can only be inserted the right way round. Two direct-current supplies are necessary—one, of about 30 volts, which must be quite steady if the lamp is to operate reliably, and cannot, therefore, be taken from a dynamo, as the commutation irregularities are too great ; and the other of 220 volts, which can be taken from an ordinary dynamo circuit provided that irregularities are smoothed out by the insertion of choking coils and condensers.

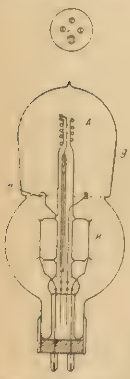

FIG. 4.—SECTION OF RELAY.

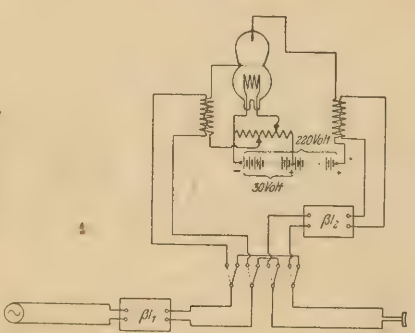

FIG. 5.—TEST CONNECTIONS.

The lamp is mounted on the top of a case containing all the necessary regulating resistances, &c.

In order to test the magnifying powers of this relay, the connections shown in fig. 5 were adopted. A high-frequency A.C. supply is connected through suitable resistances, βl_1 to a sensitive telephone, when the change-over switch is in the full line position. When this switch is moved into the dotted position, the relay and an additional resistance combination βl_2 are inserted between βl_1 and the telephone. The resistance combinations βl_1 and βl_2 were made up of elements, each of which gives a damping factor of ·1, *i.e.*, the ratio of the current amplitudes before and after such an element is $1/\epsilon^{-1}$. In making a test, the value of βl_2 is adjusted until the sound in the telephone is equal in both positions of the switch, then the value of the damping coefficient of βl_2 is a measure of the magnifying power of the relay. The value of the above ratio so obtained was $1/\epsilon^{-3\cdot5}$ for frequencies between 2,000 and 8,000, and for all values of the initial damping coefficient βl_1. even up to $\beta l_1 = 10$. This value $1/\epsilon^{-3\cdot5}$ is equivalent to a current amplitude magnification of 33. Further magnification can, of course, be obtained by using two or more relays in "cascade," as shown in fig. 6. It is estimated that with four relays arranged in this way a magnification of 20,000 could be obtained without appreciable distortion.

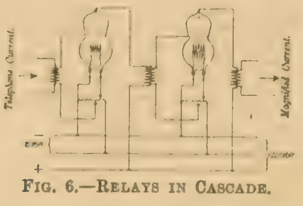

FIG. 6.—RELAYS IN CASCADE.

The absence of inertia in the relay renders it practically instantaneous in responding to current variations, and will probably enable it to be profitably applied in high-frequency wireless work as well as in ordinary telegraph and telephone work and in the testing laboratory.

Electric Truck Displaces Mules.—Carrying a load of 25 bales of cotton, a 6-ton electric truck in Galveston is doing the work formerly done by six mules, and is not only more economical, but speedier, in its operation. The novel feature of the device is a so-called cotton saddle which hangs outside the rear wheels and permits easy loading, as it has only a few inches clearance. This makes it possible to load it to capacity with very little lifting of the heavy bales. The truck was built by the General Motors Co., and the saddle is the design of Mr. John Mitchell, superintendent of the Moody Compress, who has studied for years the problem of cheapening transportation of the bulky product. The machine has an average speed of 8 miles an hour, loaded, and makes six round trips between the compress and the docks, or about 30 miles a day. Plans for using ten such trucks during the year are under way, and it is probable that the new type will displace the ones in use heretofore.

BATTERY VEHICLE FOR CARRYING COTTON BALES, IN USE IN U.S.A.

Electricity Supply Rifle League.—The following are the results of the matches arranged for March :—Brimsdown (Grant, 93), 533, *v.* Hackney (Hilling, 94), 536 ; Brompton (Mugford), 98, 564, *v.* St. James's (Roberts, 93), 542 ; Brompton (Physick, 98), 579, *v.* Westminster (Horley, 99), 558 ; Central (Cope, 97), 560, *v.* Ilford (Haeger, 96), 555 ; Central (Harvey, 99), 581 *v.* St. James' (Hocking, 98), 560 ; Ilford (Haeger, 100, H.P.S.), 568, *v.* Poplar (Randall, 92), 521; Poplar (Randall, 92), 523 *v.* Shoreditch (Weekes, Thomas, Harrison, 97), 574. The following are the positions to date :—

	Matches.					
	Shot.	Won.	Lost.	Pnts.	Scores.	Average.
Brompton ...	2	2	0	4	1,143	571·5
Central ...	2	2	0	4	1,141	570·5
Shoreditch ...	1	1	0	2	574	574
Ilford... ...	2	1	1	2	1,123	561·5
Hackney ...	1	1	0	2	536	536
Westminster	1	0	1	0	558	558
St. James's ...	2	0	2	0	1,102	551
Brimsdown ...	1	0	1	0	533	533
Poplar ...	2	0	2	0	1,044	522
City Co. ...	0	0	0	0		
County Co. ...	0	0	0	0		

ELECTRICAL TRADES BENEVOLENT INSTITUTION.

The following are the further lists of contributions mentioned in our last issue :—

OTHER CONTRIBUTIONS IN CONNECTION WITH THE FESTIVAL.

	£	s.	d.
Abel, R. P.	0	5	0
Adnil Electric Co.	2	2	0
A. H.	0	5	0
Allen, Gerbert	1	1	0
Andrews, F. E.	1	1	0
Andrews, O. M.	0	10	6
Annacker, J. P.	0	10	6
Anonymous	5	5	0
A. P. B.	0	5	0
Ardis, R.	0	10	0
Armorduct Mfg. Co.	3	3	0
Ashwell & Nesbit	0	10	0
Ashworth, H.	0	10	6
Baker, G. T.	1	1	0
Baldwin, J. H.	0	10	0
Barkham, C.	0	10	6
Barnard, —	0	10	6
Barr, Moering & Co.	1	1	0
Barwell, James, Sons and Co	0	10	6
Bastian, C. O.	1	1	0
Bastian Heating Syndicate	2	2	0
Bastian Meter Co., Ltd.	2	2	0
Baughan & Co.	0	10	6
Beaver, A. G.	1	1	0
Becker, R., & Co.	1	1	0
Belshaw, Thos. O.	2	2	0
Bentley, Geo.	2	2	0
Berliner, M.	1	1	0
Berridge, Geo. & Co.	2	2	0
Bertram, C.	0	10	0
Best & Lloyd, Ltd.	1	1	0
Bevis, H.	2	2	0
Bill, J. C.	0	2	6
Birmingham Light Co.	1	1	0
Bishop, S. & C., & Co.	0	5	0
Blackburn, Starling and Co.	2	2	0
Bond, W. G.	0	10	6
Bottchers Sohne	0	19	0
Boulton, G. & Son	0	10	6
Bowden, J. Horace	1	1	0
Breeden, J., & Co.	1	1	0
Brightwell, R.	0	10	6
Brimsdown Lamp Works	2	2	0
British Oxygen Co.	1	1	0
Broadribb, A. H.	0	10	0
Bruce, J. B., Ltd.	2	2	0
Brundle, F. H.	0	10	6
Buck & Hickman, Ltd.	1	1	0
Burney, Guy	2	2	0
Burt Bros.	1	1	0
Burton, Col. H.	1	1	0
Calvert, E.	0	10	6
Cantie Switch Co.	1	1	0
Carr & Parr	0	10	6
Chamberlen	0	10	6
Chaplin, H., & Co.	0	10	6
Charles & Dible	1	1	0
Child, J. S.	1	1	0
Clark, E. J.	1	15	0
Clifford, C., & Son, Ltd.	1	1	0
Clothier, H. W.	1	1	0
Collings, F. W. A.	0	5	6
Colwal, R. F.	0	5	0
Cook, A. H. J.	0	10	0
Cook, W. W.	1	1	0
Cookson & Co.	1	1	0
Conradty, C.	3	0	0
Cowan, E. W.	1	1	0
Crampton & Sons	0	10	6
Cranmer & Cheshire	1	1	0
Cripps, G. W.	0	10	0
Cryselco, Ltd.	1	1	0
Dade, C. H	0	10	6
Davidson & Co., Ltd	1	1	0
Davies, Kent and Stewart	0	10	6
Davy, A.	0	10	6
Devonshire, Jas.	3	3	0
Digby, L. J.	5	5	0
Dow, J. D.	0	10	6
Down, F. J.	1	1	0
Easton, C. J.	1	1	0
Eberstein, J.	1	1	0
Edison & Swan U.E.L. Co.	10	10	0
Edwards & Barnes	1	1	0
"Electrical Review," Proprietors of	10	10	0
Electricitats Gesellschaft Sirius	2	8	6
"Electricity," Proprietors of	1	1	0
Ellice Clarke, E. B.	2	0	0
Ellison, G.	1	1	0
Endolithic Mfg. Co.	1	1	0
English Bros., Ltd.	0	10	6
Esson, W. B.	1	1	0
Everett, Edgcumbe and Co.	2	2	0
Evershed & Vignoles, Ltd.	5	5	0
Falk, Max	3	3	0
Falk, Stadelmann and Co.	5	5	0
Ford, C. J.	2	2	0
Forster, J., & Co.	1	1	0
Fox, H. C.	0	10	6
Frankenberg, I., and Sons	1	1	0
F. S. W.	0	2	6
Fuller Elec. and Mfg. Co.	1	1	0
Garbe, Lahmeyer & Co.	2	0	0
Gent & Co.	3	0	0
Gimingham, E.	1	1	0
Glaholm & Robson	0	5	0
Goodyer, T. B.	0	10	6
Graves, T.	1	1	0
Green & Co.	0	10	6
Grey & Marten, Ltd.	0	10	6
Groves, J. & B.	1	1	0
Hamilton, T. S.	1	1	0
Hardy & Padmore	0	10	6
Hart Accumulator Co.	10	10	0
Hartman & Braun	2	0	0
Hatton, R. J.	2	2	0
Hay, G.	1	1	0
Henderson & Walker, Ltd.	0	10	6
Henley's Telegraph Works	25	0	0
Hewetson & Co.	0	10	6
Hill, Fred. A., & Co.	0	10	6
Hill Jones, T.	1	1	0
Hinton & Brockington	0	10	6
Hobbies, Ltd.	1	1	0
Holmes, F. J.	1	1	0
Home & Rowland	1	1	0
Hornsby, Richard, and Sons, Ltd.	1	1	0
Howard, A. H.	1	1	0
Howley, Richard J.	1	1	0
Howse, T., Ltd.	0	5	0
Hudson, Edmunds and Co.	0	7	6
Hunter, C. E.	1	1	0
Hurst, A., & Co.	2	2	0
Ickelheimer, Max	1	1	0
Indestructible Cable Co.	2	2	0
International Trade Exhibitions	5	5	0
Isaacs, Godfrey	21	0	0
Jacoby, A. M.	1	1	0
Jeary, W. C.	1	1	0
Joseph, M.	0	2	6
Joyner, Chas., & Co.	1	1	0
Judd, W.	1	1	0
Kahn, S.	0	10	6
Kiesow & Co.	1	1	0
Kidd, G. W.	1	1	0
Korting & Mathieson	2	0	0
Krausse & Anerbach	1	1	0
Land & Seekabelwerke	1	1	0
Leach, S. G.	1	1	0
Leaf, H. M.	1	1	0
Lee, H.	0	10	6
Leftwich, A.	0	10	6
Locke, Lancaster and Co.	1	1	0
London Elec. Trading Co.	2	2	0
London Electric Firm	1	1	0
London Zinc Mills, Ltd.	0	10	6
Lund, Humphries & Co.	0	10	0
Lynen, R.	2	2	0
MacGregor, G.	0	10	6
Madgen, W. L.	1	1	0
Marchant, H. F.	1	1	0
Mason & Burns	1	1	0
McDougall, J., Ltd.	1	1	0
Miles, J., & Co.	1	1	0
Miskin & Rice	1	1	0
Mitchell, Lucas and Mitchell	1	1	0
Morris, H. N., & Co.	1	1	0
Morrison, Alex.	1	1	0
Morse, S.	1	1	0
Moseley, D., & Sons, Ltd.	2	2	0
Mosers, Ltd.	0	10	0
Moul, H. E.	1	1	0
Murray, E. T. Ruthven	2	2	0
Nauheim, J. J.	5	5	0
Nestler & Co.	1	0	0
Newman, F. N.	0	10	6
Nixon, J., & Sons	0	5	0
Oliver Typewriter Co.	0	10	0
Ollivant, Sir E. C. K.	3	3	0
Owens, T. J.	0	5	0
Packenham, —	0	10	6
Parsons, I. H.	2	0	0
Peckham, G. S.	0	10	6
Pell, F. Bennett	0	10	6
Peyton, & Peyton, Ltd.	2	2	0
Pfeil & Co.	0	10	0
Pilkington Bros., Ltd.	0	10	6
Plummer, J.	0	5	0
Pollard, Wm., & Co.	1	1	0
Pond, E. J.	0	8	6
Poole, R.	0	10	6
Potter, W. J.	2	2	0
Preece, Cardew and Snell	2	2	0
Preece, Llewellyn	2	2	0
Premier Accumulator Co.	0	10	6
Prestige, J. Theo, Jun.	1	1	0
Pritchard, John, and Sons	0	10	6
Quitmann, Carl	1	1	0
Rainsford & Lynes, Ltd.	1	1	0
Rashleigh, Phipps and Co.	1	1	0
Reade & Co., Ltd.	1	1	0
Reader, E., & Sons	1	1	0
Reiss, C.	3	3	0
Reliance Elec. Wire Co.	0	5	0
R. M. S.	0	2	6
Rosling, Percy	10	0	0
Russell, C. Newton	0	10	6
Russell, S. G. Castle	1	1	0
[illegible], W. R.	2	2	0
Sanderson, C. J.	0	10	6
Sankey, Capt. H. P. R.	2	2	0
Sargent, Miss B. M.	1	1	0
Schmidt, W.	2	2	0
Schmidt, W. (Staff Collections)	0	13	0
Schumann, Miss	0	13	0
Shield, W. S., & Co.	1	1	0
Ship Carbons, Ltd.	1	1	0
Silcock, Charles	1	1	0
Sloan Electrical Co.	2	2	0
Smith, G.	0	10	0
Soames, E. R.	0	10	6
Southgate & Co.	0	10	6
Spagnoletti, James	1	1	0
Spear, F. B.	1	1	0
Spicer & Pegler	1	1	0
Spies Bros. & Co.	1	1	0
Spratt, L. W.	1	1	0
Sterling Telep. and Elec. Company	3	3	0
Stockwell, E. J.	0	10	6
Stone, J., & Co.	5	5	0
Sudicatis, Ludio, and Co.	1	0	0
Sugden & Hextall	1	1	0
Sun Electrical Co.	3	3	0
S. W. A.	0	5	0
Swiss Bankverein	2	2	0
Tapper, Wm. C. P.	1	1	0
Taylor Bros.	0	10	6
Taylor, Geo. E.	5	5	0
Taylor, W. H.	0	10	6
Tegetmeier, C. V.	2	2	0
Textile Machine Co.	5	5	0
T. S.	0	2	6
Thacker, F. C.	0	10	6
Thompson, W. P., and Co.	1	1	0
Thornley, E.	0	5	0
Thurnauer, L.	3	3	0
Thurnauer, L. (collected by)	0	19	6
Tong, G. E.	1	1	0
Turner & Burger	0	10	6
Universal Supply Co.	0	10	6
Unwin Bros., Ltd.	1	1	0
Vandervell, C. A.	1	1	0
Voigt & Haeffner	2	0	0
Von Chauvin, G.	2	2	0
Waddie & Co.	0	10	6
Wall, G. P.	0	10	0
Wallace Bros. & Co.	2	2	0
Walton, W. H.	1	1	0
Ward & Goldstone	3	0	0
Watlington & Co.	0	10	6
Whitehouse, Wm., and Co.	0	10	6
Whittall, W. J., and Son	1	1	0
Wilson, J. G.	0	10	0
Winter, F.	5	0	0
Wolf, A.	1	1	0
Wordingham, C. H.	2	2	0
Worrell & Baynes	1	0	0
Worster-Hounslow Elec. Co.	0	10	6
Wortley, Charles B. Stuart, K.C.M.P. (Rt. Hon.)	5	5	0
	£418	**14**	**0**

THE FOLLOWING CONTRIBUTIONS HAVE ALSO BEEN RECEIVED IN THE COURSE OF THIS YEAR.

	£	s.	d.
Anderson, A. Bruce	2	2	0
Anonymous, per S. R. Smith	0	5	6
[illegible]	0	10	6
[illegible], A.	1	1	0
[illegible], Morton	1	1	0
[illegible], H.	1	1	0
[illegible], O. H.	1	1	0
[illegible]	0	10	0
Cooper, R. G.	0	10	0
[illegible], H. O.	0	2	6
[illegible], J.	25	0	0
Electromotors, Ltd.	2	2	0
[illegible], C. M.	0	10	0
Ferranti, Ltd.	5	5	0
[illegible], C. G.	0	2	6
Gillespie, M. M.	1	1	0
Hart, H. M.	0	2	6
Hawes, J. D. O.	1	1	0
[illegible], E.	0	2	6
Hobbs, W. E.	1	0	0
Hunt, R., & Co.	1	1	0
Icke, J. R.	0	2	6
Kingsbury, J. E.	2	2	0
Kingston, H. W.	0	10	6
Kolle, H. W.	2	2	0
Lawrence, A.	0	10	6
Lemmon, Miss M.	0	10	0
Linolite Co.	1	1	0
Llewellyn, D.	0	10	0
Lundberg, A. P.	20	0	0
Lundberg, P. A.	10	0	0
Lundberg, G. C.	20	0	0
MacCarthy, A. F.	0	10	0
Madgen, W. L.	3	0	0
Moore, F. C.	0	10	0
Moulton, Lord	1	1	0
Murray, J. O'Hara	2	0	0
Nance, Harry	0	10	0
Nash, E. A.	1	1	0
Nierbauer, A. P.	0	2	6
Quance, F. G.	0	10	0
Randall, W. O.	0	2	6
Ratcliffe, G. Fred	1	1	0
Redmayne, L.	0	10	0
Reynolds & Bradwell	2	2	0
Richards, W. L.	0	10	6
Riseley, D. S.	0	10	0
Ritchie, T. E.	0	2	6
Robinson & Hands	1	1	0
Ruberoid Co.	1	0	0
Salomons, Sir David, Bart.	5	5	0
Samuelson, G. B.	2	2	0
Snell, J. F. C.	1	1	0
Sparrow, J. V.	0	10	0
Spencer, J., Ltd.	5	5	0
Stewart, Andrew	1	1	0
Stiller, C. H.	0	2	6
Sutton, Geo.	10	10	0
Thomas, Miss W.	0	10	0
Vaughton, W. C.	0	10	6
Walsh, R. F. V.	0	2	6
Wallis-Jones, Reg. J.	1	1	0
Williams, G. S.	0	10	0
Wilson, J. G.	0	10	0
	£148	**5**	**0**

	£	s.	d.
Chairman's List	2,463	15	1
Other Contributions connection with the Festival	418	14	0
Contributions received in the course of the year	148	5	0
	£3,030	**14**	**1**

International Engineering Congress, 1915.—The attention of the engineers of the world is being drawn to the programme of the International Engineering Congress, which is to be held in San Francisco, California, in 1915. At present enrolments and subscriptions have been received from 42 foreign countries, and of the present enrolment, approximately 25 per cent. is from countries other than the United States. In order to facilitate the work of the committee of management, it is extremely desirable that as many as possible who intend to subscribe should do so at an early date. Full information concerning the Congress may be obtained by addressing the committee of management as follows :—International Engineering Congress, 1915, Foxcroft Building, San Francisco, California, U.S.A.

High Temperatures and Electricity.—In a letter addressed to *Nature* of the 23rd ult., Messrs. G. W. C. Kaye and W. F. Higgins give briefly the results of recent experiments at the National Physical Laboratory on the emission of electricity from a number of substances at very high temperatures—between 2,000° C. and 2,500° C. The experiments were carried out in a carbon-tube resistance furnace at atmospheric pressure. Among the substances tried were the alkaline earths and a number of metals. In every instance the temperature was sufficient to vaporise rapidly the substance under test, and under these conditions very large amounts of electricity were emitted. For example, barium oxide emitted negative currents of the order of 4 amperes per sq. cm., while boiling tin gave currents of about 2 amperes per sq. cm. No external potential was applied in any of the experiments.

A Submarine Ship-Cleaner.—A recent issue of the *Shipping World* contains a description of a new apparatus for cleaning ships' hulls, without dry docking, which has been introduced by the Submarine Ship Cleaner Co., Ltd., of Melbourne, and demonstrated in this country.

Briefly, the apparatus consists of a barge equipped with a 28-H.P. petrol-electric set, which supplies power for driving the barge along, also to a winch which raises and lowers the cleaning device slung over the side from the end of a jib, and for operating this apparatus, which is in the form of a brushing gear. The latter consists of a revolving cylindrical brush, 5 ft. long by 1 ft. diameter, and a thrust propeller behind to keep the brush against the ship; between brush and propeller a 10-H.P. submersible-type motor is fitted, operating the former through a worm-geared countershaft and chain gearing, and the latter through concentric reducing gear. The air weight of the submersible gear is 800 lb., but floats are attached which reduce this to 280 lb. The brush is fitted with fibre bristles, 2½ in. long, and in practice a strip of plating 4 ft. wide is cleaned by each lowering and raising operation, which represents some seven hours for cleaning a vessel of 400-500 ft. long and average draught. The work can be carried on by day or night, and while the vessel is coaling, loading, or discharging.

Electricity in Agriculture.—Trials have been made with electrically-driven ploughs in one of the provinces of Aragon, Spain, with such success that, according to *Electron*, a further 1,000 hectares will shortly be submitted to similar treatment.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

9,213. "Electric cooking-ovens." I. T. Negus and L. Negus. April 14th.

9,225. "Starting and synchronising rotary converters." Siemens-Schuckertwerke G.m.b.H. April 14th. (Convention date, April 14th, 1913, Germany) (Complete).

9,231. "Current-collecting apparatus for electric dynamo machines." Soc. Anon. des Automobiles et Cycles Peugeot. April 14th. (Convention date, April 16th, 1913, France). (Complete).

9,232. "Electrolytic apparatus." W. Thum. April 14th. (Complete).

9,237. "Manufacture of chemically-pure soluble silicic acid." Ges. fur Elektro Osmose m.b.H. April 14th. (Convention date, April 14th, 1913, Germany). (Complete).

9,261. "Manufacture of stable colloidal solutions of metals." Ges. fur Elektro Osmose m.b.H. April 14th. (Convention date, April 14th, 1913, Germany). (Complete).

9,265. "Diaphragm for electro-chemical or electro-osmotic purposes." Ges. fur Elektro Osmose m.b.H. April 14tn (Convention date, April 14th, 1913, Germany). (Complete).

9,278. "Magneto-electric machines for medical use." E. C. R. Marks. April 14th. (Soc. Gallot et Cie, France). (Complete).

9,280. "Dynamo-electric machines." J. L. M. Yardley. April 14th. (Convention date, April 14th, 1913, United States). (Complete).

9,285. "Method of and connexions for tuning antennæ to a plurality of electric waves which are independent of one another." W. J. Mellersh-Jackson. April 14th. (Otto Scheller und C. Lorenz Akt. Ges., Germany). (Complete).

9,289. "Controlling switches for electrically-actuated lifts." G. Dirks. April 14th. (Convention date, April 14th, 1913, Germany.) (Complete.)

9,291. "Manufacture of condensation products of phenol and substances containing methylene radical." L. V. Redman. April 14th. (Convention date, February 24th, 1914, United States). (Complete).

9,292. "Manufacture of phenolic condensation products." H. Wade. April 14th. (S. Karpen & Bros., United States). (Complete).

9,300. "Automatic electrical signalling between trains." A. Brown. April 15th.

9,305. "Electric couplings of the plug-and-socket type and the like." J. W. Annand. April 15th.

9,331. "Method of and means for jointing telephone and other cables." L. J. Aron. April 15th.

9,351. "Non-magnetic compass." E. Klahn. April 15th. (Convention date, May 12th, 1913, United States). (Complete).

9,367. "Methods of coating metals and apparatus therefor." British Thomson-Houston Co., Ltd. April 15th. (General Electric Co., United States). (Complete).

9,376. "Printing-telegraph systems." Western Electric Co., Ltd. April 15th. (F. T. Woodward, Belgium). (Complete).

9,390. "Manufacture of condensation products from phenol or cresols and formaldehyde and the like." A. Heinemann. April 15th.

9,411. "Electric resistances." F. Celeri. April 16th. (Complete).

9,440. "Electric incandescence or glow lamps." A. Giorgi. April 16th.

9,451. "Methods of frequency transformation." British Thomson-Houston Co., Ltd. April 16th. (General Electric Co., United States).

9,454. "Driving road and rail vehicles." Thomas Transmission, Ltd. and J. G. P. Thomas. April 16th.

9,463. "Dynamo-electric machines applicable for the lighting and self-starting of motor road vehicles." R. W. Duncan and A. Iconomus, jun. April 16th.

9,464. "Electric motors." A. Iconomus, jun. April 16th.

9,468. "Attachment of electrical conductors to dynamo brushes and the like." Soc. Anon. Le Carbone and E. Gindre. April 16th. (Complete).

9,478. "Insulators for telegraph, telephone, and other similar wires." H. B. Corbin and Simplex Insulators (Bourke's Patent), Ltd. April 16th.

9,492. "Electric switches." W. M. Rolph. April 16th. (Complete).

9,504. "Aural electric signal repeater." J. W. Clarke. April 17th.

9,538. "Joints for electric cables." C. G. Watson and Callender's Cable and Construction Co., Ltd. April 17th.

9,539. "Joints on insulated electric conductors." C. G. Watson and Callender's Cable & Construction Co., Ltd. April 17th.

9,542. "Devices for use in connection with motors for providing safety against firedamp or the like." Maschinenfabrik Oerlikon. April 17th. (Convention date, April 19th, 1913, Germany). (Complete).

9,559. "Electric switches." J. H. Tucker and J. A. Crabtree. April 17th.

9,570. "Alarm thermometers." G. Edelmann. April 17th. (Addition to 20,342/12. Convention date, April 18th, 1913, Austria.) (Complete.)

9,578. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. and N. Shuttleworth. April 17th.

9,582. "Electric railway systems." K. E. Stuart. April 17th. (Complete).

9,504. "Fuse and contact electrical fire alarm." A. G. Pemberton. April 18th. (Complete.

9,605. "Electrical apparatus in which an electric current is switched on by means of an independently-generated current." C. O. Silvers. April 18th.

9,611. "Track circuits for railways." W. H. Dammond. April 18th. (Complete).

9,637. "Telephone transmitters." E. C. R. Marks. April 18th. (Electrical Experimental Co., Inc., United States). (Complete).

9,638. "Telephone receivers." E. C. R. Marks. April 18th. (Electrical Experimental Co., Inc., United States.) (Complete.)

9,648. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., A. B. Sperry and A. J. Ray. April 18th.

9,659. "Electric light shade carrier or holder." R. J. Eskrigge. April 18th.

9,666. "Synchronising systems." A. F. Dickson. April 18th. (Complete.)

Ultraviolet Light and Bacteria.—By the action of ultraviolet radiation upon anthrax bacilli, Madame Victor Henri has effected profound changes in the appearance and behaviour of the bacteria; two new forms have been produced, one of which sets up an infection different from that of anthrax. The new forms were stable over 60 days and upwards. The experiments are considered to open up wide possibilities in the transformation of micro-organisms.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

7,245. Overhead Lamps. H. Wade (Schneider & Naujoks Elektrizitats Ges.). 26th March.

7,544. Automatic Regulators for Electric Supply Systems. C. F. Kettering. March 31st. (August 9th, 1912.)

7,546. Automatic Regulators for Electrical Supply Systems. C. F. Kettering. March 31st. (November 11th, 1912).

7,586. Illuminated Signs Suitable for Advertising and other Purposes. T. Jacob and E. W. White. March 31st.

7,638. Electric Bells or Gongs. F. F. Macdonald. April 1st.

7,840. Electrical Dynamo Machines. J. Peugeot. April 3rd.

7,842. Driving of Looms by Electric Motors. Siemens Schuckertwerke Ges. April 3rd. (April 3rd, 1912).

8,054. Ships' Signalling or Telegraph Apparatus. J. S. Commander. April 5th.

8,115. Luminous Electrolytic Devices. L. H. Walter. April 7th.

8,124. Incandescent Electric Lamps. E. P. Beckwith. April 7th.

8,128. Dynamos. C. T. Mason. April 7th. (April 23rd, 1912).

8,172. Mercury Vapour Lamps. W. A. A. Steinmann. April 7th. (April 12th, 1912).

8,416. Electric Arc Lamps. British Thomson-Houston Co. (General Electric Co.). April 9th.

9,321. Lighting of Miners' and like Safety Lamps. A. Paxton. April 21st. (Patent of Addition not granted).

9,460. Electrical Connectors of the Plug and Socket Type. A. P. Lundberg, G. C. Lundberg, P. A. Lundberg and G. Pegg. April 22nd.

9,503. Ampere-hour Meter. Allgemeine Elektricitats Ges. April 22nd. (April 24th, 1912).

13,019. Mechanical and Electrical Device for Starting and Stopping a Stop Watch primarily intended for Timing Motor-cycle and Motor-car Racing, but applicable to all other forms of Racing. H. R. Haigh. June 5th.

13,063. Electrically-heated Flat Iron. F. S. Rippingille. June 5th.

13,148. Controlling of Electric Motors for Ship Propulsion and means therefor. Siemens Schuckertwerke Ges. June 6th. (Addition to 2,136/13).

13,721. Electric Switches. O. Lucas and F. Handley. June 13th.

14,034. Apparatus for Closing and Interrupting Electric Currents. V Poulsen. June 17th.

14,170. Electric Light Fittings of the Indirect Kind. O. D. Lucas and Veritys, Ltd. June 19th.

14,941. Cooling of Dynamo-electric Machinery. Akt. Ges. Brown, Boveri et Cie. June 28th. (February 24th, 1913).

15,318. Electric Lamp-holders or similar Coupling Members. G. St. J. Day. July 3rd.

16,885. Electric Switches. H. Lucas and O. Lucas. July 23rd.

17,532. Electric Circuit Closing Devices. Siemens Schuckertwerke Ges. July 30th. (August 16th, 1912).

17,954. Lanterns for Electric Filament Lamps. A. G. Bloxam. (Robert Bosch, Firm of). August 6th.

18,801. Railway Signals. J. D. Taylor. August 19th. (August 28th, 1912).

18,924. Sparking Plugs with an Insulator Composed of Two Parts. Siemens & Halske Akt. Ges. August 20th. (October 25th, 1912).

20,028. Electric Burglar Alarms. A. Renczewitz. September 4th.

20,870. Means for Operating Electric Switches from a Distance. Siemens Bros. Dynamo Works, Ltd., F. Lydall and R. Brooks. September 16th.

23,004. Apparatus for Electrically Smelting Metal, Metal Ores, and the like. S. Guggenheim. October 11th.

24,944. Electric Pocket-lamps. G. Hitzelberger and The New British Ever-Ready Co. November 1st.

25,176. Grapnels for Raising Submarine Cables. C. A. O. Berner and H. W. T. De Lisle. November 4th.

25,274. Electrical Protective Systems. E. G. Waters. November 5th. (Addition to 26,961/12).

25,464. Collector Brush-holders for Electrical Apparatus. W. Christie. (Galvanische Metall-Papier Fabrik Akt. Ges.). November 7th.

27,824. Relay Arrangements for the Automatic Control of Electric Circuits or Apparatus. Siemens-Schuckertwerke Ges. December 3rd. (December 4th, 1912).

29,028. Method of Covering or Armouring Electric Conductors with Metal. F. Chase. December 16th.

1914.

2,815. Devices for Obtaining Rontgen-ray Images. G. Bucky. February 3rd. (February 5th, 1913).

3,305. Stage Illusions. L. McCormick. February 7th.

5,365. Commutators for Electricity Meters. J. Elster. March 2nd. (Divided Application on 5,157/13. February 28th).

6,055. Electrodes. Fried Drupp Akt. Ges. March 10th. (April 15th, 1913).

Fatality.—An inquiry into the cause of death of John William Burton, 48, a Middlesbrough electrician, was held by the City Coroner, Mr. Appleby, at Newcastle-on-Tyne Infirmary, on April 23rd. Mrs. Burton, the widow, stated that on October 24th, 1912, her husband was working on an overhead electric crane when he was thrown against the window, in consequence, he thought of having received a shock. His right ear was cut. His injuries were attended to, but in February of the following year he complained of pains in the head. He was medically treated but got worse and was removed to the Newcastle-on-Tyne Infirmary in December, where he died on April 22nd. Dr. Pirrie said death was due to a tumour on the brain, but he did not think the accident had caused it. A verdict that death was due to a tumour on the brain was returned.

Radium.—A Committee representing the hospitals in the Manchester district is raising a fund to purchase at least £25,000 worth of radium, to be placed in the charge of a physicist and an expert medical radiologist. A number of gentlemen are arranging for the purchase of £1,500 worth of radium for presentation to the Swansea Hospital.

THE

ELECTRICAL REVIEW.

VOL. LXXIV. MAY 8, 1914. No. 1,902.

ELECTRICAL REVIEW.

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1914 EDITION

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FALSE WIRELESS MESSAGES.

IT will be remembered that at the time of the disaster to the *Titanic*, and on several other occasions, much annoyance was caused to individuals and to the public by the dissemination of false messages by wireless telegraphy; a recurrence of this trouble took place on Friday last, when messages were received in Japan purporting to emanate from the American liner *Siberia*, and stating that she was aground and sinking off the coast of Formosa. On Saturday the vessel arrived at Manila, and denied issuing the call for help; moreover, she cannot have been within 100 miles of Formosa, which lies far out of her course from San Francisco.

The *Siberia* was insured for about £400,000, and on Friday re-insurance rates were quoted at 50 per cent. British and Japanese cruisers were dispatched to her aid. Much mental suffering must have been undergone by the relatives and friends of those on board her, and it is obvious that very heavy financial loss might result, perhaps has resulted, from the erroneous announcement.

Whether the signals were transmitted in good faith by some other vessel in trouble, or whether they were the work of a practical "joker"—save the mark!—is not yet definitely settled. The incident, however, draws attention to certain attributes and possibilities of wireless telegraphy which render it capable of being employed very greatly to the disadvantage of the community.

In the first place, it is practically impossible to identify the sender of false news, except under special circumstances, easily avoided. Inquiries could be made of the owners of licensed installations on land, but even if one of these were the culprit, how could the fact be proved? It is not necessary, however, to obtain a licence in order to be able to make signals, any more than a poacher need obtain a game licence before setting about his unlawful business. A temporary aerial could be sent up with a kite or a small balloon under cover of darkness, or hauled up to the top of a tree or a flagstaff, and dropped before daybreak, without leaving any outward sign of its passing presence. While apparatus is available for determining approximately the direction from which a message is received, it would not commonly be available, or be used if available in such a case, and it gives no indication of the distance of the sender. At sea, of course, it would be an easy matter for a malevolent operator—if such a person existed—to dispatch misleading messages without fear of detection. Thus the authors of messages which are not *bona fide* can remain anonymous at pleasure, with little risk of discovery.

The evil which can be wrought by false messages is incalculable. Their employment for the purpose of causing fluctuations in the value of securities in the money market is an obviously possible form of abuse of wireless telegraphy, and it is not difficult to conceive of conditions under which false messages supposed to be transmitted, for example, from a British warship to the Admiralty, or *vice versa*, in a time of international tension, might excite a people to frenzy and precipitate an appeal to arms. Wireless communication cannot be effectually severed or interrupted, and messages cannot be prevented from arriving at their goal; but neither can their propagation be prevented, and the greatest caution should be exercised in accepting them as genuine if the circumstances afford the slightest reason for doubt. Very heavy penalties should be prescribed for the misuse of this otherwise invaluable system of communication.

Profit-Sharing.

The term "profit-sharing" now appears to have as many definitions as the term "Socialism," and many so-called profit-sharing systems would not come within the definition given to it by the Labour Co-Partnership Association. We have received from the Ford Motor Co. a statement as to what they call a profit-sharing plan which was recently inaugurated by Mr. Ford in his American factories, and is now to be extended to the English works. The Ford Co. (England), Ltd., has established a 48-hour week, the same wages, however, being paid as were previously paid for a 50-hour week. Moreover, a sum of £50,000 has been set aside to be distributed among the employés during the forthcoming 12 months, and this is not to be looked upon as an addition to the wages, but as a distribution of profits, although it will be added to the regular weekly wages of the men. From this it would appear that the profits are to be distributed before they are earned, and it is assumed that a sum of £50,000 will be available over and above the profits anticipated by the shareholders. Although the company point out that the addition to wages is not to be considered as wages, but as profit-sharing, they point out in their circular that the addition of the profits distributed with wages will ensure a minimum wage of 1s. 3d. per hour, the present minimum wage being 10d. per hour. There appears here to be some confusion of ideas, because if the additional sum is not to be considered as wages, it is not right to refer to the minimum wage being 1s. 3d. an hour, when 5d. of this is a share of the profits, and only 10d. of it normal wages.

The employés to share in this distribution are all male employés of 22 years or over. Female employés, who constitute about 10 per cent. of the total, and youths under the age of 22, will not participate in this profit-sharing scheme to the same extent, but they will get a share. Exceptions are made, however, in favour of those under 22 who have others solely dependent upon them, and these will be treated on exactly the same basis as male employés of over 22 years.

The plan of profit-sharing is declared by the Ford Motor Co. to be one of social justice, and it is claimed that the extra money paid to the employés will not come out of the pockets of the public, inasmuch as the price of the cars will not be raised. The money, it is said, will be diverted from proprietary shareholders to the working man.

In the notice received an expression occurs stating that strict investigations are being made by the company into the qualifications of the employés for participation in profits. This appears to relate to the American factories, and it may be this which is referred to in a comment by our contemporary the *Ironmonger*, in which it is stated that a "sociological department of some seven or eight inquisitors and a permanent doctor is to pry into the private affairs of the workers and ascertain if they are worthy of Mr. Ford's *largesse*." Our contemporary puts it that Mr. Ford's workers are therefore to be bribed to live as Mr. Ford thinks they should, and are not to be paid higher wages because they have earned them, but because their particular code of morals finds favour in the eyes of Mr. Ford. From this comment it would appear that our contemporary is in possession of information which is not contained in the circular sent to us for comment.

Copper.

After holding out in vain, and seeing the price of warrant copper droop almost from day to day, the chief American producers have been induced to abandon their position of nonchalance, and to make a sharp cut to induce new business. This took effect last week, when under the lead of the Amalgamated Copper Co., the price of electrolytic copper was reduced to £65 10s. a ton, from the £68 a ton level at which it had stood for some weeks. All the chief producers then came down to this price, and there was quite a good business done with consumers and dealers throughout Europe. Since then there has been a small improvement on the part of producers, whose selling prices now are £66 or thereabouts. Apart from small day-to-day movements and influences, there has not been any broad alteration in the outlines of the position of copper, except insofar as Mexico is concerned. The action of the United States in respect to that country has, of course, forced the wholesale return to the United States of American subjects engaged in the Mexican mines and smelters, with a corresponding cessation of operations all round. The enormous bulk of the mining and smelting enterprises of Mexico is owned by United States interests, so that this step virtually means that the metal and metallurgical industries of Mexico have been abandoned temporarily, and that production has ceased.

The full effects of this cannot yet be known, but it would rather appear that for a time at all events the world can manage to get along without Mexican raw copper. The United States refineries have lately been turning out considerably increased quantities of refined material from the ample amounts of raw stuff available, and so long as there is no diminution of supplies of rough copper there is no reason to look for a reduction in the amount of refined which is made. There has been a very material falling off in the Mexican contributions for a long period, hence the official closing of properties may not have very much effect. At any rate consumption is not at its apex, so that what might under other conditions have been a serious matter becomes relegated into a position of minor importance.

The policy of producers across the Atlantic being to sell their metal before its accumulation becomes onerous, it is fairly clear that the outlook is not likely to be obscured by the piling up of large secret stocks, such as has been done on some former occasions, and to this extent the position of the market is clear enough. The talk as to accumulations in certain of the Continental ports has subsided to a considerable extent, all the investigations made having failed to reveal the existence of anything of the kind. Consumers, while not entirely reassured, have none the less taken metal with considerable freedom within the last week or so, and prices now show a tendency to stiffen somewhat. The chief interests have put up their price a trifle and are disposed to await the course of events.

The statistics last issued show a distinct deterioration in the European position during April, the visible supply having increased from 26,129 tons at the end of March, to 29,278 tons on April 30th. The stocks all round indicate an increase, but they are still very moderate, and, indeed, compared with previous years, are merely trifling. The important thing is that they should at last have begun to expand, and that the growth should be in practically every direction. The supplies coming forward are very ample, totalling 53,949 tons for April, making 566,095 tons for the 12 months to that date, compared with 488,955 tons in the previous 12 months, while the deliveries were 580,645 tons and 505,019 tons respectively.

ROBERT KAYE GRAY.

The brief announcement in *The Times* last week, to the effect that on Tuesday, April 28th, Robert Kaye Gray, of Millbrae, Lanarkshire, and Lessness Park, Abbey Wood, Kent, eldest son of the late Matthew Gray and Agnes Kaye Gray, of Millbrae, had passed from amongst us, is the chronicle of the loss of the most beloved man in the broad community that centres upon the electrical and telegraph industry in this country. By his colleagues, and by those of the rank and file of those who served under him and knew him, his friendship was cherished as one of the most precious and real things of life. The wholesome quality of honesty in thought, word, and action, was the basis of the honoured name and fame of Robert Gray. He knew but one standard of professional and commercial conduct; and when the history of the development of the electrical industry in his time is written, it will appear to the credit of that industry that in it he was universally accepted as a leader of men. If honesty was the foundation of his character, knowledge of those with whom he had to negotiate, cope, and deal, was the superstructure, and the whole was embellished with natural charm of manner, heightened with modesty, and illumined with discerning charitableness. To trace his career is to survey most of the track along which electrical and telegraph engineering has progressed during the last half century. It will suffice here to give an outline, which in its several parts can be completed by the representatives at home and abroad of the innumerable sections of the profession and industry familiar with his work.

He was born in Scotland in June, 1851, and after receiving his first education in Greenock, he came in 1865 to London, where he entered first the University College School, and ultimately University College, with which he ever afterwards kept in touch. The subsequent course of his professional life was summarised by himself in 1896, when his opinion was sought by the Pacific Cable Committee. He said that he had been engineer-in-chief of the Silvertown Co. since 1875, and that at the date of giving evidence before the Committee he acted sometimes as engineer-in-chief and sometimes as managing director. He further explained that before 1875 he was chief electrician to the Silvertown Co., and that he had been associated with Silvertown since 1869. Again, in 1901, when giving evidence before the Inter-Departmental Committee on Cable Communications, he said that he was a director of four submarine telegraph companies, and that his whole career had been connected with telegraph business. With equal truth he might have added that the weight of his opinion had been the main force that destroyed the obstacles in the way to laying a cable across the Pacific, and that set at rest all doubt regarding the possibility of establishing such a cable system upon lines that were financially, as well as technically, feasible. In 1870 he accompanied his father, the late Matthew Gray, to lay the cable from Gravelines to Bordeaux, during the Franco-German war. Two years later he acted as electrician-in-chief throughout the expedition for laying the direct Spanish cable, from the Lizard to Bilboa, and the Marseilles-Algiers cable for the French Government. These early experiences, and the general trend of his subsequent professional work, combined to give him an insight into foreign negotiations. He had the advantage of being a good linguist, and he maintained to the end his cordial regard for his many friends in France, Spain and Italy. The various submarine cable operations with which he was occupied, took him to countries as widely spaced as Mexico and Senegal, Brazil and Algiers, but he never lost touch with developments at home. In later years his labours were directed towards developing an extensive manufacturing business which demanded knowledge far wider than that associated with telegraphy and electric lighting; for he lived in the age that produced the pneumatic tire, and that brought aircraft to the stage of practical working. Notwithstanding the claims that his manifold activities in the commercial and professional world made upon his time and upon his energy, he found means to aid science, and to bestow help upon all who claimed and seemed to him to deserve his assistance. He was elected President of the Institution of Electrical Engineers in February, 1903; and who is there among its members that has not good reason to remember his genial leadership, the delightful visit with him to Italy, the memorable events and cordial meetings at St. Louis, the ceremony at Colchester, the welcome he gave to the International Telegraph Conference in London? He was a member of the Institution of Civil Engineers, of the Institute of Metals, of the Royal Institution, of the Royal Society of Arts, and a benefactor to many charitable institutions. If it is permissible to single out examples of his good services, attention may fittingly be directed to the unremitting labour he bestowed to help forward the National Physical Laboratory; to his great interest in the Imperial College of Science, of the Executive Committee of which he was appointed chairman two years ago; and to his work on the Council of the Engineering Standards Committee. Some idea of the extent of his life's work, the significance of it, its sincerity and its worth, was to be gathered from the solemn assembly of those who met to pay a tribute to his memory at the service at East Wickham last Saturday; and as the sunshine streamed in upon that assembly in the old church, and as the notes of the birds flooded like happy memories through the open windows, it seemed, indeed, that Robert Gray lived yet, and lived deep, in the hearts of those he left behind.

The gathering at the church and at the graveside at Wickham on Saturday was a very large and representative one. In addition to the relatives (Mr. M. H. Gray, Miss Gray, Mr. and Mrs. C. H. Gray, Mr. and Mrs. W. E. Gray, and Miss Cameron), the following were present:—

Major Darwin (chairman, India-Rubber, &c., Co.); Sir Henry Mance, C.I.E.; Mr. Walter Kemsley (Tozer, Kemsley & Fisher, Ltd.); Mr. George Keith (Cuba Submarine Telegraph Co.); Colonel Hendry; Mr. William Duddell (President, Institution of Electrical Engineers); Mr. Robert Hammond; Prof. Cormack (Glasgow University); Sir J. Denison Pender (chairman, Eastern Telegraph Co.); Mr. J. Rippon (manager, Halifax and Bermuda Telegraph Co.); Mr. H. Alabaster, Mr. T. E. Gatehouse and Mr. H. R. Kempe (Electrical Review); Mr. Frederick Ward (Commercial Cable Co.); Mr. P. V. Luke (Telegraph Construction and Maintenance Co.); Mr. O. Latham; Mr. Roger Smith; Sir Alfred Keogh (Rector, Imperial College of Science); Prof. Carey Foster; Prof. Mather; Prof. Silvanus P. Thompson; Mr. Charles Bright (consulting engineer to Australian Commonwealth); Mr. E. Karminski (manager, Credit Lyonnais); Mr. J. Ferguson (manager, National Bank of Scotland); Mr. A. Galloway (London Dumbartonshire Association); Dr. R. T. Glazebrook (Director of the National Physical Laboratory); Mr. James Weir (Silley, Weir & Co.); Mr. T. O. Callender (Callender's Cable and Construction Co.).

Silvertown Staff.—Messrs. S. A. Russell (works manager), B. G. Bishop (sales manager), H. Cunningham, (cashier), Capt. H. Benest, F. C. Crawford, Capt. Morton, Capt. V. Jones, J. Grant, J. Rymer Jones, A. D. Raine, Rollo Appleyard, H. P. Daley, J. W. Bampfylde and T. Ivey.

Cannon Street Staff.—Messrs. E. C. Geale (accountant), F. A. Williams (controller of agencies), A. F. Bailey, J. Jeffery, E. March Webb, E. C. Daubeny, Hon. S. E. Marsham and A. P. Crouch (secretary).

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Coal for Above-Bridge Electricity Works.

On more than one occasion mention has been made in the columns of the ELECTRICAL REVIEW concerning the saving to be effected by bringing coal by steamer direct from the coalfield port to alongside the nearest available wharf to those stations situated on the Thames above bridges. That this is no freak idea is proved by gas works continuing their practice of many years' standing, of regularly shipping coal at Newcastle, Hartlepool, or Goole, and taking it direct to their works just below Putney without any second handling by barging.

Further confirmation is now forthcoming. In the recently published report to the L.C.C. dealing with the future electricity supply for London, Messrs. Merz & MacLellan offer certain suggestions having regard to a few of the present generating stations being retained, and state most bluntly those "below bridges." That is to say, in other words, that it is no use further considering works above bridges on account of the extra cost of barging and the second handling of coal. If the scheme suggested by me some time ago of using small steamers to bring the coal right around the coast and up river had been in vogue during the past few years, there is a possibility that one or more of the above-bridge stations would have been considered.

Coal represents roughly one-third of any electricity works costs, and a saving of only 6d. per ton means a considerably reduced annual coal bill. And 6d. per ton is by no means a high estimate of the economy possible when using small ships to bring the coal from a mining district to within a short distance of the spot where it is to be consumed. This method not only saves the cost of lighterage, but likewise the commission of a London agent.

Interested.

The Meetings of the I.E.E.

I am glad to see Mr. Shoults protesting against the recent alterations in the form of *Journal* and the abandonment of the old post-card notification of the meetings. The Council have surely chosen an unfortunate time, when immediately after raising the subscriptions they cut down little conveniences such as a ½d. postcard to the membership reminding them of a forthcoming meeting. The postcard was a most useful reminder, and I, personally, have missed more than one meeting this spring for want of it. If a postcard is too much trouble, surely a list of the forthcoming meetings could be included with each copy of the *Journal*.

I have yet to meet anyone who approves of the new form of the *Journal*, and I have yet to hear of any explanation having been made by the Council as to the reasons for the change. Surely ordinary courtesy to the membership would have prompted some announcement under this head. There may have been good reasons for the various changes made, but we should like to hear them.

I am afraid the Institution, which showed some signs of returning life under Mr. Ferranti, has gone to sleep for another 99 years.

M. Farrer.

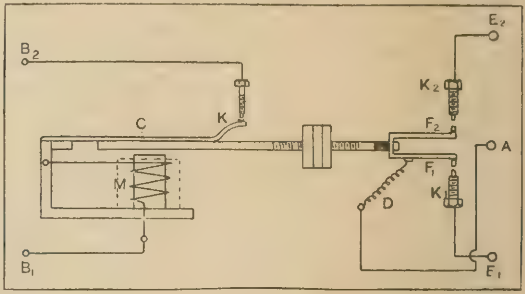
Twickenham, *May 1st*, 1914.

"The Truth, the Whole Truth. . . . ."—Commenting on the programme for the annual meeting of the Institution of Gas Engineers at Liverpool, the *Gas World* naively remarks :—"We must confess to a feeling of chilliness in regard to the promised communication from Mr. Harold Hartley, 'On the Electrical Condition of a Gold Surface during the Absorption of Gases, and their Catalytic Combustion.' The French have a wise saying that 'all truths are not proper to tell.' Similarly, in face of such a statement as the above of the labours of a gas research Fellow, we are driven to remark that all science does not appear germane to the objects of this foundation." In other words, "Let us not face the facts, when they are of an unpleasant nature." We admire our contemporary's candour, though not its ethics or the sagacity of its policy.

DOUBLE RECEIVING APPARATUS FOR WIRELESS TELEGRAPHY.

A DOUBLE receiving apparatus for wireless telegraphy is shown diagrammatically in the accompanying figure. This apparatus depends on the same general principle as that system of multiplex wire telegraphy which gives each of a number of operators exclusive use of the wire line for a short but periodically and rapidly recurring interval. In the present case an oscillating relay arm connects a single aerial alternately to each of two receiving circuits tuned for the reception of the respective messages concerned. It is, of course, possible to receive two messages of distinctive wave length simultaneously on one aerial by using continuously two suitably tuned circuits. In practice, however, the "wave separation" required at the receiving stations involves energy losses which are more serious the greater the difference in intensity between the two wave trains received. Again, the mutual interaction due to the coupling of the two receiving systems is such that adjustments in one circuit affect those in the other. By mechanically changing the connection of the aerial from one receiving circuit to the other periodically and at quite short intervals, this difficulty is eliminated.

The apparatus illustrated has been designed with this end in view by the Gesell. für Drahtlose Telegraphie, and comprises simply an automatic interrupter of the trembler-bell type, the armature of which is provided with an adjustable "bob," and carries an insulated double spring F_1, F_2, playing between stationary contacts K_1, K_2. All the intermittent contacts are platinum-tipped. The aerial is connected to terminal A, and thence through the flexible lead D to the springs F_1, F_2. As C vibrates, the aerial is connected alternately to the distinctively tuned circuits connected to the terminals E_1, E_2, and the normal frequency of vibration of the interrupter being about 30 reversals per second, each receiver is connected to the aerial a number of times during the reception of a Morse dot or dash, and there is, therefore, no risk of missing a signal.—*Elektr. Anzeiger.*



NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New "Diamond H" Switches.

A variety of new switches has recently been brought out by the HART MANUFACTURING CO., of 76 and 77, Rochester Row, Westminster, S.W.; some of these are illustrated herewith. Fig. 1 shows a switch which has been devised to break a heavy current at high voltage—40 amperes at 250 volts, or 20 amperes at 600 volts.

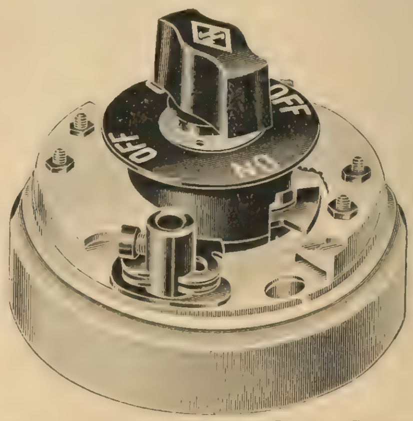


FIG. 1.—HART S.P. INTERPOSED DAMPER SWITCH (one damper shown broken away).

The novel feature in its construction is the provision of slotted porcelain damping blocks into which the blades of the switch pass directly they leave the contact springs, the cooling effect of the porcelain immediately and effectually extinguishing the arc. The mechanism is otherwise similar to the well-known Hart devices, giving a snap make as well as a snap break.

The same damping device has been applied to the series-parallel switch which is widely employed in connection with cooking and heating apparatus, but in this case the porcelain dampers are integral with the base—a remarkable piece of work in porcelain. This switch gives three heats and an "off" position. There are no materials in the switch that can be affected by heat, the insulation consisting entirely of mica and porcelain. Fig. 2 shows the principal features of the switch, including, besides the porcelain dampers, the latest pattern of binding post, which enables a firm connection to be made with ease, and without nicking the wires. This pattern breaks 20 amperes at 250 volts. Before the dampers were employed the maximum current permissible was 10 amperes.

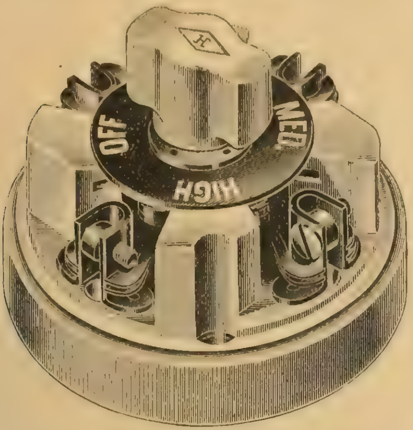


Fig. 2.—Hart Series-Parallel 20-Ampere Switch with Interposed Dampers.

Fig. 3 represents a new remote-control switch of very compact design, as arranged with an automatic relay for the purpose of changing over instantaneously from one source of supply to another in the event of failure of the former—a very necessary provision in the case of theatres and other public buildings, where extinction of the light might lead to panic. The switch is made for 5 to 200 amperes, D.C. or A.C., and either two-pole, three or four-pole; the contacts are made with laminated copper brushes, and the mechanism is completely enclosed. The action of the solenoids which operate the switch is very positive and powerful; a button controlling the releasing solenoid, which operates directly on the locking mechanism, enables the switch to be opened by hand, and "momentary contact" switches fixed at any desired points provide for remote control. The operating current is cut off on the completion of the opening or closing movement. Besides its use for the purpose above mentioned, the switch is applicable to any case where remote control is desirable, saving the expense of running the main cables to the switching points; three small wires and a push-button switch at each control point suffice. Numerous cases of this kind arise in practice.

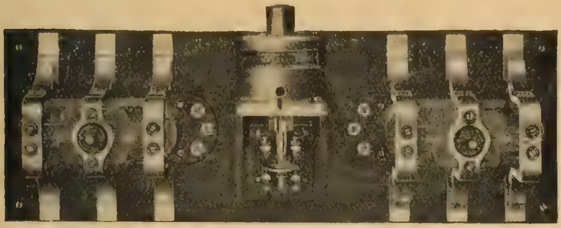


Fig. 3.—Hart Three-wire Change-over Switches Controlled by Automatic Relay.

Other new devices include a new type of bedroom-door switch, for use in hotels, which cuts off the lighting circuit when the door is locked from the *outside*, and thus effects an economy which, in practice, attains a remarkable value; and switches for use on motor-cars fitted with electric starters, capable of passing up to 200 amperes for a short time. In every case the materials and workmanship employed are of the highest order.

The "Adanac" Switch and Repulsion Fuse.

Messrs. Berry, Skinner & Co., of 78, Upper Thames Street, E.C., are introducing a new switch and fuse which embodies several features of great novelty and ingenuity; the accompanying illustrations show the device open and closed, and it will be seen that the "push-on, pull-off" principle by which the firm's switches are distinguished is employed, giving quick make and break, effective interlocking and ease of replacement. Amongst the advantages claimed for this switch are the following:—

Every current-carrying part that is capable of destruction by the operation of the switch is easily replaceable from the front. The moving switch contacts of a double or triple-pole switch can be replaced without the use of any tool, and in less than half a minute.

The design is such that a given current can be dealt with in absolute safety, and in an exceptionally small cabinet.

The current is broken upon each pole upon two contacts in series with one another and with a parallel action.

It is impossible to tamper with the contacts either by mischief or accident. The circuit can only be closed or opened by quick "make" or quick "break" action. When the switch is "on" the cabinet is automatically locked, and the contents cannot be tampered with; the fuses can only be replaced when the switch is off and the circuit dead.

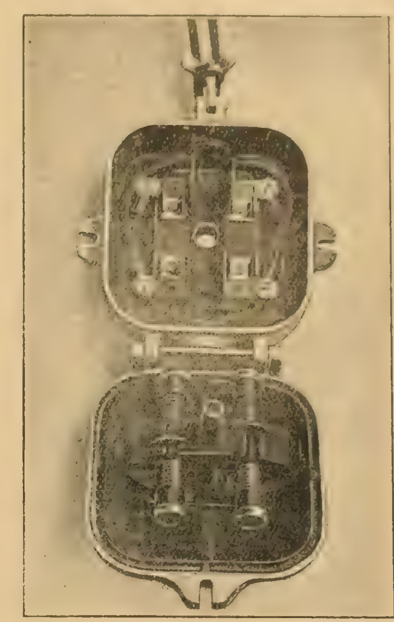


Fig. 4.—"Adanac" Switch and Repulsion Fuse, Open.

These ends are attained by the use of spring contacts screwed on from the front, and switch fuses of novel design. The latter consist of fibre tubes carrying at each end a metal spiral and terminal; the fuse wire is threaded through the interior and gripped in the terminals by caps, which screw on to the spirals, and are provided with gauze disks which prevent the emission of flame or sparks. The exposed portions of the spirals, seen in the illustration, form the contacts which enter the stationary spring clips, giving effectual multiple-point contact, and by rotating the tubes fresh contact surfaces can readily be obtained. The tubes are held in an ingenious arrangement consisting of three fibre blocks pressed together by the mainspring of the switch; they can be removed or replaced in a moment. These blocks form a kind of toggle joint, which will only rest in the extreme positions, full in or full out.

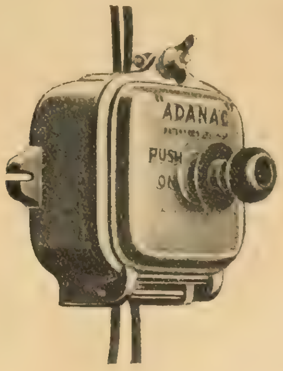


Fig. 5.—"Adanac" Switch, Closed.

As the spirals form part of the circuit, they produce a magnetic field which is stronger in proportion to the current flowing through the fuse, and by arranging for the production of a consequent pole at the middle of the tube, a radial field is obtained which has the effect of extinguishing the arc formed at rupture silently and efficiently, and rendering it impossible for the arc to flash to the cover or case. The fuse wire can be renewed by hand, without the use of any tool, as often as desired. Tested on dead short circuit on a 530-volt battery, the fuses have repeatedly interrupted a current rush of 300 amperes without noise or sparks, the same fuse carriers being rewired each time. For service main supply switches the device is very suitable, as the mains can be brought in at either top or bottom of the case, the switch box is provided with a wing nut which only requires one seal, and by removing the fuses and sealing the case the service can be completely cut off. It is certainly an extremely neat and efficient design, and should prove popular.

Schoeller Miner's Lamp and Gas Indicator.

On Tuesday we inspected a new fire-damp indicator which is being introduced by the Armorduct Manufacturing Co., Ltd., of Farringdon Avenue, E.C., and which is now receiving the attention of the British and German Governmental authorities as a substitute for the time-honoured Davy lamp indicator. The apparatus depends upon the phenomenon of diffusion of gases through a porous septum, which takes place at a rate inversely proportional to the square root of the densities of the gases concerned. A shallow chamber is provided at the head of the lamp, its base being the roof of the lamp and its cover a porous diffusion plate; one leg of a small U-shaped tube or manometer is connected with the interior of the chamber, while the other leg is open to the surrounding atmosphere, and a small quantity of coloured liquid in the bend of the tube indicates any difference of pressure between the interior and exterior of the diffusion chamber. The filament of the lamp behind the manometer renders this indication very clearly visible.

When the device is introduced into an atmosphere containing a gas lighter than air, the gas diffuses inwards into the chamber more rapidly than the air outwards, increasing the pressure inside the chamber and depressing the liquid in the corresponding leg of the manometer. The depression, under suitable conditions, is proportional to the percentage of gas in the air surrounding the chamber.

When a heavy gas such as carbon dioxide is present, the indication is of opposite sign, the liquid rising in the leg connected with the diffusion chamber. A valve in the latter is provided, by means of which the pressure in the chamber can be equalised with that of the surrounding air.

We understand that the indicator is capable of detecting the presence of as small a quantity as 0·3 per cent. of methane; it can be attached to any type of lamp, at a trifling cost, and is, of course, absolutely free from danger in use—which cannot be said of the Davy lamp, for example. The device is certainly extremely interesting, and we are informed that many lamp-makers are adopting it; no doubt it will be subjected to exhaustive tests by the Home Office authorities, and if, as we hope, it passes these successfully, the last remaining objection to the general adoption of electric lamps will be removed.

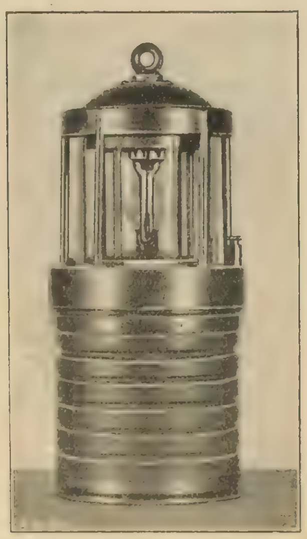


Fig. 6.—Schoeller Patent Miner's Lamp Gas Indicator.

The lamp to which the indicator was attached, illustrated in fig. 6, consists of an outer shell, into which is dropped a metal cylinder containing a 6-volt accumulator, with a clear space between the two vessels to protect the inner one from damage due to blows on the outer case; a fibre disk fitted with contact springs is placed on the top of the container, making direct connection with the terminal lugs of the battery, and the top of the lantern, fitted with a strong glass cylinder, is then screwed on, a magnetic lock being provided to prevent unauthorised opening. The lamp is held between the contacts and the upper reflector by a spring, which, if the lamp bulb is broken, instantly disconnects the lamp contact from the battery contact spring. The lamp is switched on or off by rotating the lantern with regard to the base. The complete lamp weighs 4¾ lb., and is of simple and substantial construction, giving an excellent light.

"Magnet" Electric Fires.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., has recently evolved two types of heaters known as "Magnet" electric fires in which the element is run at a pleasing glowing temperature. These electric fires are made in numerous designs to suit every style of architecture. In the first, the "panel" type, a special non-oxidising high-resistance wire is wound in a helix, and this helix is arranged in specially designed fire-resisting insulators. These are curved from top to bottom as may be seen from the illustration, fig. 7, and the terminals of each section of the element are arranged at the bottom corners. The special fire-resisting insulator is grooved from top to bottom, and the wire helix lies in these grooves, running from its point of entry up to the top, through a hole for anchoring purposes, down the next groove, through a similar hole at the bottom and up the next groove, through another hole and down to the other terminal. The wire helix is further anchored by specially designed pegs passing through holes in the insulator arranged for the purpose. By this means, it will be appreciated, the spacing of the individual turns of the helix is maintained constant throughout the whole life of the element, so that a particularly uniform heating effect is maintained.

Each element is designed for 500 watts, and the standard fires are arranged for 1,500 or 2,000 watts. Thus there are three or four unit elements in each, and a graduated heating effect may be obtained by means of two switches. The finishes are in iron, copper or brass, and the styles Modern, Adam, Sheraton and Georgian. Fig. 7 shows a fire in the Modern style.

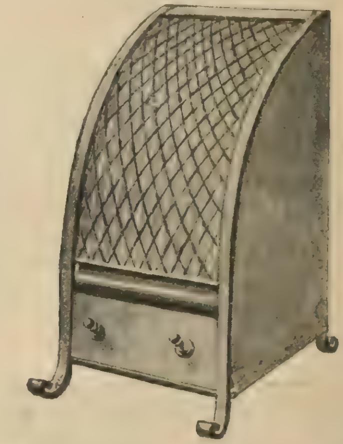


Fig. 7.—G.E. Co. "Magnet" Fire.

Another type perfected by the company is of the "rod" type. In this type each heating element consists of a special fire-resisting insulator rod, reinforced by a central steel rod, and having fine grooves arranged helically on its surface. These grooves accommodate a special non-oxidising metal wire suitable for use at high temperature. At the end of each rod connection is made by the end turns of the wire to a nickel terminal strip, of specially large surface so that this runs perfectly cool. Each of these rods is designed for a power consumption of 500 watts, and the terminal fits into vertical metal strips of substantial size at the side.

The standard sizes are for 1,500, 2,000 and 3,000 watts, and complete control can be effected as in the case of the panel type. Behind the rods at a suitable distance is arranged a curved aluminium reflector. The company gives a 12 months' guarantee in all cases, and the prices asked are extremely moderate; we understand also that the company is inaugurating a novel scheme whereby those interested in the supply of heaters on a large scale for sale, hire, or hire-purchase will be able to extend considerably their activities, and they are recommended to apply for particulars to the heating department of the G.E.C.

New G.E.C. Switches.

The General Electric Co., Ltd., has also recently introduced the 5-ampere, double-pole, ironclad explosion proof switch and fuse, shown in fig. 8, for colliery lighting work. The case is shaped to reduce the space available for gas accumulations, but adequate clearances are given.

The switch consists of a pair of tumbler switches actuated by a handle passing through the side of the box and connected through a lignum vitæ coupling box. The "on" and "off" positions are definite and clearly marked. The switch is combined with the "Rex" fuse, which is of the replacement type, and the hinged cover is interlocked with the switch movement to prevent the switch being operated when the cover is open. The switchbox is provided with 1-in. machined metal flanges, giving a metal-to-metal joint, and all holes in the box are provided with suitable plugs, bushes or glands to make them gas tight. A clamp is also provided for gripping the armouring of cable if required.

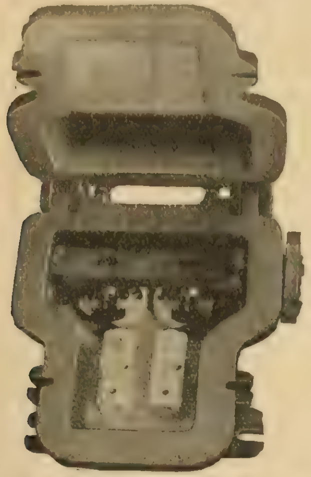


Fig. 8.—G.E. Co. Colliery Lighting Switch.

The G.E. Co. has also placed on the market a range of "Salford" mining type circuit-breakers for either A.C. or D.C. circuits, 30 to 600 amperes. We illustrate one of them in fig. 9.

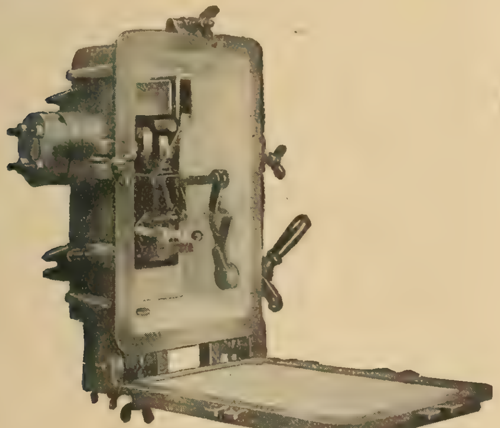


Fig. 9.—"Salford" Mining Circuit-Breaker.

The principles followed in the construction are, of course, much the same as in the case of the smaller switch described. Among the features may be mentioned loose handle, carbon breaks for A.C. and magnetic blow-outs for D.C., cast-iron case with wide machined flanges and with the lid interlocked with the switch. Both switches comply with all the requirements of the Home Office.

Copper.—As shown by Messrs. H. R. Merton & Co.'s statistical circular for the end of April, there is an increase in the quantity of visible supplies. English holdings are up 1,571 tons, French 519 tons, and total European stocks 2,799 tons, standing now at 29,278 tons. Supplies have been fairly high from North America, and distinctly high from Spain and Portugal, though these last figures vary considerably, and, being small in amount, probably even up on one month what was short in a preceding one. Chile shipments were strong, but Australian rather below average. Total deliveries at 50,800 tons, show a brisk trade, and make the visible supply figures more noteworthy. American stocks, as given by the American Producers' Association, were down 6,144 tons during March, the figure for the end of that month being 28,843 tons. The world's supply on the same date was 54,972, a reduction of 6,968 tons on the figure for the end of February. Although this cannot be looked on as a strong total, it is better than during four months of last year (August—November).

LEGAL.

Rippingille v. Hooper & Edman.

Before a Divisional Court of the King's Bench Division composed of Justices Avory, Rowlatt and Shearman the matter was considered of Mr Frank Rippingille of Winchester House, Birmingham, formerly managing director of the Rippingille Manufacturing Co., Ltd., manufacturers and factors of electrical fittings, and Messrs. Hooper & Edman, Ltd., iron and brass founders and bedstead manufacturers, of Spring Hill Foundry, Birmingham, the case having regard to an arbitration under the Arbitration Act of 1889, and presenting various questions for the opinion of the Court upon the true interpretation of an agreement between Messrs. Hooper & Edman, Ltd., and Mr. Rippingille dated November 25th, 1910, by which he was to act as traveller for the company.

Mr. McCardie appeared for Messrs. Hooper & Edman, and Mr. H. H. Joy represented Mr. Rippingille.

Mr. McCardie, before proceeding to deal in particular with the special case before the Court in this matter, said that it raised important commercial questions as to the obligations of persons who employed a man as traveller and commission agent to accept the orders given by that person, also there was the question of whether supposing the employer failed to fulfil an order, and through delay or something similar, the order was lost, the commission agent could claim his commission on that lost order that through delay had not been fulfilled. There were also broad questions of law as to what amounted to a repudiation of contract and what amounted to acceptance of that repudiation. Questions also arose of the right of the company, having regard to the agreement, to join a certain electrical trade combine. Mr. McCardie proceeded to deal with the details of the special case. In the course of a long speech he pointed out that the business of the Rippingille Manufacturing Co., Ltd., of which Mr. Rippingille was managing director, was unsuccessful, and in August, 1910, resolutions for the winding up of the company were passed. Messrs. Hooper & Edman, on October 12th, 1910, agreed to buy from the Receiver and manager for the debenture-holders of the Rippingille Manufacturing Co. the goodwill, stock, patterns and effects of the electrical fittings department of the Rippingille Manufacturing Co., Ltd., and in November, 1910, Mr. Rippingille entered into an agreement with Messrs. Hooper & Edman to act as traveller to the company for seven years, subject to certain stipulated conditions. It appeared that at the date of the agreement a trade combination, called the Electrical Conduit and Fittings Association, for fixing and regulating selling prices and other matters, had been formed by and between many companies, firms and individuals engaged in the manufacture and sale of electrical fittings and conduits, but there were certain manufacturers who were not in the combination, from whom supplies of electrical fittings and conduits could be obtained at prices very much below those fixed by the combination. Mr. Rippingille said it was agreed between him and the company, before he entered into the traveller's agreement, that he should be employed as traveller on the basis of the company carrying on the businesss—as a separate department under the name of the electrical fittings department—outside the trade combination in question, by purchasing supplies from such manufacturers who were not members of the combination, and selling the goods so obtained at prices below those fixed for the time being by the trade combination, and it was contended that the company's act in joining the combination in 1911 was in breach of the agreement, and that it went to the very root of it, or that it was an implied term of the agreement that the company of their own motion could not do anything to alter the existing state of circumstances under which the agreement was entered into, and that the conduct of the company in joining the combination put it out of their power to accept orders showing 33⅓ per cent. profit on cost (as it was stipulated they should do), and amounted to a repudiation of the agreement. Counsel went on to say that the traveller's agreement provided that the engagement should extend for a period of seven years from October 9th, 1910, provided that the accepted orders received in the electrical fittings department of the company (together with any orders received by the company through the traveller for any other department of the company) should reach a maximum of £3,000 per annum, and it was also agreed that all orders obtained by the traveller for goods not then manufactured or factored by the company should pass through the electrical fittings department. The remuneration of the traveller was to consist of 10 per cent. on the cash received in respect of all orders for electrical fittings, and 10 per cent. on the cash received in respect of all orders taken or directly influenced by the traveller for any other department of the company, with certain stipulated exceptions. The commission was to be paid monthly on all orders accepted by the company, and the traveller was also to have one-tenth of the net profits made from time to time by the company in the electrical fittings department. It was further provided that in case any order obtained by the traveller for goods manufactured or factored by the company, should show a less profit to the company than 33⅓ per cent. on cost, the traveller should, first, offer the order to the company, and if the company accepted, it bore in lieu of the 10 per cent., a commission equal to a half of the net profit that would be made by the company, and if the company declined such an order the traveller was to be at liberty to place it with any other firm at the same, or a less, price, but not otherwise. Mr. McCardie went on to say there were provisions as to the commission payable if the company should appoint any home or export representative for the electrical fittings department on ground not then worked by the traveller, it was provided that the traveller should devote so much as he might think necessary of his time to his duties as such traveller, and should do all in his power to extend and increase the business of the company. The traveller was to pay his own travelling expenses and the books and accounts in respect of the electrical business were to be open to the inspection of the traveller. It was agreed that in case the company should at any subsequent time manufacture plain or ornamental brass, copper, or hammered iron gas or electrical fittings, brackets or standards for use in dwelling houses, theatres or public buildings, the term "electrical fittings" should not be deemed to apply, and these should be excluded from the agreement provisions, except that the traveller should be entitled to the 10 per cent. on the cash received in respect of all accepted orders obtained by, or directly influenced by, him during the continuance of the agreement, but the traveller was not to be disentitled from receiving 10 per cent. in respect of goods manufactured by the company of the class, and similar in pattern, to those theretofore dealt in by the traveller's late firm, the Rippingille Manufacturing Co., Ltd. There was a clause that provided for determination of the engagement by three months' notice, should the minimum accepted orders not be reached in any year, and also a provision that if disputes arose as to remuneration payable, or as to the construction of the agreement, it should be referred to a single arbitrator under the provisions of the Arbitration Act, 1889. The traveller began to serve the company on October 9th, 1910, on the terms of the agreement of November, 1910, and he supplied to the company the name of certain manufacturers carrying on business outside of the combination, including the name of Cranmore & Co., of Aston, Brook Street, Birmingham, manufacturer of conduits and accessories for electric lighting, &c., and lists of selling prices (showing a profit of not less than 33⅓ per cent. on cost) were prepared and distributed among prospective customers in the electrical fittings department of the company's business. In January, 1911, the company said they were only prepared to pay the traveller 2½ per cent. commission on orders obtained by him for conduit tubes, and the traveller replying that he could not alter the agreement, the company told him not to take any orders for conduit tubes on their behalf in future. On February 6th, 1911, the company, who contended that they were entitled to rely upon the traveller getting proper deliveries of goods in order that they might execute orders obtained by him, also gave him notice that till he could secure delivery of goods then on order he had better not solicit further business for the company, and that further orders would not be accepted by the company. On February 6th the traveller inquired if they desired that he should not solicit further orders on their behalf, and wrote to say that he presumed they would have no objection, if that were so, if he solicited orders on behalf of other firms, and to this the company made no reply. On February 7th, 1911, the traveller entered into an agreement with Walter Edwin Cranmore, trading as Cranmore & Co., to serve them as traveller and to obtain orders on their behalf for conduit tubes and for other goods manufactured or dealt in by them, and the traveller contended he told Hooper & Edman of this, but that the company denied, and said that the agreement with Cranmore & Co. was in breach of his agreement with them (Hooper & Edman), and they called on him to terminate the agreement with Cranmore & Co. It was later agreed, to prevent litigation, that the company should withdraw its objection to the traveller's agreement with Cranmore & Co., but that the traveller should pay on account to the company one-half of the commission he received from Cranmore & Co. for the sale of conduits and conduit fittings. The company later contended that although the traveller obtained orders at prices showing a profit of 33⅓ per cent. on cost, they were entitled, in the exercise of their discretion, to refuse to accept orders at such prices, and claimed the right to fix their own selling prices at amounts that they thought fit, independently of the agreement. About May 19th, 1911, the company notified the fact that they had joined the trade combination, and the traveller protested against this, and eventually said he was advised that the company had, by joining the combination, committed a breach of the agreement. There were negotiations with a view to meeting the altered position created by the company having joined the trade combination, but no agreement was reached between the parties, and on July 1st, 1911, the traveller gave notice of his intention to proceed to arbitration under the Arbitration clause of the agreement in respect of breaches by the company of the agreement. In September, 1911 (counsel explained) Mr. J. G. Hurst was appointed as sole arbitrator to determine the disputes that had arisen. The arbitrator had heard the various contentions. It was contended for the traveller that he was not answerable to the company for the successful management of the electrical fittings department of their business, and the company could not rely on the traveller getting proper deliveries of goods for the execution of orders accepted by them; that the agreement was entered into on the basis that the company would carry on business outside of the combination; that the company was bound to afford the traveller the opportunity of covering the commission referred to in the agreement, and were bound to accept all orders obtained that showed 33⅓ per cent. profit on cost, subject only to the financial position of the combine being satisfactory, and to the company, acting reasonably, being able to cope with and execute such orders; that the company were not at liberty to join the combination; that it was an implied term of the agreement that the company would not do anything to alter the existing state of circumstances under which the agreement was entered into; that the conduct of the company in joining the combination put it out of their power to accept orders showing 33⅓ per cent. profit on cost, and amounted to a repudiation of the agreement that had been accepted by the traveller; that the traveller had done nothing since such acceptance disentitling him from relying on such repudiation and acceptance; that he was entitled to be paid monthly a commission of 10 per cent. on all orders accepted by the company, but that he was only entitled to retain the commission on cash actually received by the company in respect of accepted or executed orders; that the traveller was entitled to damages in respect of loss of commission owing to orders being lost by faulty execution and delay on the part of the company.

On behalf of the company, the chief contentions were that the company were only entitled to execute orders that they chose to accept, and they were at liberty to refuse to accept any orders obtained by the traveller, whether such orders showed a profit of 33⅓ per cent. on cost or not; that the company were entitled to fix the selling prices that they thought fit, that they were entitled to join the trade combination; that they were in all respects entitled to carry on their own business as they thought fit without being responsible to the traveller for any loss of trade caused by faulty execution of orders, delay in the execution of orders, or by raising prices at which the company were willing to sell goods manufactured or factored by them; that the company had done nothing amounting to a repudiation of the agreement, and there had been no unequivocal acceptance of the traveller of any such repudiation; that the remuneration to which the traveller was entitled was a commission of 10 per cent. payable monthly on cash received by the company in respect of such orders obtained by the traveller as the company had chosen to accept.

The Arbitrator had reported that he had heard the evidence of the traveller, and it had been agreed that on that evidence and the documents before him, he should determine certain matters for the guidance of the parties in the conduct of the arbitration. The Arbitrator had found the following facts:—

1. That the agreement was entered into on the basis of an existing state of circumstances, viz., that the company would carry on the business referred to in the agreement outside of the trade combination.
2. That the agreement could only take effect by the continuance of that existing state of circumstances.
3. If on the true construction of the agreement the company were not entitled to join the combination, their conduct in so doing amounted to a breach necessarily going to the root of the agreement and entitling the traveller to treat such breach as a repudiation on their part of the agreement.
4. That such repudiation was unequivocally accepted by the traveller.
5. That whatever was done after the traveller's acceptance of such repudiation was done by agreement between the parties, and the traveller had done nothing precluding him from relying on such repudiation and acceptance thereof.

The Arbitrator had presented (added counsel) the following questions for the opinion of the Court:—

1. Whether on the true construction of the agreement the traveller was responsible for the successful management of the electrical fittings department of the company's business, and (or) for getting proper deliveries of goods to enable the company to execute orders obtained by the traveller?
2. Whether it was an implied term of the agreement that the company, of its own motion, would not do anything to alter the existing state of circumstances under which the agreement was entered into?
3. Whether the company was bound to accept all orders obtained by the traveller showing 33⅓ per cent. profit on cost, subject only to the financial position of the customer being satisfactory, and to the company, acting reasonably, being able to execute such orders?
4. Whether the company was entitled to fix such selling prices as it thought fit?
5. Whether the company was entitled to join the trade combination?
6. What commission the traveller was entitled to be paid?
7. Whether the traveller was entitled to claim any damages in respect of loss of commission owing to orders being lost by faulty execution, and (or) delay on the part of the company, and also owing to the company refusing to accept orders from customers who were financially sound, which orders it was possible for the company to accept and execute?
8. Whether in determining the matters set out he was wrong in law?

When **Mr. McCardie** had reviewed the special case covering these facts, the fact was referred to that the Arbitrator had not completed the hearing of the evidence, and it was suggested that the better course would be for Mr. Hurst to complete the evidence before their Lordships dealt with the questions arising.

After some discussion, their Lordships directed that the whole matter should be remitted to the Arbitrator for him to complete the hearing of the evidence, and then state his award in a special case, or state a special case, with any question of law that had arisen.

Electric Light Advertisements.

Mr. Justice Astbury, in the Chancery Division, on April 30th, decided upon the construction of the covenant in a lease for 80 years from 1887 from the London County Council, that an electric light advertisement installed by the lessee, Mr. Samuel Joseph, on the façade of the premises known as Piccadilly Mansions, at the corner of Shaftesbury Avenue and Piccadilly Circus, did not constitute a breach of the covenant. According to the facts as agreed between the parties, the covenant prohibited, except with the licence of the lessors, any cutting or maiming of the principal walls or timbers, or any alterations in the elevation or in the architectural decoration of the building. The advertisement in question consisted of a framework of light iron vertical and horizontal bars bolted together in the form of a wide-meshed net, to which the letters of the advertisement, which were made of wood and fitted with electric lamps, were affixed. The whole framework was suspended from the upper part of the premises by steel bands, none of which was fixed to the structure of the building, but embraced the ornamental stone work on the top of the facade. The vertical iron bars were further supported by means of struts fixed to them and resting on the stone cornices, which ran at intervals across the facade of the premises The lessee, Mr. Joseph, for whom Mr. F. Russell, K.C, and Mr. Underhill appeared, contended that the installation of the advertisement had not caused any alteration in the elevation or in the architectural decoration of the building. On the other hand, the County Council, for whom Sir Chas. Macnaghten, K.C., and Mr. F. L. Wright appeared, contended that the installation had caused such an alteration.

His Lordship said, having regard to the fact that if the prohibition included any alteration in the appearance of the building, he could see no limit to be placed upon it or any means of arriving at any limit, he thought the covenant must be held to relate to the fabric of the building and not merely to alterations in its appearance by temporary advertisements or frameworks hung outside which could be removed at any time, and upon the removal of which the elevation and architectural decoration of the building would remain.

Wellingborough Electric Supply *v.* Hacksley.

At Wellingborough (Northants) County Court on April 27th, before his Honour Judge Radcliffe, K.C., the plaintiffs sued Wm. Hacksley, a builder, for 10s. 7d. balance of account for energy supplied.

Mr. S. J. Coales was for the plaintiffs; and Mr. W. W. James for the defendant.

The point in dispute was whether there was a binding agreement for the company to continue to supply the defendant at a certain price. When the defendant began to take the current he did so upon an agreement under which the price charged by the company was 3½d. per unit. Later a notice was served upon the defendant to the effect that the price would be raised to 4¾d. per unit. Defendant did not reply to this, but continued to use the supply, and when applied to for payment at the higher rate, relied upon the original agreement. The defence was that the defendant was a member of a firm that used a considerable quantity of electricity for power, and in consequence of that was granted a special rate for lighting purposes at his private address. There being no special agreement, it was held that it was binding upon the company to continue to supply at the original rates. Defendant stated that the manager of the company told him when he signed the agreement that the price named would be binding upon the company so long as defendant was a member of the firm of Hacksley Bros. and continued to use electricity for power for trade purposes. After a lengthy hearing judgment for defendant with costs was given, leave to appeal being refused.

Compensation Case.

Compensation amounting to £260 and 6 guineas costs was awarded in the Salford County Court on April 28th to Mrs. Elizabeth Hepworth, of Taylor Road, Stretford, in respect of the death of her son, James Herbert Hepworth, electrician, who had been employed by the British Westinghouse Electric and Manufacturing Co., Ltd., of Trafford Park. On March 13th, while at work, he accidentally caught hold of a live electric wire and was instantly killed.

Mr. Ashworth, solicitor, who appeared for the claimant, said that she was the only real dependant of the deceased. His father was living and had left the family some years before the accident, and had not since contributed to their maintenance.

Judge Mellor, K.C.: But he may still be a dependant and have a claim on a portion of this money.

Mr. Ashworth submitted that as the son had never contributed a penny towards his father's maintenance the father had no legal claim, though the position was somewhat complicated by his having recently returned from abroad.

The Judge, in making the award of £260 and costs against the company, to which the company had assented, ordered that the money should be paid into Court until proof were given that the mother was the only dependant in law.

Peel *v.* Hartley Cinemas, Ltd.

In a case heard at Colne County Court last week, Arthur Peel, electrician, Nelson, sued Hartley Cinemas, Ltd., for £17 3s. 10d. for goods sold. Messrs. Hartley counterclaimed for £39 16s. 2d. It was pointed out that the original claim had been paid into Court, and it was argued from this that the counterclaim failed, there being no action before the Court. This was not upheld. It was stated that plaintiff was engaged to supply the electrical fittings and do general electrical work in connection with a picture hall at Todmorden. This included the provision of a generator. At first defendant chose one of Baxendale's (Manchester) make, but plaintiff found this could not be delivered in time, and so it was agreed that he should get the machine from the General Electric Co. The place was not opened until August 30th, but the generator did not arrive until October 5th. Plaintiff made a temporary makeshift by fixing up a wire resister, but this was not effective, and a Gaumont resister was obtained, for which defendants had to pay £6 10s. In addition, they paid in the five weeks £23 6s. 2d. more for electricity than they would have had to pay had they been using a generator. For this loss they claimed £10. A director said he received no tender or estimates regarding the generator. They left the question of the price to Mr. Peel, and there was no question of a 5 per cent. commission.

Plaintiff stated that there was no contract for him to deliver the generator by any specific date, although in the interests of his clients he endeavoured to get the machine as soon as possible. As a matter of fact, the machine was sent to St. Helens by mistake, and when it eventually arrived at Todmorden a part was broken, causing further delay.

The Judge found that no time for delivery was guaranteed. There would therefore be judgment for the plaintiff.

Secretary of State for War *v.* Kirkland & Capper and J. H. T. Woodd.

Mr. Justice Lawrence delivered his reserved judgment on Friday, May 1st, in this action, which has been reported in our columns. His Lordship summarised the facts brought out in evidence, and said the installation was completed on May 13th, 1907, and the year of maintenance provided for in the contract expired upon the same date in 1908. No inspection or tests were made by the defendants at the latter date.

The first complaints to the defendants of the work appear to have been made in August, 1907. In February, 1908, serious complaints of the installation were made, first by the Westminster Electric Supply Corporation, who provided the current, and afterwards by the authorities of the War Office. That the installation had serious defects was then admitted by both defendants, and was not altogether denied before me, although strenuous efforts were made to minimise these defects and to cast the blame for them upon anyone provided it was not the defendants. Tests were made in July, 1908, of the installation in the college, and disclosed the fact that 23 circuits (each supplying electrical current to a number of lights) were defective out of a total of 83 circuits in this building. In January, 1910, 11 months afterwards, further tests were made on behalf of the plaintiff and defendants jointly, and then it was found that the defective circuits had increased to 30 out of 83. These defects were then located as existing in the wiring itself, and not in the fittings or switches.

The first allegation of negligence or breach of duty made by the plaintiff's counsel was that the defendants had improperly departed from the provisions of the specification, and had done so without following its provisions as to deviations. The complaint alleged was that the system of wiring adopted was that of conduits consisting of lead-covered wires buried in plaster.

The defendants' counsel endeavoured to construe the specification so as to permit this method of wiring. It was adopted by Kirkland and Capper at the suggestion of Mr. Woodd, who objected to having any projections upon the surface of the walls, or ceilings, for æsthetic and hygienic reasons. The contractors had tendered on the footing of having conduits on the surface of the walls, &c. The defendant Woodd does not appear to have thought of these matters when the designs and specifications of the buildings were being prepared, nor did Kirkland and Capper when the specification for the installation was being prepared. No doubt projections are undesirable, but it would have been easy at an earlier stage to have prevented any necessity for a projection. The difficulty arose from an entire want of co-ordination between the defendants. If it was thought that Frazzi blocks could not be chased, it was easy to specify for a thicker coat of plaster, one that would have covered as conduit a conductor in tubing. That Frazzi blocks could be chased without any difficulty before erection was demonstrated in Court. Indeed, the smoothness and readiness of the material's response to the file surprised me, after the contentions and evidence that I had heard.

Upon the construction of the specification, I come to the conclusion that burying lead-covered wires in plaster is not permissible under it. These were not "short lengths" of wire in the sense in which these words are used in the specification. The buried wires do not comply with its provision as to "accessibility," nor with that as to protection from mechanical injury, such as nails. This lead-covered kind of conduit may be quite good when placed in a position free from damp and where it cannot receive mechanical injury, but it requires specifically careful handling in erection, and is not suitable for insertion under plaster which may always contain moisture, or from time to time become damp. I am of opinion, therefore, that the adoption of this system of conduits was undesirable in itself, and improper under this specification, and that the excuse for its adoption, viz., the one of Frazzi blocks and thin coatings of plaster, is not one that the defendants are entitled to make in this action. The adoption of this system of lead-covered wires buried in plaster was one of the main contributory causes of the defects which subsequently revealed themselves.

The second head of complaint was that the supervision of the work of wiring was negligent or insufficient. This appears to me to be true. The only person upon the spot throughout was the clerk of the works, who may have been, as Mr. Woodd said he was, a very good clerk of the works in matters of mere building. He was not called before me, nor was anyone engaged on the job from the contractors, Bolding & Sons. It was admitted that the clerk of the works had had no previous electrical experience. There was no evidence to show that the Boldings or their foreman, or their workmen, had ever installed this kind of conduit in plaster before

It was admitted that Kirkland & Capper had had no representative upon the spot throughout under the provision in that behalf contained in the contract and specification.

The defendants appear to have relied entirely upon the visits of Mr. Kirkland, which, he said, were frequent and almost daily. His diary does not altogether bear this out, but even if it were true it would be an extremely risky thing to entrust the erection of this form of wiring with these frequent connector boxes to inexperienced hands, without close and constant skilled supervision.

The evidence of Mr. Kirk and the specimens of lead-covered wire produced satisfied me that there had been inefficient supervision. For example, the bonding at the connector boxes was sometimes absent and generally insufficiently executed. The wires near the switches and connector boxes showed signs of having been bent at angles that lead-covered wire should not be subjected to. Wires were run against edges of brickwork without any protection. The painting of the wires had not been done throughout. The flexes were knotted at the ceiling roses by way of stops. There was no attempt to provide any protection against nails. There were no plans or any other provision to show the course of the wires, so that no one knew where the wires ran when anything had to be done to the walls, such as the hanging of bells. See Woodd's letter to Messrs. Kirkland & Capper, January 30th, 1907. These matters seem to me to show that there was slackness in supervision. The defendants sought throughout to throw on the officials of the War Office the duties which they had undertaken or some of them, and one of their learned counsel, Mr. Walter, seemed to think that it was a sufficient answer to every complaint and every fact to suggest that it was due to subsequent interference by the Royal Engineers.

The Solicitor-General very properly admitted that where there had been interference by the Royal Engineers or anyone else on behalf of the plaintiff, he could not hold the defendants responsible for the defect in that particular part of the system. He made inquiries into this matter and handed in a schedule of cases in which he said he had reason to believe there had been such interference. I think that schedule contains all the cases as to which there is any evidence before me of any interference. I reject the cases attempted to be added by Mr. Walter founded upon hearsay evidence of Meech or anyone else who was not called. I have rarely seen a witness who gave his evidence with such accuracy and such impartiality as Mr. Kirk, and I am prepared to rely upon his investigations.

For the defendants it was contended that the defects were due to the use by the occupants of the premises of improper fuses, that is to say, of fuses which would permit a stronger current to pass than the wires were capable of carrying in safety. The arguments of Mr. Walter were elaborate and ingenious. I have given them my most careful consideration, yet they have entirely failed to convince me that they account for these defects. I cannot undertake to deal with them in detail. It is clear, indeed it is admitted, that if and so long as the wire is laid with its insulation and its lead cover intact, the heavier fuse cannot affect it. It is only when there is some break or crack in the particular circuit that the heavier fuse can, by supplying a current too strong for the wire, increase and enlarge the point of escape of current. Any section of the wire that is perfect can be affected if at all, only by first destroying the insulating power of the envelope through overheating. There was no evidence of such destruction of the insulating envelope shown. In the two specimens of wire produced which showed signs of oxidisation the insulating power of the envelope had not been destroyed, and the defect in the circuit could not be explained except by some "earthing" at some unascertained point or points in its course.

In the same way the argument founded upon the fact that the defects were almost invariably found in the section of buried wire nearest to the light does not show that such defects were due either to the use of heavy fuses or to ill-treatment of the "flexes." Next to fittings and flexes, I think this last section is the weakest part of every circuit. Any injury, however slight, to it, whether done in course of erection or after erection, is likely soon to develop into a "fault"; it requires more care in handling than a piece of conduit having a heavier wire, for it has less backbone. I am affirmatively satisfied upon the evidence of the experts that the faults in these sections are due to their treatment before or during erection.

The next question that arises is: Are both, or only one, of the defendants liable to the plaintiff for these neglects of supervision?

First, it is clear that Kirkland & Capper are liable, for they were specially charged with this work of installation; it was the sole purpose of their employment. As to Mr. Woodd, it was urged for him that the responsibility of Kirkland & Capper relieved him from all responsibility for the electrical installation. There may in some cases be considerable force in a contention of this kind made for the architect, but I do not think it avails him here.

First, his contract specially provides that he shall be responsible, *inter alia*, for the lighting and for its proper supervision and execution, while the clause providing for responsible experts contains no words of express exoneration of the architect. It may be, and I think it is quite true that if this were a case in which some scientific matters had been negligently dealt with, it would be unjust to hold the architect liable; but here Mr. Woodd himself required this system of wiring to be adopted. It was his own architectural designs which rendered it necessary, if it ever was necessary. Furthermore, he shared in the payment made by the plaintiff for this very work of supervision. It is a matter of regret to me to have heard of, and to have to express my disapprobation of, this secret commission transaction between the defendants. The excuses put forward for it were most unsatisfactory. There was no service performed by Mr. Woodd for Messrs. Kirkland & Capper proved before me which he was not bound to perform under his obligations to the plaintiff. The hollowness of this excuse was further demonstrated when it was shown that he had charged the plaintiff, under Clause 14, as for "special interviews or plans" for the very attendances which he had made upon Messrs. Kirkland and Capper.

Lastly, the argument that his commission of 5 per cent. was not to be calculated upon the cost of the electric light installation does not, in my judgment, have the effect of making his services in the matter of the electric light unpaid services. The duties he undertook by his contract are expressly provided for, the particular items upon which he is to have commission is only the mode of calculating his remuneration, it has no effect whatever in either expanding or limiting the duties he expressly undertook. For those reasons, I think all the defendants are liable to the plaintiff in damages.

Next I have to consider whether the plaintiff has made out his contention that the damages should be estimated upon the footing that the whole installation could be rejected, and the cost of the new installation be charged against the defendants. Very little attention was given to this point at the trial. The plaintiff's contention is that as the specification, when carefully read, does not authorise the system of lead-covered conductors buried in plaster, he was entitled to reject the whole installation in both buildings. I think this is an application of the maxim, *omnia presumuntur contra spoliatorem*, which the facts do not warrant. It is not as though this objection to the system had been taken during erection or upon completion. The plaintiff had ample opportunities of inspecting the work during erection, and did by his officers inspect it both during erection and upon completion. I cannot attribute ignorance of the system or of the specification to the plaintiff or his officers. It is not until three years after completion that the plaintiff decides upon the installation of a new system. I think it was then too late for the plaintiff to rely upon the terms of the specification as a ground for rejecting the whole installation. There were in the laboratories only seven circuits out of 74 that were defective, or if we limit the comparison to circuits buried in plaster, 7 out of 29. I think that, having regard to the time that was allowed to elapse, I am bound to limit the damages to the cost of reinstating in an improved method the circuits which were found to have failed upon the joint test in January, 1910, viz., the 30 in the college and the 7 in the laboratories, less those in the schedule of circuits interfered with by the Royal Engineers; that is the schedule that was put in by the Solicitor-General. The other circuits were then performing their functions and were passed as efficient. There was no sufficient evidence before me to satisfy me that they could not reasonably be relied upon to continue to do so. The cost of reinstating these defective circuits is the true measure of damages. If the parties cannot agree upon an amount, it must be referred to an Official Referee to find the cost of such reinstating. If should be quite easy for Mr. Kirk and Mr. Nicholson to agree upon this figure, and I am sure, if left to themselves, they would do so in a short time.

My judgment must be for the plaintiff for the amount so agreed or found against both sets of defendants, and with costs.

MACKIE *v.* GEO. BLAND AND THE LONDON HYDRAULIC POWER CO.

THIS case was again mentioned to Mr Justice Joyce on Friday. Mr. Erington, for the plaintiffs, said this was the case in which his clients who were electrical engineers with contracts with the Marconi Co. and other people under penalty as to the time of completion, had objected to interference with the roadway. The work had now been completed, and he would be content that this motion should be treated as the trial of the action if the defendants were ordered to pay costs.

MR. BEEBEE, for the defendants, declined to accede to this on the ground that the motion should never have been launched.

The motion accordingly stood over until trial.

PATENT INFRINGEMENT CASE.

IN the Chancery Division, on Tuesday, May 5th, Mr. Justice Joyce heard a motion by the Morgan Crucible Co., Ltd., for judgment in an action brought by them against the Electrical Engineering and Equipment Co., Ltd., for alleged infringement of letters patent 11,522 of 1904 for commutator brushes, and letters patent 9,794 of 1906 for improvements in brushes for dynamo-electric machinery.

MR. J. HUNTER GRAY, for the plaintiffs, said this was a motion for judgment in default of defence. Plaintiffs asked for delivery up of the offending articles and an injunction.

His LORDSHIP made the order asked for.

DACOLIGHT ENGINEERING CO., LTD.

IN the Chancery Division, Mr. Justice Joyce heard a motion for the appointment of a receiver and manager in a debenture-holder's action against this company. It was stated that the business of the company was that of manufacturing incandescent lamps. The company consented, and his Lordship made the order asked for, and by consent made the usual order in a debenture-holder's action.

CORRECTION.

IN the Oram Lamps Works case reported on page 737 of our last week, the defendants were the Ostro Light Co., not the *Austrolite Co.* as printed.

PARLIAMENTARY.

Bristol Corporation Tramways.

After two days' hearing a select committee of the House of Commons, presided over by the Earl of Lytton, on April 30th passed the preamble of the Bristol Corporation (Tramways) Bill.

The Hon. J. D. Fitzgerald, K.C., who represented the Corporation, opened the case for the promoters at some length. He explained that under the Tramways Act of 1870 they had an option to purchase the great bulk of the tramways in the city next year on May 1st. The portion purchaseable amounted to 28 miles, and included the central portions in the city which were most valuable to the Bristol Tramway Co. There was a small portion of 1¼ miles purchaseable in 1928, and another two miles was purchaseable in 1946. Under the bill the Corporation sought powers to purchase the tramways, which were worked electrically, and to run them themselves if they so decided. If they took the towns in the United Kingdom with a population of 180,000 and over, they found that all worked their tramways profitably with the exception of Edinburgh, where the corporation instead of working them themselves, had leased them to a company. The Bristol Corporation some time ago appointed a special committee to consider whether it was desirable to promote the present bill, and they obtained expert advice from the manager of the Leeds Corporation Tramways, Mr. Hamilton, and Mr. Snell, an electrical expert in London. Acting on the advice of these experts the special committee reported to the Corporation, and advised them that it would be advantageous to exercise the option of purchase and to seek powers to be in a position to work the tramways. Before, however, the Corporation exercised the powers which they were asking for, he would consult the ratepayers and abide by their decision. The only petition against the bill was that promoted by the Bristol Tramways Co., but he should ask their Lordships to say that the company had nothing to do with the question. It was true that certain small portions of the tramway were not purchaseable next year, but would remain in the hands of the Tramways Co. There was, however, nothing peculiar in such a position, and generally in such cases an agreement was come to between the local authorities and the tramway company for the remaining lines to be purchased by agreement, or to be worked by the local authorities, or that there should be mutual running powers. Having given the history of the Bristol Tramways Co., counsel said that what the company were asking in their petition was that the committee should reverse the settled policy of Parliament in the Tramways Act 1870. He contended that the company went into the tramway business knowing full well that it was purchaseable by the Corporation at a given time. They subsequently set up a motor omnibus business, not, so far as he knew, under Parliamentary powers, knowing that when the time arrived they would have to part with the tramway undertaking. The statistics showed that of the total number of passengers carried by the company in the trams and 'buses, 92 per cent. were carried on the tramways. It was absurd therefore for the petitioners to say that it was impossible to properly carry on the traffic facilities of the city unless the 'buses and the tramways were in the same hands. There would be no difficulty in carrying out an arrangement with regard to the tramways not taken over, unless the tramways company took up an obstructive attitude. The company by petitioning against the bill were trying to put difficulties in the way of the Corporation—they seemed to want to place the promoters in such a position that they would be either unable to purchase the tramways, or if they purchased, that they would be obliged to let the company work them for them. The petition was not really directed against the bill, but against the purchase, notwithstanding the fact that the company themselves agreed to the date of purchase in 1898, under which bargain they had received considerable benefit.

Evidence in support of the bill was given by Alderman George Pearson and other local witnesses, and by Mr. J. B. Hamilton, the manager of the Leeds City Tramways. This witness said that speaking generally the conditions prevailing in Bristol differed in little or no respect from those existing in many places which were provided with a service of tramways, and which for many years had been worked by the municipalities of the town. He thought that the tramway company had placed themselves in rather an invidious position in petitioning against the bill. They had constructed their lines on the distinct understanding that the Corporation of Bristol were to have the option of purchase at a stated time, and as powers to purchase were useless unless accompanied by powers to work, he considered that the action of the company in endeavouring to prevent the Corporation obtaining the latter power was particularly unfair. He regarded the suggestion of the company that it would be difficult to make arrangements for through running between the portions of the tramways purchased and those not purchaseable until 1915 as absurd.

Mr. J. McElroy, general manager of the Manchester Corporation Tramways, also gave evidence in support of the bill.

Mr. Honoratus Lloyd, K.C., addressed the committee against the bill. He submitted that the petitioners were not entitled to succeed because Parliament had never given a corporation power to work tramways until they had made up their mind as to whether they would exercise their power of purchase.

The Committee decided that the preamble of the bill had been proved subject to the insertion of a clause placing upon the Corporation the obligation to purchase the portion of the tramways purchaseable next May on that date, and binding the Corporation to purchase the remaining portions on terms to be agreed upon with the company, or failing agreement, subject to arbitration.

Birmingham Tramways.

Mr. Middlebrook's Committee of the House of Commons considered the bill of the Birmingham Corporation on April 30th and May 1st. Amongst the powers sought were those for the provision of additional tramways and also for working omnibuses.

Mr. Freeman, K.C., explained that it was proposed to construct tramways in various parts of the city, but the only one opposed was that to be constructed in Broad Street. Opposition was offered by the owners and occupiers of premises and by the Homœopathic Hospital. The Broad Street tramway was intended to meet a very great difficulty and necessity in that part of Birmingham. There was an enormous traffic coming down from the lines of tramway which converged at the top of Broad Street, and those who wished to reach the central part of the city had to walk down Broad Street or go by a car down Holloway Road, which was a roundabout way. By the scheme now proposed passengers would be able to travel down Broad Street without changing, and on to the central part of the city. The Corporation had tried to avoid Broad Street for a considerable time, but the traffic into the city was being so seriously interfered with that they brought forward this scheme.

Mr. Alfred Baker, general manager of the tramways, said the present system comprised 114 miles of single track through 65 miles of streets. The Corporation owned over 586 cars. Seventeen new lines were proposed in the bill, and four of these were known as the Broad Street group.

After hearing considerable evidence, the Committee decided not to allow the section of the proposed line running past the Homœopathic Hospital.

This disposed of the opposition of the Hospital authorities, and evidence was then called in support of the tramway in Broad Street itself.

Mr. H. E. Stilgoe, city engineer, expressed the opinion that Broad Street was suitable for tramways. Having regard to the narrow width it was proposed in the lower part of the street to lay a single line only.

Having heard further evidence, the Chairman said the committee were of opinion that the traffic of Birmingham required the provision of additional tramway facilities between the Five Ways and the City or about the Town Hall and Council House, and they were particularly impressed with the importance to the tramway system of the city generally of providing a connecting link between the south and north sections of the undertaking. They did not at present feel prepared to grant the Broad Street scheme. He put it in that form to safeguard the Corporation when they came forward with a more complete scheme and to prevent it being said that the committee now had condemned the need of the Broad Street scheme, which was not the case.

Mr. Jeeves urged on behalf of the Corporation that the tramways should be passed subject to there being an undertaking that they should not be constructed until the street was widened.

After legal argument the Committee intimated that they would not be unfavourable to adopting this course, but suggested that the matter should stand over until the parties had come to some agreement.

This course was adopted by the committee dealing with the unopposed portions of the bill.

North-Eastern Railway Co.'s Bill.

Various powers are covered in the North-Eastern Railway Co's. bill, which was before the Select Committee of the House of Lords, presided over by the Earl of Camperdown, on April 30th and May 1st. They include the making of a railway in Longbenton to the Blyth and Tyne Railway.

Sir A. Kaye Butterworth, general menager of the company, in giving evidence in support of the bill, said the company desired to deal with the population springing up in the neighbourhood by the electrification of the line up to a point towards Killingworth. There was a bridge over Great Line Road. The Newcastle Corporation ran tramways along this road, and if they ran double-decked cars they required a greater headway than 15ft. There were engineering difficulties in the way of making a 17ft. headway as suggested by the Longbenton U.D.C. The company proposed to substitute a bridge 35ft. wide for the level crossing at Forest Hill Station. He did not consider that it was fair to ask the company to make a wider bridge.

After negotiation between the parties, the Committee decided that the clause should be allowed, subject to the existing bridge over Great Line Road being taken down and a new bridge of 35ft. span being constructed; the additional cost was to be borne by the company and the Urban District Council in equal parts.

Mr. Talbot, K.C., then explained the proposals of the company for running trolley vehicles along the High Level bridge between Newcastle and Gateshead. The council were the owners of the bridge, and a toll of ½d. for foot passengers and 4d. for one-horse vehicles was charged. Some ingenious people had, however, started a service of one-horse 'buses and carried people over the bridge for ½d. As the 'bus carried 20 people they made a good thing out of it, whilst the passengers got the ride for nothing extra. The company now proposed to run trolley vehicles to take the halfpennies themselves, and the Corporation of Newcastle contended that they had the right to lay tramways over the bridge, and that if such a service was to be allowed, they were the people to undertake it. The company, however, held that the bridge belonged to them, and that it was unsuitable for tramways. The Gateshead Tramway Co. also objected on the ground of competition.

Mr. C. A. Harrison, chief engineer of the North-Eastern Railway Co., expressed the opinion that it would be dangerous to run tramways on the bridge. From the beginning, when the bridge was built in 1879, the engineers put a restriction of 7 tons weight on traffic passing over it, and the weight of a loaded tramcar would be 9 or 10 tons.

Mr. H. Webber, electrical engineer of the Keighley Corporation, expressed the opinion that the railless trolley system was not suitable for the bridge.

Mr. E. Hatton, general manager of the Newcastle Corporation Tramways, opposed the trolley scheme as being bound to interfere with the tramways. The company as owners of the bridge were entitled to all the money they could earn on it, and if the tramways ran over the bridge the corporation would hand over all the money less working expenses. He suggested that the company would be gainers financially by this.

Mr. Hamilton, general manager of the Leeds Corporation Tramways, supported the evidence that tramways would be better than trolley vehicles under the circumstances.

The Committee rejected the proposal and the bill was ordered to be reported for third reading.

England and Holland Cable Contract.—In the House of Commons, Mr. Stanier asked the Postmaster-General :—(1) To say who was actually making the new cable which was to be laid between England and Holland ; whether there was any clause in the agreement between the two countries as to where the cable was to be made ; and why it was not being made in this country ; and (2) whether there was any manufacturer in Holland who could make a cable suitable to fulfil the requirements of the Postmaster-General for the new cable which is to be laid between this country and Holland ; and how many there were in this country who could have made it.—Capt. Norton replied that the telephone cable which was to be laid between England and Holland at the joint cost of the two Governments was being manufactured by Messrs. Siemens Bros. in this country. The placing of the contract was left to the Dutch Administration by his department. Four leading cable manufacturers in this country were invited to tender, and two tenders were received. He was not aware that there was a cable manufacturer in Holland who could have complied with the specification.

L.C.C. Tramways and Improvements Bill.—The Select Committee of the House of Commons, presided over by Mr. Soames, has passed the preamble of this Bill. The only matter which aroused opposition was the proposal to construct a double line of tramway 4 furlongs 2·1 chains in length from the present terminus at Aldgate to a point opposite the eastern side of Trinity Square, *viâ* Mansell Street and Tower Hill, and thence a single line, 1 furlong 7·1 chains in length, along Tower Hill and the western, northern and eastern sides of Trinity Square. It was explained by Mr. E. Pollock, K.C., that the object of the County Council was to do away with dead ends, and this was particularly desirable in the case of the Aldgate tramways. The Committee, in passing the preamble, made a condition that wood paving should be put down in Trinity Place to meet the demands of the Trinity House and the Port of London Authority, and also made suggestions with regard to the Hay Market in Whitechapel.

Shropshire, Worcestershire and Staffordshire Electric Power Bill.—This Bill, which was late, will be allowed to go forward. It contains a provision for the raising of stock.

BUSINESS NOTES.

Fire.—Messrs. Hurst, Nelson & Co., Ltd., state that the fire at Motherwell was confined almost entirely to their carriage-building shops. Temporary arrangements have been made to carry on car and carriage work until the premises destroyed are re-built.

Map.—From Messrs. Leopold Farmer & Sons, of 46, Gresham Street, London, E.C., we have received a copy of the Map of London which is being issued by them free of charge, showing the free collection and delivery area, the London County Council area, the metropolitan boroughs, and the rates in each.

Private Arrangements.—Wright Electrical Sales Co., Ltd., West Bar Chambers, Boar Lane, Leeds.—Pursuant to the provisions of the Companies' (Consolidation) Act, the creditors interested herein were called together recently at the Central Bank Chambers, Infirmary Street, Leeds. It was reported that the shareholders of the company had passed the usual resolution in favour of voluntary liquidation, and had appointed Mr. A. France, incorporated accountant, Leeds, to act as liquidator. A statement of affairs was presented by the liquidator, which disclosed total liabilities of £2,563. The indebtedness to the trade was £396, and there was a cash creditor for £600, while the National Provincial Bank of England were scheduled for £1,567. There was also a fully-secured creditor for £5 16s. 4d., who held securities valued at £11. The assets were estimated to realise £1,191, less £22 for preferential claims, leaving net assets of £1,169, or a deficiency of £1,393. It was stated that the company was registered on March 7th, 1910, with a nominal capital of £2,000, divided into 2,000 shares of the face value of £1 each. It was formed to take over the business carried on by Mr. H. Wright under the style of the Wright Sales Co., and the consideration paid to the vendor was the allotment to him of fully-paid shares. The balance sheets of the company were presented, and it appeared that up to May, 1911, a net loss was incurred of £300. During the following 12 months there was a profit of £120, while in the succeeding year there was a profit of £65. During the last year there had been a loss on the trading of over £1,000. The result of the trading since the commencement of the company had been a loss of £1,135. The large loss made during the last year was due to the fact that the company had been experimenting with a patent cinematograph. A considerable quantity of material had been used on the patent, for which, so far, there had been no return. In September, 1912, debentures were issued to Mr. W. Newbould in consideration of that gentleman guaranteeing the overdraft at the bank, which then stood at £1,050. The debenture was duly issued, and it was stated that it was in order. After the company had passed resolutions for voluntary liquidation, the debenture-holder appointed Mr. France to act as Receiver. The creditors decided to confirm the voluntary liquidation of the company, with Mr. France as liquidator.

Meeting of Creditors.—George Braulik.—According to a circular issued by Messrs. Lumley & Lumley, of 15, Old Jewry Chambers, London, E.C., a conference of the principal creditors of the above, representing about £5,000 out of trade liabilities of about £7,000, was held on April 30th, at which it was unanimously resolved that Mr. Braulik should be asked to assign his estate to Mr. S. P. Child, of 36/7, Queen Street, E.C., and Mr. G. E. Corfield, Balfour House, Finsbury Pavement, E.C., as trustees for the benefit of his creditors generally, with an advisory committee of five of the principal creditors, and it was agreed that upon the creditors receiving 10s. in the £1 by equal instalments at 3, 6, 9 and 12 months his estate should be reassigned to him. One of the principal inducements to the creditors to adopt this course was, that if agreed to, a claim of £4,504 by the debtor's wife (in respect of which she holds security on the assets to the extent of £2,500) would be withdrawn. The trustees propose to at once have a statement of affairs prepared up to date, for submission to a full meeting of creditors. The Committee of the principal creditors (whose debts amount to £2,686) consists of :—Siedle & Sohne, Schwabe, Ltd., London Electric Warehouse Co., Ltd., A. Green, Ltd., and Pirelli, Ltd.

Bankruptcy Proceedings.—Charles H. Ley & Co., wholesale and export hardware merchants, 8, Bush Lane, Cannon Street, E.C. The first meeting of creditors was held on April 30th at the London Bankruptcy Court. The receiving order was made on the petition of Johnson & Phillips, Ltd. Mr. W. P. Bowyer, Official Receiver, said there seemed to be some question as to the identity of the partners in the firm. No one had surrendered under the proceedings, and he had no information as yet to give to the creditors. In the absence of any resolution the case was left in the hands of the Official Receiver to be wound up in bankruptcy.

A first meeting of creditors was held the same day under a receiving order made against Edgar Morgan & Co., described as importers and shippers, of 24, Southwark Street, E.C. The receiving order in this case was also made on the petition of Johnson and Phillips, Ltd. The chairman reported that he understood that the members of the firm were practically the same as in Charles Ley & Co., but no one had surrendered under the receiving order. An Inspector had attended at 24, Southwark Street, and found that the landlord had distrained for his rent. He had received information to the effect that large quantities of goods (mainly electrical fittings) had been obtained on credit by the firm from wholesale houses, who appeared to have supplied them without making any inquiries. The estate was also left in the hands of the Official Receiver.

David Smith & Co., formerly dealers in electric lamps, 2 and 3, Red Lion Court, Fleet Street, E.C.—The first meeting of creditors was held on April 29th, before Mr. Egerton S. Grey, Official Receiver, at the London Bankruptcy Court, under a receiving order made on April 7th, upon the petition of the Osram Lamp Works, Ltd., judgment creditors for £180. The Chairman reported that a Mr. William Walker had attended under the proceedings as having carried on the business of David Smith & Co. A statement of his affairs showed unsecured liabilities £206 and assets *nil*. On behalf of the debtor an adjournment of the meeting was asked for in order that a proposal for a composition of at least 5s., and possibly 7s. 6d., in the £ might be submitted. The petitioning creditors opposed the application, and intimated that they would not accept 7s. 6d. in the £. The Official Receiver (to the debtor): It is no use kicking against the pricks. If you can come to terms with the petitioning creditors at some future date you can then submit a new proposal. The meeting was closed without any resolution, and the estate was accordingly left in the hands of the Official Receiver.

Charles Blake (Bilston Electrical Co.), electrical engineer, Bilston.—A first and final dividend of 8s. 10d. in the £ is payable on May 11th, at the Official Receiver's office, 30, Lichfield Street, Wolverhampton.

Re Edwin Moorhouse, electrical engineer's traveller, living at 26, Francis Street, Chapeltown Road, Leeds.—The above-named bankrupt applied for his discharge at the Leeds County Court on Monday last. The receiving order was made on December 22nd, 1910, on the debtor's own petition. The liabilities were estimated at £145, and the proofs lodged amounted to £238, creditors for the remainder of the amount having failed to prove their claims. Prior to this failure debtor had been adjudicated bankrupt in 1891. He said that it was impossible for him to make any offer to his creditors. His Honour Judge Graham suspended the discharge for two years.

Tom Murray Woodcock, electrical engineer, 64, Holly Street, Sheffield, York.—The following are creditors:—

General Electric Co.	£72
Scattergood & Johnson	39
Drake & Gorham	18
International Correspondence Schools	21
British Westinghouse Co.	31

W. Walker (trading as D. Smith & Co.), dealer in electric lamps, formerly of 2 and 3, Red Lion Court, E.C., present address unknown.—Adjudication order, April 29th.

The Globe Associated Cable and Telegraphic Services, Ltd., Hatton House, 20 to 23, Holborn, W.C.—First meetings of creditors and contributories, May 12th, at 33, Carey Street, W.C.

Catalogues and Lists.—Messrs. Anderson's Bristol Rubber Co., Ltd., High Street, Bristol.—Sixty-four-page illustrated catalogue (No. 265), containing particulars and prices of rubber goods, engine packings, rubber hose, machine belting, tires, &c.

Messrs. A. Seage & Co., Cambridge Switch Works, Hammersmith, W.—Illustrated and priced leaflets of variable resistances, dynamo switchboards, distribution boards, knife switches, accumulator switchboards, and ironclad fuses.

Mr. P. W. Rands, Caxton House, S.W.—A copy of *Rand's Plant*, which is a register of motors, dynamos, engine and dynamo sets, motor-cars, &c., in stock and the prices of same; also a leaflet relating to electric cookers.

Messrs. Krupka & Jacoby, Ltd., 26 to 36, Chapter Street, Westminster, S.W.—Illustrated price lists as follows:—H F. dealing with Holophane fittings (reflector bowl and sphere); FI and FIa showing electric fans oscillating, ceiling, and desk types.

The Lunken Co., Ltd., 35, Great Dover Street, London, S.E.—12-page pamphlet giving an illustrated description of their power meters or integrating indicators. Four pages are occupied with symbols and equations for English and metric measurements respectively.

Messrs. T. & E. Wannbacher, 5, Appold Street, London, E.C.—Three illustrated lists dealing respectively with centrifugal pumps ("A" type), ditto H.W.Z. small type, and rotary lift and force pumps.

Messrs. C. E. Lugard & Co., Chester.—12-page illustrated pamphlet describing Hegenscheidt's high-speed wheel lathes.

Messrs. W. Geipel & Co., Vulcan Works, London, S.E.—Table of aluminium conductors on card for hanging.

The Western Electric Co., Ltd., Norfolk House, Victoria Embankment, London, W.C.—The second edition of the company's catalogue of telephone apparatus and accessories is an excellently produced volume of close on 200 pages. It contains some fine specimens of the illustrator's art, the effect being enhanced by colour printing in the case of the London to Birmingham trunk telephone cable (dry core paper insulated); some of the pictures show cable-laying operations in progress, and one a consignment of telephone cable on board ship for China. The opening section of the book shows, and clearly prices, auxiliary sets, interphones, switchboards, and telephones for various classes of service; the second part details a host of telephone accessories; the third deals with line material; and following these are important sections relating to the Western electric machine switching system; telephone, power and electric light cables; and loading coils. A number of useful tables, as well as general business information, and a telegraph message code, are well laid out, indeed the arrangement of the catalogue leaves nothing to be desired.

Messrs. Veritys, Ltd., 31, King Street, London, W.C.—Illustrated price-leaflet No. 773 relating to the Aston-Imperial electric vacuum cleaner.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Leaflet (F 1,809), gives illustrations and reduced prices of "Aluminium Striplite" and "Narro Striplite."

Messrs. R. S. Price, Ltd., 12, Norfolk Street, Strand, London, W.C.—Ten-page publication, giving a general description, with explanatory diagrams, of the "Iona" steam turbine, its construction, guide passages, capacities, speeds and dimensions.

Mr. Chas. E. Miller, Reade Street, New York.—Two hundred and fifty-page illustrated and priced catalogue of supplies for motor-cars, motor-boats, motor-planes, &c.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.—New folder (No. 10,330) containing illustrations and prices of various forms of "Veluria" glassware for semi-indirect lighting. Quantities of this publication, overprinted on front cover as desired by the trade, may be obtained.

Messrs. E. Brook, Ltd., Colne Road, Huddersfield.—May stock list (8 pages), with prices, of single, two and three-phase motors.

Edison & Swan United Electric Light Co., Ltd., Ponder's End. Leaflet No. B3,013, giving electrical data, dimensions and prices of E.C.C. dry cells, for which they hold the sole selling rights for the United Kingdom.

We have received a small pamphlet of 8 pages relating to the centenary of Messrs. Hardy & Padmore, Ltd., of Worcester Iron Foundry—an interesting story of a grand old firm.

Trade Announcements.—The Edison and Swan United Electric Light Co., Ltd., will be opening, next week a West End showroom, situate at 71, Victoria Street, Westminster, S.W., required owing to increased trade throughout the whole of the West End area. The showrooms will contain an extensive display of all Ediswan electrical accessories, lamps, electric heaters, fans, fancy fittings, glassware, suction cleaners, flat-irons, cooking utensils, &c.

Messrs. Nalder Bros. & Thompson, Ltd., inform us that the agreement for the agency which has been held for some years past by Messrs. Frampton & Paine, of 29, Old Queen Street, Westminster, has now expired. Pending new arrangements, all inquiries should be sent direct to Nalder Bros. & Thompson, Ltd., 97a, Dalston Lane, London, N.E.

Trade catalogues and lists are wanted by Messrs. Golden and Halton, mechanical and electrical engineers, Lincoln Chambers, Lincoln Place, Dublin.

Condenser Protective Gear.—The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have concluded arrangements to supply the Moscicki condeser and Giles valve in this country in those cases where the protective gear forms part of the general scheme of switchgear. For South Africa, China (excluding Southern Manchuria), Australia and India, they have the sole right of sale and representation. The G.E.C. are now prepared to quote for such gear for the protection of overhead and underground lines and power houses, in addition to their standard lightning arrester equipments.

Book Notices.—We have received from Messrs. Laing, Wharton, Ltd., the first number of a new bi-monthly magazine entitled, "La Haute Tension," which will be issued by Messrs. Vedovelli, Priestley & Cie., of 160, Rue St. Charles, Paris. Its purpose is to deal with questions relating to high-pressure apparatus and other electrical matters.

We have received a copy of the *Hydro-Electric Bulletin* for April. It is the first number of a small monthly magazine issued by the Hydro Electric Power Commission of Ontario. Its object is "to encourage co-operation between municipal electrical utilities and the economical use of electrical energy in the province of Ontario."

"*Journal* of the Institution of Electrical Engineers." Vol. 52, No. 233. May 1st. London: E. & F. N. Spon, Ltd. Price 3s. 6d.—This issue contains the following papers:—"The Signalling of a Rapid-Transit Railway," by H. G. Brown; "Some Methods of Improving the Power Factor in Alternating-Current Circuits," by G. Stevenson; "Experiments on Air-Blast Cooling of Transformers," by F. J. Teago; and "Electric Lighting of Cottages," by W. Fennell.

Liquidations and Dissolutions.—The Midland Electric Corporation (1900), Ltd.—This company is winding up voluntarily, with Mr. H. E. Abbott as liquidator. A meeting of creditors was held yesterday, May 7th.

The Rose Automatic Target Co., Ltd.—A meeting of creditors will be held at 8, Princes Street, on May 18th.

E. D. Bonney & Co., plumbers, glaziers and electricians, Bowness-on-Windermere.—Messrs. E. D. Bonney & M. S. Turner have dissolved partnership. Mr. Turner will attend to debts.

LIGHTING and POWER NOTES.

Abercarn (Mon.).—Prov. Order.—A prov. order for E.L. within the area of the U.D.C. has been granted by the B. of T. to the South Wales E.P.D. Co.

Aberdovey.—Proposed E.L.—The U.D.C. is making efforts to get an electric supply installed for public lighting. Plans and other particulars were sent to the Charity Commissioners in January last, with an application for power to use the water power available at Dolgoch for the provision of electric lighting, but no reply has been received to the application.

Accrington.—Year's Working.—The output of the electricity undertaking for the year ended March 31st last was 5,855,929 units, made up as follows:—Lighting, 503,310; power, 3,838,037; Haslingden bulk supply, 435,015; tramways, 949,054; street lighting, 60,481; rateable value supply, 70,032 units.

Algeria.—The central electricity station at Algiers, which has a capacity of 8,500 kw., is to be extended by the addition of two 3,000-kw. steam turbines and generators.

Ashton-under-Lyne.—Electric Lifts.—The L.G.B. has sanctioned an expenditure of £666 on the provision of two electric lifts at the workhouse hospital.

Australia.—A committee of citizens of Ipswich (Queensland) and district has issued a report on the possibility of establishing an electric supply in the area. Ipswich is situated on a coalfield, estimated to cover 12,000 sq. miles, and apparently having a number of small pits, turning out 600,000 tons per annum ; it is some 22 miles from Brisbane. The promoters of the scheme are anxious to interest a syndicate in the matter, and point out that if a plant were established there it would be able to cope with the demand for power in the pits, the domestic and public lighting in Ipswich, power for the 20 factories and works there, also for the Council's pumping plant and suggested tramways, for lighting adjoining areas which have no gas or electric supply, and the townships on the route to Brisbane and in the Brisbane area itself. There is no electric supply in Ipswich at present, and gas costs 6s. 8d. per 1,000 cb. ft. for lighting. The committee estimates that 5½ million units per annum would be disposed of, with a working load factor of 57 per cent., and using a turbine plant, the total cost should be ·83d. per unit. The cost of generating and distributing plant is estimated at £92,000. The local authorities concerned have decided not to support any other scheme for six months. Mr. S. H. Hancox, of Ipswich (Q.), is the hon. secretary of the committee.

Brierfield.—The U.D.C. has come to an agreement under which the Nelson T.C. will supply the Brierfield district with electricity for seven years.

Brighouse.—Mill Driving.—The Electricity Committee, on the application of Messrs. John Cheetham & Sons for a supply of A.C. for power at the Calder Bank Mills, has agreed to supply current at ¾d. per unit net, plus the usual coal clause ; the agreement is to be for three years, and the minimum consumption is to be 80,000 units per annum. Owing to this extra demand the Committee has given notice to the Yorkshire E.P. Co. to increase the A.C. supply to 400 KW.

Bristol.—In regard to the illumination scheme for the Bristol Exhibition, referred to last week, we are informed by the contractors (Electrical Engineering and Equipment Co.) that the main lighting will be carried out entirely with half-watt lamps.

Bury.—Bulk Supply.—The application of the T.C. for an order to dispense with the consent of the Lancashire E.P. Co. for the supply of electricity in bulk to Heywood has been granted by the B. of T.

Canada.—The Ontario Legislature has voted $5,000,000 for the extension of the undertaking of the Ontario Hydro-electric Commission.

China.—Shanghai Annual Report. — The always interesting report of Mr. T. H. U. Aldridge, chief engineer, on the year's working of the Shanghai municipal electricity undertaking for 1913, points out that the new Riverside station was opened in April last and that the cost of production has fallen 15 per cent., although this station was not in full working. The plant capacity of the two stations is given as 10,400 KW. ; the maximum load was 8,650 K.V.A., as against 6,000 K.V.A. in the previous year, the increase of 2,650 K.V.A. comparing with 1,993 K.V.A. in 1912. The load factor has risen from 23·5 to 30·8 per cent., and the output from 12,130,537 to 21,888,230 units. The improved load factor is attributed not alone to the additional power load, but also to the more general use of electric lighting by Chinese, who, as a rule, use their lamps for much longer hours than foreigners. During the year 178 miles of overhead and underground mains were added, and to meet additional demands four 2,000-KW. transformer sub-stations are being erected. For street lighting, 125 arc and 1,098 metal lamps are in use ; a large number of enclosed arcs have been replaced by metal lamps with improved lighting results. The service connections now number 10,987, and the lighting connections 429,121 equivalent 30-watt lamps. At the end of the year 623 hired and 60 private radiators were in use, and 43 electric cookers ; it is anticipated that a further 500 radiators will be added this year, this form of heating being popular with the Chinese. The power connections have nearly doubled, some 6,000 H.P. of motors being now connected, while the prospects of the present year point to motor connections reaching 10,000 H.P. In some of the electrified mills the yarn production has increased by 15 per cent. and 10 per cent. is considered a safe estimate. The extensions this year are to include two 5,000 KW. turbine units at Riverside ; the machines will cost only £2·01 per KW. as against £3·1 per KW. for the existing 2,000-KW. machines, and be smaller owing to their higher speed. Two 11,000-volt trunk mains are being laid between the two stations, and the central district is to be largely changed over from single to three-phase supply. After providing for capital charges, depreciation, contribution to the rates and other charges, the net profit on the year was taels 69,381.36, and it is calculated that had the new plant been ready earlier and the mains not overloaded, an additional surplus of taels 29,000 would have accrued.

Chorley.—Prov. Order Granted.—The B. of T. has issued a prov. order empowering the Lancashire E.P. Co. to supply electricity in the borough.

Colne.—Proposed Plant Extensions.—The borough electrical engineer has been requested to prepare a report on the proposed installation of new generating plant at the electricity works, &c.

Continental Notes. — Germany.—Some interesting information has just been made available as regards the electric supply undertakings in the Province of Pomerania. It appears that some years ago it was decided to keep the electricity supply in the hands of the provincial authorities, a Provincial Committee being formed for the purpose. A start was made in 1910, since which time a number of overland electricity stations have been established, the capacity of the same being now 35,000 KW. The high-tension mains (40,000 volts) extend to about 475 miles, while there are also 4,600 miles of 15,000-volt mains, as well as over 2,000 transformer stations. Current is being supplied to no less than 46 towns (including Stettin, the largest in the Province), to 675 villages, and to 1,250 estates and private consumers. Twenty-six sub-districts of the Province are interested in the undertaking, in which £2,150,000 is invested. Although the oldest of the plants only dates back about two years, the undertaking is already proving a financial success, and with the view of providing the funds for further extensions, the Provincial Landtag has just voted an additional sum of £225,000.

The West Prussian Provincial Landtag has decided to construct an electric power station on the Schwarzwasser, near Groddeck, at a cost of £250,000.—*Elektrotechnische Nachrichten.*

The Bielefeld T.C. has voted £80,000 for extensions of the electricity works, to enable the whole of the surrounding district to be supplied.

The large generating station which is being built near Bockum a/Lippe by a semi-communal company, will be assisted by the generating plants of a number of collieries ; a large portion of Westphalia will be covered by the network.

A meeting of representatives of urban and rural authorities in the Cassel district has recently been held in Hanau to consider a project for utilising the water-power rendered available by the canalisation of the River Main. It was resolved to take further steps towards the realisation of an extensive scheme.

The War Minister has announced that, petrol gas lighting having been found too expensive, electric lighting will in future be adopted for all new barracks, and that the conversion of all remaining existing buildings is contemplated.

Belgium.—La Société de Gaz et d'Electricité du Hainaut has decided to establish a third electricity generating station near La Louviere.

Portugal.—The Compagnie Reunies de Gaz et Electricité, of Lisbon, has decided to increase its capital, with the view of establishing a new electricity generating station.

Spain.—A number of schemes for the utilisation of water-power in the Province of Lerida are under consideration. One is the utilisation of the water-power of the River Noguera Ribaogorzana, at Vielle, where over 13,000 H.P. is stated to be available ; another (about 2,100 H.P.) is to be on the River Garona de Ruda, at Tredos ; while a third plant (5,300 H.P.) is to be on the River Mola, at Bagergue.

Russia.—At Bogorodsk, near Moscow, an electric lighting company has acquired an extensive peat bog with a view to utilising the same as fuel for the generation of electricity. It is proposed to establish one of the largest electricity generating stations in Russia near the peat deposits, and to supply current to Moscow and within a wide radius of the plant.

Norway.—The municipal authorities of Risor have approved of the project of a Christiania firm to utilise the water-power of the Hogefossenes Falls, near Treungen, for the generation of electricity in the town, which is about 6 miles away from the Falls. A company is to be formed, with a capital of nearly £70,000, to carry out the scheme, and about 25,000 H.P. is available.

A company has been formed, with a capital of £10,000 and the title, the Bremanger Kraftselskab, to establish an electric generating station at Bremanger.

Coventry.—Annual Report.—The report of the Electric Light Committee states that during the year the number of consumers increased from 2,157 to 3,175, and the number of units sold from 13,337,482 to 16,508,338. The revenue amounted to £71,207, compared with £60,521 in the previous year. The gross profit was £42,832 ; capital charges took £21,082, the result being a net profit of £21,749, against £16,245 in the previous year. The Committee recommended that £6,000 be paid over to the rates ; £16,250 be paid to the reserve fund, and that £13,250 of that amount be applied in lieu of raising a loan :—£2,000 for house services, £2,000 for sub-station equipment, £4,250 for cooling towers, £5,000 for laying of mains in streets where the work is not likely to be immediately productive. Also that £375 be applied in payment of a bonus to the employés in the department. On the presentation of the report to the Council it was agreed to increase the rate aid to £6,000 ; it was also agreed as from April 1st to reduce the power rate for L.T. consumers to 1d. per unit all round, and to amend the scale of H.T. power charges which will, from the same date, range from 1d. per unit up to 50,000 units per quarter to ·6d. per unit for all exceeding 375,000 units per quarter.

Criccieth.—E.L. Scheme.—Messrs. A. J. Leigh and Partner, of Northwich, have been appointed consulting engineers to the U.D.C. electricity scheme.

Dewsbury.—New Plant Inaugurated.—On April 30th, the members of the T.C. officially inspected the extensions recently carried out at the electricity works at a cost of £11,000. This includes two new Babcock boilers, with induced draught apparatus, having a rated output of 25,000 lb. steam per hour ; a low level jet condenser, supplied by Messrs. W. H. Allen ; a Harris feed purifier; and a 1,000-KW. Brush disk and drum turbine coupled to two generators in tandem, with Ferranti switchgear. Other items include an air-filtering apparatus for the generators, Leskole distance thermometer for bearing temperatures, CO_2 recorder, &c.

Durham.—School Lighting.—The C.C. has accepted the offer of the County of Durham E.P.D. Co. to supply electricity for lighting to the County Industrial Schools, at 3d. per unit.

Edinburgh.—Estimates for 1914-1915.—The estimated revenue of the E.L. department for next year is £150,480, as against £140,620 received last year, and the expenditure is estimated to amount to £83,025, as compared with £76,136, actual, for 1913-14. The T.C. has received sanction to its application for an E.L. order authorising it to supply electricity to five parishes in Mid-Lothian.

German East Africa.—According to *African Engineering*, arrangements are being made for utilising the Pangani Falls for supplying electricity for agricultural purposes, the lighting of Tanga and the electrification of the Usambara Railway.

Hebden Bridge.—The Electricity Committee has decided to grant the application of the Hebden Bridge Fustian Manufacturing Society for a supply of electricity, provided the firm pays half the cost of laying the service.

Heywood.—Year's Working.—There was a loss on the electricity undertaking for the past year of £2,840, against a deficit of £4,118 in the previous year. On the tramways undertaking there was a loss of £364, against £808 in the previous year.

Irvine.—Prov. Order.—The T.C. has consented to the Kilmarnock E.L. prov. order. It had previously decided to take a supply from Kilmarnock, but the Irvine T.C. has now secured distributing powers for its own area.

London.—The companies supplying electricity in the areas of the Lambeth and Camberwell B.C.'s having intimated their intention to increase the price of current for lighting, owing to the continued high cost of coal, &c., the Councils have decided to make representations to the Board of Trade to have the decision altered. It is pointed out as regards Lambeth, that the working costs of the South London E.S. Corporation are amongst the lowest in the metropolitan area.

The Bethnal Green B.C. has been recommended by its E.L. Committee to appoint Mr. J. F. C. Snell as electrical engineer to carry out his E.L. scheme for the borough, at a remuneration of £5 per cent. on the capital expended.

Lowestoft.—Electrical Exhibition.—The recently-closed Electrical Home Exhibition is reported to have been very successful. The electricity department's stand was a leading feature, appliances having been contributed by the leading electrical firms. A series of electric cooking demonstrations was held on Eclipse and Belling cookers, which, we understand, has stimulated business in this direction in the town.

Korea.—Up to the end of last year, official permission had been granted to 18 companies to undertake electrical enterprises in Korea. The aggregate capital amounted to £1,188,000, and the total capacity of the proposed generating plants was 8,100 KW. Fifteen electrical companies, with a paid-up capital of £649,784, were actually engaged in business. The number of consumers of electricity was 11,058, and a total of 77,880 lamps were installed. A small central station has been started at Suwon, while others are in course of construction at New Wiju and Hamheung.

Newcastle-under-Lyme.—The T.C. has applied to the Stoke-on-Trent T.C. for permission to supply electricity in Lancaster Avenue, Newcastle, which is within Stoke County Borough, and is at present supplied with gas by Newcastle. An agreement for the protection of the Stoke Council is to be prepared.

Redruth.—Street Lighting.—The U.D.C. has only received one tender, that of the Urban Electric Supply Co., for public lighting. The tender is to be discussed *in camera.*

Rickmansworth and Chorleywood.—Prov. Order.—The B. of T. has granted the Colne Valley E.S. Co. an order to supply electricity within the areas of the Rickmansworth and Chorleywood U.D.C.'s and part of the rural district of Watford.

Rotherham.—Annual Report.—The annual report of the borough electrical engineer states that the cost of coal last year increased by £744. The total cost per unit was ·651d., compared with ·757d. in the previous year, and the output increased by 32·68 per cent. The total receipts were £26,376, as against £21,849, and the net profit was £7,358, against £5,179. He recommends that power for traction purposes be reduced from $1\frac{3}{8}$d. to $1\frac{1}{4}$d. per unit, which represents a concession of £1,000 per annum.

L.G.B. Inquiry.—Mr. T. C. Ekin held an inquiry, on April 29th, into the application of the T.C. for powers to borrow £19,956 for extensions to the electricity works. The Council had received applications for a further 1,000 H.P., and the electrical engineer stated that he would not be surprised if the output in three years' time reached 10,000,000 units per annum.

Skelton and Brotton.—Proposed Loan.—The L.G.B. has intimated to the U.D.C. that it is prepared to sanction a loan of over £9,000 for the E.L. scheme, on condition that the B. of T. first consented to the use of overhead wires. Steps are being taken to get its consent.

Stockton Heath.—Proposed E.L.—The Parochial Committee has decided to ask the Warrington T.C. upon what terms it would supply electricity to Stockton Heath.

Thirsk.—Workhouse Lighting.—Owing to the high price of gas the B. of G. has requested the House Committee to consider the advisability of installing E.L. plant at the workhouse.

West Bridgford.—Proposed E.L.—At the annual meeting of the U.D.C., the chairman intimated that during the year the Council would have to take up the E.L. question, which had been deferred. The Council favours having its own prov. order.

West Bromwich.—Year's Working; Proposed New Battery.—The revenue of the T.C. electricity department for the year ended March 31st last amounted to £18,106.

The Electricity Committee has recommended that a storage battery be installed at a cost not exceeding £5,000, to meet the demand next winter.

Whitstable.—Overhead Wires.—The U.D.C. has received a petition, signed by 420 ratepayers, asking the Council and the Kent C.C. not to agree to the use of overhead mains attached to wooden poles for the proposed E.L. scheme. The Council decided to request the E.L. Co. to meet the Council to consider the pattern of the poles to be erected in the main streets.

Worthing.—Public Lighting. — The General Purposes Committee of the T.C. has accepted the terms of the Electricity Committee for lighting the Steyne Gardens, at an initial cost of £240, the Committee to pay $3\frac{3}{8}$d. per unit for current and £10 p.a. for maintenance, fixing, and renewal of plant.

York.—Proposed Plant Extensions.—The Electricity and Tramways Committee has recommended the T.C. to seal an agreement to which it has come with the Bishopthorpe R.D.C. with reference to the price of electricity which it proposes to supply to the rural area.

A sub-Committee appointed to consider the advertising and extension of the electricity undertaking, and a free wiring scheme, has reported that new mains and plant are necessary, and recommends the Council to apply for L.G.B. sanction to a loan of £19,150 for the following purposes:—Feeder cable, £5,500; rotary converters and sub-station buildings, £3,000; further mains and transformers, £3,700; prospective services, £3,000; rotary converter and transformers at the central station, £1,500; and £455 over-spent on a previous loan.

TRAMWAY and RAILWAY NOTES,

Aberdeen. — Tramway Surplus. — The T.C. has secured powers to appropriate each year from the free surplus revenue of the tramway undertaking, any sum not exceeding a third of such surplus towards reduction of the rates, or to carry out city improvements.

Belfast.—Year's Working.—The total revenue of the Corporation's tramways for the past year amounted to £272,000, and the gross profit was £112,000. The net profit was £51,500, or nearly £2,000 less than the previous year, due to the added debt interest on the extensions being £2,500 higher. £9,000 has been placed to the general purposes fund, £31,353 to the sinking fund, and £17,000 to the depreciation fund.

Blackburn.—Annual Report.—The revenue of the T.C. tramways department for the past year amounted to £69,403, as compared with £64,559 in the previous year. The working expenses were £47,170, an increase of £4,600. Repayment of loans, interest, &c., amounted to £20,157, and the net profit was £4,011, against £3,870 in the previous year. The passengers carried numbered 12,734,532, an increase of over one million, and the car mileage was 1,149,462, an increase of 72,768. Current consumption averaged 1·64 units per mile.

Continental Notes.—Switzerland.—The Swiss Railway Department has drawn up a scheme for the adoption of electric traction on the St. Gothard Railway between Erstfeld and Bellinzona, which is estimated to cost 37 million francs. Single-phase current will be used, eventually at 10,000 to 15,000 volts; but owing to the necessity of using steam traction and electric traction simultaneously during the conversion, a pressure of 7,500 volts will be provisionally adopted. It is stated that the scheme will enable the importation of coal to be reduced by 2 to 3 million tons a year. Battery locomotives, charged at night, will be used in the yards and for local traffic. There is plenty of water power in the neighbourhood of the line.

Germany.—Most of the fire engines and escapes in Berlin are horse-drawn, but it has recently been decided to replace these as rapidly as possible by accumulator vehicles. Fire engines intended for long journeys will have a petrol engine both for propulsion and for pumping, but those for city use only will be driven by accumulators; these will, however, each have a petrol engine to drive the pump, and a dynamo will also be coupled to the engine, so that in emergencies the battery of the vehicle itself, and of electrically-driven escapes, &c., can be charged at the scene of the fire.

Doncaster.—Proposed Extensions.—The T.C. has been informed that sanction to the proposed tramway extensions to Woodlands and Warmsworth is about to be issued.

Dudley.—The T.C. has been recommended to remove the tramway poles in Birmingham Road and Queen's Cross, and convert the present overhead construction to the span-wire system, at a total estimated cost of £330.

Glasgow.—Tramway Insurance.—The T.C. has decided to carry its own insurance against third-party risks in connection with the tramways. The insurance company required a premium of £31,000 per annum for the next five years.

Japan.—The Shikizan Cable Railway Co. has been granted a charter for the construction of an electrically-operated cable railway between Sano and Tochino (Ikomangun). The line will be 1 mile 29 chains long, and is estimated to cost £20,000.

London.—The electrification of the L. and N.-W. Railway between Earl's Court and Willesden has been completed, and electric cars commenced running on May 1st. Owing to the L. and N.-W. electrically-equipped rolling stock not having been delivered, the Metropolitan District Railway has lent the necessary trains.

The preamble of the L.C.C. Bill for the construction of a single-track tramway round Trinity Square, and a double line from Tower Hill to Aldgate, in order to abolish the dead end at Aldgate, has been found proved by a House of Commons Committee.

The B. of T. has granted the L.C.C. permission to run trailer tramcars on several routes, and the Highways Committee is considering the matter.

The Highways Committee has recommended the Council to continue the agreement, whereby the Bexley U.D.C. pays 6½d. per car-mile from July, 1913, to March, 1914, and 6d. per mile from April, 1914, to July, 1918, for running powers over the L.C.C.'s track from Wickham Lane to Beresford Square, Woolwich.

Morecambe.—Proposed Electrification.—The T.C. has authorised the Tramways Committee to obtain particulars regarding electric tramways, with a view to the conversion of the Council's horse-drawn system.

Preston.—Year's Working.—The net profit on the Corporation's tramway undertaking for the past year amounted to £7,410.

Rochdale.—B. of T. Report.—The report of Lieut-Col. E. Druitt on the tramway accident of February 4th, when a tramcar left the rails at the corner of John Street and Smith Street, states that the magnetic brake was not applied until the car was on the steep gradient from Fagan Street, and that the driver did not follow instructions and put the controller to the last braking notch. The car probably got out of control through attaining a high speed while the controller handle was on the third braking notch, and when it was put on the last notch the wheels locked and skidded. The Inspector states that the sander on the car was not efficient, and, at his suggestion, on a number of the cars the sanders have been converted from an intermittent to a continuous type with satisfactory results.

Rotherham.—Annual Report.—The receipts of the T.C. tramways for the past year amounted to £44,565, against £40,258 in the previous year. The passengers carried were 9,874,231, and the car-miles run totalled 852,639. The net profit was £5,037, a decrease of £750, attributed to the miners' strike. There was also a surplus of £1,009 on the railless-traction vehicles, and of £508 on the motor-'buses.

Salford.—The Tramways Committee is setting aside £2,000 out of the current year's revenue of the tramway undertaking in order to form a fund for the payment of third-party compensation claims, &c.

South Shields.—Proposed Extension.—A Sub-Committee of the T.C. has been appointed to consider proposals to link up the South Shields tramway system with the Sunderland system, a distance of 6½ miles, and to extend the tramways to Boldon Colliery.

TELEGRAPH and TELEPHONE NOTES.

Bolivia.—The Government has issued bonds to the value of 300,000 Bolivianos for the construction of wireless telegraph stations at Yacuiba and Riberalta.—*Review of the River Plate.*

Cable Tariffs.—The revised tariff for week-end messages to Australasia came into force on May 1st. Similar facilities for such messages to Australasia, South and East Africa, India, Burmah, and other places were announced by the Eastern Telegraph Co. from the same date.

Hull.—At a meeting of the Finance Committee, on April 30th, it was reported that sanction had been received from the L.G.B. to the borrowing of £192,423, for the purchase from the Postmaster-General of the National Telephone Co.'s plant in the Hull area, the period allowed for repayment being 19 years from the date of the borrowing of the amount.

Excess Telephone Calls.—In an action brought by the Postmaster-General to recover £1 for calls in excess of the number allowed for 30s., on Monday, the Judge decided that a demand note was sufficient evidence of the amount due, and found for the plaintiff, but granted leave to appeal. In another case on the same day the Judge disallowed as unjust an item of 15s. for the use of the telephone during a period when it was cut off owing to a dispute over excess calls.

Imperial Wireless System.—The Select Committee of the House of Lords last week issued its report on the charges against Lord Murray. The report was unanimous, and stated that Lord Murray committed errors of judgment, but nothing in his conduct reflected upon his personal honour. In the Committee's opinion, there should be henceforth an inflexible rule to preclude those who held any public office from entering upon any speculative transactions in stocks or shares in any circumstances whatsoever. This rule should be by them inculcated on their subordinates both by precept and example. The evils that might arise from a violation of this principle were incalculable.

Post Office Expenditure.—On the vote in Parliament for the expenses of the Post Office, on Thursday last week, the P.M.G., Mr. Hobhouse, said that the total expenditure would be £26,150,000, an increase of £1,770,000 over last year. The engineering staff accounted for only half a million. The revenue expected was £31,750,000. The income from telegraphs was £3,150,000, and the expenditure £3,500,000; telephones brought in £6,900,000, and cost £6,600,000, the surplus on the latter approximately balancing the deficit on the former. During the last 40 years the loss on telegraphs had amounted to 22 millions, mainly due to the action of the House of Commons in adopting sixpenny telegrams (which cost 11d.). The above deficiency is in addition to the capital charges on the purchase money. The total expenditure on telephones was £28,262,000, and they were now valued at about 23 millions. It was impossible to secure enough skilled workmen to maintain and extend the service sufficiently quickly, but they were being trained at schools in London and elsewhere, and turned out at the rate of three or four thousand a year. In the country 23,000 party-line telephones were installed, an increase of over 1,400, and the demand was increasing rapidly. He proposed to extend the automatic telephone system as soon as possible. Regarding telephone charges, he could not offer much reduction, but hoped to introduce an improved measured service and subscribers' check meters. There were nine coastal wireless stations at work, and one was being built at Valentia. He hoped to re-arrange them for internal communication on an extensive scale. The sites of the two Imperial stations in England had been purchased at Leafield and Devizes; the erection of plant at the former had been begun, and work was in progress on the stations at Cairo and Ismailia, and Poonah. The Marconi Co. was in a dominant position in wireless telegraphy, and had only one serious competitor—the Poulsen Co. If the latter could demonstrate its ability to give an efficient service, he would gladly give it a licence, but no such proof had yet been given.

The Telephone Service.—A referendum was recently instituted in the City of London by the Parliamentary Telephone Committee; 1,500 question forms were sent out, of which nearly half were returned. In reply to a question whether the local service had deteriorated since the transfer to the Post Office, says the *Standard*, 50 per cent. said "Yes," 11 per cent. "Deteriorated, but now better," 29 per cent. indicated "No change," and 10 per cent. "Improved."

Thirty-eight per cent. said that their lines and instruments were frequently out of order, but 62 per cent. replied "Not often." Similarly, 36 per cent. experienced frequent difficulty in getting through to the exchange, but 64 per cent. did not. As to trouble in getting through to subscribers on other exchanges, 33 per cent. reported "No difficulty," 19 per cent. "Not often," and 48 per cent. "Frequent trouble." A considerable majority of replies indicated that wrong numbers were often given. To the question: "Do you frequently get cut off in the middle of a conversation?" the replies "Yes" and "Very frequently" proportioned 65 per cent., "Occasionally" 21 per cent., and "No" 14 per cent. As to the "no reply" grievance in business hours, "Frequently" and "Very frequently" were the answers to the question of 52 per cent.; "Occasionally" and "No" represented the other 48 per cent.

With regard to being rung up in mistake, 70 per cent. replied "Frequently." Fifty-nine per cent. had no trouble in calling the operator's attention in such circumstances. When trying to obtain a clear line after a conversation, in order to give a fresh number, 59 per cent. are generally successful, but 19 per cent. report that there is "Sometimes difficulty." Forty-six per cent. have "Difficulty" or "Very great difficulty" in securing the operator's attention, after failing to obtain an answer to a number asked for. Sixty-three per cent. state that the authorities pay prompt attention to complaints and removal of faults. Of the remainder, 27 per cent. say "No," and 10 per cent. state that they "Get attention, but no improvement." Seventy per cent. say that the practice as regards subscribers' contracts and accounts is unsatisfactory.

The trunk service is considered satisfactory by 78 per cent., but 73 per cent. say that the charges are "Unreasonable" and "Excessive."

To the question:—"In your view, is it more important that the telephone service should be highly efficient or that the rates should be reduced?" seventy-three per cent. reply: "Efficient service"; 20 per cent. hedge with "Efficient, but rates reduced"; while the remaining 7 per cent. ask for reduced rates. "Is it your experience that a large proportion of your daily calls are ineffective ?" To this 52 per cent. replied "No," 42 per cent. "Yes," and 6 per cent. "Very many."

Replying to a question in Parliament, Captain Norton says it is estimated that the extension of the telephone system will involve the expenditure during the current financial year of approximately the following amounts:—

	London.	*Provinces.*
Exchange equipment	£145,000	£160,000
Subscribers' station equipment ...	70,000	120,000
Junction wire cables between exchanges...	95,000	250,000
Subscribers' cables and distributing cables and wires	300,000	1,000,000
	£610,000	£1,530,000

Wireless Telephony. — It is reported that the Marconi Co. is now installing wireless telephone equipments on Italian warships, capable of maintaining communication over a range of at least 50 km. under all conditions.

CONTRACTS OPEN and CLOSED.

OPEN.

Argentina.—May 16th. Public electric lighting of the City of Tucuman, for the Municipality. Guarantee deposit of $5,000 to accompany tender.—*Review of the River Plate.*

Ashton-in-Makerfield.—May 11th. D.C. overhead transmission line, with switchboards and internal wiring for power and lighting, for the sewage disposal works. Messrs. Banks, Fairclough & Stephen, civil engineers, Leigh.

Australia. — May 26th. Adelaide Tramways Trust. Overhead tramway equipment and construction. Board of Trade Commercial Intelligence Department in London.

Sydney.—July 20th. Box compound, meters, maximum-demand indicators, arc lamp carbons, and straight-stem insulators, for the Council. Specifications for each section 10s. 6d., from City Electrical Engineer, Town Hall.

Melbourne —May 20th. 1,132.000 arc lamp carbons, for City Council. See "Official Notices" May 1st.

Ipswich (Q.)—Syndicate wanted to undertake electricity supply. For particulars of proposed scheme, see our "Lighting Notes."

Balearic Isles.—Tenders have just been invited by the Municipal authorities of Montuiri, Balearic Isles, for the concession for the electric lighting of the town during a period of ten years.

Belgium.—May 16th. The Belgian Post and Telegraph authorities in Brussels (Salle de la Madeleine) are inviting tenders for 195 tons of copper wire for telegraphic purposes.

Birkenhead.—May 18th. 12 months' supply of rough slack and small coal for the electricity stations. Mr. G. P. Shallcross, Borough Electrical Engineer.

Blackpool.—May 20th. Clean rough slack (12,000-15,000 tons) for the Electricity and Tramways Committee. Mr. C. Furness, Borough Electrical Engineer.

Bulgaria.—Sophia.—May 15th. Supply of electrical equipment to the State colliery at Pernik. Deposit 500 fr. Kreis Verwaltung in Sophia.

Bexley.—U.D.C. Six controllers for tramcars; also five cast-iron boxes. Particulars from Mr. L. P. Stokes, Electricity and Tramway Offices, Bexley Heath.

Bury.—May 20th. Corporation. Floor girders, stanchions, &c., for the electricity generating station. Specification from the Borough Electrical Engineer, Bank Street.

Cardiff.—May 28th. Corporation. Pipe work and feed tank. See "Official Notices" to-day.

Carlisle.—Corporation. Steam coal suitable for use on underfeed mechanical stokers, for the Electricity Department. Particulars from Mr. F. W. Purse, City Electrical Engineer, Victoria Viaduct.

Cleckheaton.—May 23rd. U.D.C. 2,000 yards of concentric cable and 2,000 yards of three-core pilot. See "Official Notices" to-day.

Clifton Junction.—May 20th. Electric power station for the L. & Y. Railway. Engineer's Office, Hunt's Bank, Manchester.

Colchester.—May 19th. Corporation. 12 months' supply (5,000 tons) steam coal, for the electricity works. Forms of tender from Mr. W. Frisby, Borough Electrical Engineer, 36, Osborne Street.

Devonport.—May 12th. Steam coal (5,000 tons) for a year, and general engine-room stores. Mr. J. W. Spark, Borough Electrical Engineer.

Dundalk.—May 11th. U.D.C. Diesel generating plant, balancer and booster, motor generator, switchboards, battery, mains, crane, oil pipe line and storage tank. See "Official Notices" April 24th.

Edinburgh.—Installation of electric light in premises at 42, George Street, to be occupied by Messrs. Millar & Stewart as electrical showrooms, &c. Specifications and schedules at 7, Hanover Street.

Hastings.—May 18th. E.L. installation at several schools for the T.C. Borough Electrical Engineer, Earl Street.

Hoylake and West Kirby.—May 8th. Coal for a year for the U.D.C. E.L. works (about 3,500 tons, washed peas). Mr. Chas. J. Turner, Electrical Engineer, Hoylake.

May 11th. U.D.C. Ornamental iron transformer station. See "Official Notices" May 1st.

Hindley.—May 18th. U.D.C. Four-core L.T. paper-insulated lead-sheathed armoured cable, c.i. joint boxes and feeder pillars. See "Official Notices" to-day.

Ilkley. — May 11th. U.D.C. Electricity generating station buildings. See "Official Notices" April 17th.

Keighley.—May 25th. Corporation. One 750-KW. converting plant, for A.C., three-phase, 6,600 volts to D.C. 500 volts. See "Official Notices" to-day.

Leeds.—May 11th. Corporation. Steam turbine, three-phase alternator and exciter, 12,000 KW., 1,000 to 1,500 R.P.M., and condensing plant. See "Official Notices" April 3rd.

June 10th. Corporation. Motor-driven induced draught plant; six water-tube boilers; 12 mechanical stokers; six economisers; three induced draught plants and accessories. See two "Official Notices" to-day.

London.—L.C.C.—Firms wishing to tender for stores and general maintenance contracts should see a notice in our advertisement pages to-day.

Hammersmith.—The Electricity Committee recommends that tenders be invited for the supply of six 100-KW. transformers for fixing at Messrs. Lyons & Co.'s premises at Cadby Hall, W.

Fulham.—May 27th. B.C. 9,000 tons of coal for electricity works. See "Official Notices" to-day.

St. Marylebone.—May 18th. B. of G. Wiring, complete, Infirmary at Rackham Street, Ladbrook Grove, W. See "Official Notices" to-day.

Luxemburg.—May 18th. The municipal authorities of Bertrix are inviting tenders for the concession for the supply of electrical energy for public and private lighting and power purposes in the town.

Manchester. — May 13th. Corporation. 5,000-KW. turbo-alternator complete. See "Official Notices" April 17th.

May 19th. Corporation. For the supply of steel girder tramway rails for the Tramway Committee. Specification from Mr. J. M. McElroy, General Manager, Corporation Tramways, 55, Piccadilly.

New Zealand.—Wellington.—July 9th. City Council. Electric chassis for a 2,000-lb. parcels delivery van, and an electric car, for the Electric Tramways Department. Specification may be seen at the Board of Trade Commercial Intelligence Department in London.

June 1st.—Public Works Office. Oil-break switches for the Lake Coleridge hydro-electric power scheme. Specification can be seen at the Board of Trade Commercial Intelligence Department, London.

Nottingham.—May 21st. (*a*) 650 tons of steel tramway rails; (*b*) 11 tons of steel tie bars, City Tramway Committee, Specifications, &c. (£1 1s. each), from Mr. A. Brown, City Engineer.

Plymouth.—May 21st. Corporation. For the supply of 9,000 tons steam coal for use with mechanical stokers for the Electricity Department. Forms of tender from Mr. E. G. Odell, Borough Electrical Engineer, Electricity Works, Prince Rock.

Salford.—May 18th. Erection of sub-station in Robert Hall Street, Salford. Messrs. C. S. Allott & Sons, 46, Brown Street, Manchester.

South Africa.—The Municipality of Worcester, Cape Province, will shortly invite tenders for the carrying out of an electric lighting and power scheme already approved by the ratepayers, and estimated to cost £15,000. Particulars from the Town Clerk, Municipal Buildings.—Orders will shortly be given out for plant and fittings for a £10,000 electric lighting scheme to be undertaken by the Municipality of Beaufort West, Cape Province. Particulars from the Town Clerk, Municipal Building.—*British and South African Export Gazette.*

South Shields.—May 9th. Stores, &c., Tramways Department for 12 months. Mr. W. T. Robson, Tramways Manager, Dean Road.

Warrington.—May 12th. Extra-high and medium-pressure paper cables, for Electricity Department. See "Official Notices" April 24th.

May 12th. Corporation. For the supply of 10,000 tons of slack, for the electricity works. Specification from Mr. F. V. L. Mathias, Borough Electrical Engineer, Howley.

West Ham.—May 16th. Corporation. For 15 double-deck bogie tramcars and one four-wheel single-truck double-deck tramcar. Specifications from Mr. J. S. D. Moffet, Tramways Manager, Greengate Street, Plaistow, E.

May 18th. Corporation. For the installation of low-pressure water heating apparatus, supplemented by electric motor pumps, at the Rosetta Road School, for the Corporation. Application for particulars to be made by May 11th (£1) to Mr. W. Jaques, Architect to the Education Committee, 2 Fen Court, E.C.

Wolverhampton. — May 12th. E.L. installation, Walsall Street Schools, for the T.C. Secretary, Education Offices, Town Hall.

York.—May 12th. Feeder cables for Electricity Department. See "Official Notices" April 24th.

CLOSED.

Australia.—P.M.G.'s Department :—

QUEENSLAND.

10¼ tons h.d. copper wire, 200 lb. per mile, £834.—Elder, Smith & Co., Ltd.

16,000 porcelain insulators, 2⅜d. each.—Theodore Zwicker & Co.

SOUTH AUSTRALIA.

1,100 yards paper-insulated, lead-covered cable, 416 pairs, £1,070 per mile; 8¾ miles ditto, 208 pairs, £620 per mile; 8 miles ditto, 52 pairs, £280 per mile; 1⅝ miles ditto, 26 pairs, £150 per mile.—B. I. & Helsby Cables, Ltd.

¼ mile switchboard cable, £54 per mile; ¼ mile, ditto, £102 per mile; ¼ mile, ditto, £86 per mile; ¼ mile cable, £140 per mile.—Western Electric Co. (Aus.), Ltd.

4¼ miles paper-insulated lead-covered cable, 104 pairs, £368 per mile.—Callender's Cable Co., Ltd.

TASMANIA.

28 chains paper-insulated, lead-covered cable, 416 pairs, £1,060 per mile; 65 chains ditto, 208 pairs, £605 per mile.—Callender's Cable Co., Ltd.

DEPARTMENT OF HOME AFFAIRS FOR THE FEDERAL CAPITAL.

Transformers for water-pumping plant, £1,485.—Siemens Bros. Dynamo Works, Ltd.

Motor switchboard, £1,882.—Australian G.E. Co.

NEW SOUTH WALES METROPOLITAN WATER AND SEWERAGE BOARD.

Two motors, £110 each.—Australian G.E. Co.—*Australian Mining Standard.*

Bolton.—The Electricity Committee has accepted the following tenders in connection with Back-o'-th'-Bank Works :

Balcke & Co., Ltd, for six air filters.
Alex. Wright, Ltd., for CO_2 recorders.
Ferranti Ltd., for single-phase transformers.

Dublin.—The Edison & Swan United Electric Light Co., Ltd., have received through a Dublin firm of contractors orders for over 2,300 Royal Ediswan drawn-wire lamps for Maynooth College, which is at present changing over from carbon to metal lamps.

Germany.—The Schwarzkopf Co., of Frankfort-am-Main, have submitted the lowest tender to the municipal authorities of that city for the supply and erection of two 1,250-KW. steam turbines and generators, with condensers, at the central electricity station, the price quoted being £9,600.

Halifax.—The Tramways Committee has accepted the following tenders :—

B.T.H. Co., Ltd.—1,000 KW. rotary converter, with transformer and E.H.T. switchgear (£2,100).

Babcock & Wilcox, Ltd.—Water-tube boilers (£2,400).

Holywell.—The B. of G. has accepted the tender of Messrs. E. M. Evans & Son, of Manchester, for installing the electric light at the new infirmary, at £712, subject to deletion of items not included in the specification, reducing the tender from £738. There were 11 tenders received, the highest being £1,132, and the lowest (excluding the reduced one of Evans & Son), £718.

Kingston.—The T.C. has accepted the tender of the Craigpark Cable Co., Ltd., at £150, for the supply of cable, and has accepted the offer of Messrs. Wm. Cory & Son, Ltd., to continue their contract for the supply of coal to the lighting department for a further three months.

London.—L.C.C. The Stores and Contract Committee reports the acceptance of the following tenders during the Easter recess :—

For iron castings for permanent way, &c., for the Tramway Department, Schedule 91.—Anderston Foundry Co., Ltd.; Brightside Foundry and Engineering Co., Ltd.; British Griffin Chilled Iron and Steel Co., Ltd.; T. Bullen & Co., Ltd.; S. Griffith; J. Martin & Son; T. Summerson & Sons, Ltd.

For steel and iron castings for permanent way for Tramways Department.—E. Allen & Co., Ltd.; "M. & G." Truck Engineering Co., Ltd.; National Steel Foundry, Ltd.

The Stores and Contracts Committee recommends the acceptance of the tender of the B.T.H. Co., Ltd., for the supply of carbon-filament lamps for 12 months.

The Committee also recommends "That none of the tenders received for the supply of metal-filament lamps with filaments other than drawn," (Schedule 17, Items 8 to 27) see ELEC. REV., March 6th, p. 397, be accepted. The Committee says that since its report was submitted circumstances have been brought to its notice which, in its opinion, render it undesirable at the present time to accept any of the tenders received.

The Education Committee reports the withdrawal of the tender of Napier-Kimber, Ltd., of £257 for installing electric light at the Upper Marylebone Street School, and the acceptance of the next tender, that of Messrs. Lund Bros. & Co., for £294.

The Highways Committee reports the acceptance of the offer of Messrs. Siemens Bros. Dynamo Works, Ltd., of £147, for rewinding and repairing one of the motor-generators at Clapton sub-station, the firm being the makers of the machine.

The Highways Committee reports the withdrawal of the tender of the Castle Rubber Co., Ltd., for plough lead cable sleeves (Schedule T 9, item 7); the price quoted, 6s. 6d. per 100, was an error, and should have been 66s., and the Committee has accepted the next lowest tender, that of the Irwell and Eastern Rubber Co., Ltd., at £1 17s. 6d. per 100.

For the supply of one 10-H.P. three-phase motor and one 2-H.P. three-phase motor in connection with the equipment of the boiler house workshop at the Greenwich generating station, the following tenders have been received :—

General Electric Co., Ltd. .. .. (accepted)	£100
Electric Construction Co., Ltd.	106
Electric Construction Co., Ltd. (alternative)	114
British Westinghouse Electric and Mfg. Co., Ltd.	108
Siemens Bros. Dynamo Works, Ltd.	127

For the supply of electric lighting material for the central car repair depôt (third portion) and Abbey Wood car-shed, the following tenders have been received :—

General Electric Co., Ltd. .. .. (recommended)	£217
Edison & Swan U.E.L. Co., Ltd.	223
Armorduct Manufacturing Co., Ltd.	224

The General Electric Co., Ltd., has secured the contract from the Asylums Committee to supply Osram lamps during the ensuing year.

LAMBETH.—The Guardians have received the following tenders for the provision and installation of electric motors for laundry plant at the infirmary, Brock Street :—

A.E.G. Electric Co., Ltd.	£250	Lund Bros & Co.	£277
John Biggs	822	Marryat & Place	321
C. H. Cathcart & Co.	325	Arthur Newman, Ltd.	285
Electrical Apparatus Co. (part)	83	Scholey & Co., Ltd.	262
Electrical Construction Co., Ltd.	295	South London Elec. Supply Co.	240
General Electric Co.	310	G. Weston & Sons	329
W. E. King	311	W. M. Williamson	285
Langdon-Davies Motor Co.	347		

The tenders were referred to the Works Committee for consideration. The Guardians also received the following tenders for electric light wiring and fittings for the children's infirmary at Norwood :—

A.E.G. Electric Co.	£323	Sherratt Bros.	£240
John Biggs	469	**South London Electric Supply Co.** (accepted)	247
C. H. Carthcart & Co.	357	Stegmann & Co.	316
Haycraft & Son	318	W. C. Tackley & Co., Ltd.	310
Lund Bros. & Co.	355	G. Weston & Sons	315
Arthur Newman, Ltd.	331	W. M. Williamson	319
Private Telephone Co., Ltd.	361		
W. R. Reynolds & Co.	315		

Mr. F. Kinnaird gave notice that at the next meeting he would propose that the resolution accepting the tender of the South London Electric Supply Co., Ltd., be rescinded. He maintained that the Guardians had not discussed the relative cost of gas lighting as against the electric light.

MARYLEBONE.—The tender of Messrs. Geipel & Co. for flexible wire is recommended for acceptance.

HAMMERSMITH.—The B.C. Electricity Committee recommends that the tender of Messrs. Wicks & Dale of £46 be accepted for the supply of pipes and foot valves in connection with the pumping plant for the supply of condensing water to the electricity works.

BERMONDSEY.—The tender of Messrs. E. Green & Son, Ltd., to replace the existing economiser at the electricity works, at £239, plus £26 10s., for putting the three groups of pipes in series, is recommended.

Liverpool. — The City Council is recommended to accept the tender of Callender's Cable Co., Ltd., for an annual supply of stoneware troughing, insulators, &c., also the tender of the Staveley Coal and Iron Co., Ltd., for c.i. circulating water pipes, &c., for coupling-up cooling towers at Lister Drive.

Nottingham.—The Corporation Electricity Department has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for Wotan drawn-wire lamps and for carbon lamps.

Shipley.—The U.D.C. has accepted the tender of Mr. Jos. Speight, Leeds, for tramway reconstruction works in the Bradford and Keighley Road, between the Branch Hotel and the Rosse Hotel, Saltaire.

Wimbledon.—The B.C. Electricity Committee recommends the acceptance of the tender of the Union Cable Co. to supply and lay two extra high-pressure cables, in one line of four-way 3-in. Sykes conduits, from the electricity works to Coombe Lane, for £7,345 10s.

Salford.—The following tenders are recommended by the Electricity Committee for acceptance :—

Edison & Swan Co. At the transformer sub-station, Park Lane, Broughton, two H.T. distribution switchboards and 12 oil-switch cubicles for separate wall mounting, £813.

J. Hopkinson & Co., Ltd. Seven Hopkinson Ferranti steel parallel slide valves, for the main boiler range at the Electricity Station, Frederick Road, £136.

Vaughan & Son, Ltd.—At transformer sub-station, Fobert Hall Street, Salford, a 10-ton hand-operated overhead travelling crane, £115.

British Westinghouse Co., Ltd.—Three 1,000 KW. compound wound rotary converters and static transformers, £7,388.

Browett, Lindley & Co., Ltd.—Re boring 3 H.P. cylinders of reciprocating engine and fitting same with three new pistons and patent resistance piston rings, £51, plus cost of labour in dismantling or erection of same.

The following tenders have also been accepted for annual supplies :—

L. Andrew & Co.—Carbon-filament glow lamps.
Cryselco Co., Ltd.—Tungsten drawn-wire filament lamps.
H. R. Mansfield.—Stoneware pipes.
Albion Clay Co., Ltd.—Cable protectors and bearers.

Stretford.—The Education Committee has accepted the tender of Mr. Bertram Thomas, of Manchester, for electric lighting at the new Trafford Park School, for the sum of £293.

Walthamstow.—The U.D.C. has accepted the tender of the General Electric Co., Ltd., for Osram drawn-wire lamps.

Warrington.—The following tenders are recommended to the City Council for acceptance :—

General Electric Co., Ltd.—Switchboard, £83.

George Wallington.—Turbo-alternator foundations, £210; and sump and pipe trenches, £181.

B.T.H. Co., Ltd.—3,000 K.V.A. turbo-alternator E.H.T. switchboard panel (extension), £216; and E.H.T. and L.T. switchboard panels, £365.

British Westinghouse Co., Ltd.—Rotary converter, £1,537.

FORTHCOMING EVENTS.

Iron and Steel Institute.—Friday, May 8th. At Institution of Civil Engineers, Great George Street, S.W. Annual Meeting.

Physical Society of London.—Friday, May 8th. At 8 p.m. At Imperial College of Science, S.W. Paper on "Gyrostatic Devices for the Control of Moving Bodies," by Dr. J. G. Gray.

Institution of Electrical Engineers (Newcastle Students' Section).—Monday, May 11th. At 7.30 p.m. At Armstrong College. Paper on "The Application of Electricity to the Mercantile Marine," by Mr. B. S. Orme.

(Yorkshire Local Section).—Wednesday, May 13th. At 7.15 p.m. At Philosophical Hall, Leeds. Address on "Modern Converting Plant with Special Reference to Rotary Converters," by Dr. R. Pohl.

Institution of Mechanical Engineers (Graduates' Association).—Monday, May 11th. At 8 p.m. At Storey's Gate, S.W. Paper on "Steel Tires as Applied to Railway Practice," by Mr. W. J. Maize.

Society of Engineers.—Monday, May 11th. At 7.30 p.m. At Institution of Electrical Engineers, Victoria Embankment, S.W. Paper on "Notes on the Water Supply of Greater New York," by Mr. W. T. Taylor.

Royal Society.—Wednesday, May 13th. At 9 p.m. At Burlington House. Conversazione.

Concrete Institute.—Thursday, May 14th. At 7.30 p.m. At 296, Vauxhall Bridge Road, S.W. Ordinary General Meeting.

Royal Institution of Great Britain.—Thursday, May 14th. At 3 p.m. At Albemarle Street, W. Lecture on "Identity of Laws: in General and Biological Chemistry," by Prof. Svante Arrhenius, Hon. F.R.S.

Junior Institution of Engineers.—Friday, May 15th. At 8 p.m. At 39, Victoria Street, S.W. Lecturette on "A Few Notes on the Design of Surface Condensing Plant," by Mr. W. V. Treeby.

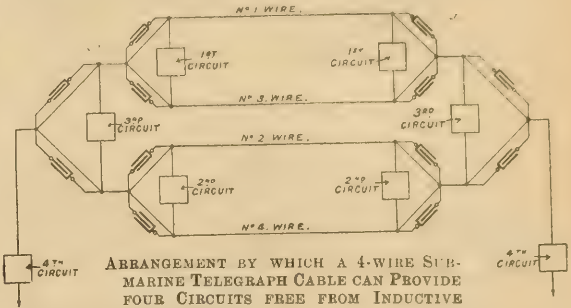
Saturday, May 16th. At 2.30 p.m. Visit to Southwark Bridge Widening Works.

ANGLO-CONTINENTAL TELEGRAPHS AND TELEPHONES.

The traffic between England and Ireland and the Continent grows continually in volume, resulting in the need of additional means of communication. The Post Office engineers are now making experiments with the object of obtaining a greater output from the telegraph and telephone submarine cables connecting this country with Ireland and the Continent. The following is a brief outline of the methods adopted in the tests :—

Disturbances in submarine telegraph cables, due to stray currents, &c., have been one of the chief difficulties in connection with successful cable telegraphy. This disturbance is very much more marked when the submarine cable contains more than one circuit, because every pulsation of current in one circuit generates a current in each of the neighbouring circuits, with the result that the sensitivity of the receiving apparatus has to be reduced sufficiently to avoid the effects of these induced currents.

Speaking generally, this reduction in sensitivity reduces the working speed to about half of what it should be. With the view to avoid this reduction of speed in working, experiments are being made with metallic circuit working and superposed circuits as indicated in the following diagram :—



Arrangement by which a 4-wire Submarine Telegraph Cable can provide four Circuits free from Inductive Disturbance.

The above represents a four-wire cable, and shows how four circuits entirely free from inductive disturbance from each other can be obtained :—

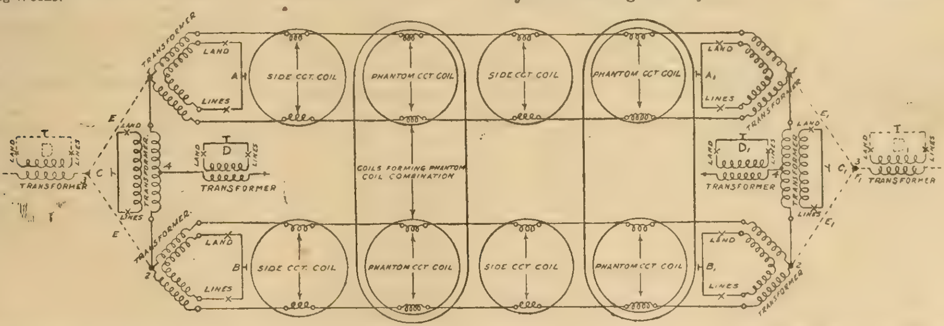
Circuits 1 and 2 work on ordinary metallic loops.

Circuit 3 is superposed on circuits 1 and 2.

Circuit 4 is superposed on circuit 3.

There are thus three loop circuits and one earthed circuit; the latter, although the equivalent of a single-wire circuit; is not subject to any inductive disturbance from the other three.

It is well known that a loaded cable can be constructed either on the coil or continuously loaded principle, to give three independent double-wire telephone channels in a four-wire cable. The interesting point about the present experiments, however, is the extension of the principle so as to obtain a fourth independent loaded circuit in such a cable. The following diagram shows two ways of achieving this object.



Scheme for Working four loaded Submarine Cable Circuits in a 4-wire Cable from two Pairs of Wires.

The diagram represents a four-wire coil-loaded telephone cable. Circuits A A_1, B B_1 and C C_1 are worked on the usual phantom scheme, and are all loaded in the regular manner. Circuit D D_1 is obtained by working in parallel through all the four wires. If the phantom coil combination at each loading point consists of two separate loading coils (one coil in each pair of wires and two windings on each coil), then all the windings in circuit D D_1 will be inductive as well as in A A_1, B B_1 and C C_1, and therefore the four circuits will be loaded. The scheme also applies to a continuously loaded cable. As an alternative to tapping off the earth circuit at 4, the arrangement shown in dotted lines may be adopted for this circuit, E and E_1, being inductive impedances in series from 1 to 2, but non-inductive in parallel from 3. If this latter method be adopted, the transformers in circuit C may theoretically be dispensed with, but there is an advantage in retaining them for practical reasons.

Experiments on a coil-loaded cable between England and Ireland and a continuously-loaded cable between England and France have given excellent results, and telephone circuits are now working on this system.

For Sale.—Bradford Corporation offers for sale by tender two Willans three-crank, triple-expansion engines, 200 KW., 220-260 V., and one Willans three-crank compound engine, 220 KW., 460-570 V.

Croydon Borough Electricity Committee invites tenders for the purchase of three Economic boilers.

Messrs. J. and W. Heathcote, The Mart, Derby, are instructed to sell by auction, on Friday, 22nd inst., a freehold works and factory, by order of the mortgagees of Metalite, Ltd. Particulars are given in our advertisement pages to-day.

By tender: 40 double-carbon Brockie-Pell arc lamps and 20 Brush Vienna arc lamps; Barry Railway Co.

The Batti-Wallahs' Society.—This Society will go for its up-river trip on June 27th. The *Royal Thames* has been chartered for the trip, and 150 can be comfortably accommodated. Further particulars will be issued in due course.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued :—

Friday, May 8th.—"D" Company. Technical instruction, 7 to 10 p.m. Miniature range practice, 7 to 9 p.m.

Saturday, May 9th.—Headquarters will be open for regimental purposes only from 10 a.m. to 12 noon.

Monday, May 11th.—"A" Company. Company supper at St. James' Tavern, Westminster, at 7 p.m.

Tuesday, May 12th.—"B" Company. Infantry drill, 7.30 to 8.30 p.m. Technical instruction, 9 to 10 p.m. Miniature range instruction, 9 to 9.30 p.m.

Wednesday, May 13th.—All Companies. Annual course of musketry at Purfleet Rifle Ranges. Rating examination at Headquarters for all Companies, 7.30 to 9.30 p.m.

Thursday, May 14th.—"C" Company. Technical instruction, 7 to 10 p.m. Miniature range instruction, 7.30 to 9 p.m.

Friday, May 15th.—"D" Company. Infantry drill, 7.30 to 8.30 p.m. Technical instruction, 9 to 10 p.m. Miniature range instruction, 8.45 to 9.30 p.m.

Saturday, May 16th.—All Companies. Annual course of musketry at Purfleet Rifle Ranges. Members should notify early on the postcards supplied the date on which they intend to fire; every endeavour should be made to fire as early as possible. Headquarters will be open for regimental business from 10 a.m. till 12 noon.

Corps Sports will take place at the Duke of York's Headquarters, Chelsea, on Saturday, the 9th inst., at 3 p.m. An excellent programme has been arranged, and it is hoped that members will turn up in large numbers to make it a success.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Senghenydd Colliery Prosecution.—The *Manchester Guardian* states that Mr. Clement Edwards, M.P., and Mr. Trevor Lewis have been briefed by the Home Office to conduct the case against the Senghenydd Colliery management.

Electrical Contractors' Association (Inc.).—The annual banquet of the Association was held at the Grand Hotel, Leicester, on April 29th. The President, Mr. H. S. Webb, occupied the chair, and 49 members and visitors were present. In proposing the toast of the Association, Councillor C. Squire expressed Leicester's appreciation of the honour done to it by that assembly. The Association maintained the high standard of electrical contracting, took care of the varied interests of electrical contractors, and dealt with manufacturers and employés far more effectively than could individual contractors. What Trade Unions were to employés, the Association was to traders. Speaking as an outsider, he believed a system of registration would add greatly to the prestige of members. There were now 97 branches of the Association in various parts of the kingdom. The most important single function of the Association was watching Bills in Parliament. This demanded combined effort. The Municipal Engineers' Bill now before Parliament struck at the vitals of individual trading, and must be opposed. The speaker said that he was opposed to any extension of municipal trading, and in this particular connection, it was absurd that a heterogeneous Corporation, including any men but electrical engineers, should have control of electrical trading. He suggested that a representative of electrical interests in Leicester should be elected to the Council. At recent municipal elections in Germany, 42 important municipalities recorded large majorities against any extension of municipal trading, which had proved disastrous to private interests and was likely to engender injurious competition between Corporations. In replying to this toast, the President said that the object and aims of the Association were well known and had met with universal approval. During the 13 years the Association had been in existence its energy and expenditure had been devoted almost entirely to protecting the interests of electrical contractors in Parliament and to fighting municipal bodies. It was a shame that such should be the case. Municipal activities should be limited by the question whether private enterprise could not render equally efficient service. Municipal enterprise meant that traders subscribed the capital used to fight them. This was eminently unfair. It was difficult indeed to determine whether any municipal enterprise was not run at a loss. By inadequate allowance for rent, rates and general office expenses, it was easy to convert a real loss into apparent profit. Where municipal services were engaged, they should be for service only ; there should be no element of profit transferred to expenditure in other directions. Rates should be collected directly, not indirectly, in the shape of gas, electricity, or other surplus which encouraged municipal extravagance and inefficiency, and led to artificial prices for articles or service. In a particular case in Leicester the gas surplus relieved rates to the extent of 10d. in the £, on an assessment of £4,000. The Association's "guarantee of work" scheme represented an effort to make the letters "N.E.C.A." of real significance. Going beyond the initial standard of attainment required of candidates for admission to certain professions, the Association aimed at establishing a definite standard of result. This aim was unique, and would have far-reaching results. No contractor would be eligible for full membership of the Association till he had been five years in business, and the Association would guarantee, up to £50 liability, proper fulfilment of work undertaken by its members under the I.E.E. specifications. Old-established firms would certainly be placed on the same level as younger firms, so far as the Association was concerned, but the personal equation would still operate fully so far as concerned clients. London members were strongly in favour of the guarantee scheme, owing to the comparative ease with which a bad reputation could be lost (undeservedly) in the Metropolis. For years past the municipal engineers had persisted in their endeavour to secure selling powers. The speaker did not wish to introduce any animus into the proceedings or to threaten the I.M.E.A., but he would say that the Electrical Contractors' Association would oppose municipal selling powers now and always. Such powers must not be granted, or they would certainly be used sooner or later. What was bread and butter to the contractor was outside the legitimate province of the municipal engineer. Surely the time had come when contractor and municipal engineer should combine to fight gas interests. If municipal engineers would give up the idea of sales departments, contractors were prepared to recognise the necessity for hire-purchase schemes in certain cases. The E.C.A. was stronger financially than ever before, so that offers of conciliation and compromise could not be interpreted as a sign of weakness.

In proposing "the Institution of Electrical Engineers, the Association of Municipal Electrical Engineers and kindred Associations," Mr. E. C. Wallis (Past President) spoke of the growth and power of the I.E.E and regretted that only 15 per cent. of its members were connected with electrical contracting. Though the E.C.A. had been in conflict with the municipal engineers, they wished them every success in their own domain. Kindred Associations were so numerous that it was impossible to mention all specifically ; representatives from many were present and welcome. The Benevolent Institution deserved special mention. The object of all these Associations was the furtherance of civilisation and public prosperity. Mr. T. R. Smith (borough electrical engineer, Leicester), in replying to this toast, said that he did not come personally under the strictures uttered by previous speakers. He had found his own business to occupy all his time and energies ; he acknowledged gratefully the assistance he had received from contractors in Leicester : and he trusted his cordial relations with them would long continue. The total capital now invested in Leicester tramways and electricity supply was £1,119,000. On this investment inhabitants were entitled to adequate return, either as profit or cheapened service, and the Electricity Committee had sought diligently the latter alternative, with what success he showed by interesting statistical data. Mr. W. H. Allen (borough electrical engineer, Loughboro') said that the I.M.E.A. would doubtless reconsider their position when they appreciated fully the E.C.A. guarantee scheme. Though full powers were possessed by the Loughboro' Electricity Department, they confined their activities to the hire-purchase of motors. This was essential to secure factory electrification. If contractors would organise hire-purchase schemes, and make arrangements to help consumers when in trouble and keep their plant running, they would strengthen greatly their position, and municipalities would be glad to be relieved of an irksome responsibility. Collaboration between the B.E.A.M.A., E.C.A. and I.M.E.A. was quite feasible, and would be of immense benefit to all parties concerned.

Councillor H. L. Harrison (Hull), chairman of Northern Section E.C.A., proposed "The Health of the President," and laid stress upon the success which had attended his enthusiasm and energy. Mr. S. H. Webb suitably responded. An excellent musical programme was provided by the Misses Elsie Carter and Beatrice Wells and Mr. S. L. Jordan, while flute duets by Mr. A. H. Hind (President of Leicester Architects' Society) and Mr. F. H. Rowlett (President Leicester Building Trades Employers' Association) were much appreciated.

The Electrical Trades Benevolent Institution.—We have received from the Secretary, Mr. Hawes, the following supplementary list of contributions not in connection with the annual festival :—

Avila, F. J.	£1	1	0	Moffatt	£0	10	0
Barralet, Edgar S.	1	1	0	Nalder, F. H.	1	1	0
Calm & Bender	2	2	0	Nalder Bros. & Thompson	5	5	0
Dusell, S.	1	1	0	Prior, E. R.	1	1	0
Harris, A. F.	0	10	6	Tremble, J. H.	1	1	0
Hughman, R. W.	1	1	0	Union Cable Co., Ltd. ..	10	0	0
Jones, J. H.	1	1	0	Weeks, B. C.	1	1	0
Kelman, W. H. M.	1	5	0	Whitehouse, J. R.	1	1	0
Miller & Sons, Ltd.	1	1	0				

The "other contributions" received down to date thus amount to £179 8s. 6d. Mr. Hawes writes as follows :—

"The liberal support which the Institution has received this year, due in the main to the untiring energies of Mr. Hirst, will cause the invested funds to reach a figure of about £8,000. It is desirable, however, to draw attention to two material points :—

"1. That no satisfaction can be felt until the invested funds reach a figure of about £20,000 or over, because the calls for pensions will undoubtedly become a considerable item in the course of some three or four years, and

"2. Members of the staffs of firms will realise, in view of the solid backing which the present invested funds give the Institution, that it is practically a satisfactory business proposition from their point of view to become members, in addition to the good which they are doing to their fellow beings.

"I may here remind you that the subscription of members is 10s. per annum or such larger amount as each member is willing to give, and it may be paid in instalments."

Inquiry.—A correspondent asks the name of the maker of the Faraday waterproof electric bell.

Institution and Lecture Notes. Institution of Electrical Engineers. The Committee of the Manchester Local Section has submitted to the members its report for the 14th Session, which states that the number of members at the close of the Session was 797, showing a slight decrease on the figures for last year. During the Session the Engineers' Club, on the provisional Committee of which the Committee appointed representatives, opened its doors in Albert Square with a membership of 500, which has since increased to over 600. The Committee has been requested to appoint representatives to a conference of all the engineering societies in the city with a view to the establishment of a common meeting hall and other facilities. The Committee for 1914-15, elected at the annual general meeting, April 28th, 1914, is as follows:—Chairman, Dr. E. Rosenberg; vice-chairmen, Messrs. G. Layton and P. P. Wheelwright; Committee, Messrs. C. C. Atchison, C. J. Beaver, K. M. Faye-Hansen, E. L. Hill, E. M. Hollingsworth, A. E. McKenzie, S. L. Pearce, J. S. Peck, H. D. Symons, Prof. Miles Walker, S. J. Watson and F. H. Whysall.

Votes of thanks were accorded to the chairman and hon. secretary for their work during the session. The business of the meeting was followed by a very interesting and instructive lecture by Prof. J. A. Fleming, D.Sc., F.R.S., on "Propagation of Electric Waves Along Wires."

The members of the Yorkshire Local Section visited the generating station of the Yorkshire Electric Power Co., at Barugh, near Barnsley, on the 25th ult. Mr. W. B. Woodhouse, chief engineer of the company and chairman of the Section, had charge of the arrangements, and between 60 and 70 members took advantage of the company's invitation to inspect the works. Near the latter are the Old Silkstone Collieries, and the visitors were shown the manner in which the gases given off by the coke ovens of the collieries are utilised to supply heat to the boilers of the Power Co., who, in turn, transmit energy to the collieries to drive the electrical machinery at the workings. The gases given off in the coking process are drawn along mains from the ovens by turbines, and the valuable by-products—tar, ammonia and benzol—are extracted by subsequent processes. The collieries consume as much as 3,000 tons of coal per week for conversion into coke, and 60 per cent. of the gas produced is supplied as fuel to the power station. The Power Co. is authorised to supply electricity over an area of 1,800 sq. miles, and has already nearly 300 miles of mains, extending to Pudsey and Horsforth on the north, Penistone and Sowerby Bridge on the west, Castleford, Micklefield and Hemsworth on the east, and Wombwell and Worsboro' to the south. After tea at the Queen's Hotel, Barnsley, the thanks of the visitors were accorded to the Electric Power Co. and the Colliery Co. for their hospitality, and to Mr. Woodhouse for the excellent arrangements which he had made for the comfort of the guests.

Igranic Engineering Society.—At the fortnightly meeting of this Society, held at Bedford on April 15th, two papers were read. The first, on "Alternating-current Control Apparatus," by Mr. F. Oglesby, fully described, with lantern slide illustrations, the most recent developments of the Igranic A.C. automatic switchgear, involving the use of A.C. clapper switches for auto-transformer and resistance starting of squirrel-cage and slip-ring induction motors, and for special schemes of A.C. control. The second paper, on "Automatic Temperature Control," by Mr. H. H. Rapley, dealt with the important problem of automatically controlling motor-driven refrigerating plants to maintain a constant temperature in the refrigerating chamber. The solution of the problem involves the use of suitable watertight thermostats, and automatic control gear for starting and stopping the motor, which may be D.C. or A.C., as and when required. Mention was also made of Igranic controlling equipments suitable for heating biological and similar incubators, and each detail was illustrated on the lantern screen. Interesting discussions followed.

Rontgen Society.—In a paper read before the Society, on Tuesday, Mr. L. W. Bragg dealt with recent discoveries in connection with "X-Rays and Crystals." He stated that it had been proved that the rays resembled ordinary light rays, but had a wave-length only one-thousandth that of light waves, and that half-a-dozen wave-lengths were included within the diameter of an atom. The knowledge gained had been used to analyse the atomic structure of crystals, which made perfect diffraction gratings for X-rays. By using rhodium anticathodes Prof. Bragg (his father) had succeeded in obtaining homogeneous X-rays. The latter originated within the atom. In the discussion, Prof. Soddy said that while they could not yet stimulate radio-activity, they could now stimulate the inner portions of the atom with electricity derived from ordinary sources.

Barrow Association of Engineers.—The annual meeting was held on April 27th. Mr. H. R. Burnett, the borough electrical engineer, presided, and was warmly thanked for his services as president during the past two years. Mr. H. B. Weeks, head chemist and metallurgist to Messrs. Vickers, Ltd., was elected as the new president, Mr. D. Kingston as hon. treasurer, and Mr. J. W. Osborne as hon. secretary.

Association of Mining Electrical Engineers.—A meeting of the Yorkshire Branch was held at Leeds on May 2nd. The report on the work of the branch for the past year showed that there had been a net increase of 24 members, the total membership now being 115. A paper on "Repairs to Electric Plants," by Mr. F. Smith, Pinxton Collieries, was read.

Royal Institution.—The annual meeting of the members was held on May 1st, the Duke of Northumberland, K.G., President, in the chair. The annual report of the Committee of Visitors for the year 1913, testifying to the continued prosperity and efficient management of the Institution was read and adopted. Thirty-three new members were elected in 1913. The following gentlemen were elected as officers for the ensuing year:—President, the Duke of Northumberland; treasurer, Sir James Crichton-Browne; secretary, Alexander Siemens, Esq.

Association of Electrical Station Engineers.—At a special meeting held at Liverpool on April 23rd, the Hon. General Secretary (Mr. W. J. Ebben) stated that the present Executive Committee had decided that the objects of the Association must be attained by peaceful means, and that the Association must go forward firmly and steadfastly, untrammelled by ties with other organisations. Station engineers must rely on their own efforts to better their conditions. The members of the Association, in endeavouring to raise the salaries paid and status of the profession generally, must remember that it was essential to start any improvement in the lower grades; if these grades were first raised, the higher grades must automatically improve, and even chief engineers might remember this, as by raising the salaries of their assistants, &c., there was every possibility of ultimately benefiting themselves. To improve the conditions of the lower grades, it was necessary to have the assistance of those in higher positions, and all should be members of the same organisation; the secretary appealed for more members, but emphatically insisted that they must have certain qualifications before being admitted, such as technical training and long practical experience. He then proceeded to explain some of the methods of the A.E.S.E., and referred particularly to a bad case which was recently dealt with of a Lancashire private power station where the charge engineers had had their salaries reduced 25 per cent. Upon one of the charge engineers resigning his position, the firm in question advertised for a "switchboard attendant" (under a box number) at the reduced salary to fill the vacancy. In the meantime the Association had circularised all the members with the facts of the case, and also asked them to inform all non-members with whom they came in contact. It was believed that the firm received about 100 applications in reply to their advertisement, and such was the far-reaching influence of the A.E.S.E. that not one of these 100 applicants could be prevailed upon by the chief electrical engineer of the firm to accept the position. It was the intention of the A.E.S.E. to use this method of boycott on all electrical undertakings where the salaries offered were ridiculously low for the duties involved.

The information bureau was becoming more complete every day. The advantage of this would be fully realised when it was pointed out that upon a man applying for a position, he could obtain full particulars of the conditions, salaries, &c., of the station concerned before being interviewed. The Association had successfully filled a number of vacancies notified to it by chief engineers, and efforts were being made to extend these facilities.

An animated discussion ensued, in the course of which a statement was made with regard to the conditions of employment prevailing in the Liverpool Corporation electricity department, it was stated that more than 90 per cent. of the men employed in *charge* of the various generating and sub-stations were stokers promoted to drivers, and then classed as machine attendants. At the Lister Drive power station a senior driver had charge of the night shift, two station superintendents taking the other two shifts. When rotary converters were recently installed in some of the sub-stations it was found necessary to synchronise these from the power station by means of a feeder temporarily isolated from the power station bus-bars, instead of, as is usual elsewhere, by the sub-station engineer or attendant, the authorities evidently being doubtful of the synchronising abilities of the sub-station "machine attendants." But it was rumoured that the present chief engineer was endeavouring to fill vacancies with technically qualified men, and that an extra engineer was to be obtained for the Lister Drive power station.

Bad conditions in other stations in the district were commented on, and it was thought that the Liverpool branch would be very busy in the future.

At the close of the meeting a new branch secretary was appointed and several members added to the local Committee.

Owing to the recent large increase in the membership of the Association and the decision of the Executive Committee that London should be on the same basis as other branches and incidentally to relieve the hon. general secretary, Mr. W. J. Ebben (who has also been acting as secretary of the London branch), of the London branch work, and thus enable him to give more time to the general work of the Association, it was decided recently to appoint Mr. W. E. Russell as London branch secretary.

Melbourne Electric Railways.—According to a Melbourne newspaper, discussion has been proceeding as to the necessity for appointing a thoroughly experienced electric railway manager in connection with the operation of the lines which are now being electrified. An official denial is given to the suggestion that any of the present Railway Commissioners intend to retire in order to facilitate the introduction of a new electrical official.

The London Strike.—The electrical wiremen's dispute in London is still unsettled. The London Engineering Employers' Association has refused the demand of the London District Committee of the E.T.U. for an increase of 1d. per hour to electrical workers employed by them.

Engineering Trades Dispute.—Representatives of the Engineering Employers' Federation were to meet the sub-committee of the engineering and shipbuilding trade unions in conference in London yesterday afternoon. The chief demands of the men are stated to be a reduction in working hours to 48 per week, with a corresponding increase in wages.

Lillooah Power Station.—The Governor of Bengal recently paid a formal visit to the East Indian Railway Workshops at Lillooah, where 6,700 men are employed in the manufacture of rolling stock. The visitors were received at the electrical power station by Mr. H. L. Tyson-Wolff, the electrical engineer of the line, and Mr. J. S. Colquhoun, assistant electrical engineer in charge of the installation. The first shop was erected in 1900, and the works now occupy an area of 95 acres, of which 18½ are covered. A full account of the visit was given in the *Englishman*, from which we learn that the works are electrically driven; the power station was opened in 1903, with two 170-kw. Willans-E.C.C. three-phase alternators generating at 220 volts, but since then a 300-kw. Howden-Vickers set and two 600-kw. Belliss-G.E.C. sets have been installed, and two 550-kw. mixed-pressure turbo-alternators are about to be added. Supply is given from this station to Howrah and Bamangachi through step-up transformers at 10,000 volts, the pressure being reduced to 220 volts for driving cranes, pumps, air-compressors, &c., and part of the supply being converted to D.C. for lighting and driving fans in the adjoining premises. The works are served with electric cranes, and are well up to date in equipment; wagons and carriages are manufactured complete from the raw material, or in some cases from partly manufactured forgings and other parts imported from England. The out-turn of wagons in 1914 will be 2,800, and next year 6,500, and from 50 to 100 new bogie coaches are built annually. The accompanying illustration shows the exterior of the power station. There are five power stations in all on the railway, and others are being built; they are all under the control of Mr. Tyson-Wolff, whose headquarters are at Jamalpur.

Lillooah Power Station

Stockbrokers' Claim for Commission.—In the Lord Mayor's Court, on Friday, before Assistant-Judge Jackson, and a jury, a claim was made by Messrs. Lindeck, Cahn & Co., stockbrokers, 25, Austin Friars, E.C., against the Dubilier Electrical Syndicate, Ltd., West India House, 96 and 98, Leadenhall Street, E.C., and Mr. M. Maclean, for commission alleged to be due in connection with the introduction of the General Electric Co., in consequence of which the General Electric Co. became licensees of certain wireless patents owned by the syndicate, and paid £2,500 in respect of them. The defendants denied that there was any agreement with the plaintiffs. The second defendant had not been served with the process of the Court. The case against the defendants, it was said, arose out of an endeavour to form a large company, with a capital of £60,000, to take over the syndicate's interests in certain other wireless patents, which belonged to a Mr. Dubilier. Instead of a company being formed the syndicate obtained the financial assistance required by granting licences to the General Electric Co. to work the wireless patents. The defendants had been paid £1,000, and there was a sum of £1,500 held in trust, subject to certain provisions being carried out. The plaintiffs' claim was for 5 per cent. commission upon any sums received by the defendants from the General Electric Co. as a result of their introduction. For the defence it was said that Mr. Maclean had no authority to act on behalf of the syndicate in entering into any contract with the plaintiffs for payment of commission. The syndicate had settled with Mr. Maclean for the introduction to the General Electric Co., and the plaintiffs should look to that gentleman for payment of their commission. The hearing was adjourned.

Educational Notes.—A course of lectures on "Rubber," organised by the London County Council, is in progress at the Sussex Road Commercial Institute, Brixton, S.W.

The British Westinghouse Electric and Manufacturing Co. have introduced a new scheme at their Trafford Park works for the training of apprentices; a schoolroom has been provided, in which the apprentices receive instruction from the expert staff of the company, free of charge, and during working hours. Some 200 students are attending the classes, which deal with the whole range of work carried out in the factory, and they spend 1½ hours daily, five days a week, in listening to lectures. It is reported that the boys have taken to the course with enthusiasm.

Milk Sterilised by Electricity.—As the result of tests which have been carried on for some months by Prof. J. M. Beattie, the Liverpool City Bacteriologist, the following conclusions have been reached:—

The electrical method of treating milk will destroy disease-producing bacteria.

The main milk souring bacteria are either completely destroyed or may be neglected as far as the keeping power of the milk is concerned for ordinary household use

The milk is not sterilised in the strictest sense of the word, but there is a reduction in the total number of bacteria by 99·93 per cent. over a series of 15 daily examinations.

The milk will keep perfectly sweet for at least three or four days after treatment, a period long enough to cover distribution and household use.

The chemical constitution of the milk seems to be unimpaired, and the taste is not in any way altered.

The milk is not only rendered non-pathogenic as regards ordinary bacteria, but in two cases in which the control supply was tuberculous, the electrically-treated milk was non-tuberculous.

The milk, after treatment, is, in his opinion, perfectly satisfactory as a food for infants.

Appointments Vacant.—Third engineer-in-chief, for Bermondsey B.C. (£110); two assistant inspectors of wireless telegraphy, for the G.P.O., age 25-28 (£200); assistant electric and signalling engineer, for South Indian Railway Co., age 24-30 (Rs. 500 per mensem); meter room superintendent for Durban Corporation, Natal (£300). Particulars are given in our advertisement pages.

Central Station Feeders.—A correspondent writes:—"At the Bath Corporation Electricity Works last week the works' cat was knocked down by a motor-car and killed. A family of three kittens was left, but these are doing well under the kindly care of a member of the staff, who feeds them at regular intervals during the day with milk from a fountain pen filler! The kittens have got quite used to being fed by this new method, and their eagerness at feeding time makes quite a pretty picture."

Bournemouth Tramway Report.—The annual report of Mr. Bulfin, the Corporation tramways manager, on the last year's working, shows that the revenue reached £104,969, an increase of nearly £9,000 on the previous year's results. Nearly £6,000 of this was due to Sunday traffic on the whole system. The net profit was £13,107, as compared with £10,320 in the previous year. It will be remembered that Bournemouth was one of the few towns which refused to provide Sunday tramway facilities until recently.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. W. A. STREET who recently resigned his position in the St. Marylebone electric supply department to take up his duties with the Sturtevant Engineering Co., was on Thursday last week the recipient of a silver plated afternoon tea service, from the members of the staff. Mr. Holmes (sales manager), in making the presentation, referred to Mr. Street's progressive career with the department, and paid a high tribute to his successful record. Mr. Street suitably responded.

The marriage has taken place at St. Matthias' Church, Torquay, of MR. CHAS. CULMER HODGES, chief engineer and manager of the Dawlish E.L. and P. Co., Ltd., only son of Councillor R. Hodges, of Bournemouth, and Miss Louise Bromley Jane Garrett, elder daughter of Mr. H. A. Garrett, borough surveyor at Torquay. Amongst the numerous presents were a cheque from the directors of the Dawlish E.L. and P. Co., a salad bowl and servers, from the staff, and a pair of water-colour drawings, from the station engineers.

The Stoke-on-Trent T.C. has appointed MR. S. G. MARSTON as mains engineer in the Hanley, Stoke, Fenton and Longton areas; and Mr. F. C. LEESE as mains inspector and assistant to the mains engineer for distribution work.

The Hammersmith B.C. Electricity Committee has appointed MR. J. BUCHANAN, at present employed by Messrs. Wellman, Seaver, & Head, Ltd., to the position of draughtsman in the electricity department at a salary of £150 per annum. There were 52 applicants.

At Fleetwood Parish Church, on April 30th, MR. WM. ALLAN BANNISTER, who is employed in the electricity department of the Preston Corporation, was married to Miss Beatrice Kent.

MR. H. A. BEST, assistant engineer at the Worksop E.L. Works, has been appointed to a similar position at the Worthing Corporation works.

MR. H. A. HOWIE, deputy electrical engineer of Sheffield, is recommended for the appointment of borough electrical engineer at Walsall.

Tramway Officials.—The York Electricity and Tramways Committee has appointed Mr. J. W. Horton, of Walsall, as traffic superintendent of the tramways.

The Liverpool Tramways Committee recommends the suspension of a standing order so that the following increases may be granted to officials in the tramways department:—Mr. Thomas Ridyard, rolling stock and works superintendent, from £350 to £400 per annum as from April 1st last; Mr. Thomas Blaney, mechanical and electrical engineer, from £230 to £250 per annum; and Mr. Robert Roulston, depôt inspector, from £220 to £230 per annum.

Mr. H. Holliday concluded his engagement as engineer and manager to the Torquay Tramways Co. on Thursday last week, and on Friday he left Torquay preparatory to entering upon the duties of engineer and manager to the Rhondda Valley Tramways Co. Mr. Holliday's successor at Torquay is to be Mr. H. J. Nisbett, of Porth.

General.—The marriage arranged between Mr. T. Reginald H. Tetley, of Tetley & Co., Manchester, son of the late T. Humphreys Tetley and of Mrs. Tetley, of Rock Ferry, and Miss Hannah Firth, younger daughter of Mr. and Mrs. James Musgrave, of Knowsley Grange, Bolton, will take place quietly on June 3rd, at the Parish Church, Bushey, Herts.

With reference to a paragraph in our last issue, we are informed that while it is correct that Mr. S. V. Lancey was formerly employed by Messrs. Mawdsley's, Ltd., of Dursley, he was not on their electrical staff.

Mr. John B. Sparks has resigned his position with Dr. H. F. Parshall, consulting engineer, to take up the position of chief electrical engineer to the Bergwerks u. Hüttenverwaltung G.m.b.H. (Gallus Anlage 2, Frankfurt am Main), a company owning copper, tungsten and tin mines in Silesia and Bohemia.

Mr. James Urmston, who holds a position with Messrs. Callender's Cable and Construction Co., London, was married at Leigh, last week, to Miss Connie Smith, of Parkfield, Pennington. His colleagues presented him with a smoker's cabinet.

On April 23rd a social meeting of the directors, officials and employés of Messrs. Kelvin, Bottomley & Baird, Ltd., of Glasgow, took place. The gathering was convened to celebrate the jubilee, or fiftieth year of employment, of one of the employés, Mr. John Gilchrist, who entered the service of the firm in the year 1863. A most enjoyable evening was spent in song and sentiment. Dr. J. T. Bottomley, chairman of the directors, presided, and Mr. Alfred W. Baird, one of the directors, presented Mr. Gilchrist with a purse of sovereigns. In a neat speech he referred to the happy relationship which had always existed between the directors and employés of the firm, and also to the long term of service of Mr. Gilchrist, whom he congratulated on the splendid example which he had set to the younger workers employed by the firm. Mr. Gilchrist, in replying, entertained the company with workshop reminiscences of a most interesting nature, describing, among other things, the work carried through by the firm in the early days. Special reference was made to the first electrometers and galvanometers designed by Sir Wm. Thomson, and also to the instruments made in connection with the first Atlantic cable, followed subsequently by the siphon recorder. Reference was also made to the work done in connection with Sir Wm. Thomson's compass and sounding machine when these were first introduced. At the close, a vote of thanks was accorded to the chairman, Dr. J. T. Bottomley, on the motion of Mr. M. B. Field, general manager.

Obituary.—Mr. E. Olding.—The death has taken place suddenly of Mr. E. Olding, of Waterside, Chesham, Bucks, a member of the firm of Howard & Olding, electricians, Chesham. Deceased, who was 41 years of age, succumbed to hemorrhage of the brain.

Mr. W. H. Parkins.—The death is announced of Mr. W. H Parkins, electrician at the Plymouth Collieries, Abercanaid, near Merthyr Tydfil

NEW COMPANIES REGISTERED.

Torpoint Electric Supply Co., Ltd. (135,575).—This company was registered on May 2nd, with a capital of £6,000, in 10s. shares (10,000 about to be offered for subscription), to take over the benefit and obligations of an agreement between the Urban District Council of Torpoint and L. James, St. John Mullen, E. H. Micklewood and T. P. Lyne, and to carry on the business of an electric supply company at Torpoint and elsewhere in Cornwall. The subscribers are:—J. A. Samuel, M.D., North Hill House, Torpoint, Cornwall, 50 shares; L. James, Antony Passage, Saltash, Cornwall, gentleman, 50 shares; St. John Mullen, Antony Passage, Saltash, Cornwall, gentleman, 50 shares; E. H. Micklewood, 5, St. Michael's Terrace, Plymouth, engineer, 50 shares; T. P. Lyne, West Antony, Torpoint, Cornwall, yeoman, 50 shares; W. A. Chamberlain, 1, Lawrence Road, Romford, Essex, engineer, 50 shares; J. A. Pearce, 1, Penlee Gardens, Devonport, solicitor, 25 shares. Minimum cash subscription 6,000 shares. The number of directors is not to be less than three or more than seven; the first are J. A. Samuel, M.D., L. James, St. John Mullen, E. H. Micklewood, T. P. Lyne and W. A. Chamberlain; qualification, 50 shares; remuneration as fixed by the company. Registered office, 10, St. Aubyn Street, Devonport.

Mears Ear Phone Co. (London), Ltd. (135,550).—This company was registered on May 1st, with a capital of £2,000, in £1 shares, to carry on the business of manufacturers, importers and exporters of, agents for, letters to hire of and dealers in earphones, microphones, electrosages and instruments of all kinds for aiding the deaf, &c. The subscribers (with one share each) are:—S. Lewis, 39, Newington Crescent, Kennington Park Road, S.E., clerk; C. J. Parker, 18, New Fillebrook Road, Leytonstone, clerk. Private company. The number of directors is not to be less than two or more than five: the first are not named. Solicitors, Kenneth Brown, Baker, Baker and Co., Lennox House, Norfolk Street, Strand, W.C.

Volta Instrument Co., Ltd. (135,161).—This company was registered on April 27th, with a capital of £2,000 in £1 shares, to promote as a going concern the business of electrical measuring instrument makers, at Premier Place, High Street, Putney, to carry on the business of electrical engineers, contractors, manufacturers of, and dealers in, electric fittings, switchboards, switches and gear, telephone and telegraph apparatus, dynamos and motors, &c., and to adopt an agreement with C. A. West and D. Watson for the acquisition of certain inventions, designs and patents relating to electrical instruments. The subscribers (with one share each) are:—C. A. West, 9, Tideswell Road, Putney, S.W., electrical engineer; D. Watson, 101, Disraeli Road, Putney, S.W., electrical instrument maker. Private company. The number of directors is not to be less than two or more than six; the first are C. A. West and D. Watson (both permanent). F. A. Fowler is first secretary: qualification, 50 shares. Registered office, 78, Sheen Lane, East Sheen, S.W.

Fisher, Humphries & Co., Ltd. (135,426).—This company was registered on April 25th, with a capital of £5,000 in £1 shares, to take over the portion of the business lately carried on by the Horsfall Destructor Co., Ltd., and now by A. C. Hutt at the Atlas Works, Pershore, as general engineers, and to carry on the business of mechanical, electrical, agricultural and general engineers and contractors, steam, oil and internal combustion engine manufacturers, machine and boiler makers, &c. The subscribers (with one share each) are:—Colonel H. E. M. Lindsay, C.B., Ystrad Mynach, Glamorgan; A. P. James, Cardiff, solicitor. Private company. The number of directors is not to be less than two or more than five: the first are Colonel H. E. M. Lindsay, C.B., A. P. James and A. C. Hutt. Registered office, Atlas Works, Pershore, Worcester.

New Destructor Co., Ltd. (135,427).—This company was registered on April 25th, with a capital of £6,000 in £1 shares, to take over the portion of the business recently carried on by the Horsfall Destructor Co., Ltd., and now by A. C. Hutt, as makers and builders of destructors for refuse of all sorts, and to carry on the business of makers and builders of furnaces, machinery and apparatus, &c. The subscribers (with one share each) are:—Col. H. E. M. Lindsay, C.B., Ystrad-Mynach, Glam.; A. P. James, Cardiff, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are Col. H. E. M. Lindsay, C.B., A. P. James and A. C. Hutt. Registered office, Atlas Works, Pershore, Worcs.

Printex Accumulator Co., Ltd. (135.574.)—This company was registered on May 2nd, with a capital of £3,000 in £1 shares (1,500 8 per cent. cumulative preference), to take over from F. C. Grund, W. H. A. Butterfield and A. E. Frost, trading as the "Printex Manufacturing Co.," at 32a, Denmark Road, Hornsey, N., the secret involved in the manufacture of, and forming part of, a special accumulator, to carry on the business of manufacturers of and dealers in accumulators, motors, cycles and accessories, &c. The subscribers (with one share each) are:—F. C. Grund, 32a, Denmark Road, Hornsey, N., electrical engineer; A. E. Frost, 50, Lansdowne Road, Tottenham, N., traveller. Private company. The number of directors is not to be less than three or more than five; the first are F. C. Grund, A. E. Frost and W. H. A. Butterfield; qualification, £200.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

London and Suburban Traction Co., Ltd.—Particulars of £350,000 5 per cent. "A" debenture stock, created March 10th, and secured by trust deed dated April 6th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital £350,000 4½ per cent. first mortgage debenture stock, 168,246 6 per cent. cumulative preference and 181,190 ordinary shares of £1 each in the South Metropolitan Electric Tramways and Lighting Co., Ltd., and 12,490 ordinary shares in the Gearless Motor Omnibus Co., Ltd. Trustees: Union and Commercial Investment Co., Ltd.

Wellingborough Electric Supply Co., Ltd.—Issue on April 7th, 1914, of £500 debentures, part of a series of which particulars have already been filed.

Krupka & Jacoby, Ltd.—A memorandum of satisfaction in full on April 2nd, 1914, of debs., dated December 2nd, 1912, securing £8,000 has been filed.

Northampton Electric Light and Power Co., Ltd.—Issue on April 9th, 1914, of £150 debs., part of a series of which particulars have already been filed.

Bridgwater and District Electric Supply and Traction Co., Ltd.—Particulars of £13,400 debentures, created by resolutions of November 11th, 1903, and October 22nd, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,400. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Premier Electric and Hardware Co., Ltd.—Debenture dated April 29th, 1914, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. H. S. Evans, Chandos House, Rickmansworth Road, Watford.

CITY NOTES.

Great Northern Telegraph Co., Ltd., of Denmark.

In the absence of the chairman, Commodore E. Suenson, D.R.N., owing to illness, Rear-Admiral F. C. C. Bardenfleth, D.R.N., presided at the annual meeting held in Copenhagen, on April 25th. He said that during 1913 there were seventeen interruptions on nine cables in Europe and nineteen on six cables in the Far East. The increase in interruptions in the Far east was principally due to the more common use of trawlers in Chinese and Japanese waters. The cable steamer *H. C. Orsted* was occupied in Europe for 95 days, and the *Store Nordiske* and *Pacific* in the Far East for 206 days, of which 27 and 71 respectively were for the account of other Administrations. A new submarine cable has been laid between Great Britain and Denmark (Newbiggin-Sondervig), its principal object being to establish direct telegraphic communication between Great Britain and the capital of Denmark, the connecting landline between Sondervig and Copenhagen being provided by the Danish Government. The cable, about 350 N.M. long, was manufactured and laid by Messrs. Siemens Brothers, of London, under the control of the company's own engineers. The laying was successfully completed on 18th September, and direct service between Copenhagen and Newcastle commenced on the following day.

In spite of the political disturbances in Mongolia the Kiachta route has worked regularly. Traffic sent by this route, as well as the traffic by the route via Wladiwostock, has materially increased owing to the quick and reliable service, and also to the political events in China.

Last year reference was made to the company's extended negotiations with Japan. The working out of the details has taken so long that the final agreement could only be signed at the end of August, 1913. The shareholders have, however, no reason to complain as the delay, although contrary to the wishes of the company, postponed the coming into force of the considerable tariff reductions, and the decrease in the receipts was consequently felt only during the last few months of the year 1913. In order to terminate the negotiations it became necessary to make a last amicable sacrifice, viz., to place at the disposal of the Japanese Administration during the night one of the company's cables between Nagasaki and Shanghai, until the government cable between these two places could be laid, it being necessary first to obtain the sanction of the Japanese Parliament for the cost of such a cable. The consent of the Chinese Government was also necessary for this arrangement as well as for several stipulations affecting China's interests in the other agreements negotiated with Japan. Thanks to the support of the Ministers of Great Britain and of Denmark at Peking, the negotiations in this connection with the Chinese Government are so far promising, although all the points under discussion are not yet settled.

The financial results have not been so good as those of the previous year. No doubt the extraordinary boom in commerce and shipping in 1913 largely contributed to an increase in the traffic over the cables and lines, and this increase, combined with the postponement of the introduction of the tariff reductions in the Far East made the traffic receipts higher than they had the right to expect a year ago. The traffic receipts had nevertheless decreased by £13,280, and, at the same time, the expenses had increased by £31,400. The result was a decrease of the net revenue of about £48,000, without taking into consideration the amount brought forward from 1912. Notwithstanding this considerable decrease the Board was glad to be able to propose the same dividend and bonus as last year, making a total of 20 per cent. for the year.

From the revenue account the shareholders would notice that traffic receipts had decreased by £13,280, and that there had been a loss on exchange of £14,560 against a gain on exchange of £12,500 in 1912. Interest was less by £280 and sundries also showed a decrease of £3,100, principally due to the company's cable steamers having been less employed by other administrations. The expenses had been increased considerably, particularly salaries and wages, etc., by £18,360; expenses of stations and offices by £2,360; instruments and cells by £5,360, and travelling expenses by £2,230. These increases were due to the larger staff and to the new and improved telegraph instruments which were required for the satisfactory transmission of the constantly increasing traffic. Ordinary supervision had also increased by £2,950, mainly owing to an expensive repair of the cable steamer *Store Nordiske*, and to the cost of a wireless installation for that steamer. Rates and taxes had increased by £2,550, whilst sundries had decreased by £620. The balance sheet showed an increase under participation in other telegraph undertakings of £27,770, which represented a loan advanced to Iceland for the purpose of developing the Iceland telegraphic system. Investments had been written down by £29,400 owing to the decline in the value of the Government bonds during 1913. Amongst the other items it was only necessary to mention the decrease of sundry debtors by £16,230. The usual amount had been credited to the reserve and renewal fund, whilst an extraordinary amount of £91,500 had been debited that fund, the greater part of which was the cost of the manufacturing and laying of the new Anglo-Danish cable. The dividend equalisation fund had been credited with the usual interest, and sundry creditors showed a decrease of about £27,910.

Craigpark Electric Cable Co., Ltd.

The directors' report for the year ended March, 1914, shows a net profit of £10,671, plus £370 brought forward, making £11,041. The following appropriations are recommended :—Depreciation off buildings and machinery, £2,500; reserve account, £1,500; dividend, six per cent. preference shares, £2,850; dividend on 37,500 ordinary shares, at six per cent., for the year, £2,250; balance carried forward (subject to payment of directors' fees), £1,941. The directors report the continued steady expansion of the company's business. All departments are fully employed, and the number and value of orders in hand are satisfactory. The stocks have been carefully gone over by the managing director, and are certified by him as being correct. Owing to the large increase in the business, an additional director is nominated, Mr. W. H. Luther.

Continental.—Norway.—It is reported from Notodden that the Albion Products Co., which has for years had a large factory in operation for the production of carbide of calcium, are now going to extend their works by the building of an additional factory for the manufacture of ferro-silicium and electro-steel. The new project is due to the initiative of Mr. Hugo Laurell, who is the managing director of the company. He is an electric smelting expert, has invented a new type of carbide furnace, and the furnaces to be employed in the new works are of his design. Scrap-iron and pig-iron will be used as raw material, some of it being supplied from the Tinfos Electrical Works and the Ulefos Electrical Works, both situated in the vicinity of Notodden.

France.—The report of the Société Française des Cables Electriques, Système Berthoud, Borel & Co., Lyons, for last year, shows a net profit of £10,852, as compared with £10,789 in 1912.

Germany.—The report of the Akkumulatorenfabrik Gesellschaft, of Berlin and Hagen, for the last financial year shows a net profit of £147,608, as compared with £125,067 in 1912. The dividend is being reduced from 25 to 20 per cent., the capital of the concern having during the last 12 months been increased from £400,000 to £600,000.

Anglo-American Telegraph Co., Ltd.—The directors' report for the year ended March 31st, 1914, states that the dividend payments absorbed altogether £262,500, being the rent paid by the Western Union Telegraph Co. for the year, equal to 3¾ per cent. on the ordinary stock, 6 per cent. on the preferred stock, and 1½ per cent. on the deferred stock. The balance at credit of revenue account (£69,942) includes £4,317 bank interest, &c., received, and the balance of £65,625 is available for the payment of dividends for the quarter to March 31st, 1914, which was announced in our last issue.

West Coast of America Telegraph Co., Ltd.—In their report for 1913 the directors express regret that they are unable to recommend the payment of a dividend. The gross receipts were £53,645, as against £53,737 in 1912, but the working expenses were £47,586, as compared with £39,646. Owing to the readjustment of the International traffic proportions the receipts have been sufficient to pay expenses and the interest on the debentures, although the cable sections were interrupted for a period totalling 114 days, principally due to earthquakes, which affected adversely the revenue and materially increased expenses.

Alderley and Wilmslow Electric Supply, Ltd.—The directors' report for the year ended December 31st, 1913, showed that the total lamp connections increased from an equivalent of 24,898 to 27,823 8-C.P. lamps. The result of the year's working showed a profit of £2,848, which, with £445 brought forward from last year, gave a total of £3,293, and after paying £1,762 interest on debentures and loans, there remained a balance of £1,531. £900 is to be put to reserve fund, and the balance, £631, carried forward.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—Gross receipts for 1913 £738,129, against £747,230 for 1912. Working expenses £354,864, against £321,012. A final dividend of 1¼ per cent. is recommended, making 5 per cent. for the year, and a bonus of 2 per cent. is also to be paid. £130,000 has been transferred to general reserve fund, and £30,617 is to be carried forward.

Submarine Cables Trust, Ltd.—The accounts for the year ended April 15th show an available balance of £24,065. After providing £16,470 to meet payment of the coupons, £7,565 has been transferred to redemption fund, and £30 carried forward.

Eastern Telegraph Co., Ltd.—The directors recommend a final dividend of £1 5s. per cent., and a bonus of £2 per cent., making a total distribution of 7 per cent. on the ordinary stock for the year 1913.

Increase of Capital.—It is stated that the capital of the Alldays and Onions Pneumatic Engineering Co., Ltd., is to be increased from £125,000 to £275,000.

Prospectus.—*West Penn Traction Co.*—This week there have been offered in London $6,000,000 three-year 6 per cent. secured gold notes at 99 per cent.

Lisbon Electric Tramways, Ltd.—A final dividend of 3 per cent. is recommended in the directors' report, making 6 per cent. for the year. £1,749 is carried forward.

Dudley, Stourbridge and District Electric Traction Co., Ltd.—After paying a dividend of 4 per cent. for the year 1913, £75 is to be carried forward.

Bombay Electric Supply and Tramways Co., Ltd.—A dividend of 6 per cent. on the ordinary shares for 1913 is announced.

City of Buenos Ayres Tramways (1904), Ltd.—A quarterly dividend of 1¼ per cent. is announced.

West African Telegraph Co., Ltd.—Final dividend 4s. per share, making 4 per cent. for the year.

Electrical Apparatus Co., Ltd.

The directors report that for the year ended 31st December, 1913, the profit (after providing £777 for depreciation and £272 for writing off 33⅓ per cent. of development account) amounted to £7,157, which, after deducting directors' fees and proportion of profit estimated to have accrued to the 30th June, 1913, and paid to the old company £3,845, leaves available £3,312, which the directors recommend should be dealt with as follows:—Preference dividend for half-year ended 31st December, 1913 (already paid) £139, writing down formation expenses by 50 per cent. £118, placing to reserve account £1,000, dividend at the rate of 7 per cent. per annum on the ordinary shares for the half-year ended 31st December, 1913, £1,100, leaving to be carried forward £24. The company's sales for the year under review have increased from £22,105 to £32,262, or 46 per cent.; whilst the net profit, before payment of directors' fees, has increased about 33 per cent. The percentage increase in profit would have approached more closely to the percentage increase in sales, but for a large amount of new development work which has been paid for out of revenue. Another factor which had a similar bearing was the establishment of branches in Cardiff and Birmingham, the full benefit of which had not been felt during the period under review. The directors state that the company's new products are meeting with success, and the turnover effected by the various branch offices is now increasing in a satisfactory manner. The directors are of opinion that the turnover and profits will again show a satisfactory increase in the current year.

We are informed that at the annual meeting of the company, held at Vauxhall Works, South Lambeth Road, on 27th April, Mr. E. B. Schattner, who presided, after commenting upon the satisfactory nature of the accounts, explained that an exceptional amount of development work was carried on during 1913, and as a large proportion of the expenses incurred in connection with same was due to important improvements introduced in the company's standard apparatus, the directors considered it desirable to pay same out of revenue. Further, their technical staff had been doubled in order to effect more complete supervision of their manufactures in course of progress and whilst under test. They would in the future reap the benefit of their progressive policy, and their present staff was capable of dealing with a larger turnover. The efforts of the directors had always been directed towards improvement of their manufactures, and this had met with appreciation from their customers; the remarkable progress that the Company had made during the past seven years was well illustrated by a chart shown.

The report was adopted.

Stock Exchange Notices.—Applications have been made to the Committee for a special settling day and quotation in :—

Victoria Falls and Trans. Power Co., Ltd,—£650,000 5½ per cent. second mortgage debentures, series "B."

And for an official quotation in :—

Calcutta Tramways Co., Ltd.—Further issue of 2,705 5 per cent. cumulative preference shares of £5 fully paid, Nos. 47,296 to 50,000.

A special settling day has been appointed as follows :—

Thursday, May 21st.—Waygood (R.) & Co., Ltd.—Further issue of 15,000 ordinary shares of £1 each fully paid, Nos. 135,001 to 150,000 and 15,000 6 per cent. cumulative preference shares of £1 fully paid, Nos. 135,001 to 150,000.

And the following is to be quoted in the Official List :—

Christchurch (City of).—Scrip fully paid for £100,000 4½ Electric Power District Loan.

Consolidated Diesel Engine Manufacturers, Ltd.—A circular has been issued, dated April 30th, advising shareholders that after the issue of the circular on March 6th, giving the preliminary figures of the valuation by Messrs. Wheatley Kirk, Price and Co., of the works at Ghent, the directors, on 10th ult., held a conference with some of the larger shareholders, when the outlines of an arrangement for the provision of the necessary working capital were considered. Negotiations for the carrying out of this arrangement were thereafter commenced, and are still in progress. "The delay which has taken place in completing them has been unavoidable, but the directors hope to place the completed scheme before the shareholders at an early date."

Bridgwater and District Electric Supply and Traction Co., Ltd.—The directors report a steady increase in the business and a saving to consumers by the introduction of the metal-filament lamp. Last year the company sold nearly a quarter of a million units, most of which was for lighting; while their power load now consisted of 50 motors. The company regarded Bridgwater as the cheapest town for electricity in the West of England. After providing for debenture and other interest charges £693, renewals £439, and the 6 per cent. cumulative preference share dividend, there was, including the amount brought forward from the last account, a net surplus of £652, which was carried forward.

Amalgamation.—It is announced that the directors of R. Waygood & Co., Ltd., are acquiring the entire interest of the Otis Elevator Co., of America, in the Otis Elevator Co., Ltd., of London. The details of the scheme are set forth in a circular which has been sent to shareholders.

Callender's Cable and Construction Co., Ltd.

For the year ended December 31st, 1913, the accounts shew a balance at the credit of profit and loss of £[illegible], plus £91,745 brought forward, making £[illegible]. From this there are deducted:—Interest on debenture stock, £[illegible], dividend on preference shares, £10,000, appropriation for depreciation of buildings, plant and machinery, £[illegible], appropriation for depreciation of office furniture, £256, making together £[illegible], leaving an available balance of £150,[illegible]. It is proposed to deal with this as follows: Dividend on ordinary shares at the rate of 10 per cent. per annum, less income tax, being 10s. per share, whereof 5s., less income tax was paid on 1st November, 1913, and 5s., less income tax, will be paid on 16th May, £17,500; a bonus of 5s. per share, less income tax, £8,750; carrying forward £124,591. The directors are of opinion that the above results are highly satisfactory, although the balance at the credit of the year's working is slightly less than that of 1912, which marked a record in the history of the company. The workshops were kept continuously busy during the past year, large orders having been secured both at home and abroad, but the most satisfactory aspect of the year's trading was the regular increase in general business in all classes of cables manufactured in Erith. The increased use of electricity for power in mills and factories and on railways has brought important orders for cables to the company. It appears likely that considerable extensions in this direction will take place in the near future. Complete arrangements have been made to deal with the higher voltages and increasing requirements of this branch of supply. During the year important developments have taken place in regard to telephone work, and considerable orders have been executed for the Colonies and abroad. On January 1st, 1913 (1912?), the telephone system of this country passed into the hands of the Government, and after lengthy negotiations contracts were entered into, in November last, between this company and the General Post Office by which much of the telephone development work in the South of England is placed in this company's hands. These contracts have already resulted in important orders for the laying of conduits and for the cables required therein. The telephone department is therefore very busy, both in the factory and in the numerous towns in which active operations are proceeding, and there is every prospect of continued activity during the present year. To render it possible to deal efficiently with the increased work thus secured, considerable additions to the plant and some re-organisation of the existing machinery were made at the Erith factory, and much of the cost of this has been charged to repairs and renewals account. Fresh agreements for the representation of the company in South Africa and in several of the South American Republics have been entered into, and other arrangements made for the extension and consolidation of the company's business in cables, for lighting, power and telephones, and in rubber wires. The Anchor Cable Co. of Leigh, which is controlled by this company, has again had a prosperous year. The sales of rubber wires and cables have considerably increased, and as in the previous year, the directors have declared a dividend of 15 per cent., besides adding considerably to the amount of undivided profits. The labour unrest, though not so acute as in the previous year, continued. The engineering department had no active trouble with its men, but the after effects of the strikes of 1912 gave considerable anxiety to the management. As usual, all machinery, plant, and appliances at the factory, and upon outside contracts at home and abroad, have been thoroughly maintained, and all expenses in so doing have been charged against the year's accounts. The electrical undertakings in which this company hold shares and debentures, are making steady and satisfactory progress. The use of electricity for power, especially in the manufacturing districts, is steadily increasing, and the company has secured a large amount of business resulting from its connection with these undertakings.

The meeting will be held on May 14th.

Eastern Telegraph Co., Ltd.

The accounts for the year ended 31st December, 1913, show that the revenue amounted to £1,462,844, from which is deducted £562,953 for the ordinary expenses, and £122,265 for expenditure relating to maintenance of cables. Sundry differences in exchange, income tax payable abroad, and interest on temporary loans, leave a balance of £777,626, plus £26,382 brought from the preceding account, making a total available balance of £804,008. After providing for income tax payable in England, interest on mortgage debenture stock, and dividends on the preference stock, which in all absorb £168,321, there remains a balance of £635,687, out of which the directors have placed £330,000 to the general reserve fund, and have paid three interim dividends of 1¼ per cent. each on the ordinary stock, aggregating £150,000. The directors recommend a final dividend on the ordinary stock of 1¼ per cent. and a bonus of 2 per cent., amounting altogether to £130,000, making a total distribution of 7 per cent. for the year. It is proposed to carry forward £25,687. The important renewals to the Red Sea and Indian Ocean cables have been carried out, and the new cables between Suez, Aden and Colombo have been successfully laid. Additional cables have also been laid by the Eastern Extension Co. between Colombo, Penang, Singapore and Hong Kong, and a new alternative route via Colombo is thus added to the system. The tariffs between Europe and Hong Kong, China, Japan, Straits Settlements and the Dutch East Indies were considerably reduced on 1st September. By arrangement with the Indian Government and the Administrations interested in the Indo-European route, the tariff between Europe and India, Burmah and Ceylon has been reduced from 2s. to 1s. 8d. per word as from 1st May. The acceptance of "week-end" telegrams has been extended to additional countries and the regulations relating thereto have been simplified. The Right Hon. Lord Inchcape has been appointed to the board.

Hastings and District Electric Tramways Co., Ltd.

The directors reported that for the year ended December 31st, 1913, there was an increase in the traffic receipts of £3,638, mainly due to the improved weather conditions. The expenditure shows a net increase of £2,612, caused by the enhanced cost of coal, and by certain extra renewals of power house and car equipments, etc. The revenue account of this company, after crediting receipts from the statutory company, £18,505, and debiting administration expenses, £1,339, shows a balance of £17,166, plus £3,051 brought forward, and deducting £10,390 for interest charges, there remains an available sum of £9,827. An interim dividend of 3 per cent. on the preference shares was distributed in October last, and it is now proposed to pay a final dividend of 3 per cent. making the full 6 per cent. for the year. There is to be £2,990 transferred to depreciation account (making it £25,000), £1,000 is to be written off the suspense account, and £1,037 carried forward.

"As announced at the annual general meeting last year, the bill promoted by the company for the substitution of overhead traction for the Dolter system on the front line was thrown out by the House of Lords. As the Board of Trade had in the meantime condemned the Dolter system, it was necessary to find some other means of carrying on the service in that part of Hastings. After the most careful consideration the board decided to adopt the Tilling-Stevens petrol-electric system, and an order has been placed for the conversion of the 17 cars required for that purpose; six of these have been delivered and are in use, the remainder being promised for delivery before the beginning of the summer season. The Dolter system has, in the meantime, been finally abandoned, and the studs physically disconnected. To meet the cost involved your directors have made financial arrangements which they hope will obviate the necessity of any fresh issue of capital."

The annual meeting was held on Tuesday, at 1, Queen Victoria Street, E.C., Mr. George Kitchin presiding.

The Chairman said that at the last meeting he said that as a result of their bill being thrown out the position was acute. The bill was dead, and with it the prospect of substituting the only really efficient and economical system that they knew of that could be adopted in place of the stud system. Further, they had been notified by the Board of Trade that in September they would call upon them to cease using the stud system. They had taken time by the forelock, and, as a preliminary to the placing of their case before Parliament, had discussed with their consulting engineers all other known schemes of electric traction, and had received from Messrs. Kincaid Waller, Manville and Dawson a report upon the subject of these possible alternatives. This report was, however, mainly theoretical; and when the decision of Parliament was known it became urgently necessary for them to have further and more exact particulars as to the possible methods of getting round the difficulty which confronted them. In July their engineers were in a position to definitely advise them as to the various alternatives; and after careful enquiry they decided, subject to the approval of the Board of Trade, to instal the Tilling-Stevens petrol-electric system on the front line. Before, however, that decision could be carried into effect, there were numerous technical difficulties to be overcome. For instance, owing to the fact that they had a 3ft. 6in. gauge, and that, consequently, their cars were narrow compared with those in use, for instance, in London, it was found impossible to instal, as the contractors had wished, a 40 horse-power engine, and it was only by a great deal of very ingenious scheming that it was found possible to get a 30 horse-power equipment with the necessary machinery on to the cars at all. In devising these arrangements their consulting engineers received every assistance from the contractors, Messrs. W. A. Stevens and Co.; but some valuable time was necessarily lost. Eventually a car, converted for the purpose of the new system, was delivered in Hastings and inspected by the Board of Trade on January 15th last. With certain slight modifications it was approved, and the provisional contract, which contemplated four cars only, was shortly afterwards extended to cover the whole of the requirements of the front line, namely, 17 cars. The number might seem large, but it was not so when they bore in mind that these cars had to run, after they left the front line at Hastings, a through service by means of the overhead system to Bexhill and Cooden Bay; and as they ran a three or four minutes' service in the busy season on the front line, it was necessary that their fleet of cars should be adequate for the purpose. The route was the most important and valuable of the whole system, and anything that involved its even temporary disuse would be both a calamity to the company and a cause of the greatest inconvenience to the inhabitants of Hastings and Bexhill. Fortunately for them the Board of Trade held its hand for a time, so far as ordering the cessation of the Dolter system was concerned; and he wished to say that throughout this difficult period the Board of Trade had treated the company with the greatest courtesy and consideration. To this, indeed, was due the fact that when it finally became necessary to cease running the cars on the surface contact system, they had four of the converted petrol-electric cars ready to take up a shuttle service between the Memorial and Bopeep. They had now six cars in service, and Messrs. W. A. Stevens were under contract to deliver the remaining 11 by the middle of July, which was practically the beginning of the busy season. The cars which they had were running satisfactorily, but they had not been in service a sufficient length of time to enable them to say what the running cost was going to be. That it would be more than that of the Dolter system they were assured, but every effort would be made to reduce it to a minimum. As was to be expected, some of the good folks in Hastings had been exciting themselves because there was noise in connection with the changing of gear and running on the lower speeds, and because the smell of petrol was perceptible in the cars. But, after all, it was not possible to satisfy everyone, and as the Corporation of Hastings had decreed that the overhead system was not to be used on the front line, the board had had to do what it could, in the shareholders' interests and those of the public, to provide an efficient substitute. They wished to give Hastings the best, but as, to their regret, they would not have it, they must needs be content with what they were allowed to give them. Turning to the financial aspect of the matter, the board had decided to place to a suspense account the cost of the bill—amounting to very nearly £2,000—also the cost of the conversion of the cars, which they estimated at something under £12,000, with the intention that the item should be written off from time to time as the occasion might offer. He was pleased to say that they had made arrangements for financing this expenditure, at any rate for the present, which were of a satisfactory nature; and which they hoped would enable them to avoid the issuing of further capital. This expenditure could not, in their opinion, be properly charged to capital account, inasmuch as it was a replacing of one asset which had ceased to exist by another. With regard to the accounts he thought they would agree that they were more satisfactory than those which the board last year placed before them. There had been a fair increase in the traffic receipts, amounting to £3,638, principally due to the fact that last summer they had brilliant weather as compared with the same season of 1912. This increase of receipts, however, had involved increased expenditure. In carrying 530,000 passengers in excess of 1912, they had to run 67,000 more car miles; and while the traffic receipts per car mile increased from 9.31d. to 9.49d., the expenses increased from 6.43d. to 6.58d. There was an increased expenditure at the power house of £1,500 or thereabouts, largely due to the increased number of units generated to provide energy for the increased mileage, though the enhanced average price of coal—which cost 0.515d. per unit as against 0.495d. per unit for 1912—also contributed to the result. In this latter respect he was hopeful that an improvement would be shown during the current year—the price of coal having given way somewhat. They were carrying forward a much less sum this year than last. On the other hand, last year they added nothing to their reserve for depreciation, but took from that reserve £1,990. This was now being made good, and a further £1,000 added. At this time last year also, they were in the dark as to what might happen in the near future. They were faced with the danger that they might be compelled to cease running on the Dolter system before they had had time to provide a substitute; and they, therefore, thought it necessary to carry forward a considerable sum. Fortunately that contingency was avoided, and therefore they thought it sufficient to carry forward only £1,036. In view of the financial arrangements to which he had referred, and of the uncertainty which at present existed as to the working cost of the petrol-electric system, it was quite possible that the board might think it advisable not to pay an interim dividend on the preference shares in the autumn. He did not wish them to misunderstand him. He did not say that the dividends on the preference shares would not be paid in full when the year's accounts came to be made up. He only wished to notify them beforehand in order that should they not receive an interim dividend they might not be unnecessarily alarmed. Their relations with the corporation remained fairly amicable, and he was glad to say that, in the opinion of those best qualified to judge, there was a decided stirring of the dry bones in Hastings. During the last twelve months the corporation had taken several important steps in a forward direction, which while involving considerable expenditure, should have the most satisfactory results for the town and the inhabitants. In added prosperity that might accrue from this policy of the corporation, they might hope to participate. Meanwhile the traffic on the unremunerative section of their line—that to Cooden Bay—was increasing, and they still hoped that eventually this part of the system would at least pay its way. In conclusion he hoped that they would prove to have surmounted the worst of their difficulties, and to be at the beginning of a progressive and more prosperous series of years.

Mr. J. C. Williamson seconded the motion, and the report was adopted unanimously.

Kalgoorlie Electric Power and Lighting Co., Ltd.

The annual meeting was held on April 29th at Winchester House, E.C., Mr. Edward Pope presiding.

The Chairman, in proposing the adoption of the report (see Elec. Rev. p. 750), dealing first with the balance sheet, said that on the debit side there was no alteration in the capital account or in the debenture issue. The reserve for depreciation and renewals had been increased to £11,000. That money they had been previously informed had been spent in the Company's business, some of it in renewals, most of it in new plant and machinery. During the last six years £62,120 had been spent on new plant, new machinery and equipment, a sum larger than the whole debenture issue. In the same period £56,500 had been paid in dividends. He was pointing out those facts because he had been informed that some of their debenture holders considered they should have already provided a fund for the redemption of the debentures. If they would calmly consider the information he had given them he thought they would be reassured. The Company's position was thoroughly sound both financially and industrially, and having now provided the new plant necessary, the directors would take the necessary steps to provide for the debentures. On the credit side of the balance sheet there was an item of £7,629 sundry debtors including payments in advance. The payments made in advance were small, and the bulk of the sum was money due in the ordinary way of business for current supplied. Nearly the whole of that had been paid, and the manager had reported that he considered the small balance—under £100—was good, and would be paid. The speaker referred to the item of £850 for directors' fees. Those fees were fixed by the Articles of Association. The maximum number of directors permitted by the Articles was seven, and the minimum three. In the early days of the Company they had seven directors, and the fees amounted to over £2,000 per annum. As opportunity occurred the number was reduced to three. A resolution for the reduction of the directors' fees would be out of order, because it amounted to a proposal to alter the Articles of Association. As regarded the general position, there were three classes of shareholders interested in that company, and the first were the debenture holders. They were not partners, but creditors of the company. The company were debtors to them for money lent, and, as prudent men, the directors must be prepared to settle with them when the day arrived. The money they lent had been spent in improving their security. The other two classes of investors were partners owning the business—the preference and the ordinary shareholders. The preference shareholders, who were the backbone of the business, were, he knew, not well pleased on that occasion that their dividend was reduced to 4 per cent., but he hoped they would agree that the directors were doing the right thing in conserving the company's money at the present time. Their interest had always been the first consideration of the directors in the past. They had always looked upon the preference shareholders as being the backbone of the enterprise. They had received as dividends £71,800 in cash out of a total sum paid of £73,800. They had also received as dividend £37,500 in ordinary shares, and he trusted they would not now object to the company's position being strengthened for the special purpose of being in a strong position to deal with the debentures. They had lost something in dividend, but he hoped they would be in a measure recompensed later by the strong financial position of the company, which would restore confidence and thereby produce a legitimate appreciation in the price of their shares. When the debentures had been entirely paid off, or the amount outstanding greatly reduced, there would be, he hoped and believed, a time when even the holders of the ordinary shares would get a satisfactory dividend. If any criticism was offered to that forecast it would probably be by the pessimist, who would say that the Kalgoorlie goldfields would be dead before they could do all this. Without pretending to see any further into the future than any other man of experience, he ventured to think that the Kalgoorlie goldfield would be requiring a great amount of power for a long time to come. The falling-off in profit last year should not be read as a sign that they were drawing near the end of their profitable period. He had given the matter much serious thought, and he believed that by constant care and watchful attention they would continue to make some modest profit for many years to come. He was glad to be able to tell them that the present year had started better than last. The amount of gross profit at Kalgoorlie for January, 1913, was £1,271; this January it was £1,376; an increase of £105. For February, 1913, the figures were £1,354, this February £1,702; an increase of £348; while for March this year the figures were £2,150 against £1,521 for the corresponding month in 1913; an increase of £629. Thus there had been an improvement in the gross profit in the quarter of £1,082. That increase was partly due to new contracts and partly to improvement in economy in the working of the plant, resulting from the large expenditure on new plant and from the forethought bestowed upon it. That seemed to indicate that their profits might be again as good as they had been in past years. During the time they had had control of the company they had built up the business from the state of being a paper proposition to being a successful enterprise with an average net profit of about £20,000, and while they retained the confidence of the shareholders, they believed they could keep the company in the path of prosperity.

Mr. G. P. Doolette, J.P., seconded the motion.

Mr. Cross asked what steps they were taking to redeem the debentures, and to what extent, if any, the Trans-Continental Railway would affect Kalgoorlie.

The Chairman said that in so far as the Trans-Continental Railway benefited the town and increased trade and business there they would undoubtedly derive some small advantage, but in the main the railway would not benefit them unless it should happen that manufacturing businesses were started in the town as a result of its becoming a great railway centre.

Mr. Parker, as representing second debenture holders, pointed out that the company was practically earning its preference dividend and he would suggest that instead of cutting down the dividend it should be paid in full, a portion being paid in second debentures. He felt sure that would greatly strengthen the cash position of the company.

The Chairman said that the point as to whether they could arrange to issue second debentures or something similar had been exercising his thoughts for some time. It must, however, be remembered that while they had 150,000 preference shares they had also 100,000 ordinary shares, and anything of that kind might be upset by the ordinary shareholders. The Board would again take the matter into consideration and the shareholders might rest assured that their most earnest desire was to arrange the matter in a way that would be satisfactory to the whole of the shareholders.

The report was adopted.

Willans & Robinson, Ltd.

Mr. J. C. Peache presided at the annual meeting, held on April 30th, at Rugby. After referring to the financial result (see Elec. Rev. p. 709) and the payment of a dividend of 10 per cent. on the small ordinary capital, he said that the depreciation had not been written off the Rugby plant and premises as it was not considered necessary in view of the moderate figure at which they stood in the balance sheet in consequence of the recent reduction of capital. Stocks had been gone through and written down as necessary; all liabilities on outstanding work had been well covered by a large sum spent out of revenue on renewals and efficient upkeep of the works plant. The loan from the bank had been reduced by £5,000. The three months' strike in the foundry had adversely affected production in other departments, besides causing direct loss of orders for castings from outside customers who depended on quick and regular delivery. Some thousands of pounds' worth of business was lost, but customers were now returning to the company. The damaging effect upon the whole business of sudden stoppage in one department resulted in loss of orders, which meant loss of employment for workmen. During the year there had been a good volume of turbine work and a large increase in the volume of Diesel engine work—that was, during 1913 the output of Diesel engines had exceeded that of 1912 by some 50 per cent. One gratifying feature of the Diesel engine business was that the orders received were largely composed of repeat orders from people who had already installed Willans Diesels. But for the high price of fuel oil during the past year in this country, the sales in England would have been better than they were. A large portion of the sales had been for export. The company now held a strong position in the Diesel engine business. Apart from turbines and Diesel engines, which still formed the largest portions of the business of the company, there were other lines of manufactures, more recently introduced, that were now steadily becoming a regular part of the business, and were promising favourable results. Mr. Harry Barber was, in April last, appointed a director.

Mr. Barber seconded the adoption of the report, and this was unanimously agreed to.

Mr. J. C. Peache was re-elected a director, and a fee of £250 was voted to Mr. Harry Barber for his services during 1913. It was resolved that the total annual remuneration of directors (other than the managing director) be at the rate of £1,200 per annum, payable quarterly, to be divided as they themselves might determine.

Paignton Electric Supply Co. Ltd.

The annual meeting was held on Monday, Mr. W. J. Ham presiding. The report of the directors stated that on the revenue account the trading showed a profit of £1,452, and from this £508 was taken for depreciation and £27 towards reduction of the debenture suspense account, leaving a gross profit of £916. Debenture interest required £375, and interest on temporary loan and truck interest amounted to £144. The net result was that the balance against the net revenue account stood at the end of the year at £491, against £888 at the commencement of the year, thus showing a net profit on the year of £397, which the directors considered was highly satisfactory. They look forward to the next year being a record one, and also to the near future, when a dividend would be declared. The sale of electricity increased from £2,695 for 1912 to £3,123 for 1913.

The Chairman said that they had had a year of great success. The only drawback was that they had overstepped the capital, and had to pay interest on a loan of £3,000. The report was adopted.

United River Plate Telephone Co., Ltd. — The directors' report shows that for the year ended December 31st, 1913, the gross receipts in sterling in the River Plate were £599,548. Deducting expenses in Argentina and London, debenture interest, dividend on preference shares and interim dividend on ordinary shares, and adding interest on investments, transfer fees, &c., and the sum of £5,805 brought forward, there remains an available balance of £119,357. After making the appropriations shown in the accounts the directors recommend that a final dividend of 5 per cent. be paid on the ordinary share capital of the company, making, with the interim dividend paid on November 1st last, a return of 8 per cent. for the year, free of income-tax, and that £6,357 be carried forward. The business continues to make sound progress, and the outlook is satisfactory.

West African Telegraph Co., Ltd.—The directors' report for 1913 states that the revenue was £45,915, from which is deducted £17,350 for the ordinary expenses, and £12,311 for expenditure relating to maintenance of cables, sundry differences in exchange and income-tax abroad, leaving a balance of £16,253, plus £94 brought forward, making a total available balance of £16,348. £1,038 had been provided for income-tax, £6,000 transferred to general reserve fund, and an interim dividend of 2 per cent., absorbing £4,622, was paid on December 1st. The directors recommend a final dividend of 2 per cent., making 4 per cent. for the year, £66 being carried forward. The directors record with deep regret the death of Mr. Robert Kaye Gray, who had been a director of the company from its inception.

Iceland.—It is reported from Copenhagen that the subscription of shares in the new company which is being formed for the purpose of harnessing the Jettifos, Iceland, is making very good progress, and large sums have already been subscribed by Danish and Norwegian financiers. It is intended to erect a large manufactory for the production of "Norge Salpeter," or nitrates similar to those at Rjukan, although the methods to be employed for the manufacture are said to be new.

Reduction of Capital.—The Calmon Asbestos and Rubber Works, Ltd., and Reduced.—A petition for the confirmation of the reduction of the capital from £50,000 to £6,001 8s., has been presented, and will be heard on May 12th.

Potteries Electric Traction Co., Ltd.—A dividend of 3½ per cent. for 1913 is announced.

STOCKS AND SHARES.

Tuesday Evening.

The Budget, by the time this paper appears on Friday, will have lost the immediate freshness of its interest; but to-day, Tuesday, discussion of its provisions has been the principal source of Stock Exchange attention. Upon prices the immediate effect was dulness in Consols and other gilt-edged securities, since the additions to the taxations of wealth militate against stocks and shares which bear comparatively low rates of interest. So far as the electrical descriptions are concerned, the Budget has had practically no effect at all, for such issues as 4 per cent. Debenture stocks and the like are too well held for their quotations to be affected in any direct manner.

Market dispositions continue to move mercurially, according to the rise and fall of the political barometers at home, as affecting Ulster, or abroad, as concerned with Mexico and Brazil. The impression grows that a middle way will be found through the Ulster tangle, and, accordingly, more confidence is felt in the domestic outlook. The muddle in Mexico is also conceived to be a shade less involved than it was at the end of last month, and this sentiment is reflected in substantial rallies from the slump in the various Mexican utility stocks and shares.

Home Railway stocks recovered smartly, on the olive-branch speech of Mr. Winston Churchill a few days ago; but prices sagged back again to some extent, because of the heaviness of Consols. However, the Undergrounds recovered a little from their previous flatness, and Metropolitans went up 1, Districts ¼, and Central London Assented Deferred gained a point. The Underground Electric Railways group shared in the improvement, but the advance was difficult to sustain, and there has been a relapse from the best. The company's £10 shares are ⅛ better on balance.

The District Railway, with its usual commendable enterprise, is reserving special coaches for season-ticket holders: and this should not only conduce to the comfort of the present travellers, but ought to have the effect of increasing largely the numbers of those applying for season tickets on this line. Many people have felt that it was useless to take out a season ticket, especially first-class, when they knew that they would probably be unable to find room in carriages into which trooped third-class ticket-holders who paid excess without demur, but kept their seats, when inspectors appeared.

British Electric Traction 6 per cent. Preferred stock eased off to 89½. We understand that the board are not unfriendly to representations which have been made to them in regard to a re-organisation of the present split-up capital account, and it may be that a carefully-devised plan for grouping the issues into fewer stocks will be forthcoming this summer.

Electricity supply shares hold their ground with noticeable steadiness. City Lights have recovered to 16¾, and Westminster Ordinary are better at 8⅝. Mr. H. B. Renwick's scheme, defeated though it stands at present, is quite likely to form the basis of some kind of compromise between the various interests in the London supply industry; and it seems to be plain enough that the question, as a whole, is not going to be allowed to drop. Some plan of unification will be evolved; and the various parties, after the excitement of the withdrawing of the recent Bill, are taking breathing space, and stock of the situation, pending the next definite move by one section or another.

Mexican securities, as already stated, have undergone a sharp change for the better, but the improvements registered this week wipe out only a part of the heavy losses recorded in our last issue. Events in Mexico appear to be working—by devious ways and with many impediments—towards the *rapprochement* of that country and the United States, because friendly offers made from outside sources in the cause of mediation are evidently acceptable to both. Meanwhile, private property appears to be respected in a manner which evokes a mild degree of surprise from those who know what Mexican soldiers are, and who include the present fighting forces under the single term of brigands. Up to the present, little damage has been done, so far as reports have reached this country, to the undertakings in which foreign capital is invested. The hope that these concerns will escape has led to the recoveries just mentioned.

Mexico Trams and Mexican Light and Power shares and bonds show rises ranging from 1 to 7 points. Brazilian Tractions, after their fall of 6, recovered 1½; and Canadian General Electric Common also regained 4 points of its last week's drop. An appeal has been issued to holders of Mexican Northern Power bonds to ensure the deposit of a sufficient number in order that the creation of the three million dollars Prior Lien bonds, referred to in these columns last week, may be sanctioned. A strongly-worded cable received the other day declared that failure to deposit the majority of bonds by May 12th will involve practically the total loss of the work already done. Having regard to the fact that the current quotation is 20-25, it would appear that holders can scarcely lose much by consenting to the present scheme.

Callender's report makes very pleasant reading for the shareholders, and the company is in an exceedingly strong position; the Ordinary shares remain at a little over 12. India-Rubber Ordinary eased off to 10½, a drop of the fraction, but Telegraph Constructions added this amount to their price. Babcocks are 3, *ex* the dividend, and British Aluminium Ordinary went back to a sovereign. The rubber put up at the Mincing Lane auctions this week realised a fair price, and a good demand was reported; but so far as prices of shares in the Stock Exchange were concerned, the market has been slightly dull, although there is still steady demand for the shares of the best-class investment variety.

After their slump to 2⅞, Marconis have recovered to 3⅛. Americans are dull at 15s. 9d.; Canadians keep a trifle above 7s. Mackay Common and Preferred gave way on Wall Street pressure to sell. West India and Panama Ordinary are $\frac{1}{16}$ harder. Eastern Extensions put on another ⅛. West Coast of America shares have fallen $\frac{3}{16}$ on the report, which shows that the company has made very little more than is required to pay expenses and interest on the Debentures. The Submarine Cables Trust report announces that £9,700 Anglo-American Telegraph Preferred stock has been sold during the year, part of the proceeds being exchanged into Great Northern Telegraph and Mackay Companies' shares.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Apl. 22	4,026	+ 692	16	12,512	+ 855	..	..
Blackpool-Fleetw'd	„ 25	2,985	+1,515	16	5,888	+ 716	8	..
Bristol	„ 24	26,384	+8,007	17	126,727	+11,740	80·5	..
Brit. Elec. Trac. Co.	„ 27	204,043	+ 813	..	..	..	429·8	..
Chatham and Dist.	„ 23	4,149	+ 617	16	18,969	+ 891	14·98	..
Cork	„ 23	2,038	+ 128	16	7,426	+ 113	9·89	..
Dublin	„ 24	23,501	+ 54	17	87,707	2,671	54·25	..
Hastings	„ 22	4,307	+ 891	16	..	+ 264	19·3	..
Lancashire United	„ 22	7,132	+1,580	16	25,574	+ 3,398	42	·3
Llandudno-Col. Bay	„ 24	1,217	+ 400	21	8,808	+ 91	6·5	..
London United ..	„ 24	29,153	+5,435	17	94,584	+ 4,877	..	..
Tyneside	„ 22	2,655	— 757	16	8,312	— 572	11	..
Anglo-Argentine ..	„ 22	224,145	3,961	16	979,699	+18,186	..	..
Auckland	„ 10	21,702	+1,486	40	204,124	+ 4,813	25·42	1·81
Calcutta	„ 25	17,675	+ 693	..	..	+ 3,495	..	..
Kalgoorlie, W.A. ..	Mar.	2,476	..	13	6,985	..	20·5	..
Madras	Apl. 10	4,320	+ 699	17	15,337	+ 1,252	15·25	..
Montevideo ..	April	29,645	— 442	26	200,176	+ 414	..	..
Cen. London Rly.	Apl. 25	18,411	−2,510	17	86,284	− 4,085	6·78	·4
City & S. Lon. Rly.	„ 25	10,331	−1,421	17	39,650	— 2,512	7·26	..
Dublin Lucan Rly.	„ 24	694	+ 71	16	1,981	— 46	7	..
L'pool Overh'd Rly.	„ 26	6,855	+ 399	17	28,121	+ 1,052	6·6	..
London Elec. Ry. Co.	„ 25	55,865	—1,870	17	246,585	+ 610	21·25	..
Mersey Railway ..	„ 25	9,236	+ 22	17	38,472	+ 133	4·5	..
Metropolitan Rly.	„ 26	72,328	+6,448	17	304,052	+26,987	29·25	8·5
Met. District Rly.	„ 25	51,733	—1,027	17	224,203	+ 506	25	..

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 5th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	15½ — 17½	..	..
Do. Do. Deferred ..	100	..	..	6½ — 8½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	88 — 91	—1	6 11 10
Do. 7 % Non-Cum. Pr'f.	100	3	..	56 — 59	..	5 1 8
Do. 5 % Perp. Deb. ..	100	5	5	98 — 99	..	5 1 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 80 xd	..	5 12 9
Central London Railway, Ord...	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	83 — 85	..	4 14 3
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	81 — 83	+1	4 16 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1903	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88 xd	..	4 11 0
Hastings Trams, 6 % Pref. ..	1	6	6†	17/32 — 3/4	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord. ..	1	..	..	3/8 — 9/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	17/32 — 21/32	+1/32	7 12 8
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	78 — 83	..	5 8 5
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	56 — 60	..	6 13 4
Metropolitan Railway Consol. ..	100	1⅝	1⅝	40¾ — 41½	+1	3 18 9
Do. Surplus Lands	100	2¾	2¾	63 — 65	..	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	..	4 5 4
Metropolitan District Ord. ..	100	Nil	..	26¾ — 27½	+ ½	Nil
Do. 6 % Deb.	100	6	6	138 —141	..	4 5 3
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 1
Do. 4 % Prior Lien	100	4	4	95 — 97 xd	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	84 — 87	..	5 3 6
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	87 — 90	—1	5 0 0
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 13 0
Potteries, Ord.	1	3½	..	⅜ — ½	..	..
Do. 5 % Pref.	1	5	5	17/32 — 21/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	3⅛ — 3⅜	+ ⅛	Nil
Do. "A"	1/-	..	..	7/16 — ½	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	114 —116	..	5 3 5
Do. 4½ % Bonds	100	4½	4½	99½ —101½	..	4 8 8
Do. 6 % Income	100	6	6	89½ — 90½	+ ½	6 12 7
Yorkshire (West Riding). Ord. ..	5	Nil	..	5/16 — 7/16	..	Nil
Do. 6 % Pref.	5	3	4	4⅜ — 4⅞	..	4 2 3
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 5th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅝ — 4⅞	..	5 12 10
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 9/16	..	6 0 7
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	98½ —101½	..	4 8 6
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 —106	..	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	78½ — 80½	+ 1½	7 9 0
Brisbane Trams Invt., Ord. ..	5	8	8	7½ — 8	..	5 0 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	111 —115 xd	..	6 19 4
Do. Pref. Ord.	100	6	6	104 —108	..	5 11 1
Do. 5 % Pref.	100	5	5	103 —105	..	4 15 2
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	96 —99 xd	..	4 11 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	93 — 95	— ½	4 9 1
Calcutta Trams, Ord.	5	7½	9½	6 11/16 — 7 3/16 xd	..	6 12 0
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	87 — 89 xd	..	5 12 4
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie El. Trams 5% A Deb.	100	5	5	84 — 89	..	5 12 4
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord. ..	1	..	..	¼ — ⅜	..	..
Do. Pref.	1	4⅜d.	6	23/32 — 31/32 xd	..	6 5 0
Lisbon Elec. Trams, Ord. ..	1	6	6	1¼ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	95 —100	..	5 0 0
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
„ Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	78 — 81	..	6 3 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ —100½	..	4 19 6
Mexico Trams Com	$100	7	7	67 — 70	+5	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	77 — 81	+5	6 3 5
Do. 6 % Bonds	100	6	6	72 — 77	+4½	7 15 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	3⅞ — 4⅜	..	11 8 6
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	89 — 92	..	5 8 8
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	95 — 97	—1	5 3 0
Do. 5 % Mort. Bonds	100	5	5	88 — 90	—1½	5 11 0
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	96 —100	..	5 0 0
Singapore Trams, 5 % Deb. ..	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅞ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	92½ — 95½ xd	..	5 4 9
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 5th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bournemouth & Poole, Ord. ..	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref... ..	10	6	6	10⅜ — 10⅞	..	5 10 4
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 9
Brompton & Kensington, Ord. ..	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8½ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91½ — 94½	..	4 4 8
Charing Cross, West End & City	5	5	6	4⅞ — 5⅜	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	97 —100	..	4 10 0
City of London, Ord.	10	9	10	16½ — 17½	— ¼	5 16 0
Do. 6 % Cum. Pref.	10	6	6	12¾ — 13¾	..	4 7 3
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 —103	..	4 8 1
County of London, Ord.	10	6	7	11¾ — 12¼	..	5 14 3
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	103 —106	..	4 5 8
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101 xd	..	4 9 1
Edmundson's, Ord.	£3	..	..	5/16 — 9/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4¼	..	7 1 2
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅞ — 5⅜	..	5 11 7
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9
Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 8	..	5 12 0
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅝ — 1¾	..	5 2 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	93 — 95	..	4 4 1
Metropolitan	5	4½	4½	3¼ — 3¾	..	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford..	5	7	7	5 13/16 — 6 5/16	..	5 11 0
St. James' and Pall Mall, Ord. ..	5	10	12	9⅛ — 9⅝	..	6 4 8
Do. 7 % Pref	5	7	7	6⅞ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2¾ — 3⅜	..	6 10 4
Do. 5 % First Mort. Deb. ..	100	5	5	99 —102	+ 1	4 18 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord...	£3	Nil	..	5/16 — 9/16	..	..
Do. 5 % Cum Pref.	5	3‡	4	2¾ — 3	..	6 13 4
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 12 8
Westminster, Ord...	5	10	10	8⅜ — 8⅞	+ ⅛	5 12 8
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5¼	..	4 5 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 5th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 11 7
Calcutta, Ord.	5	8½	5†	7⅞ — 8	..	5 6 8
Do. 5 % Pref.	5	5	5	4 13/16 — 5 3/16	..	4 16 8
Calgary Power, 1st Mort. Bds. ..	100	5	5	90½ — 92½	..	5 8 0
Canadian Gen. El. Com.	$100	7	8	107 —112	+ 1	7 2 10
Do. 7 % Pref.	$100	7	7	117 —122	..	5 18 10
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 — ⅝	..	7 12 0
Do. 5 % Deb.	100	5	5	87 — 90	..	5 11 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87 — 89	..	6 14 10
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ — 95½	..	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	4	¼ — ½ xd	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 —105	..	4 15 2
Madras, Ord.	5	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	104 —107	..	4 13 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	60 — 65	+2½	7 13 10
Mexican Lt. & Power, Common	$100	4	4†	41 — 44	+5	..
Do. 7 % Cum. Pref.	$100	7	7	70 — 75	+7	9 6 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	71 — 76	+2½	6 11 7
Do. 5 % 2nd Mort. Bonds ..	100	5	5	60 — 65	+1	7 18 10

NAME.	Stock or Share.	Dividends for		Closing Quotations May 5th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	49 — 53	+1	..
Montreal, Lt., H. and Power ..	$100	9	10†	220 —225 xd	..	4 9 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	245 —255	..	3 18 5
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	103 —108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital ..	$100	5½	6	131 —135	..	4 9 0
Do. 5 % Con. 1st Mort. Bonds	$100	5	5	107 —109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	101½ —103½	..	4 7 0
Toronto Power, 4½ % 1st Deb. ..	Do.	4½	4½	98 —100 xd	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 — 89	..	5 12 4
Victoria Falls Power, Pref. ..	1	6	6	23/32 — 25/32	..	7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	102 —104	..	5 15 5

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 5th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	23/32 — 27/32	..	8 5 0
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	6 17 2
Babcock & Wilcox	1	16	16	2 15/16 — 3 1/16 xd	..	5 4 7
Do. Pref.	1	6	6	1¼ — 1⅜ xd	..	4 7 6
British Aluminium, Ord. ..	1	..	5	15/16 — 1 1/16	—1/32	4 14 1
Do. 6 % Cum. Pref.	1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Prior Liens Debs. ..	100	5	5	96 — 99	..	5 1 0
Do. Deb. Stk.	100	5	5	88 — 98	..	5 7 6
B.I. & Helsby Cables	5	10	13	9¼ — 9¾	..	6 13 4
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	101 —104	..	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref. ..	2	Nil	5	1 5/16 — 1½	..	6 13 4
Do. Deb.	100	4	4	73 — 75	..	5 6 8
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	49 — 53	..	8 10 0
Do. 4½ % Second Deb. ..	100	4½	4½	29 — 33	..	13 12 8
Callender's Cable	5	15	15	11¾ — 12¼	..	6 0 0
Do. Pref.	5	5	5	5 — 5¼	..	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	22½	2 23/32 — 2 27/32	..	7 18 2
Do. Deb.	100	4½	4½	104 —107	..	4 4 1

NAME.	Stock or Share.	Dividends for		Closing Quotations May 5th.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	⅜ — ⅝	..	..
Do. Pref.	1	6	6	21/32 — 25/32	..	7 18 4
Edison & Swan, A, £2 paid ..	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	61 — 66	—1	7 11 6
Electric Construction	1	5	..	17/32 — 21/32	..	7 12 6
Do. Pref.	1	7	7	15/16 — 1 1/16	..	6 11 7
Greenwood & Batley, Pref. ..	10	7	7	6¾ — 7¼	..	9 18 9
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref. ..	10	6	6	10¼ — 10½	..	5 14 8
Do. Deb.	100	4	4	85 — 89	..	4 10 0
Henley's, Ord.	5	15	20	13½ — 14½	..	6 17 11
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 9 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	7½	10 — 11	— ⅛	6 16 5
Do. Pref.	10	5	5	8¾ — 9¼	..	5 5 8
Telegraph Construction	12	20	20	36½ — 38½	+ ½	6 4 7
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	64 — 68	..	5 17 8
Do. B 4 % Cum. Pref. ..	100	..	..	46 — 51	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 5th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾ — 6¼	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 8 0
American Telep. & Teleg., Cap.	$100	8	8	121 —125	..	6 8 0
Do. Collat. Trust	$1000	4	4	90 — 93	..	4 6 0
Anglo-American Telegraph ..	Stock	3	3	64 — 67 xd	..	4 9 7
Do. 6 % Pref.	Do.	6	6	108½ —109½ xd	..	5 9 10
Do. Def.	Do.	30/-	30/-	23½ — 23¾	+ ⅛	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7⅜ — 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80 — 82	..	4 17 7
Cuba Telegraph	10	6	6†	8¾ — 9¾	..	6 8 1
Do. 10 % Pref.	10	10	10	15¾ — 16¾	..	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7½ — 8	..	6 5 0
Direct United States Cable ..	10	4	4	6⅝ — 7⅛ xd	..	5 12 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	133 —136	..	5 3 0
Do. 3½ % Pref. Stock	Do.	3½	3½	77 — 79	— ½	4 8 7
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96 xd	..	4 3 4
Eastern Extension	10	7	7	12⅞ — 13⅜	+ ⅛	5 4 9
Do. 4 % Deb.	Stock	4	4	94½ — 96½	..	4 3 0
Globe Telegraph and Trust ..	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12½ — 13	..	4 12 4
Great Northern Telegraph ..	10	20	20	30½ — 32½ xd	..	6 8 1
Indo-European Telegraph ..	25	13	13	58½ — 60½	..	5 7 4
Mackay Companies Common ..	$100	5	5	81 — 84	—5	5 19 1
Do. 4 % Cum. Pref.	$100	4	4	68 — 71	—2	5 12 7

NAME.	Stock or Share.	Dividends for		Closing Quotations May 5th.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph ..	1	20	20	3 1/16 — 3 3/16	+ ⅛	6 6 6
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2 7/16 — 2 11/16	+ ⅛	6 6 5
Monte Video Telephone, Ord. ..	1	6	6	13/16 — 15/16 xd	+ 1/16	6 8 0
Do. 5 % Pref.	1	5	5	27/32 — 29/32 xd	..	5 10 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98 — 99 xd	..	4 11 0
Oriental Telep. and Elec. ..	1	10	10	2 1/16 — 2 5/16 xd	..	4 6 7
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16 xd	..	4 11 5
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	8½ — 9½	+ ½	10 10 6
Submarine Cables Trust	Cert.	6	6	125 —128	..	4 13 9
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 —100	..	4 10 0
United River Plate Telephone	5	8	6†	6⅜ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅝	..	4 9 0
West Coast of America	2½	2½	..	1 — 1½	— 3/16	5 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	1½	2¼ — 2½	+ 1/16	5 0 0
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅝ — 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref ..	10	6	6	8⅝ — 9⅛	..	6 11 6
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd. ..	10	7	7	13⅜ — 13⅞	..	5 1 11
Do. 4 % Debs.	Stock	4	4	95½ — 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	93 — 96	..	4 18 9

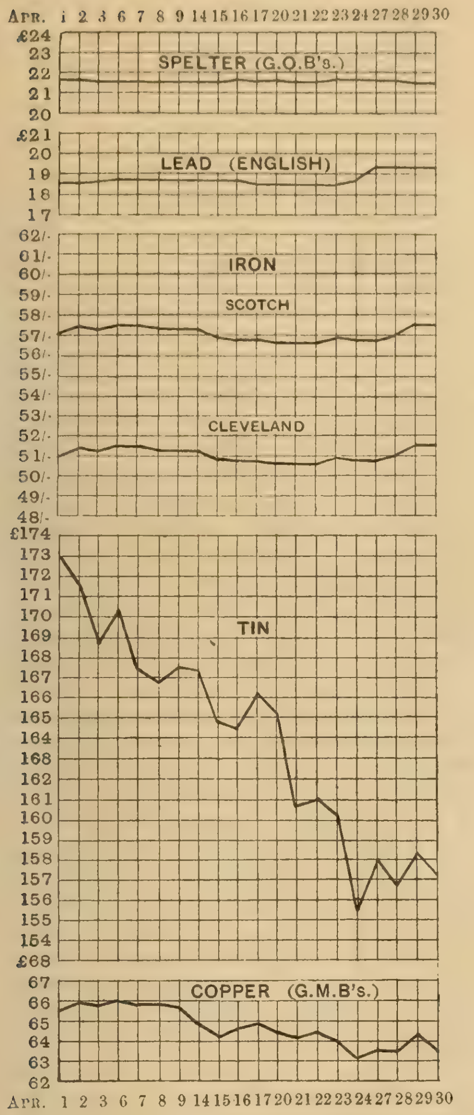
* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Labour Increases for L.C.C. Employés.—We have from time to time noted the reference to the Conciliation Boards of the L.C.C. of applications from various classes of workers for increased wages. The Rolling Stock Conciliation Board has just issued an award which is to be regarded as a settlement of all recent applications for increases from employés of the rolling stock section. This award is to be operative for two years from the date when the various increases come into operation:—Amongst the electrical workers the following classes benefit from the new rates: Electrical labourers—raised from 6½d. to 7d. per hour; body shop labourers, from 6½d. to 7d.; slingers, from 7d. to 7½d.; magnet and coil winders, from 7½d. to 8d.; plough repairers, from 7d. to 8d. to 7½d. and 8½d.; solderers, from 7d. to 7½d.; wiremen, from 9½d. to 10d.; controller and motor cleaners—to be included in one classification, and the rate to be increased from 6½d. to 7d. per hour. In the case of the wiremen, if any alteration in the rate of pay of this grade is agreed upon between the Association of employers and the Trade Union and is embodied in the Council's list of rates of wages and hours of labour, if such agreed rate is higher than that fixed by this agreement, the said higher agreed rate shall be paid to the wiremen employed in this section.

METAL MARKET.

Fluctuations in April.



Copper Resistance Standards. — As we recently mentioned, the International Electrotechnical Commission has issued publication No. 28 containing the final recommendations adopted by the Commission at Berlin last year, for the establishment of international standards for the resistance of copper. Hitherto there have been small but appreciable differences between the values adopted by different countries, preventing the computation of tables of universal application. The normal value for a wire of standard annealed copper at 20° C., 1 metre long and 1 sq. millimetre in section, is $\frac{1}{58}$ ohm = 0·017241 ohm; the density is 8·89, and the temperature coefficient 0·00393 per degree Centigrade. The temperature of 20° C. is adopted as the normal, and measurements are to be made within a range of 10° C. from that point for commercial copper. The values named have been arrived at as the result of a large number of tests.

Street Lighting.—King Edward Street, Hull, has lately been illuminated partly by "Royal Ediswan" half-watt lamps. Arc lamps have been replaced in two standards, which appear in a picture before us, by these lamps of 500 watts, 72 volts burning in series on 220 volts.

DIFFICULTIES ATTENDANT UPON THE WORKING OF ELECTRICAL APPARATUS IN MINES.

By SYDNEY F. WALKER.

Metalliferous mines and coal mines may be regarded as distinct from the electrical engineer's as well as from the mining engineer's point of view, because the methods of working are totally different. With both classes of mines, however, there are certain difficulties that are common: —

(1) The entire absence of other than artificial light; and the very poor light that is provided in almost every position where electrical apparatus and accessories have to be fixed.

(2) The irregularity of the roads, etc.

(3) The high temperature and humidity ruling in deep mines.

In addition to the above, in coal mines, there is the great danger of igniting explosive mixtures of gas and air, and of igniting coal dust.

In practically all metalliferous mines, and a great many coal mines, there is a great deal of water, which is often impregnated with salts which it has absorbed during its passage underground.

Taking the difficulties mentioned above, which by no means exhaust the list, in their order, it is almost impossible for anyone who has never worked underground in a mine, to realise the full meaning of the entire absence of light. On the surface, even on the darkest night, there is still some little light. In mines there is absolute blackness—darkness that can be felt. The open oil lamps that are employed very largely in "open light mines" give a better light than the old "dip" candle, but even that is very poor; but the light given by those old candles, and those smoky lamps, was far superior to that given by the very best of the modern safety oil lamps. Men who are accustomed to working by the aid of miners' lamps are able to accomplish work that would seem to be impossible; but it must be remembered that the work which the miner has to perform is very rough.

The introduction of the portable electric miners' lamps has enormously improved the conditions under which work is caried on underground; but even with them, the light given is still poor, compared to daylight, and there is a great deal of accurate work to be done upon electrical apparatus underground, for which a good light is almost a *sine qua non*. If it is in the neighbourhood of the shaft bottoms, the light in modern mines is generally good. Modern shaft bottoms in coal mines are nearly always arched; the arches are, or should be, whitewashed, and a number of comparatively high-C.P. incandescent lamps are fixed in such positions that the strain upon the eyes is not great.

The question of poor light is felt perhaps most of all in the shaft, when repairs have to be done, and at the face of the coal. In those two places there is no other light than that which is furnished by the portable lamps. The examination of cables, for instance, has to be done from the cage. The shaft, except within a few yards of the top, is absolutely pitch dark; the cage is usually some feet from the side of the shaft where the cables are fixed, and it is an exceedingly difficult matter to get a sufficient amount of light to bear upon them, to make the careful examination that is necessary to locate a fault.

At the face of the coal practically the same thing holds, but for an entirely different reason. The face of the coal is constantly moving, and in a great number of coal mines, there may be an outburst of gas at any moment; or there may be an ignition of coal dust if it rises in a cloud. Of all places where work is carried on, light, and plenty of it, would be the very greatest boon at the coal face; yet it is the place where, for reasons of safety, the light is almost always least. Working at the face with the ordinary miner's pick, and with the lamps that are available, is by no means easy; but working coal-cutting machines at the face of the coal is far more difficult. Several fatal accidents have occurred at the face of the coal, owing to the insulation between one of the wires of the trailing cable and the carcass of the machine having broken down. In a good light, it is not easy to see that an ebonite bush, for instance, has failed; in the light of an oil safety lamp it is almost impossible. With practice, it is possible to see it with the best of the portable electric lamps; but it is not too easy even then, and requires a considerable amount of experience. One requires to have detected such a fault at least once before, to be able to locate the trouble there again. The difficulty is of course increased by the fact that the carcass of the machine is covered with coal dust.

The poor light at the face of the coal also makes it exceedingly difficult to ensure that the trailing cable is protected from accident, and to ensure that the gate-end box is also protected; and it is still more difficult to examine the trailing cable in case of a fault appearing. In matters of this kind, prevention is very much better than cure, and it is of the very highest importance to locate trouble that is coming in the trailing cable; it is there that the poor light is felt. The electricians who are employed about a mine necessarily have neither that hereditary tendency for the eyes to adjust themselves to the poor light, nor the hereditary skill in avoiding accidents and in working under the very poor light conditions that obtain, that characterises the practical miner.

The difficulties mentioned above occur also to a large extent in metalliferous mines, but of course there is no danger of firing coal dust or fire damp, though there is a very serious and ever-present danger of firing the timber with which the roads and working places in metalliferous mines are supported.

The irregularity of the roads, etc., is another very important matter, which both in metalliferous mines and in coal mines militates very strongly against the successful working of electrical apparatus. In all mines, there is a pressure of the overlying strata upon the workings—a very large proportion of the coal mines in the United Kingdom are deep, and in these the pressure is considerable. The effect of the pressure is to cause a closing-in of the roof and floor, and the sides of the roadways. In some of the anthracite coal mines in Carmarthenshire, it is no uncommon thing for a roadway to be left six feet in height clear at the end of a shift, and for there to be hardly room to crawl through between roof and floor on the following day. This makes the conditions of working of motors difficult; but probably the effect is felt far more upon the cables, switch boxes, joint boxes, etc. Electric motors are employed underground for pumping, hauling, coal-cutting machines, drilling machines, and the driving of face conveyors. For haulage plant there is usually no difficulty in providing a good solid foundation. The location of the haulage drums is very carefully chosen, and by the aid of stone or brick arching, or in some modern mines by the aid of concrete, provision is made against the "squeeze," or "working of the mine." With pumping underground also, it is sometimes possible to arrange a similar engine house, and mining engineers are very careful to adopt this method when possible. In a great many cases, however, it is not possible. For the drainage of dip workings, for instance, the pumping plant usually has to follow the workings down; the most convenient arrangement consists of a trolley, made to run upon the mine rails and carrying the motor and pump, a coil of cable, and the accessories. The location of the movable dip workings pump at any moment may be such that working at it is very difficult indeed, bearing in mind that the light available is so poor. Usually the place where the pump is located for the time is very wet; often water is streaming down from the roof. The roadway in which the pump is standing is often very narrow and very low. Further, the sides and roof and floor of every part of the mine, except where arching is put in, consist of more or less jagged rocks, for all mine roads are temporary. It is a matter of economy in mining, not to spend more upon roads than will enable them to last out the life of the mine. The roofs of the roads and working places are supported by timbers, which are practically the only places to which attachments can be made for switch boxes, junction boxes, etc. Occasionally there may be a fairly solid piece of rock or coal that can be plugged to enable a board to be fixed on it; but those occasions are rare. In the case of the portable pumping stations, the timbers and everything around will be wet; electrical men can easily understand how great are the difficulties of maintaining insulation under the conditions, and in particular, of avoiding shock.

The electrical drilling machine usually follows the coal-cutting machine, and is far more easily handled; not a great many of them are used. The most difficult conditions of working for the electric motor are undoubtedly those involved in driving coal-cutting machines. The machine itself is very difficult to design within the conditions of working. It is of the greatest importance that the whole machine shall not occupy a greater space, and that it shall not weigh more, than is absolutely necessary. The space available for the motor, the switch, and the starting arrangements is very limited; and necessarily the space available for insulation is small. The roof at the working face is very frequently bad, and the problem of supporting it by timber is often an exceedingly difficult one. With longwall working, which is the system, in this country at any rate, on which coal-cutting machines are mostly used, the available space for machine and men is somewhere about 4 feet wide at the outside, and is bounded by a line of poles supporting the roof, just in front of the last break. After the face has moved forward, and the supporting props are removed, fresh supporting props being fixed in front of the new face, the roof breaks behind the new line of props; and the whole roof gradually settles down, between the gate roads, forming what is called the "goaf." The floor of the roadway, along which the machine is working, is strewn with small lumps of coal and rock. The earlier coal-cutting machines always ran on rails, and this is still the practice with some forms of machine at the present day. The tendency is, however, to run them on skids, so that the machine will accommodate itself to the floor. As the machine works, a considerable amount of dust is made, and finds its way over everything, giving rise to difficulty in adjusting the parts of the machine. The current for the motor has to be supplied by a trailing cable, which is connected to a gate-end box, in the most convenient position near at hand; and the trailing cable has to follow the machine right through the shift. That is to say, it must either be long enough to follow the machine through a cut that may be 100 yards in length, or the gate-end box itself must be moved; and this is a very troublesome affair. The gate-end box is fixed at the end of one of the gate roads, which are temporary roads, made by building pack walls between the goaf, rails being laid on the roads for the mine wagons to run on up to the face; and the cables leading to the gate-end box must be carried along one of these temporary roads. As the face moves forwards, the gate roads are cut off and abandoned, fresh gate roads being formed, dividing up the new goaf which forms as the face advances.

(*To be continued.*)

DEVELOPMENT OF ELECTRICAL INDUSTRIES IN THE BALKANS.

[FROM A CORRESPONDENT.]

Having just returned from the Balkans after a somewhat prolonged tour, I should like to give my impressions on the possibilities of development in the many branches of electrical engineering concerned in the supply and erection of small generating and power plant, and the sale of accessories.

One of the countries which, in my opinion, is going a long way towards commercial development, and that, in spite of the recent war, is Bulgaria.

On all sides one heard, from Ministers and others, how earnestly Bulgaria wished to get in closer touch commercially with Great Britain. Sofia, the capital, standing some 1,800 feet above the sea level, enjoying an incomparable climate, and forming as it does the heart of the Balkans, is admirably suited for an entrepôt. King Ferdinand himself, a very astute and able man, takes a keen interest in all propositions of commercial enterprise, and is by no means inaccessible where undertakings of some importance are proposed.

The railways, which are under State control, are well equipped, and connect up the Servian frontier—Rustchuk, on the Danube, Black Sea ports, Thrace, and Constantinople; many lines are in course of construction and others are contemplated.

Until recently, many important contracts for mechanical and electrical accessories were given to inexperienced local tradesmen, frequently jobbing Jews, who had the greatest difficulty, owing to their ignorance of the markets, in carrying out the contracts satisfactorily.

There are opportunities and facilities for obtaining concessions for building generating stations and giving supply to many growing towns of 50,000 to 60,000 inhabitants. The concessions would probably carry with them a monopoly for wiring. All such work would be in the hands of the supply company, and there is little doubt that current for lighting could be supplied at a rate that would prove attractive to all classes of the inhabitants, who at present pay exorbitant prices for petroleum fuel, imported under a heavy tax. That there would be very little difficulty in inducing the public to adopt electric lighting is shown in Sofia, where almost every cottage or hut is lighted by electricity, and in this advantage of civilisation they are certainly ahead of London.

The cloth-making industry is a growing one, particularly at Sliven, a town of 30,000 inhabitants, and manufacturers to whom I spoke, expressed their willingness to adopt electric power if it could be brought to the town.

At present coal, obtained chiefly from the Government Lignite mine at Pernik, is used, but this is costly, and the greater part very poor in quality. There are local mines close to growing towns, the acquisition of which would be a great asset to a company prepared to erect a generating station adjacent to the mine, and possessed of the aforesaid concessions. The mines are at present worked in a very irregular and primitive manner by inexperienced peasants, but expert opinion has declared that many million tons of coal, as proved by outcrops, lie practically on the surface of the Balkan Hills awaiting development by more economical and profitable means.

I have no hesitation in saying that a ready market could be found for the better quality coal, whilst the low grade could be utilised in the local generating stations. Upwards of 100,000 tons of Welsh coal is imported annually, retail prices ruling from 35s. to 40s. per ton.

Owing to the scarcity of coal in Sofia during last winter, wood was the principal fuel used, but this, besides being costly, is becoming scarce, the demand being so great as to severely handicap the Government in their scheme for the preservation of forests.

There is at present no great competition for Bulgarian Government contracts, and there should be opportunities for enterprising agents for both mechanical and electrical accessories.

Servia, with its recently acquired Macedonian territory, will undoubtedly forge ahead, and Austrian and German manufacturers are already busy exploiting certain industrial districts—this also applies to Salonica and Thrace.

Constantinople will offer enormous possibilities as soon as the central stations scheme is completed, and as soon as current is available in the main streets there will spring up a great demand for many forms of electrical machinery and advertising signs.

I have only dealt generally with the situation in the Balkans. I feel that badly as all British manufactures are in demand, manufacturers are not doing their best to supply the want. Good representatives are required, who have a pretty solid knowledge of the French and German languages.

English is very little spoken between Buda-Pesth and Constantinople, German being almost a *sine quâ non* in Sofia, if one wishes to dispense with the aid of commercial touts.

REVERSING AN INTERPOLE MOTOR.

By "WHISTLEFIELD."

The action of the interpoles in a motor can be so easily represented by means of diagrams that there should be no difficulty in determining how the interpole winding will be affected when the direction of rotation of the motor is reversed either by changing the field or by changing the armature connections.

Fig. 1 shows why interpoles are necessary. In a two-pole dynamo all the conductors in front of one field magnet are carrying current in one direction, and all the conductors in front of the other field magnet are carrying current in the other direction because the brushes are resting on the segments of the commutator connected to the conductors A A midway between the pole tips, which are consequently not cutting lines of force, and therefore not generating an E.M.F. The currents flowing in these conductors, however, set up a cross-field as shown; and the interaction of this field with the field due to the field magnet system produces the distorted field shown in fig. 2.

This distortion is due to the current flowing in the armature conductors, and the amount of the distortion is therefore proportional to the armature current or load on the motor, so that as the load increases the brushes have to be moved back to get them to rest on the segments which are connected to the conductors A^1 A^1, which are situate in a suitable reversing field.

To obviate the necessity of moving the brushes for every change of load, compensating or interpoles CP are used as shown in fig. 2. These poles correct the displacement of the field by drawing it up on the side where it is depressed, so to speak, and pushing it down on the side where it is distorted up.

If the compensating poles are to be automatic in their action, they must be excited by the main current flowing in the motor circuit, or by a proportion of it, so that compensating poles are very often in large machines connected across a shunt in the main circuit. In this way the compensating effect is very slight when the load is light and therefore the distortion small, but increases in proportion to the increase in the load and consequent increase in the distortion.

Fig. 3 shows the effect on the magnetic fields of reversing the direction of the field to reverse the direction of the motor; from it we see that the direction of the distortion is reversed, but since the field due to the field magnets is reversed also, the compensating, or interpoles, must be left unchanged. A comparison of the diagrams shown in figs. 2 and 3 makes this perfectly plain.

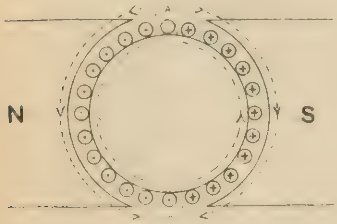


Fig. 1.

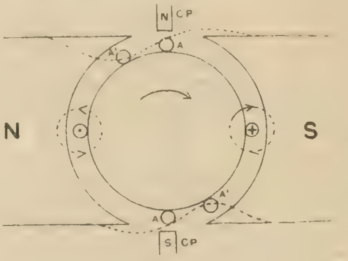


Fig. 2.

If, however, we reverse the direction of the motor by reversing the direction of the current in the armature, we get the magnetic system and the distortion shown in fig. 4. To counteract this distortion the interpoles must be reversed as will be seen from a comparison of figs. 2 and 4.

To summarize the above results, we see that in the case of a shunt motor reversing the field does not affect the interpole, but reversing the armature current necessitates the reversal of the interpoles also. In most machines, however, the interpole winding is placed between the brush terminal and the terminal marked A (armature) on the motor (see fig. 5) so that the reversal of the armature leads involves the reversal of the interpole fields also, so no further changes are needed. In multipolar machines it is easy to reverse the direction of rotation by moving the brush gear round through a distance equal to the pitch of the brush-holders, where the leads are long enough to permit of this adjustment. If this were done in the case of the two-pole motor shown in fig. 5, we would get the result shown in fig. 6, that is, the current would be reversed in the armature only and not in the interpoles. When therefore the direction of rotation of a motor is reversed by moving the brush gear round through a distance equal to the pitch of the brush-holders, it is necessary to change the leads of the interpoles to reverse the direction of their field also.

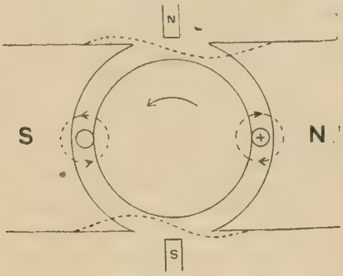


Fig. 3.

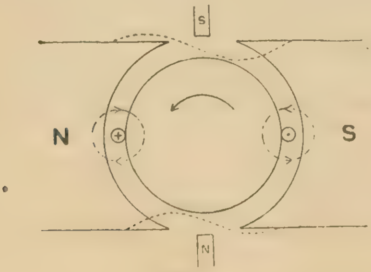
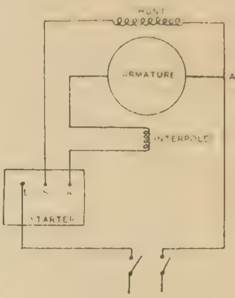
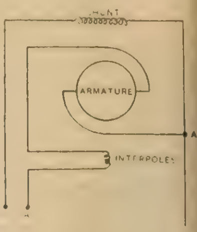


Fig. 4.

In compound wound dynamos, the compound winding and the shunt winding act together or in opposition, as the case may be, to form a resultant field. The interpole corrects the distortion of this resultant field so that the same rule holds as in the case of a shunt motor; that is, when the field due to the field magnets is reversed, the interpole must be left as it was; when the field is not changed but the armature current is reversed, the magnetisation of the interpole must be reversed also. When in doubt as to the resultant effect of any combination of magnetic systems, it is always better not to trust to rules, but to sketch down the facts in the form of a diagram as shown in these figures, then the correct thing to do will be obvious to anyone who knows what result he wants.





STATIC TRANSFORMERS FOR THE SIMULTANEOUS CHANGING OF FREQUENCY AND PRESSURE OF ALTERNATING CURRENTS.

By A. M. TAYLOR, M.I.E.E.

(*Abstract of paper read before the Institution of Electrical Engineers at Birmingham, April 29th, 1914*).

The earliest public announcement of the invention of a frequency changer, as far as the author is aware, was made by the late Mr. Maurice Joly, and was communicated to the Académie des Sciences early in 1911. Two other inventors have also entered the field, both of them Italians, namely, Signor Vallauri, who, the author understands, has invented a frequency changer for doubling the frequency, and Signor Spinelli, who has invented an arrangement trebling the frequency.

The essential difference between M. Joly's arrangement and that of the author is that whereas M. Joly takes a single phase of the supply and resolves a half-wave into three half-waves of electromotive force of triple the frequency, the author, on the other hand, takes a three-phase supply and from each individual phase of that supply, and from each half-wave of each phase, abstracts two incompletely formed half-waves of triple the frequency, supplementing these by other half-waves from the other two phases and delivering to the triple-frequency circuit a single-phase triple-frequency current. The author's arrangement, in fact, only works when transforming from three phases to a single phase. This statement does not apply, however, to his arrangement for obtaining a step-up of the frequency in the ratio of one to two.

As regards Signor Vallauri's invention, the author believes this to be substantially the same as that of M. Joly—but with some interesting developments—in that it transforms one phase of the supply into single-phase current at double the frequency. The invention of Signor Spinelli differs from those of Vallauri and Joly in that it takes a three-phase supply and combines the three phases in such a way as to obtain a single-phase supply of triple frequency from the secondary coil.

The author understands that Signor Spinelli has obtained an efficiency of 60 per cent., so that evidently the method possesses possibilities, though this is hardly a sufficiently high efficiency to admit of its entering into serious competition with motor-generators in sub-stations for general lighting supply.

Before M. Joly, of France, had evolved his frequency changer, the author of the present paper had, without at first appreciating it, arrived at an arrangement giving a three-fold change of frequency and converting from three-phase to single-phase supply in one operation.

The germ of this idea was evolved in the summer of 1909. The author was at that time considering a means of deforming the E.M.F. wave of an alternating-current supply, by flattening it at the commencement and end of the half-wave (with a view to facilitating the commutation in changing from alternating current to continuous current with a rotating rectifier). He proposed to draw current from the alternating-current mains, pass this current through a transformer wound on a saturated core, thus tending to give the wave of current a very sharp peak in a way that is well known (see Fig. 1, Curve C), and then to pass this deformed wave of current through an unsaturated choking coil in which the flux responded to the deformed wave of current so received, and in which in consequence two impulses of back electromotive force (see Fig. 1, Curve D) were generated, one at the commencement and end of each half-cycle of the fundamental electromotive force, thereby absorbing part of the electromotive force received from the mains at this instant and leaving a deformed E.M.F. wave generated in the saturated-core transformer, as shown in Fig. 1 (Curve E).

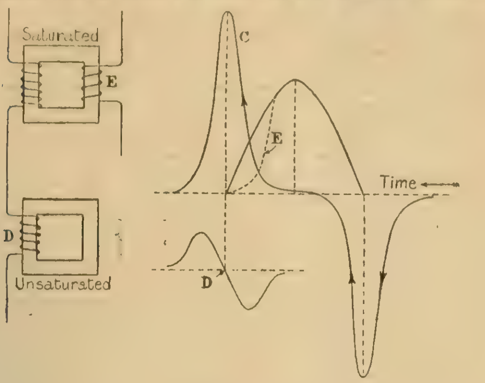


Fig. 1.

It occurred to the author that it would be practicable, by winding a secondary coil on the unsaturated-core choking coil (D), to generate an E.M.F. wave of partially-complete triple frequency; and shortly after this he thought of employing a three-phase current and making up the missing parts of the E.M.F. wave from the other two phases. This led at once to the present invention.

The principle of the present invention will be clearly understood by reference to the accompanying figures. In Fig. 2 the connections are shown that would obtain if the arrangement were single-phase; this arrangement, however, is not practicable, owing to the triple-frequency impulses received being incomplete, and their having one half-wave missing in every series corresponding to a half-cycle of fundamental frequency.

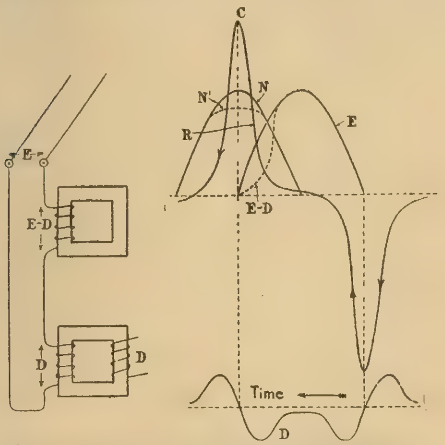


Fig. 2.—Principle of Taylor's Arrangement.

It will be easiest to consider first what would happen in the choking coil if the primary winding of the working transformer were short-circuited; *i.e.*, in fact, the condition that would obtain if the saturated choking coil were connected direct to the supply mains.

The wave-form of the current which would then flow is shown by Curve C in Fig. 2. It will be seen at once that if the current took this form the portion of the curve marked R would be that on which the rate of change of current was very rapid; and in consequence if the current undergoing this change could be passed through the primary coil of a transformer winding, on an unsaturated core, so that the flux virtually followed the current wave, the electromotive force in the secondary-coil windings on the core of this transformer would have the wave-form marked D at the bottom of the figure. This, however, would leave a large period of the fundamental cycle in which no useful work was being done in the secondary coil of the transformer, and would be an unsatisfactory arrangement. Another disadvantage would be that the half-waves of electromotive force would not be exactly symmetrical, because the ascending and descending sides of the peak of the current are not exactly symmetrical about the axis. If, however, the arrangement is repeated on the three phases as shown in fig. 3, these two difficulties disappear, the blank spaces being filled in by the impulses received from the other phases, and the dis-symmetry of the positive and negative half-waves of electromotive force being nullified by corresponding impulses from other phases, in the manner indicated by fig. 4.

A further investigation of the wave-form obtained in the secondary circuit (fig. 4) shows that at any instant only two out of the three transformers are active. The author decided that it would be better to couple the secondary coils in parallel than in series, because if in parallel the idle winding merely receives a small magnetizing current from the other two windings; whereas if they are in series the whole of the electromotive force of one winding is absorbed in driving the current through the impedance of the idle winding, leaving virtually only one winding effective. The author has confirmed this deduction experimentally.

In fig. 4 the currents in the primary windings and the secondary electromotive forces in the three circuits are plotted in relation to one another on a time basis, and the way in which they combine in the secondary circuit can be easily seen.

An obvious deduction from what has already been stated is that it would be desirable to avoid difficulties with the idle current in the third phase by having a single winding in the secondary, and by employing a common core, which is magnetized by the three primary currents having peaked wave-forms, as received from their respective choking coils. This is shown in fig. 5.

The apparatus shown in fig. 5 carried a load up to 7 kw. without the drop of pressure exceeding 8 per cent. (*i.e.*, 4 per cent. up or down). There are means of improving this; but the value given suited the requirements for the present, and further experiments in this direction were deferred.

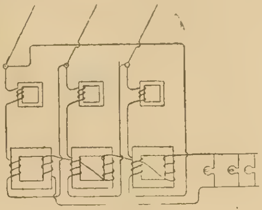


Fig. 3.

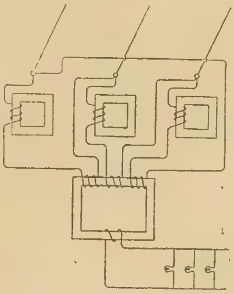


Fig. 5.

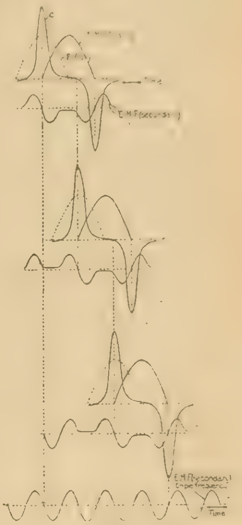


Fig. 4.

Fig. 3.—Connections of Taylor's Frequency Changer.

Fig. 4.—Principle of combining Three Phases to form a Single Phase (Taylor's Arrangement.)

Fig. 5.—Present Form of Taylor's Arrangement.

The author has analysed carefully the losses obtaining in the experimental 7-kw. set and has got out a design for a 28-kw. transformer which has an estimated efficiency of approximately 86-88 per cent. This set is now being constructed. On a 100-kw. size the author would certainly expect to get an efficiency of over 90 per cent., and on a 500-kw. transformer 95 per cent.

One use of the apparatus would be the conversion of three-phase current, on systems having a frequency of 25 periods per second, to single-phase triple-frequency currents having a frequency of 75 periods, for lighting work.

The apparatus lends itself in such a case to competition with rotary-converter sub-stations. Instead of supplying continuous-current lighting from the latter, it would be possible in any town where there is a large network of high-tension three-phase mains, to install kiosks or small static "exploitation" sub-stations at various points along the route, with transformers to reduce the pressure and increase the frequency. The current delivered in the secondary circuit of the frequency changer is single-phase current, but this is actually advantageous for such work, in that it only requires the low-tension main to be run as a single-phase main, and the wiring of consumers' premises may also be single-phase wiring without any question of unbalancing the supply. The transformers being also entirely self-regulating (there being no automatic apparatus to look after), the frequency changers are eminently suitable for fixing in kiosks, where they will have to work without attention for perhaps a month or more at a time.

Another use for this apparatus would be for those power consumers who obtain current at 25 periods on specially cheap terms for lighting purposes and have their power supply in the form of an extra-high-tension supply. In this case it would only be necessary for them to take a supply of low-tension current from the secondaries of their power transformers, lead this through the frequency changer, and use it for the lighting of their building at 75 periods.

For electric welding purposes, and possibly also in connection with single-phase electric furnaces, the frequency changer may find a useful field of application, its special feature being that any load (even a complete short-circuit) may be put upon a secondary winding without disturbing the "balance" of the power on a three-phase supply. In the case of certain three-phase furnaces the author is advised that the short-circuiting of the poles on any one phase may introduce extremely severe demands upon a single phase of the three-phase high-tension mains, upsetting the regulation, and disturbing the supply to other consumers. Here there should be a useful field for the frequency changer.

Another field in which the frequency changer may find a large sphere of usefulness is in connection with three-phase low-periodicity railway work, where it would be specially suitable for taking a supply from the mains at, say, 16 periods per second, and changing this to a supply for lighting at 48 periods per second for use in lighting the stations along the line.

With a small modification the apparatus can be made reversible; for instance, 16.6 cycles might be obtained from 50 cycles. This would open up the possibility of existing power concerns supplying current for electric furnaces or perhaps for railway work.

A brief consideration of fig. 4 will lead to the conclusion that if we were to have nine phases of supply instead of three, and nine choking coils and working transformers (or nine choking coils and one "common" working transformer), the electromotive forces in the various secondary windings would combine in a similar way to give a current of nine times the primary frequency. The only condition that would be lacking would be that the durations of the secondary electromotive forces would be too long, and they would therefore overlap and partly nullify one another. This defect can be avoided by the simple expedient of generating an E.M.F. wave in the primary generator which is not a true sine wave.

Fig. 6 shows the natural period of time existing between the commencement of the rush of current through the choking coil and the crest of the current wave, where the choking coil is placed directly across the mains and a sine wave of electromotive force is applied. This can be employed for a three-fold step-up in the frequency.

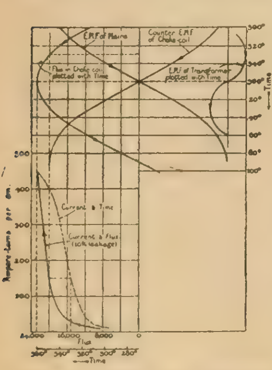


FIG. 6.—THREE-FOLD STEP-UP.

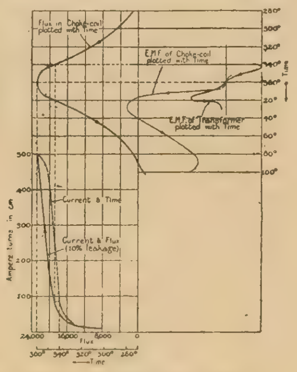


FIG. 7.—NINE-FOLD STEP-UP.

Fig. 7 shows how by a very trifling alteration in the E.M.F. wave of the generator the above period has been shortened from about 50 electrical degrees to 20 degrees; this latter corresponding with a nine-fold step-up in the frequency. In a similar way, the step-up in the frequency might be increased to 27-fold. It will be understood that the apparatus tends to give the same multiple of the frequency whatever the original frequency may be.

Using the 9 : 1 step-up arrangement the proposal would be to build a generator having a wave-form similar to that shown in fig. 7, and a periodicity of, say, 11,000 per second, which will give 99,000 periods on the high-tension winding of the frequency changer.

If it is found practicable to step up 27 times, the generator need only be built for 3,666 periods in order to obtain 99,000 periods.

In conclusion, the author believes that he has been the first to show a practical application of the principle of employing as many phases of the supply as it is desired that the final frequency shall be a multiple of the original frequency, and combining all these independent waves of electromotive force into a common wave of electromotive force of the same number of times the original frequency that there are phases of supply.

APPENDIX.

A few further notes as to the operation of the apparatus may not be out of place.

Referring to fig. 2, it will be noticed that the curve of flux (N) is flat on the top, due to the back electromotive force (D) in the primary winding of the working transformer leaving the electromotive force (E-D) to be taken up by the choking coil instead of the electromotive force (E) of the mains. Now, when the electromotive force (E) is at its maximum, the rate of change of flux in the choking coil is also at its maximum, though the current in the choking coil is nearly zero. Again, when the electromotive force (E) is at its minimum, the rate of change of flux is also at its minimum, though the current in the choking coil (drawn from the mains) is at its maximum.

In other words, we may look upon the choking coil as a kind of valve which keeps out the electromotive force (E) of the mains from the primary coil of the working transformer at the time when the electromotive force of the mains is at its maximum, and lets it through on to the working transformer for about 60 electrical degrees on either side of the point of zero electromotive force in the mains.

We can also consider that by altering the shape of the electromotive force wave received from the mains the "valve" may be opened or closed for a longer or shorter period during each half-cycle of the supply, as is indicated by the relative time-values for the "current rush" in figs. 6 and 7.

During the reading of the paper the author added the following particulars regarding power factor, which, we understand, are to be embodied in the paper after being refereed by the London Committee :—

It is important to consider how the power factor, which is only of the order of 0.2, can be compensated for. In a large system of, say, 30,000 KW., there will no doubt be found motors of large size aggregating perhaps 15,000 KW., or, say, 50 per cent. of the aggregate power of the system, upon which it would pay to introduce phase advancers for this purpose.

The author is advised that certain phase advancers which are already on the market could be applied in the case where the periodicity is as low as 25 periods, at a cost of not very much above 5s. per KW. of the motor capacity to which they are applied. The question then arises to what extent it would be practicable to introduce a lighting load on such a system, through the medium of frequency changes compensated for by phase advancers.

Referring to fig. 8, it will be seen that if we have an existing motor load of 100 KW. at a power factor of 0.70 lagging, and if by means of phase advancers this is improved to 0.95 leading, and, further, that a 40-KW. lighting load at 0.2 power factor is then superimposed on the system, the resultant power factor will be 0.77, which is decidedly better than it was before the change, and the motive power consumer will gain considerably, his power factor being raised from 0.70 lagging to 0.95 leading.

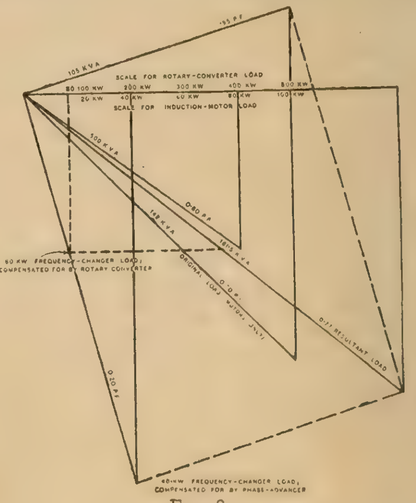

·95 P.F.
105 K.V.A.
SCALE FOR ROTARY-CONVERTER LOAD
80 100 KW
200 KW
300 KW
400 KW
500 KW
20 KW
40 KW
60 KW
80 KW
100 KW
SCALE FOR INDUCTION-MOTOR LOAD
100 K.V.A.
0·80 P.F.
148 K.V.A.
181·5 K.V.A.
80 KW FREQUENCY-CHANGER LOAD, COMPENSATED FOR BY ROTARY CONVERTER
ORIGINAL LOAD MOTORS ONLY
0·70 P.F.
0·77 RESULTANT LOAD
0·20 P.F.
40-KW FREQUENCY-CHANGER LOAD, COMPENSATED FOR BY PHASE-ADVANCER

FIG. 8.

From this we see that we can introduce, for every 100 KW. of motor load, no less than 40 KW. of lighting load, by means of phase advancers on the existing motors of consumers, that is to say, that on a 15,000-KW. motor load—the figure taken above—we could introduce 6,000 KW. of lighting load by means of phase advancers; and the cost of the maintenance of these phase advancers, as well as that of interest and sinking fund on the same, works out at something of the order of .06d. on every unit, even if we take a load factor as low as 7 per cent.

If, instead of taking up a lighting load, we were considering the taking-up of, for instance, a furnace load, by means of phase advancers which step *down* the frequency, the cost to be added, being on a probable load factor of something like 25 per cent., would only be something of the order of .02d. per unit. Both this figure and the figure previously given (.06) include a fair margin for contingencies. It would thus appear that, if the supply company were themselves to install the phase advancers on the consumers' premises, they could make a paying proposition out of it, without at all unduly hampering the consumer by the charge which would have to be made for this phase rectification.

An alternative method of phase compensation, which, however, would only carry the compensation as far as the sub-station, would be the insertion of rotary converters in the sub-stations, which would have a margin of power on them for introducing a leading wattless component of current on the system. It has been shown elsewhere (see *Electrical Engineer*, 30/8/07) that if a 500-K.V.A. suitably-excited rotary converter is used to supply a D.C. load of 375 KW., there could also be drawn from the E.H.T. mains, by the A.C. side of the converter, a leading wattless current corresponding with that required by an induction motor load of 500 K.V.A., having a power factor of 0.80. The vector curves given in fig. 8 show that the wattless component of the current would, in this case, be the same as the wattless component for an 80-KW. load at a power factor of 0.2, corresponding with the power factor of the frequency changer on the primary side. (The power factor on the secondary side is very nearly unity).

We thus arrive at the conclusion that we can take up an 80-KW. load on the frequency-changer for every 375 KW. of load supplied on the D.C. side of the rotary converter, i.e., roughly, 20 KW. for every 100 KW. of load on the D.C. side of the sub-station.

Now, the proportion of the copper and iron of the converter used for improving the power factor of the induction motor load is that represented by 125 KW. (which would otherwise be available for an extra D.C. load of that amount); and this at, say, £2 per KW., represents £250, which is the capital cost of getting 80 KW. additional as a lighting load; or 250/80 = £3.1 per KW. of lighting load taken up through the frequency changer. The motors on the E.H.T. side of the sub-station could be used to assist in further compensating for the power factor, thus providing for another 40 KW. of lighting load on every 100 KW. of induction motor load.

Taking now, interest and sinking fund on the above £3.1 per KW. at 10 per cent. we have approximately 6s. 0d. per annum per KW., and at a 6.8 per cent. load factor, representing approximately 600 hours per annum, we have

$$\text{Cost per unit} = 72/600 = 0.12\text{d. per unit.}$$

So that if, for instance, energy were sold for lighting purposes at 3d. per unit, the price would only have to be raised by ⅛d. per unit on account of phase compensation; or by ¼d. per unit even if we put on 100 per cent. margin for other charges and for contingencies.

If, however, electric furnaces were being supplied, having a load factor of perhaps 25 per cent., the last mentioned figure (viz., ¼d.) would be reduced to approximately .06d. per unit, which should not prove any undue handicap on a charge of 1d. per unit.

There must, of course, be added to the above the cost of the frequency changer itself, which is of the same order, but even so, considering that this would bring in an entirely new class of load, the cost would not be at all prohibitive. The distribution costs would, as compared with D.C. distribution from rotary-converter sub-stations, be saved the heavy expense of the latter and of the D.C. cable networks from these sub-stations; which would much more than compensate for the cost of the frequency changers. The special field for the scheme would be on the outskirts of the areas fed by the rotary converter sub-stations.

At the close of the paper the author performed an experiment with his apparatus showing the conversion of 25-cycle current to 75 cycles, the secondary current being employed to light a bank of lamps.

Mr. Taylor also performed a very interesting experiment to show the reversibility of the apparatus, which consisted in passing through a special transformer a current received at 75 cycles, and obtaining from the transformer a current of 25 cycles per second. This, he believes, is the first occasion when such a thing has ever been done by means of static transformers.

The magnetic valve action described in the paper is utilised to permit current from the 25-cycle supply to be passed through the special transformer to the load which has to be carried during two out of every three half-cycles of the high-frequency supply, and to suppress every third half-cycle.

The wave thus passed through is not a complete wave, but by the addition of self-induction could be made more complete, and in any case should be quite sufficiently so to be utilised for such purposes as the operation of electric furnaces; and, if the power factor difficulty could be satisfactorily overcome, it might even be utilised for electric railways—in fact, any application where the close regulation of the voltage is not of much moment.

Mr. Taylor informs us that he has not yet had time to perform any careful experiments on the regulation of the voltage under these conditions, but he is hopeful that it will not be found to be materially worse than when stepping up the frequency.

A frequency meter put upon the secondary circuit showed a very pronounced 25 periodicity with only slight traces of the original 75 cycles. A bank of 24 lamps of 50 C.P. (carbon filament) was illuminated by the low-frequency current.

Owing to the lateness of the hour the discussion was very short.

ELECTRIC COOKING.

At the last meeting of the "Point Fives," held on April 17th, Mr. Hame, of York (whose address was read by Mr S. T. Allen), said he had found a considerable difference of opinion amongst users of cookers, as to the heating from the sides, as in the "Eclipse" oven, and in heating from the top and bottom.

The advantage of using these two types of cooker seemed to depend on whether it was desirable to hang the joint when being cooked; in this case, probably the side heating would be found to be the better, whilst when cooking in drip tins, the oven with the top and bottom heating would have the advantage.

Some consumers attached importance to having a glass window in the door of the oven, but the only practical use he had been able to make of this was for the purpose of reading a thermometer; it was better to hang the thermometer in the oven than to rely on instruments fixed to the ovens: these latter he found to be misleading and in most cases quite unreliable.

It was doubtful whether it was a wise policy to increase the cost of electric cooking apparatus by the addition of glass windows in the doors, and the supply of thermometers, and he had found that users preferred to depend on their knowledge, gained by experience, as to the time it took to heat an oven.

Some much more prominent indicating device was required than the small opening on the Hart switch with the "ON" and "OFF," and illuminated glass discs or other conspicuous indicating devices to show what was being used, were most necessary when using electric cookers.

Regarding utensils for use on hotplates he found the "Tricity" porcelain and Carron brownware utensils very useful additions, and that cast-iron kettles and pans with the bottoms turned or ground flat, had proved the best, taking into consideration the cost of the utensils.

He found it took just twice as long to boil water in a utensil which had been in use on a coal fire as it took to boil a similar quantity of water in a cast-iron kettle with a ground bottom.

The table utensils manufactured by the Brompton and Kensington Accessories Co. had many advantages, both in reliability and in being able to use the one cord connector with any of the utensils which this firm supplied.

With a table in the centre of the room, an improved means of taking the supply to the table would be warmly welcomed. Where central indirect fittings are in use for lighting, a connector could be attached to the bottom of the inverted bowl, and a connection brought down to the utensils.

In electric radiators, the "Belling fire" had found much favour amongst his consumers, but the finish was not all that could be desired, and he hoped the makers would see their way to improve on the piece of sheet metal which is attached by means of four screws to the back of the fire.

Amongst other domestic uses, electricity should be more generally used than it is at present in connection with private washing and laundry machines.

Mr. Beauchamp, who opened the discussion, considered a thermometer was useful for accuracy also inspection windows, but lamps soon failed. He preferred a window in the back and front of the oven, and a lamp at the far side. It was very important to indicate whether the switches were on or off, and the best method was to use illuminated signs. Besides a complete cooker with grill, hot plates and oven, there was room for a simple oven with no accessories. He did not believe there was any future for laundry apparatus for use in residences, at any rate in London.

Mr. Redick was anxious to obtain information as to British practice in electric supply. The central stations in this country did not seem inclined to go out of their way to help in the selling of apparatus to consumers.

Mr. Rycroft considered that the electric iron was the best introduction to other uses of electricity. He complained bitterly of the absence of hiring powers by municipalities. He made a point of giving a certain number of irons to consumers each year as a kind of substitute for discount.

Mr. Cooke thought at one time that it was essential to standardise cookers, but in view of continual improvements he had had to modify his views. The present high cost of apparatus necessitated a fairly high charge for hire, which could not be modified until the manufacturers were able to increase the output. He preferred side heating to top and bottom heating.

Mr. Travis thought it a hardship that electrical supply engineers in this country should pay for their experience; he suggested a central association or bureau of research, which could employ an expert testing staff to report on various samples and types, and publish the results of the test for the benefit of the industry. This would also help in standardization, as faulty designs could be eliminated practically before they were put on the market. Most makers were giving up top and bottom heat and using nothing but side heat. As to radiant and black heat for oven work, it was difficult to draw a hard and fast line; radiant heat was best for roasting, and the black heat best for pastry; he did not think windows and thermometers and such refinements were necessary. Thermometers gave very inaccurate readings when applied to cookers. With regard to connections for separately heated utensils for use in conjunction with an electric cooker, he suggested the well-known rise and fall billiard chalk attachment, so as to keep the socket of the plug well out of the way when not in use.

Mr. Pickvance advocated the use of thermometers and thought that each engineer should get experience for himself in electric cooking. He did not agree as to the undesirability of windows in ovens; they could easily be kept clean, and lamps lasted very well inside an oven. He considered that an iron, kettle, or grill was the best introduction to other uses of electricity, and he made a point of loaning these on trial to consumers.

Mr. Street emphasised the importance of paying more and more attention to the water boiling problem, and said it would be an advantage for each consumer hiring a cooker to be supplied with a quick boiling kettle.

Mr. Allen thought it most desirable for each engineer to test personally various types of ovens under actual conditions. He did not agree with the use of thermometers, windows, or lamps in an oven, and considered aluminium the best material for utensils, with a ground bottom, the bottoms being slightly concave when cold, which caused them to be dead flat when hot. The Belling type of heater was the best yet put on the market. In order to encourage the use of heaters among consumers on his rateable value system of charge, he hired a heating circuit and plug at a rental of 1/- per annum, and this had effected an enormous increase in the use of electric heating by consumers. He considered the vacuum cleaner an excellent introduction for other uses of electricity, and made a point of supplying irons on free trial.

Mr. Nichols Moore thought that they must rely upon the manufacturers for improvements in the electric cooker. He had electric cookers on both A.C. and D.C. circuits, and was troubled with pressure variation on the latter, but not on the single-phase supply at 200 and 100 volts. This illustrated the superiority of A.C. circuits for distribution purposes so far as domestic use was concerned, particularly where there were large size D.C. motors in the immediate vicinity which made an intermittent and heavy demand on the distributors. He considered that the electric iron was the finest introduction to "other uses" of electricity. In Newport, gas cookers, together with three points and all piping, were put in free by the Gas Co., and he found this a very serious factor in endeavouring to cope with competition for domestic purposes.

In Mr. Downe's opinion the cooking was going to be greater than the power business. The gas companies had standardised a type of domestic cooker, and they could not do better for the time being than take advantage of their educative work. He considered it was well worth while standardising cookers and ovens, and he advocated a model specification being drawn up. (It was pointed out that this matter as well as the standardisation of plugs and sockets was already in hand by Mr. Wordingham's Committee of the Engineering Standards). He considered that no method of cooking could approach the electric oven and grill. The slowness of the hot plates was a distinct difficulty, but a quick boiling kettle supplied with the cooker would get over it. The results of several complete cooking outfits used by families in Brompton, was a consumption of 1½ units per head per day.

Mr. Farndon said in West Ham they had several dozens of complete cookers of various makes installed, all of which had given great satisfaction. A fair number were installed on hire, but in the majority of cases the apparatus had been purchased outright, which indicated that a considerable amount of business was to be obtained with this class of apparatus irrespective of the facilities afforded for hire, whilst it was generally appreciated that universal electric cooking was a result obtainable only by hiring at a nominal rent per quarter. He agreed with the system recently adopted by Mr. Seabrook, *i.e.*, in making a nominal charge for hire and slightly increasing the charge for energy with a view to bringing the total hire to a figure approximating the present standard rental. The relative value of cooking accounts in Marylebone and West Ham would appear, roughly, to be as 5—1, or even as high as 10—1 in favour of the former, and although an additional ½d. per unit on Mr. Seabrook's price could be expected to bring a reasonable return towards the cost of hire the result in West Ham would be correspondingly unsatisfactory. He did not agree with windows, thermometers or lamps in ovens. He found that electric irons "dumped" to consumers was the best means of affecting a sale, and they were now proceeding to dump kettles; the best results were obtained by leaving irons at the consumers' doors, for a month's free trial. Arising from the use of the higher capacity heating apparatus now being more generally recommended and the consequent necessity for heavier flexible cords, he described an ingenious plug designed by Messrs. Lundberg, due to representations made and assistance rendered by the West Ham staff; the main features of the apparatus were the contact pins and terminals, which were made in one solid piece, two set pins being provided in the terminal for securing good contact with the flexible wire, thus overcoming the possibility of over-heating at the joints forming the contacts on the usual type of plug. The plug top was made in halves clamped together by means of brass set pins, the result being to form a cord-grip on the braiding of the flexible wire and very satisfactory results had been obtained.

The Secretary (Mr. Seabrook) said he saw no reason why side heating should not be standardised. As to depreciation of cookers, there were many types in use in Marylebone, some four or five years old; an obsolete type of cooker could be brought up to date by replacing the old elements by modern ones at quite a small cost. They purchased cookers out of revenue and allowed no depreciation, but brought them up to date by the method indicated, and in the event, which was very rare, of being compelled to scrap a complete cooker, it was simply written off the books. He referred to the desirability of developing a thermostatic control of oven heating which would do away with individual switching, when the cook would simply turn a pointer to the temperature required, and the thermostat would maintain the oven at that temperature. Water heating at one of the Marylebone conveniences, at ½d. per unit, came out rather less than the previous gas cost. They had tried a continuous heat, with a thermostat controlling the accelerator for sudden demands, but this came out a great deal more expensive than gas. Then, they tried a rather larger constant heat and no thermostat and this came out worse. But with a thermostat alone and no constant heat, the current being turned off at night, when the convenience was closed, and switched on in the morning again, the thermostat keeping the water at the required temperature all day long, the consumption of current was considerably reduced; the type of thermostat was the "Grundy." He firmly believed in properly illuminated indicators, showing the position of switches. Switches and fuses should be mounted on a separate control board. He agreed with the author that cast-iron pots with turned bottoms proved the best for hot plate heating. He emphasised the necessity of fixing to each cooker, either a rapid boiler or a separately heated kettle for small quantities of water required quickly. Either of these heaters would supply hot water at a quicker rate than was obtainable by gas.

ELECTRICITY IN DENTISTRY.

A considerable amount of attention has been paid to the therapeutic value of high-frequency currents, and one of the most interesting developments in this connection is the application of d'Arsonvalisation to dentistry. Reference in this connection may be made to the paper given before the Stomatological Congress in Paris in 1911, by Dr. Julian Zilz, on the Therapeutic Influence of d'Arsonvalisation on Alveolar Pyorrhoea, a paper by O. Libotte in the Annales Dentaires, 1912, on Alveolar Pyorrhoea and its treatment, and Moore Stevens on High-Frequency Currents for the Treatment of Alveolar Pyorrhoea and Inflamed Conditions of the Mouth in Dental Cosmos, 1913. The good results from the clinical and stomatological standpoints have given considerable inducement to the development of special apparatus for the particular purposes of dentistry. It will, of course, be remembered that the high-frequency currents used in this connection are, briefly, alternating currents with extremely high pressures and very high frequency. The frequency of the currents which are used for dentistry work of this description ranges from 100,000 to more than 1,000,000 per second, and the usual form of the application of these currents is by means of special vacuum electrodes constructed by Dr. Zilz. The radiations proceeding from these electrodes are bactericidal and stimulating in operation, and local anæsthesia can by their use be obtained in a very short time.

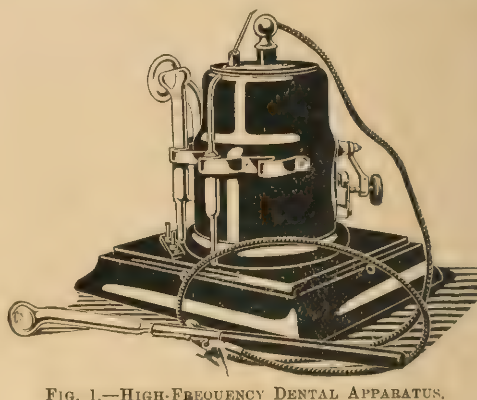


Fig. 1.—High-Frequency Dental Apparatus.

Fig. 1 shows a high-frequency apparatus used in this connection, made by Messrs. Fischer & Rittner, of Dresden. The whole arrangement is extremely simple for handling, which means that economy of time is secured, the average time for an operation being not more than five or ten minutes.

The speed and convenience of the method and the bactericidal and ozonising property reduce the secretion at the diseased portion of the mouth to a minimum as has been shown by numerous experiments by Dr. Zilz. The method is therefore in addition to being extremely useful and reliable, quite harmless, and is a relatively inexpensive method of dealing with pyorrhoea alveolaris. It can also be applied to neuralgia of the face, tuberculosis or lupus of the mucous membrane, &c. The construction of the apparatus is such that, in addition to simplicity of operation, there is absolute safety to the operator and to the patient. As will be seen from the illustration, an electrode holder and a high-pressure cable give flexibility to the conduct of the work. The necessary length of spark is about 40 mm., which is sufficient to operate the normal vacuum electrodes.

One of the essential portions of the equipment of a dental surgery is some means whereby hot water can be provided with as little loss of time as possible, and in this respect electricity has been found to be of considerable service. A very neat and compact arrangement of electric water heater has been introduced by the Insto Electric Heater Co., of Cincinnati, U.S.A., which operates either on direct or alternating current, and can be used on any voltage from 95 to 125. Its external form is that of a small metal cylinder, to one end of which is attached a flexible tube containing the electrical connections of an ordinary electric light socket. The immersion of the heater in a vessel of water gives hot water in five minutes, and boiling water in less than 10 minutes. It can be easily cleaned, and its polish is maintained by ordinary care and a little attention.

This is combined in the dental and medical steriliser with the necessary apparatus for holding small instruments and broaches, the steriliser consisting of the regular electric heater and the steriliser proper, which has a little mesh box, $2\frac{1}{2}$ in. × $1\frac{1}{2}$ in. × $1\frac{1}{2}$ in., for the instruments. One tray of the smallest mesh is placed in the bottom of the steriliser, another tray with a larger mesh being placed in the top on shelves provided. The instruments are stood up through the holes of the top mesh with the points resting on the small mesh in the bottom, thus keeping the instruments from sliding. The regular Insto heater is then placed in the steriliser, resting on the bottom mesh. The apparatus is so constructed that it is very easily cleaned, and as it has a separate heating device this may be used in either the steriliser proper or any other vessel. The entire heater is in positive and direct contact with the water, thus ensuring very efficient results. A special advantage is that in making renewals the new heating element can be readily slipped into place at a very low cost, instead of its being necessary to return the steriliser for renewal. The whole arrangement appears to be a very simple and neat solution of the special difficulties involved in electric sterilisation.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

New Tariff for Imports into Columbia.

The Board of Trade has just issued a translation of a new Columbian tariff, which was sanctioned on December 6th, 1913. A circular of the Government dated December 17th notified that all alterations effected by the new law which involved *reductions* of duty were to commence after the expiration of 90 days from the date of the law (*i.e.*, December 6th), and that such reductions were to be carried out by 10th parts during the ensuing 10 months. *Increases* of the former rates of duty were to commence from December 6th by amounts of one-third during three months. It would appear, therefore, that all increases of duty consequent on the passage of the new law are already in force, but that the reductions of the former rates of duty will not be in operation until January 5th, 1915. Attempts have been made to show in the return issued by the Board of Trade, the rates of duty applicable under the previously existing tariff, but for reasons stated by the Board of Trade it is impossible to be sure as to the accuracy of the rates given. The Columbian Minister himself in reporting the Bill stated that "no real tariff now exists, but merely a confused and shapeless mass of decrees and resolutions, which the Customs officers are unable to apply and which are an abomination and an injustice to the importer."

The rates of duty applicable under the new tariff to goods of interest to readers of the Electrical Review are given below, and so far as is possible information has been added as to the rates formerly levied in order to indicate whether the rates have been increased or decreased :—

	Old rates. Cents per kg.	New rates. Cents per kg.
Pumps, turbines and monitors for mines	1·7	1
Pumps, turbines and monitors for other purposes	5·1 and 3·4	1
Steam motors and their boilers for large industries	1·7 and 3·4	1
Electric motors and dynamos ...	5·1	1
Hydraulic motors, such as water wheels, Pelton turbines, &c., gasoline, petrol or spirit motors and windmills	3·4	1
Apparatus and machines for arts and crafts	5·1	3
Apparatus and machines for scientific work	not specified.	5
Scientific instruments and utensils	8·5	10
Motors of all classes and boilers for arts and crafts	3·4	1
Electrical accessories of porcelain composition and slate, wood or glass with or without metal parts	17 and 34	2
Electrical accessories not specified	not specified	4
Insulators of glass or porcelain ...	17	1
„ of faience	8·5	1
„ of rubber and other materials suitable for making insulators not specified	136	3
Electric measuring instruments ...	not specified	2
„ apparatus not mentioned ...	„ „	4
Telephonic and telegraphic apparatus	5·1	2
Electric chandeliers, brackets, pendants, lustres, and other apparatus, ornamented or not	according to material	25
Lamp glasses for electric lighting	17	25
Metal wires not specified, for electricity and metal cables protected with gutta-percha, tar or other substance	not specified	1
Dynamos, motors, transformers, rheostats	5·1	1
Electric lamps of steel and all lamps for outside lighting ...	according to material	2
Shades and reflectors of glass, faience or iron, enamelled or not	17 and 34	10
Ventilating fans	34	5
Fuse wire of copper, lead, silver, &c.	3·4	20
Cylinders or bars of carbon or zinc for electric purposes	not specified	2
Rubber bands for insulators and all materials for insulating not specially mentioned	5·1	2
Electric machines for medical purposes and batteries	136	25
Electric materials not specified ...	not specified	8
Piles or batteries and accumulators and plates for accumulators ...	8·5 to 34	2
Jars of glass or faience for batteries	17	2
Jars of wood or lead for batteries ...	34	2
Locomotives and locomobiles for haulage and traction	not specified	free
Rails for railways and tramways ...	free	free
Iron or steel sleepers	not specified	free
Fishplates for railways or tramways	5·1	free
Coaches and wagons for railways or tramways	free	free
Posts for telephones, telegraphs, electric installations, &c.	1·7	1
Copper wire	various	1

Note.—100 centavos = 4s.

The German Cable Syndicate.—The German cable syndicate, which is composed both of the purely cable manufacturing works and the large undertakings which also make cables, has just incorporated a new member in the firm of Brown, Boveri & Co., with an allotment of 5 per cent. of the total allotments of all the cable works. This company acquired the copper works of J. Wahlen, of Cologne, in July of last year, and the establishment has been developed into a cable factory in the meantime.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

9,686. "Electro-magnetic wave detector for wireless telegraphy of a mercury and crystal type, carborundum or other crystals." J. Kuhn and A. W. Bridges. April 20th.

9,707. "Method for changing the frequency of alternating currents." Isaak. (Alias Isaco.) April 20th. (Complete.)

9,718. "Electro-mechanical selector." E. G. Godfree. April 20th. (Complete.)

9,726. "Electric fans and motors." S. G. Jones, F. E. Wilson, and W. A. Shepherd. April 20th. (Complete.)

9,744. "Electrolytic interrupters." J. Poliakoff. April 20th. (Complete.)

9,768. "Electric pocket lamps." A. Veron. April 20th. (Convention date, April 19th, 1913. Switzerland.) (Complete.)

9,772. "Process of and apparatus for manufacturing wire from tungsten and its alloys." K. R. R. Seifert. (Convention date, April 21st, 1913. United States.) (Complete.)

9,794. "Electric heating-stove and radiator." S. E. Foster, W. H. Arundale, and C. H. Davies. April 21st.

9,818. "Starting rheostats for dynamo-electric motors." G. Ellison. April 21st.

9,822. "Automatic telephone systems." Aktieselskabet Elektrisk Bureau. April 21st. (Convention date, April 22nd, 1913, Germany.) (Complete.)

9,832. "Electric clocks." F. F. Reid. April 21st.

9,840. "Automatic or semi-automatic telephone exchange systems." G. A. Betulander. April 21st. (Convention date, April 23rd, 1913, Sweden.) (Complete.)

9,855. "Electric lamps." British Thomson-Houston Co., Ltd. April 21st. (General Electric Co., United States.)

9,856. "Return circuits of electric railways, tramways, and the like." British Thomson-Houston Co., Ltd., and F. W. Carter. April 21st.

9,861. "Device for packing electric candle lamps and like fittings." H. Garde. April 21st.

9,862. "Electric arc lamps and their operation." W. S. Simpson. April 21st.

9,874. "Apparatus for manufacturing wire from tungsten and its alloys." K. R. R. Seifert. April 21st. (Addition to 9,772/14. Convention date, July 30th, 1913, Germany.) (Complete.)

9,908. "Automatic life-saving guard for motor omnibuses and motor, electric and steam vehicles." C. Carpenter and H. Tagg. April 22nd.

9,940. "Machine for shaping the exterior of clay insulators and the like." W. Podmore. April 22nd. (Divided application on 7,859/14, March 28th.)

9,960. "Electric arc lamps." Siemens-Schuckertwerke G.m.b.H. April 22nd. (Convention date, April 22nd, 1913, Germany.) (Complete.)

9,970. "Retrievers for trolley collectors on electric traction systems." F. A. Wasson. April 22nd. (Divided application of 27,163/13. November 25th. Convention date, May 12th, 1913, United States.) (Complete.)

9,993. "Electrical fuses." R. Stephenson, A. H. Drewer, C. R. Curtis, and A. M. Stevens (trading as Drewer, Stephenson & Co.). April 22nd.

10,001. "Telephony and telegraphy." A. T. M. Johnson, F. H. Varley and A. C. N. Try. April 22nd.

10,004. "Safety devices for electrical circuits." P. Torchio and H. R. Woodrow. April 22nd. (Complete.)

10,015. "Electric clocks." I. H. Parsons and A. E. J. Ball. April 23rd.

10,027. "Magnetic motor engines." H. M. Ployne. April 23rd.

10,041. "Electric switches." P. S. Turner. April 23rd. (Divided application on 14,112/13, June 18th.)

10,048. "Device for use in connection with electric motors directly coupled with pumps, water sirens, and the like." Signal G.m.b.H. April 23rd. April 23rd. (Addition to 7,821/14. Convention date, August 18th, 1913, Germany.) (Complete.)

10,050. "Commutators for dynamo-electric machines." W. S. Pyrah. April 23rd.

10,060. "Electric warning signals." E. H. Jones and Sears Cross Speedometers, Ltd. April 23rd.

10,061. "Electric furnaces." A. L. J. Queneau. April 23rd. (Complete.)

10,082. "Safety devices for electric circuits." Siemens-Schuckertwerke. G.m.b.H. April 23rd. (Convention date, May 3rd, 1913, Germany.) (Complete.)

10,083. "Process for the exchange of ions absorbed by colloids." Ges. Fur Electro-Osmose. April 23rd. (Convention date, April 23rd, 1913, Germany.) (Complete.)

10,089. "Dimmers for electric lights with remote control." W. H. Clegg. April 23rd.

10,090. "Manufacture of sparking-plugs." K. E. Lee-Guinness. April 23rd.

10,100. "Storage batteries." B. Ford. April 23rd. (Convention date, May 21st, 1913, United States.) (Complete.)

10,104. "Combination of electric alarm-clock lamp battery, and connections, with an overmantel." G. S. Hosley and G. W. Hosley. April 23rd.

10,107. "Boxes for use with secondary batteries." F. J. Clark and Hart Accumulator Co., Ltd. April 23rd. (Complete.)

10,109. "Automatic switches for electric advertising signs or other electrical apparatus." F. W. Sturgess. April 24th.

10,110. "Gas-detecting apparatus for portable electric hand lamps." G. J. Ralph. April 24th.

10,120. "Metallic conduits for electric conductors." A. Noirit. April 24th.

10,124. "Electro-depositing of metals." J. F. Bennett and G. A. Frost. April 24th.

10,132. "Non-spillable vents for accumulators or galvanic batteries. D. W. John and J. H. Berry. April 24th. (Addition to 17,308/10.)

10,170. "Electric lamps." Constant Ficq. April 24th. (Complete.)

10,171. "Carbon electrodes for galvanic cells." V. Scholz. April 24th. (Convention date, May 17th, 1913, Germany.) (Complete.)

10,193. "Apparatus for the production of alkali metals by the molten electrolysis of alkali compounds." Deutsche Gold und Silber Scheide Anstalt vorm Rossler. April 24th. (Convention date, April 26th, 1913, Germany.) (Complete.)

10,223. "Variable candle-power incandescent electric lamp and holder." W. G. Rhodes. April 25th.

10,247. "Winding for transformers, repeating coils, and any electrical apparatus requiring a differential winding." J. Simpson and R. Simpson. April 25th.

10,251. "Indicators." F. G. Brettell. April 25th. (Apple Electric Co., United States.) (Complete.)

10,253. "Variable-speed generators and storage battery systems. H. A. Gill. April 25th. (United States Light and Heating Co., United States.) (Complete.)

10,275. "Apparatus for the electrical transmission of the energy of a heat motor to the driving-wheels of a vehicle or the like." Prosper Bills. April 25th. (Complete.)

10,308. "Electrical machine." Don Francisco Juan. April 25th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

5,529. Lowering and Breaking Connections for Continuous Current Electric Hoisting Apparatus. Allgemeine Elektricitats Ges. March 5th. (March 5, 1912.)

5,582. Controlling of the Starting and Working of Engines. A. Esplen. March 6th.

5,648. Means for the Electrical Transmission of Orders, Signals, and the like. E. A. Graham and W. J. Rickets. March 6th.

5,653. Machine Telephone Switching Systems. Western Electric Co. (Western Electric Co.) March 6th.

7,898. Method of Increasing the Strength of Magnets. P. May. April 3rd. (August 29th, 1912.)

8,033. Production of Gases by Electric Arc. R. Hadden (International Ionizing Process Co.). April 5th.

8,123. Incandescent Electric Lamps. E. P. Beckwith. April 7th.

8,249. Signalling Systems and the Control of Trains. E. C. R. Marks (Mascarenhas). April 8th.

8,412. Telephone Call Apparatus. Rebesi, Ltd., and F. Holden. April 9th.

8,497. Water Heaters, such as Geysers or the like. C. O. Bastian. April 10th.

8,772. Process and Apparatus for the Treatment of Liquids by Nascent Ozone. A. Breydel. April 14th.

9,396. Hose Pipes, particularly for Fire Hose having Electric Signalling Apparatus. C. H. Light. April 21st.

9,725. Magnetic Separating Machines. H. H. Thompson and A. E. Davies. April 25th.

10,373. Electrically operating Jacquard Machines. G. Corsi. May 2nd.

11,017. Treatment of Metals or Alloys to render them Ductile and Malleable. Westinghouse Metallfaden Gluhlampenfabrik Ges. May 9th. (May 13th, 1912. Addition to 12,869/12.)

11,335. Starting Systems for Internal Combustion Engines. J. D. Bell. May 15th.

11,825. Electricity Meters. Compagnie Internationale D'Electricite Soc. Anon. May 21st. (May 31st, 1912.)

14,317. Means or Appliances for Mounting and Securing Half-tone, Electro, Stereo and Zinco Plates. C. F. Moore. June 20th. (Dec. 1st, 1913.)

16,742. Pocket Lamp with Writing Attachment. T. Sendler. July 21st. (Feb. 26th, 1913.)

17,603. Electro-plating Apparatus. T. R. Canning. July 31st.

17,947. Thermo Electric Current Consumption-regulator. G. B. Caminati. August 6th.

21,109. Electrical Resistances. C. E. Hay and H. W. Sullivan. September 18th. (September 18th, 1913.)

26,479. Telegraph or like Systems and Apparatus therefor. H. H. Harrison and Automatic Telephone Manufacturing Co. November 18th.

28,823. Electric Condensers. A. G. Bloxham (Robert Bosch, Firm of). December 13th.

28,824. Containing Vessel for a Granular Mass of which the Electric Resistance is varied by pressure. Robert Bosch (Firm of). December 13th. (January 9th, 1913.)

29,059. Sparking Plugs. C. Spada. December 16th. (February 25th, 1913.)

29,242. Electric Writing Telegraphs. E. H. Widegren and K. A. Widegren. December 18th. (December 30th, 1912.)

29,721. Electrical Switches. A. P. Lundberg, G. C. Lundberg, P. A. Lundberg and G. Pegg. December 24th.

1914.

528. Process for Manufacturing Condensation Products from Phenol Formaldehyde and the like. K. Tarassoff. January 8th.

895. Machine Telephone Switching Systems. Western Electric Co. (Western Electric Co.) January 12th. (Divided application on 5,653/13, March 6th.)

2,211. Circuit Arrangements for Telephone Systems. Siemens and Halske Akt. Ges. January 27th. (January 28th, 1913. Additions to 22,013/10.)

2,492. Transformers for use in connection with Electric Measuring Instruments. Siemens Brothers Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.) January 30th.

5,230. Apparatus for the Manufacture of Tubes, Cable Casings, and other products of indefinite length from Molten Lead or other Metals and Alloys. H. Debauge. February 28th. (Divided application on 5,639/13, March 6th.)

5,510. Machine Telephone Switching Systems. Western Electric Co., Ltd. (F. T. Woodward, acting for Western Electric Co.) March 4th. (Divided application on 5,653/13, March 6th.)

6,353. Vapour Electric Devices. E. Weintraub. March 12th. (March 13th, 1913.)

The Aluminium Industry.—It is stated in the annual report of the Neuhausen Aluminium Industry Co. that, as a result of the agreement existing between international producers of aluminium, the situation of the market both in regard to prices and sale conditions was normal and satisfactory in 1913. Consumers are gaining increased confidence in the stability of the market situation, and this contributes largely to the constantly growing use of the metal. The prices for the current year have been fixed on the same basis as in 1913, and although the demand at present is less active in consequence of the quieter course of business in general, the manifold applications of aluminium and the corresponding increase in the consumption assure constant employment for the company's works.

The Point Fives.—At the meeting held on April 17th, at the B. and K. Restaurant, Messrs. Shaw (Worcester) and Furness (Blackpool) were elected members. It was decided that in future the dinner and meeting should be open to guests. The next meeting takes place at the Grand Hotel, Birmingham, on the Thursday of the I.M.E.A. Convention, when, after a supper, the discussion will apparently take place in the "wee sma 'oors ayant the twal." A summary of the last discussion, on heating and cooking matters, appears elsewhere in our pages.

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ELECTRICAL REVIEW.

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THE LIABILITIES OF CONSULTING ENGINEERS AND ARCHITECTS.

MUCH as we may regret the result of the action taken by the War Office against Messrs. Kirkland & Capper and Mr. J. H. T. Woodd, we cannot, having carefully read the evidence, profess any surprise at the Judge's decision. The case has been reported at some length in several of our recent issues, so that we need only refer here to the leading features.

Mr. Woodd was engaged as architect by the War Office in connection with the building of a medical college at Millbank, and, as is now not very unusual, the architect's duties included the supervision of the internal equipment. It was, however, expressly provided in his instructions that the electric lighting work should be placed in the hands of experts, and Messrs. Kirkland & Capper were the experts employed, their remuneration to be at the rate of 5 per cent. on the amount of the electrical contracts. This is the recognised fee for consulting work, which includes the drawing-up of a specification and general supervision of the work during erection, but in this case a general specification was drawn up by the War Office, so that the work of the consulting engineer was, perhaps, somewhat lighter than usual.

The action was for damages due to negligence and insufficient supervision, and it was part of Mr. Woodd's defence that, as he was not paid any commission by the War Office on the electrical portion of the work, he could not be held responsible, but on this point the learned Judge made some rather caustic remarks. The Solicitor-General, Sir Stanley Buckmaster, in opening the case for the plaintiffs, read certain statements made by the defendants in reply to interrogatories as to the terms on which they were engaged. The answer of Mr. Woodd, which was confirmed by Messrs. Kirkland & Capper, was as follows:—

> The plaintiff, through me, appointed Messrs. Kirkland & Capper as experts to prepare the plans for and to supervise the electrical engineering and lighting work for a payment based upon the cost of work carried out under their supervision. Their payment was to be at the usual rate of 5 per cent., and in accordance with a then standing agreement between myself and Messrs. Kirkland & Capper 1 per cent. out of this 5 per cent. was to be paid by them to me for services to be rendered by me to Messrs. Kirkland & Capper in connection with the work, for which I should not have been entitled to charge, and did not charge, the plaintiffs.

In delivering his considered judgment, Mr. Justice Lawrence, referring to Mr. Woodd's liability, said:—

> Furthermore, he shared in the payment made by the plaintiff for this very work of supervision. It is a matter of regret to me to have heard of, and to have to express my disapprobation of, this secret commission transaction between the defendants. The excuses put forward for it were most unsatisfactory. There was no service performed by Mr. Woodd for Messrs. Kirkland & Capper proved before me which he was not bound to perform under his obligations with the plaintiff. The hollowness of this excuse was further demonstrated when it was shown that he had charged the plaintiff, under Clause 14, as for "special interviews or plans," for the very attendances which he had made upon Messrs. Kirkland and Capper.

From this it seems quite clear that the 1 per cent. paid by Messrs. Kirkland & Capper to Mr. Woodd was not for services rendered, but was by way of commission, and that there is, or was, a standing arrangement between them to pay this commission. We refer to this matter specifically because the case for the defendants was taken up by the Association of Consulting Engineers, an association which somewhat arrogantly, as we have always thought, appears to claim for its members a standard of professional integrity which is not to be found outside its ring fence. The Association was officially represented at the trial by its hon. sec., Mr. A. H. Dykes, who gave evidence in support of the defendants, and as the arrangements existing between Messrs. Kirkland & Capper and Mr. Woodd were disclosed at the trial before he gave his evidence, the Association must accept the responsibility of approving them. We should like to know, therefore, how it reconciles such standing arrangements with its rule that no member "shall improperly solicit professional work either directly or by an agent, *nor shall he pay, by commission or otherwise, any person who may introduce clients to him*."

This point had, of course, nothing to do with the action of the War Office, the action being one to recover damages due to the negligence of the defendants. According to the general specification of the War Office, the conductors were in all cases to be accessible to authorised persons. "Barrel" was to be employed for the protection of conductors when buried below plaster or in concrete work; lead-covered conductors might be used provided they were accessible, and might be run through walls or partitions, or under plaster for short lengths, *e.g.*, behind cornices and mouldings.

The contract was given to Messrs. John Bolding & Sons, and the method of wiring accepted, according to Mr. Kirkland's reported evidence, was "by means of vulcanised india-rubber wire in folded tube on the surface." It is not quite clear what system is here indicated, but whatever it was the architect would have none of it, nor, in fact, any system in which the conduits or wires were not concealed. The method of building construction, as regards ceilings and partitions, involved the use of Frazzi blocks, on which there was a layer of plaster about $\frac{5}{8}$ in. thick, and as this is not sufficient to conceal ordinary barrel conduit, the consulting engineers, with the concurrence of the architect, decided upon a lead-covered system sunk in the plaster. This, it was admitted, did not comply with the I.E.E. rules, which, according to the War Office specification, were to be observed, and the system of wiring was one of which there was no evidence that the contractors had had previous experience.

It was contended by Mr. Kirkland that a sunk lead-covered system was accessible, because the ends of the conductors were exposed!

In his evidence Mr. Kirkland stated that he had been in private practice since 1891 on his own account, and took Prof. Capper into partnership in 1898. Mr. Kirkland's name does not appear in the list of members of the Institution of Electrical Engineers.

So far, then, the facts of the case appear to be that an important electrical installation is to be carried out on a system which is not in accordance with the rules of the Institution of Electrical Engineers; the contract is placed with a firm of plumbers and sanitary appliance manufacturers, who, presumably, have had no previous experience of the system of wiring adopted; and the work is to be supervised by a consulting engineer who is not a member of the Institution of Electrical Engineers.

It is distasteful to have to refer to this point, but we feel bound to do so in the interests of a large body of qualified consulting electrical engineers, who, whilst not members of the Association of Consulting Engineers, have to bear their share of whatever stigma is cast upon their profession by the action of members of that Association.

Mr. Patchell—who gave evidence on behalf of the plaintiffs—stated that samples which he had examined showed evidence of wire having been bent until it had burst, that it was badly knocked about in other places, that it had been handled a good many times, and that the lead was pitted in some cases, most likely by electrolysis through leakage.

The defence sought to prove that plaster is electrically an insulator. It is, perhaps, not sufficiently well known that although lead-covered wire may last for a considerable time in dry plaster, it is certainly acted upon when run along damp brickwork or left in plaster which remains damp for any appreciable time.

A good deal was made in the case of the impossibility of chasing the Frazzi blocks, and it was stated that the only possible system, therefore, was a lead-covered system.

Mr. Swinburne, who gave evidence for the defence, was handed a Frazzi brick and a file, and asked to chase the brick with it. He found that he could do so quite easily. This was rather clever on the part of the plaintiffs, but, as a matter of fact, it was not a practical test, as no wireman would think of using a file to chase out a groove in a brick partition; he would naturally use a hammer and chisel, and break the blocks, as the defence contended.

The Judge held that, as lead wiring was prohibited by the War Office specification, and also by the rules of the Institution of Electrical Engineers, the obvious thing for the architect to do was to increase the thickness of the plaster, so as to permit of a sunk conduit installation. In other words, he held the common-sense view that an architect should design his building to suit the various installations which it has to hold, and not attempt, as is apparently the regular practice of architects, to make contractors modify their work to suit his architectural designs.

The important part of the case, however, is the liability of architects and consulting engineers for failures of installations carried out under their supervision. The Judge held that upon the construction of the specification buried lead-covered wires, except in short lengths, were not permissible. He held also that the supervision of the work of wiring was negligent or insufficient, that the bonding at the connector boxes was sometimes absent and generally insufficiently executed; and, finally, that both defendants, that is, both the architect and the consulting engineers, were liable under the terms of their engagement.

As to the damages, the Judge held that the plaintiffs could not claim to reject the whole installation because a portion of it had proved defective, and he, therefore, limited the damages to the cost of reinstating on an improved method the circuits which had failed.

It must not be assumed from the judgment that architects and consulting engineers may always be held liable for the breakdown or failure of an installation at any time after it has been passed by them. It is essential in order for a case of this kind to succeed to show incompetence or negligence on the part of those who were entrusted with the work of supervision. It is, of course, impossible for either an architect or a consulting engineer to spend the whole of his time on one installation or building, nor is it always essential to have a representative or clerk of the works on the spot. It is, however, most essential, particularly in electrical work, that a consulting engineer, as much in his own interests as in those of his clients, should only employ firms who are specialists in the particular class of work covered by his specification. Consulting engineers are from time to time accused of favouring certain contractors, and unworthy motives have been suggested for their doing so. The fact is, however, that the consulting engineer is very largely dependent upon the integrity of the firm he employs, and it is only natural that, having found a few firms who can be trusted to carry out his specifications honestly without continuous supervision, he should hesitate before giving important work to firms of whom he has no previous experience.

The Budget.

On Monday last week the public were informed that fundamental changes were about to be made in the relations between Imperial and Local Taxation. It is not, therefore, inopportune to make a few observations upon the matter from the point of view of those who are concerned with the electrical industry. With the Budget or the Budget Speech we are not concerned, whether as politicians or otherwise.

We may have our own views about the increase in the national annual expenses; about the policy of taxing the few for the benefit of the many; some may even take a mild interest in the super-tax. We shall not, however, embark upon the consideration of any of these matters, but rather restrict ourselves to those features of the Budget which are of special interest to the readers of this journal.

First and foremost, it would seem that, upon the admission of the Chancellor of the Exchequer, there are numerous municipalities up and down the country which are in a bad way. "We have come to the conclusion," said Mr. Lloyd George, "that further aid, and substantial aid, from the Exchequer is inevitable and imperative, to save the municipalities from bankruptcy; to spread the area of contribution, and, above all, to ease certain changes we propose to make in local taxation."

With the fact that certain municipalities are bankrupt we are not greatly concerned. It is into the cause of the bankruptcy that we are interested to inquire. Without entering into particulars, we may say that we have little doubt that the bankruptcy to which the Chancellor of the Exchequer alluded may often be assigned either to disastrous municipal trading or to the fact that the local government is run not for the benefit of the ratepayers, but for the benefit of certain classes of ratepayers.

We need not pause to give instances of municipal trading which have failed; but we have a favourable example of the other cause of failure ready to hand. The memory of the famous Leeds strike has not yet (we hope) faded from out of the public mind. The story is soon told. Cherishing the belief that they had only to stand firm for 48 hours, the Leeds Corporation employés struck *en masse.* The strike failed, owing to the firm attitude adopted by the "employers." The City Fathers of Leeds, many of whom, no doubt, are hard-headed business men, took the opportunity of retrenching. They found that they were expend- £36,000 a year too much on municipal services, and very wisely decided to save this expenditure by a permanent reduction of their staff. In the second place, they found that by the use of vertical retorts in the gas works an enormous amount of labour might be economised. They had recourse to labour-saving machinery.

It required the fact of the Leeds strike to show that any able-bodied man, even if he has only one leg, can sweep a street or empty a dust-bin. He can even act as watchman in a municipal park without using faculties of a very-high order.

It is not always a safe proceeding to argue from the particular to the general. We have, however, little doubt that if inquiry were made into the wages list of every local authority in the country, it would be found that many wise and prudent economies could be effected.

To insist on such economies is of importance to the electrical world. A large proportion of the rates are paid directly or indirectly in many towns by or through those who are connected with the electrical industry. To this extent then anything in the shape of Government grant which may tend to relieve the burden of local taxation would be welcome. But it would, in our judgment, be far better to insist upon narrowing the bounds of municipal trading, and the restriction of each local authority to the performance of its legitimate functions under a more careful control.

A Literary Coincidence.

Many years have elapsed. Time for reference is not available, and we are not prepared to vouch for every word or every detail. We are relying on memory, and memory on details is frequently treacherous, but on the broad question our memory probably serves. It was the *Daily Telegraph* which published an article on the Near East, describing the wanderings of a travelling correspondent. The recital included a reference to an "irreclaimable old savage on the confines of civilisation." It was the *Globe* which discovered a singular similarity between the correspondence in the *Telegraph* and an article in a magazine published some months previously. Publishing the synonymous paragraphs in parallel columns, the *Globe* suggested that the place of origin of the correspondent's letter was Fleet Street rather than Asia Minor. The *Times* in those days paid little attention to its contemporaries, but published the remarks of the *Globe* under the heading of "A Singular Coincidence," or some similar title.

We are reminded of the circumstance by the article in the *Times* of the 11th inst. on "The Story of the Telephone," and we give a small sample from bulk in the form of parallel columns such as the *Times* utilised perhaps 40, certainly more than 30, years ago.

The Times, May 11th, 1914, page 6.	*The History of the Telephone,* by Herbert N. Casson page 250. (Chicago A. C. McClurg and Co. 1910.)
Soon afterwards *The Times* printed a highly appreciative leading article on the telephone. "Suddenly and quietly the whole human race is brought within speaking and hearing distance," it declared. "Scarcely anything was more desired and more impossible." *Queen Victoria's Interest.* Several days later Queen Victoria expressed a desire to talk by telephone. Accordingly a wire was put up from a Downing Street office to the City house of Sir Thomas Biddulph. For an hour or longer her Majesty talked and listened by telephone to Kate Field. Miss Field sang "Kathleen Mavourneen"; and the Queen thanked her by telephone, saying she was "immensely pleased." She congratulated Bell himself, who was present, and asked if she might be permitted to buy the two telephones, whereupon Bell presented her with a pair done in ivory.	Soon afterwards the *London Times* surrendered. It whirled right-about-face, and praised the telephone to the skies. "Suddenly and quietly the whole human race is brought within speaking and hearing distance," it exclaimed: "scarcely anything was more desired and more impossible" . . . . . And one wintry morning in 1878 Queen Victoria drove to the house of Sir Thomas Biddulph, in London, and for an hour talked and listened by telephone to Kate Field, who sat in a Downing Street office. Miss Field sang "Kathleen Mavourneen," and the Queen thanked her by telephone, saying she was "immensely pleased." She congratulated Bell himself, who was present, and asked if she might be permitted to buy the two telephones; whereupon Bell presented her with a pair done in ivory. . . .
A few weeks later a wire was put up to Windsor Castle, and a tiny telephone exchange, with 10 wires, was started in London. An order for 100 telephones was sent to Boston, and so, under the most favourable auspices, the telephone service of Great Britain began.	A wire was at once strung to Windsor Castle . . . A tiny exchange with 10 wires was promptly started in London; and on April 24th, 1879, Theodore Vail, the young manager of the Bell Co., sent an order to the factory in Boston: "Please make one hundred hand telephones for export trade as early as possible." The foreign trade had begun.

Let us say, for the honour of Fleet Street, that the coincidence discovered by the *Globe*, and afforded influential circulation by the *Times*, was satisfactorily explained by the fact that the articles in the magazine and in the *Daily Telegraph*, were shown to be by one and the same author. A similar satisfactory explanation will probably be forthcoming in the present case.

The sentiments inspired by the irreclaimable old savage were, we believe, the same in both publications. The author in the present examples (if the assumption of identity of origin be correct) experiences a double thrill. The same order for 100 telephones develops a feeling of pride in the one publication, and a righteous indignation in the other. This arises from an excessive and inartistic application of local colour, which is much to be deplored. Telephone men, both in the United States and Great Britain, whose names are freely used in the articles, have our cordial sympathy.

On the purport of the *Times* article, we do not comment, except to say that to be effective authority is beneficial, and style is not to be despised. The technical information thus published by the *Times* would certainly not pass muster in its Engineering Supplement now relegated to a monthly status, but the *Times* happily still issues a Literary Supplement weekly. Last week's issue contained an article on "Mr. Balfour and English Thought." In it there is some reference to style: "Mr. Balfour, at his best, writes the purest prose of our generation . . . . A different style is in fashion to-day. The startling word, the haunting phrase, the impassioned epithet, are more generally acclaimed," and—quoting Mr. Balfour himself—"The ear gets wearied with their unrelenting scream, the palate jaded with their perpetual stimulants."

Whilst we have considerable sympathy with the *Times* in its efforts at ameliorating the telephonic situation, we have our doubts of the efficacy of the "unrelenting scream." We have more faith in statements of sober fact, and singleness of purpose, which are quite valuable aids even to literary style. The *Times*' traditions in that direction might have been expected to save it from a method of publication which is to be deplored, for in truth some telephonic errors of the past are worth recalling with a view to a modification of their unfortunate results in the future. The *Times* defeats its own aims.

Lead.

After showing considerable strength and activity based upon a scare in connection with the news that the American Smelting and Refining Co. had closed all their Mexican mines and smelters, and that the other mine-owners in the northern and central parts of the country had done likewise, there was a reaction. It is pretty certain that the rise was not justified by the circumstances of the case, for it had been already clearly enough apparent that the world could rub along without any assistance from Mexico in the matter of lead contributions. Still, it served to scare the shorts who accordingly covered heavily, and the price was put up to about £19 for prompt —an advance of £1 a ton. Since then there has been a reactionary tendency, the heavy arrivals having the effect of bringing about a more cautious feeling, and it being known, too, that there were large quantities afloat both of soft lead and of silver-lead from Australia. The silver-lead, of course, takes time to become available for delivery in its refined condition, but it comes on to the market sooner or later, and the fact that the desilverisers have ample supplies of raw material upon which to work, and this in spite of the shutting off of metal from Mexico, is naturally a matter of importance from the market point of view. Meantime, however, the market, as a whole, presents a steady front. One point which has had an influence upon stiffening holders is that the United States has not made any further sales of domestic lead to Europe. The New York selling a little while ago had a very marked effect upon sentiment, and indeed was largely responsible for the drop to about £18 for prompt delivery, hence the increased stability displayed as regards the United States situation is viewed with the utmost satisfaction. The trade reports which are coming forward are, however, barely so satisfactory, the falling off in the tonnage of new buying being now commented upon in connection with the cable-makers. This may prove merely a temporary feature, but it is rather unfortunate that it should be in evidence, for the electrical trades have of late been the only portion of the lead-consuming industry in which no abatement of activities was recorded. However, the position is as has been said, and it remains to wait in patience to see what the next few weeks bring forth in the way of new business. Possibly the slackening reported is local, and not indicative of any alteration in the broad outlines of the market.

While the world's returns as to output are not yet available, the official figures for the United States have been issued, which show that the production of primary refined lead in the United States in 1913 was 462,460 tons, against 480,894 tons in 1912, a falling off of about 18,000 tons, whereas the primary lead available for United States consumption increased from 388,000 tons in 1912, to 419,000 in 1913. A very important point in this connection is that the United States imports of lead ore from Mexico were only 4,500 tons, against 7,400 tons in 1912, and those of Mexican silver lead 37,359 tons, against 76,805 tons in the previous year. This reflects the reduction in the imported material owing to the Mexican troubles. The returns give the stocks in bonded warehouses at the end of 1912, as 10,492 tons, and those at the end of the following year as 5,310 tons. As regards secondary lead, the United States output last year is returned as being 72,384 tons, compared with 67,168 tons in the previous year.

The British import returns show that the scarcity of lead from Mexico is entirely unfelt so far as our trade is concerned. The April imports were 21,990 tons, making 77,265 tons for the four months, against 20,629 tons last April, and 73,507 tons for the four months, and 16,081 tons and 69,006 tons respectively in 1912.

The Flying Train.

Under this and similar titles, the daily Press of London during the past week has been publishing paragraphs—even columns sometimes—of awe-struck admiration of the model electric "train" which Mr. Emile Bachelet has been exhibiting in the City. The English language has been strained to the limit to find expression for the fruits of the fertile imagination of the omniscient and versatile reporter, who far out-Herods Herod in the flowery extravagance of his prognostications. We are told that the laws of gravitation have been broken (*Standard*), that it is "the eighth wonder" of the world (*Globe*), that Mr. Churchill is considering its application to airships and to warcraft rushing at a tremendous pace over the surface of the water, and similar balderdash, *ad nauseam*. The great railway chiefs of England have seen it and are amazed—everyone who has seen it is amazed, says the *Express*. We, too, are amazed—at the tolerance and credulity of the newspaper-reading public, which are so cynically traded upon by the ready writers of the sensational Press. For what is it all about? A scientific toy—no more and no less.

The train consists of a metal car which is supported between a set of four guide rails by magnetic repulsion, and is propelled by solenoids encircling the rails at intervals. Rail friction being removed, it is alleged that speeds of 300 and up to even 600 miles per hour are attainable. And it is so cheap! To convey a pound of merchandise 300 miles, says Mr. Bachelet, would cost ½d. But let us see what are the facts.

In the first place, the only feature of novelty in this system is the actual combination of old ideas; the miraculous levitation which has left the lay Press gasping with amazement is a commonplace lecture experiment, and has been known for 30 years. The propulsion of a car by the attraction of solenoids is almost as ancient; an experimental line 3,000 ft. long was operated on this very system for months in 1890 by Dolbear and Williams, in America—where is that system now? What has become of the "automatic electric carrier" of Dubs and Laffitte, of 1900? Of the Rosenfeld and Zelenay "tangential traction" of 1901? Of Taeggi's "electric post" of 1902? They are all in the limbo of past failures. Some of these, and others that we could name, depended upon the same vicious principle—that of attaching part of the motor to the carriage, and distributing the corresponding part along the track. It can be done, of course, but at what a cost! No electrical engineer who contemplates the electrical conditions of working of such an undertaking can for a moment regard it seriously.

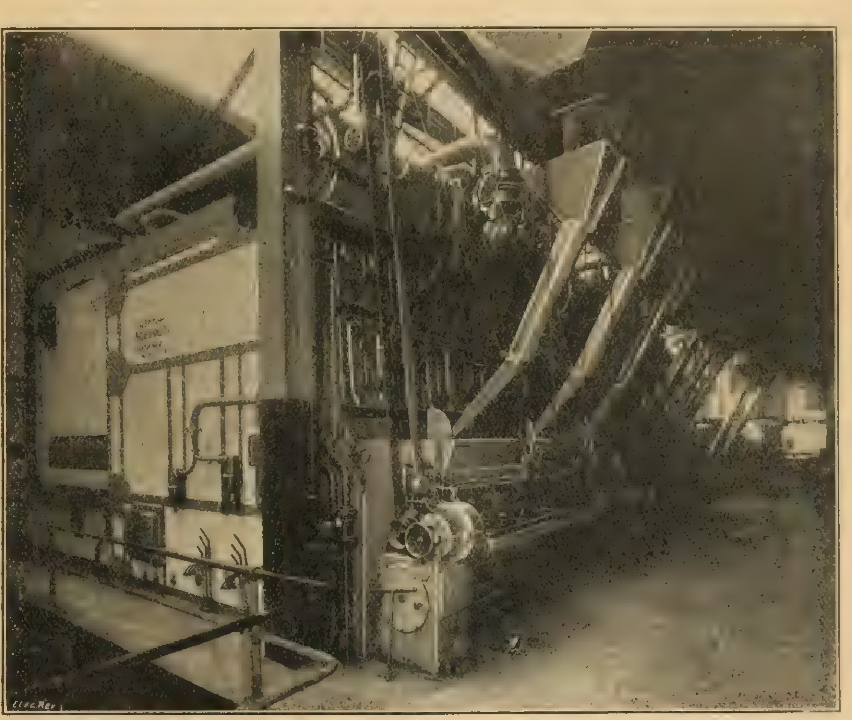
But apart from the cost of the installation, what can be said of the speed? The Press speaks of the elimination of rail friction as opening the way to hundreds of miles per hour—in point of fact, the air resistance to a train running at 50 miles an hour is the most important obstacle to its progress, and as the resistance increases roughly as the square of the speed, at 300 miles per hour it would be 36 times as great as at 50. The power required to propel a body at this speed would be enormous, even with an efficient means of propulsion, which the solenoidal system most certainly is not, and to this would be added the enormous power required to sustain the train—far greater than the resistance due to rails. The thing is preposterous, and no sane man will risk a farthing on so far-fetched a scheme. We have no quarrel with the inventor, for whom we feel only sympathy, as he is doomed to suffer disappointment; but we cannot too severely reprove those papers which, utterly unable to appreciate the invention at its true value, have permitted their columns to be filled with nonsense, and have misled the public as to the facts.

THE NICLAUSSE BOILER.

On Friday, May 8th, a party of engineers and others made an inspection of the Southend-on-Sea Electricity Works for the special purpose of seeing there the new boilers recently laid down by Messrs. J. & A. Niclausse. There are two of these boilers, complete with superheaters and mechanical stokers. The following are the main features :—

Pressure	160 lb. per sq. in. (boilers built for 225 lb. and tested to 360 lb.)
Capacity and superheat	25,000 lb. from and at, normal } superheat 150° F. 35,000 lb. from and at, overload
Boiler H.S.	3,700 sq. ft. outside tube only, neglecting headers 1,700 sq. ft. inner tubes (circulating)
Superheater H.S. ...	1,076 sq. ft.
Headers and tubes...	20 headers, each having 21 evaporating tubes and one cleaning tube plug Size of tubes 80 mm. × 10 ft. 1¼ in. long
Drum	1 m. diameter × 17 ft. 1½ in. long
Space	Battery of two boilers 36 ft. 6 in. × 15 ft. 6 in. long
Thermal efficiency...	80 per cent.

The Niclausse boilers are raised above the old boiler house floor level about 8 ft., so as to bring the firing floor level with the yard and adjacent engine room. Advantage has been taken of this to arrange the new main flue under the economisers and to provide better means for handling the ashes. The Niclausse stoker is fitted with hoppers under the grate to trap in separate compartments all green fuel and fine ash shaken through the bars, the clinkers being delivered continuously over the end of the grate into a brick-lined chamber at the back, whence they are discharged to ash wagons run along the basement. Low-pressure fan draught is employed, the fans being placed in the basement under the firing floor and delivering through ducts to the hoppers under the grate. The air supply is regulated in correct proportion to the different zones of the fuel bed. Levers worked from the side of the furnace control registers for admitting or shutting off the air supply to the different compartments of the hoppers under the grate, after the manner employed by the late Eckley B. Cox, of Pittsburg.



Niclausse Boilers and Bennis Stokers at Southend-on-Sea.

The furnaces are divided into three sections in the width, and contain a number of trough bearers for carrying the fire bars, which are made up in thin sections about a foot long, and set in the bearers five abreast. A very fine air distribution through the fuel bed is thus obtained. The bearers are moved intermittently and successively in a longitudinal direction, and being inclined about 10° the fuel is gradually fed forward from the hoppers at an initial thickness regulated by a movable shutter controlled by the fireman. The bars have low steps on their surface, each step 3 in. long. This assists to prevent back travel of clinker when the bar moves backward.

The bar movement is effected by means of a slowly rotating shaft with hard steel trip pieces engaging with steel blocks mounted on the bearer heads. The speed of the stoker shaft can be varied from 1 to 6 r.p.m. by change gears, and any desired intermediate speed is given by speed regulation of the electric driving motor. Thus the stoker is readily adjustable as to thickness of fire, pressure of air supply, point of air supply, and speed of the grate.

It is claimed that the stoker is capable of burning with satisfactory results fuel from the richest to the poorest grades. At Southend, Midland fuel having 12 per cent. of volatile matter is being used, and only a light smoke was issuing from the chimney when the party left at about seven o'clock. The whole of the coal-handling plant has been made by Messrs. E. Bennis & Co.

The boiler comprises a compact bunch of short straight tubes connected at one end to a drum by a single row of headers, the tubes being closed at the other end. Both the headers and the tubes are thus free to expand. The headers are divided into two compartments and the tubes are fitted with thin internal tubes, so that the water flowing down the front side of the headers travels through the internal tube to the back closed end of the evaporating return outer tube, which delivers steam and hot water, *via* the rear compartment of the header, and so to the steam drum. The feed water first enters the upper rows of tubes, where it is heated to steam temperature, and is afterwards delivered to the lower tubes, *i.e.*, those nearest the furnace, and a high evaporative duty is obtained without the slightest possibility of tube troubles. Impurities contained in the feed water are deposited in a detartarising trough in the drum, whence they can be blown out. The remainder of the impurities which cannot be so extracted are harmlessly deposited in the upper tubes, which are surrounded only by exit gases at comparatively low temperatures.

The external surface of the tubes is kept clean by a steam jet lance used once during the day. It is inserted between the tubes through small holes in the boiler front, which are closed with little caps. The lance is connected and fed through a flexible hose with steam at boiler pressure ; it is passed backwards and forwards amongst the tubes, and blows off any deposit of soot or dust upon them. An efficiency on test is claimed of 80 per cent., and we see no reason to doubt this figure under satisfactory conditions.

The French-made boiler is well and neatly finished, and should obtain its full share of employment in this country. It has many good features, including tubes not overlong, and it is compact and manageable. It is also fortunate in finding itself in so clean and well-kept a boiler house as this one of Mr. Birkett's (Mr. Birkett is manager and engineer). It is fortunate also in its feed water, which is soft and good, though it contains salts which must be blown out to prevent undue concentration.

These boilers are excellent examples of what the French can do, and may be studied with advantage by those who think we have nothing to learn in boiler-making. After the inspection, the party dined at the Palace Hotel as guests of Messrs. Niclausse, and a very enjoyable evening was spent before the 10.30 train by which the return to London was made. We congratulate Messrs. Niclausse on their excellent work and on this successful installation.

THE PROBLEM OF THE SMALL CONSUMER. IS IT SOLVED?

Amongst the many questions which have confronted electricity suppliers in this country, probably not one has involved so much worry and trouble, with so little real practical result, as the finding of ways and means for supplying electricity at a profit to the small consumer, particularly when, as is more often the case than not, his premises are unwired.

Some engineers have ignored the problem, which is obviously not capable of solution by the ordinary cut and dried methods of electricity supply; others have manfully tackled the question and achieved results on a minor scale, and, it is to be feared, sometimes of a doubtful character, while yet others, such as for instance, Mr. Fennell, at Wednesbury, who connected 250 consumers in 18 months, can claim a considerable measure of success.

The best and most successful example of small-consumer supply, however, which we have come across, is that carried out by the Fixed Price Light Co., Ltd., in conjunction with the Corporation Electricity Department, at Wimbledon, which concern, starting in September, 1912, has connected 1,008 consumers with 3,593 lamps (4,495 equivalent 30 watt lamps) in the first 18 months of working, and is still steadily increasing. This result is sufficient testimony to the businesslike proposition put forward by the company, which, under its arrangement with the corporation, can only supply unwired premises, and it will also be gathered that the turnover in practice represents gas consumers who prefer electric lighting if it can be obtained on terms, equal to or more favourable than gas, and who otherwise would never on the score of the expense of wiring be able to adopt electricity.

Russell & Sons] [*Wimbledon.*

Service shown dotted

Typical Houses supplied on "Fixed-Price" System

The Company is competing directly against gas supply through slot meters, and it is hopeful to find that, at any rate in Wimbledon, electricity can compete with gas even on the score of expense, as consumers are agreed that their bills from the Fixed Price Light Company are less than those they had paid to the Gas Company.

The company provides the necessary fittings, wiring, etc., free of initial expense to the consumer, on his agreeing to take a supply for not less than one year, and to pay weekly or monthly in advance certain fixed charges per lamp. These charges are as follows:—

Lamps.	Approximate Candle-power.	Charge per lamp per week. Summer months (April to Sept.).	Winter months (Oct. to March).
No. 1	100	5d.	6d.
No. 2	50	3½d.	4½d.
No. 3	32	3d.	4d.
Nos. 4 and 5	25 and under	2½d.	3½d.

The company reserves the right to install a 16 c.p. lamp in any place where it is suitable for proper lighting, even if a 25 c.p. lamp has been applied for. The installations are maintained by the company, but breakages must be paid for by the consumer. Specially constructed and marked lamps and holders are employed, which prevent a larger size lamp being employed in the holder than it is designed for. The lamps are hired to the consumer at a fixed rental for the period of their natural life, renewals being obtained on payment of the rental, which is as follows:—1s. per 16, 25, or 32 c.p., 1s. 6d. per 50 c.p., and 2s. per 100 c.p. tungsten lamp.

Russell & Sons] [*Wimbledon.*

View showing External Service Cable partly dotted in.

The company's operations, as mentioned, are confined to unwired property, both houses and shops, the former mostly of rentals between £18 and £35 per annum, although some of the larger unwired houses, of up to £50 rental, are being attracted by the company's terms. As to shops, it is surprising how many of them have adopted electric lighting through the company, usually with 100 c.p. tungsten lamps in the windows, and 50 c.p. lamps over the counters.

All the wiring work is carried out by local contractors, at schedule rates, to the standard specification of the company.

The method adopted for supplying these consumers is simple; the well-known Stannos wire is employed and one side of the system is earthed. The Corporation lay a service into a house or shop in a row, terminating in a corporation cut-out; this is connected up by the company through a double wound 220/110 volt transformer and main cut-out to a common service main running generally along the front of the buildings, from which individual services are teed off, passing through a consumer's cut-out to a small distribution board fitted with tumbler switches and placed conveniently for serving the lights.

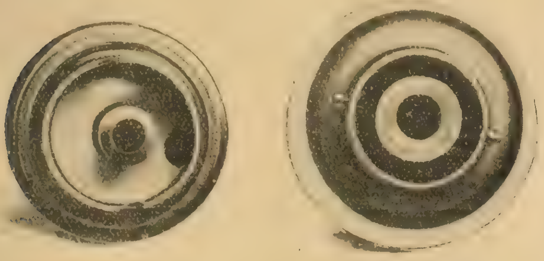
The single copper sheathed Stannos wire serving each light is quite unobtrusive when clipped to the ceiling or wall, and this unobtrusiveness extends to its use outside a building, where, being no larger than an ordinary lead pencil, even in the largest sizes employed, it is practically unnoticeable when run on the brickwork joints. In the great majority of cases, however, the outside wire is run under the facias of shops and in the corners of the mouldings on the front of houses, and is therefore invisible; where a passage intervenes between houses, the wire is carried across inside iron barrel fixed at sufficient height to avoid interference. The cost of running a service of this kind along the front of buildings is about 1s. 6d. per yard for material and fixing. One road containing small houses, which we take as an example of what the company can do with its system, has 35 consumers on one side and 28 on the other, supplied through two corporation services only, from mains passing the end of the street; the company's common service commences with a 7/20 Stannos wire, gradually reducing in size, and it is extended towards the other end of the road.

Service partly shown dotted.

SMALL PROPERTY SUPPLIED ON "FIXED-PRICE" SYSTEM.

To the station engineer it may be of interest to add that the 35 consumers previously referred to have 83 lighting points amongst them, giving a connected load of 2.23 KW., and they are supplied through a 1 KW. transformer, thus emphasising the diversity factor of this class of business; in fact, we understand that its load factor is over 23 per cent.

As showing the popularity of electric light with the company's consumers, it may be pointed out that the average lamps per house was originally three, but owing to extra lights added by consumers the average is now nearly four. Again it is the experience that once a consumer is obtained in any street, it is only a matter of time for the majority of the tenants in that street to adopt electric lighting and we can quote no better testimony to the success of the scheme, than that the price of gas has been reduced twice since the company commenced operations.



A central plunger pin fits into a hole in lamp cap; variation in length of pin ensures that only lamps of permissible c.p. are used.

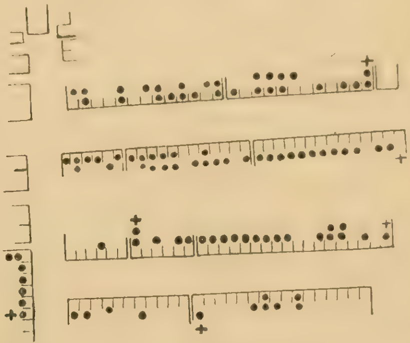
LAMPHOLDER. LAMP CAP.

It is on record that as many as 120 consumers were connected in one week in August last, and in view of the systematic circularisation and subsequent canvassing of all potential consumers, there is little doubt that progress will be continuous.

It will be noticed that the supply is unmetered by the corporation, who receive a fixed amount per lamp per annum from the company, which amount considerably exceeds the average revenue per lamp obtained from the corporation supply as a whole.

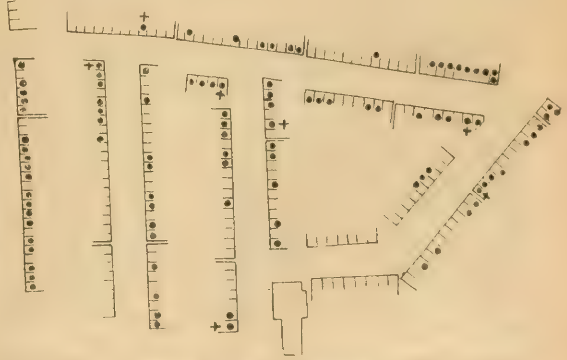
Services of the kind mentioned can be provided without delay, no statutory notice being required and, of course, no street disturbance entailed. Nor has any difficulty arisen with landlords in regard to the carrying of wires across premises which do not take the supply.

Each consumer has a rent card hung up, showing the amount due from him, the rentals being mostly collected weekly, although there are a few monthly and quarterly consumers. We understand that the company rarely experiences trouble with its consumers, and in the event of a tenant being compelled to leave, the installation is readily taken on by the succeeding tenants.



CONSUMERS' PLAN, INDICATING POPULARITY OF "FIXED-PRICE" LIGHTING.

It will be gathered that the revenue per light from the "fixed price" consumer is very considerably more than that derived from ordinary consumers, and as the company undertakes the canvassing for, and collection of accounts from, its consumers, and takes the risk of bad debts, and the corporation have only to deal with one account and lay no new mains and only a small percentage of the services required in the ordinary way, it would appear that the arrangement is a most desirable one for the corporation.



STREET PLAN SHOWING GENERAL ADOPTION OF F.P. LIGHTING IN ADJACENT STREETS.

This becomes even more apparent when it is realised that existing mains are used, and that the load could not have been obtained from such property except by some special arrangement of this kind, which most electricity suppliers would hesitate to undertake as an addition to their present multifarious business.*

We have dealt at considerable length with the operations of the Fixed Price Light Co. at Wimbledon, because we believe that the success which has attended them is not generally known, and that central station engineers who are confronted with the problem of the small consumer may, with advantage, avail themselves of the organisation and experience of the company.

The consulting engineers to the company are Messrs. Handcock and Dykes, the scheme being the outcome of the paper read by them before the Institution of Electrical Engineers in 1909.

The Wimbledon Corporation and their electrical engineer, Mr. Tomlinson Lee, are to be congratulated on having grasped the opportunity to develop an unexpected source of revenue, while recital of the company's progress is a testimonial in itself, and one which, from observation, appears to be well earned.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Protection or Tyranny?

I have been greatly interested in the correspondence under the heading "Protection or Tyranny?" which has been in progress in your columns for some considerable time. I heartily endorse the statements made by "Junius" and others (which, however, err on the side of mildness) respecting the underhand practices, with regard to their staffs, indulged in by firms who are members of the B.E.A.M.A. I have come across several cases amongst friends who have been prevented from taking more lucrative positions owing to a clandestine correspondence having been carried on and arrangements made between the respective firms, after the unfortunate candidate had been given to understand that the job was practically his. There is another case which occurs to me of a foreman, who, having been discharged for a trifling breach of regulations, now finds himself debarred from obtaining any position superior to an ordinary tradesman's, owing to the action of his late employers.

For some years I have had the misfortune to be a member of the staff of one of the largest electrical manufacturing companies in the country, and have noticed how the treatment of both office and works employés has deteriorated since the B.E.A.M.A. has got into its stride. To take one instance on the works side; in the instrument department girls of 17 or 18 (who receive the liberal wage of 6s. per week of 52½ hours) are being gradually introduced presumably with the object of supplanting the men employed on testing and calibrating, the company evidently having come to the conclusion that the enormous wages (25s. to 30s. per week) paid these men are too great a strain on its financial resources.

One has only to look round to see many cases on a par with the above, which form a striking commentary on the policy of the gentlemen who form the Committee of the B.E.A.M.A., and who profess, with a fine flow of rhetoric, their intention of "guiding a sorely-tried industry into the paths of prosperity"—this high-sounding phrase simply meaning that they are desirous of augmenting the profits of themselves and their *confréres* at the expense of the truly "sorely-tried" employé, on the one hand, and the customer, on the other.

Finally, I would impress on all those staff engineers who are not already members of the Staff Engineers' Association, the importance of becoming members without delay, in preparation for the upheaval that is bound to come sooner or later.

Under Dog.

Manchester, *May 6th*, 1914.

Static Frequency Changer.

With reference to my paper on the above, read before the Birmingham Local Section, and the addendum to the paper on the subject of compensating for the power factor, I gather, from discussing the matter with one or two of the members of our Local Section, that there is an impression conveyed that the method which I suggested for compensating the power factor, would only be available if there was a large power load in the same district of the town where the lighting load obtained.

As I look upon it, the matter is more a financial than an electrical one, always provided that there are sufficient motors somewhere in the town to draw upon for phase correction.

Let us look at it this way. I have to compensate on, say, 2½ KW. of motor load for each 1 KW. of lighting load added.

This costs the supply company a certain sum of money. If the lighting load is able to bear the charges on this account (that is, if every frequency changer is debited with a certain cost), then surely it does not matter if we incur a certain expense in cables on, say, the west side of the town, where there are no motors, provided that we save an equal sum on the east side, where there are motors. It all comes out of the common purse.

Referring to the diagram accompanying my addendum to the paper on the subject of power factor, it will be seen at once that if, for instance, we had a 40-KW. lighting area situated between the generating station and the 100-KW. motor load, then the power factor, up to the lighting area, after phase correction is 0·77, or 10 per cent. better than with motors alone, while between the lighting load and the power load it is 0·95, or more than 30 per cent. better than with motors alone. If, on the other hand, the lighting load is more remote than the motor load, the power factor out to the motor load is now 0·77, or 10 per cent. better than it would be on motors alone; and the saving on the cables to the motor load must therefore be set off against the loss on the cables beyond this point.

If the motor load had been on the opposite side of the generating station, the power factor would have been 0·95 (for the same amount of rectification), and the saving on cables would have helped to counterbalance the cost of the lighting cables.

In certain cases it might pay to step up the pressure for the lighting cables; the frequency changer, however, acts as its own step-down transformer, so only step-up transformers are required at, say, 15s. per KW.

The cost of extra cable section, if not so stepped up, would be about £1 14s. per KW. per mile, after allowing for the poor power factor; so for distances above a mile it might pay to step up. In the case where there is no power load at all in the town (on large motors), there will generally be rotary converter, or motor-generator sub-stations, and the second method of phase compensation which I have described in the addendum to my paper would then obtain.

On the other hand, if there are are plenty of motors to fit phase advancers to, but on the wrong side of the town, the scheme would certainly bear the equipping of double, or even treble the number of them with phase advancers that would otherwise be necessary, and the cables saved through improved power factor could be credited against the extra cable section required by the lighting system. It does not matter that the two loads are on opposite sides of the town; from the financial standpoint it is all one common purse. In the same way we average up the cost of long and short cables to different consumers, and charge them all on an average price basis.

It further seems to me that if the supply authority wants to get electric furnaces on its mains fed from frequency changers, all it has to do is to make such a charge for such apparatus as shall pay for compensation of the power factor in a manner satisfactory to itself, protecting itself against being swamped as regards power factor by too much furnace load, in the same manner that restricted-hour loads were protected against at Burton-on-Trent and other places. If there existed a large motor load, such protection would probably be unnecessary.

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* In support of this we may quote the opinion of Mr. R. A. Chattock, City Electrical Engineer, Birmingham, who during the discussion on an I.E.E. paper by Mr. Fennell, on cottage lighting at Wednesbury (see ELEC. REV., page 607), agreed that the author's scheme—*i.e.*, carried out by the council—was workable for a concentrated community, but was afraid that in Birmingham, where 100,000 such consumers could easily be reached, the personal touch would be lost and it would be impossible to tell whether waste was going on or not.

The cost of phase advancing on induction motors being so very low, it might pay to provide consumers with wound rotors in certain cases in order to be able to introduce phase advancers.

A. M. Taylor.

King's Heath, *May 8th*, 1914.

Unfair Municipal Trading.

I am instructed by my Association (which represents most of the leading electrical contractors in Bristol), to ask you if you would be kind enough to publish the following correspondence in the Electrical Review. It is their wish to point out, if possible, to the general public how municipal trading may affect existing businesses.

V. G. Burkitt,
Acting Honorary Secretary, Bristol Electrical Contractors' Association.

Bristol, *May 8th*, 1914.

The Manager, Electricity Department,
The Exchange, Corn Street, Bristol.

Dear Sir,—I am instructed by my Association to draw your attention to the following grievances which they have against the electricity department of the Bristol Corporation.

The way in which the work is given out now leaves very little profit (if any) to the contractor, who, in spite of this, has to take all the responsibility of carrying out the work, while the electricity department make all the profit on lamps, fittings, switches, &c.

My Association think it would be fairer to include in the specifications sent out, all lamps, switches, and plain fittings, and, in the event of fittings being selected from your showrooms, to allow the contractor, who has to fix these fittings, say, 15 per cent. on their cost.

I shall be glad if you will bring this matter before your Committee, and let us have their reply.—I beg to remain, yours faithfully,

(Signed) V. G. Burkitt,
Acting Honorary Secretary.

April 2nd, 1914.

[Reply received.]

The Bristol Electrical Contractors' Association,
10, Orchard Street, Bristol.

Dear Sirs,—With reference to your letter of April 2nd.

This matter has been very carefully considered, and I do not see my way to recommend that the present procedure be departed from.

As you are no doubt aware, we used to include a greater amount of material in the work given out than we now do, but owing to the troubles which arose by faulty material being supplied, we had to take the course we now follow, and even now there is so much trouble that I think my Committee would have to seriously consider the propriety of continuing to let out to contract so much of the work as we do.

I have frequently expressed the opinion that I prefer leaving the wiring work in the hands of contractors. I do not wish to be troubled in this department with a large quantity of such detail work, but our hands are somewhat forced in this matter, owing to the results of the different methods which have been employed hitherto.

You ask me to lay this matter before my Committee, and on your confirming this request I shall be pleased to do so. I must tell you frankly that I do not think the result will be in accordance with your apparent desires.

As regards the question of lamps and fittings being included in the work let out, I may say that this department is put to considerable expense in the matter of showrooms and publicity, and it is equitable that to a certain extent this expense should be met by any profits which can be secured on the sale of fittings. I can assure you that such profits are not sufficient to exceed the expense.

Yours faithfully,
(Signed) H. Faraday Proctor,
Engineer and General Manager.

April 7th, 1914.

The following letter was sent in reply on April 11th :—

H. Faraday Proctor, Esq.,
Engineer and General Manager,
The Exchange, Corn Street, Bristol.

Dear Sir,—Yours of the 7th inst. to hand, which I have placed before my Committee, who desire me to reply as follows :—

I much regret to note that you cannot see your way to recommend a change in present procedure.

I am aware that contractors used to supply more material than at present, but I think the reason given for altering your arrangements is somewhat [illegible].

The trouble arising by faulty material being supplied might have been more easily met by passing the material, and would doubtless have been avoided altogether if contractors had been allowed a fair share in the profits of the [illegible] by them.

It appears to me that the very material which it is most essential should not be faulty, viz., wires and [illegible], which are usually out of sight together with the labour, which on inspection contracts should certainly be fully qualified and properly paid, are left still to the contractor, whereas switches, roses and ceiling blocks are open for easy inspection are supplied by [illegible]; obviously the wiring is relatively of greater importance than the latter.

It looks as though the latter is a known quantity with a certain profit, the former unknown, consequently there may be a loss when carried out, and this you generously leave to the [illegible] contractor, keeping the certain profit for your department.

I am aware that you have expressed your preference for wiring to be done by contractors, which is good, but it is degrading to any self-respecting contractor to quote for work on your present conditions, and there are contractors who have simply refused to entertain your inquiries for this reason.

I agree that the department is under expense in the matter of showrooms and publicity, but consider this should be covered by the sale of current, which I believe is what you want, and the expense appears to me a reasonable charge to be made against current sales, but a further source of revenue might be obtained by a division of the profits from sale of fittings with the contractor, not by taking the certain profit and leaving the contractor with a problematical profit or loss.

I note that you say the present method is not satisfactory to your committee, and can assure you that it is equally unsatisfactory to the contractors who are also ratepayers.

You state that the profits on lamps and fittings are not sufficient to exceed the expense, and I can only reply to this by stating that your expenses must be excessive; if this is so it is a strong argument against your present system.

I shall be glad if you will bring this correspondence before your committee, and as you state you are in favour of contractors doing the wiring, I have no doubt that it is possible for more amicable and fairer arrangements to be made. Awaiting your reply,

I beg to remain, yours faithfully.
(Signed) V. G. Burkitt,
Acting Honorary Secretary.

The following reply was received April 27th, 1914, from Mr. H Faraday Proctor :—

April 27th, 1914.

V. G. Burkitt, Esq.,
Honorary Secretary,
The Bristol Electrical Contractors' Association,
10, Orchard Street, Bristol.

Dear Sir,—I submitted the correspondence which has passed between us with regard to contract work, to the Electrical Committee at their meeting yesterday, when I was instructed to inform you that the Committee are in entire accord with the views expressed in my letter to you on April 7th.

Yours faithfully,
(Signed) H. Faraday Proctor.

Ignition of Explosive Mixtures by Electric Sparks.

A good many years ago, it may perhaps be remembered, I made a long series of experiments upon this subject. I think it is well known that I pioneered electrical signals pretty well all over the United Kingdom, and from time to time the question would come up, whether it was dangerous to fix them on engine plane roads, where there was a possibility of gas. I was also called in as an expert in connection with an explosion of petroleum vapour, which took place on board a ship in a dry dock at Newport, and made a considerable number of experiments in connection with that. What I found was that it was not a spark per se, nor a particular voltage that exploded gas.

This, of course, has long since been confirmed. I found that it was the delivery of a certain quantity of energy, which might be either in the form of a spark, or in the form of a heated wire, or heat in any other way, which caused ignition. I found also that the amount of energy required for ignition of an ordinary mixture of town's gas and air was 10 watts. It is now I think well known that mixtures of methane and air are much less sensitive to ignition than town's gas and air. The curve which Dr. Wheeler gave, showing the easier ignition of methane and air when the percentage of methane was between 8 per cent. and 9 per cent., has also, I believe, been well known for a good many years.

Sydney F. Walker.

Bath, *May 11th*, 1914.

Review of Electrical Meters.

The last portion of the letter appearing in your issue of April 21st, under this heading, raises an old and recurrent question. Considered from a logical standpoint it certainly would appear that the method of calculating the percentage error of a meter advocated by the reviewer of the book in question, which, by the way, is generally adopted in the States ("Where they never do things by halves"), is preferable to that advocated by Messrs. Everett, Edgcumbe and Co., Ltd.

If, for example, a quantity Y is being compared with a smaller quantity X of the same nature which is taken as the basis of comparison, then it is perfectly natural and logical to express the relationship by saying that Y is $(Y - X/X) \times 100$ per cent. greater than X. In the case of an integrating meter which for a load W watts, as indicated by a standard instrument, registers at the rate of W_1 watts as deduced from a time test, then the meter would have, adopting this same method, an error of $(W_1 - W/W) \times 100$ per cent.

The usual method of testing an integrating meter is to determine the time T_1 taken by the armature to complete a certain number of revolutions at a definite and steady load. If corresponding to this load the time as deduced from the dial gearing should be T, then the meter error is simply $(T_1 - T/T_1) \times 100$ per cent., adopting this same method of calculation, or $(T_1 - T/T) \times 100$ per cent., using the alternative method.

Obviously the first method of calculation gives the percentage error of a meter that does not run when current passes through it, as 100 per cent. slow, while the second method gives the error as "infinity" per cent. slow. These extreme cases emphasise the difference between the two methods of calculation. For small percentage errors such as those which have to be considered in the case of well-designed meters, the difference between the results obtained by the two methods of calculation is not large. I certainly do not consider that there is anything to choose between the two methods as regards the amount of calculation involved in deducing the correct result from the instrument reading and percentage error, whereas from other considerations the method in dispute seems to have everything in its favour, and personally I prefer it, no doubt, for the perfectly natural reason that I have been brought up to use it in preference to the alternative method.

Nevertheless, I think that the time has arrived when some definite understanding should be arrived at regarding this question, and now that an agitation is on foot to obtain the long-delayed revision of the British Standard Specification for consumers' electric supply meters, it seems not only desirable, but necessary, that some ruling as to the method of calculating percentage errors should be given in the revised specification, assuming that the necessary revision is eventually carried out. The accuracy clause at present allows an error on low loads of as much as 5 per cent., and as a meter which runs slow by this amount as calculated by the one method has an error of 5·27 per cent. when the computation is made by the alternative method advocated by Messrs. Everett, Edgcumbe & Co., it would certainly be interesting, and at the same time instructive, to know what particular method the Committee had in mind when the specification was drafted, as there is no reference whatever to this question in the text.

A. P. Young.

Kenilworth, *May 5th*, 1914.

The Modern Motor.

In reply to L. Seno, I desire to point out distinctly that I did not mention the use of gauze brushes on the motors of 10 or 15 years ago. He would evidently take us back to the days of Pixii, Gramme, Brush and Edison. Upon the merits of gauze brushes I have little to say; personally, I have no desire to revive them on high-voltage machines. Their use is, however, still essential on low-voltage machines with a heavy amperage. The wooden brush rocker on the older machines was generally lignum vitæ or other very hard American wood, and was a lovely insulator. I am glad to note that Mr. Butler and I agree on so many points.

The idea of keeping to the open types is, I think, in many instances preferable to the semi-enclosed, which are often put down to work under conditions which would ruin any motor. Dust and grit have free access to any part of the motor. An open-type motor boxed in, or with a small shed over it, is a common sight on any steel works. A quick repair is essential in a steel works. The circumstances under which a motor has to work should decide its type in all cases. We see totally enclosed machines in damp places sweating to death, semi-enclosed ones working in flour, carbon and cement and other dusts. I am, of course, certainly not interested in any particular make of machine, and only quoted a few out of the many types which I have had charge of, leaving A.C. machines out of the question. There is room for general improvement in motor designing from a practical point of view.

Henry Fowler.

Liverpool, *April 27th*, 1914.

Charging a Small Battery.

May I ask for your readers' experience in the case of a small battery of 54 cells, which is to be charged off a 100-volt circuit in connection with a plant. The dynamo is run all day for some motors and several lights, and for charging the battery; the latter is required for week ends for a few lights, and a 1-H.P. motor in case of emergency. There is plenty of power on the circuit to spare.

It appears necessary to halve the battery and charge the two halves through two suitable resistances, discharging them in series and regulating them in the usual way. A booster is out of the question for reasons of expense. The prime mover is reckoned to cost nothing, as it is worked from waste power.

H. T. B.

Schoeller Miners' Lamp Gas Detector.

Your notice of the above gas-detecting miners' electric lamp has greatly interested me, because I have been using an instrument similar in construction for some years for testing CH_4, and H and CO_2, and obtained excellent results with it. It appears to be in principle very much like the Ansell instrument, consisting of a box or chamber with an aneroid barometer or manometer inside to indicate changes of internal pressure, and, *given absolutely unchanging temperature and atmospheric pressure*, I find this class of instrument very sensitive to light and heavy gases; like Ansell, however, I have found it impossible to use it where the above conditions do not obtain, and shall be exceedingly interested to hear how Herr Schoeller's instrument behaves within a range of say, 20° F., and difference in floor level of 80 ft., and taking separate tests in, say, first 10 per cent. methane, and then 1 per cent. methane, without access to fresh air.

Fred. J. Turquand.

London, W.C., *May 11th*, 1914.

Anglo-Continental Telegraphs.

It is gratifying to see, on page 787 of your issue of May 8th, that the feasibility has been realised of obtaining four circuits simultaneously worked and free from mutual disturbance, from four parallel conductors, by adopting the method of connections described in the specification of my Patents 231 and 3,281 of 1882, just 32 years ago.

F. Jacob.

Woolwich, *May 9th*, 1914.

[A detailed abstract of Patent Specification No. 231 was given in our issue of August 26th, 1882, p. 159.—Eds. Elec. Rev.]

Dry Cells.

I have been carrying out experiments with primary "dry batteries" for the past nine months with the object of obtaining a higher terminal E.M.F., and have produced a dry cell having an open circuit E.M.F. of 2 volts. I may add that I have had one batch of cells giving 2·2 volts. May I inquire through your columns if there is a dry cell at present made with an E.M.F. of two or more volts?

J. W. Warr.

St. Helens, *May 11th*, 1914.

"Dense Wireman" is requested to note our rules at the head of "Correspondence" columns.—Eds. Elec. Rev.

IRON AND STEEL INSTITUTE.

A NUMBER of matters of interest to electrical engineers were touched upon in papers read at the meeting of the above Institute on Friday last week, though none of the papers were devoted to electrical subjects entirely.

Mr. H. L. Heathcote, of the Rudge Whitworth Works, Coventry, gave an interesting account of the steps he had taken to place the works' case-hardening practice on a scientific basis. He pointed out that while the machine shop had gone ahead, the hardening shop, as a rule, was still in the dark ages of rule of thumb and unskilled labour, and unfit to do justice to the products of the machine shop. The author's first aim was to control the temperatures in the furnaces, but he found an efficient electrical pyrometer outfit of the usual type too expensive, and decided to depend upon optical methods. To this end he investigated the properties of a large number of dye solutions, and found that it was possible to organise a series of these such that, when a body above dull red heat was viewed through them, the temperature could be determined to within 5° C. The case-hardening temperature is now controlled by using an instrument having two pairs of cells containing dye solutions adjusted to 900° and 925° respectively; if the object is visible through the former and invisible through the latter, the temperature is considered correct.

Similar cells are adjusted for the hardening and reheating temperatures. The instrument is simple to use, and gives consistent results with different observers. A special advantage of it is that it gives the temperature of the actual object, and not merely that of the pyrometer.

The author next investigated the properties of case-hardening compositions, and found that those in general use were inefficient owing to their short life and low heat conductivity. Experiments showed that the essential constituents of a good composition were charcoal and an alkali. Charcoal alone quickly lost its carburising power, but this was at once restored by the addition of potassium carbonate or hydrate, or sodium carbonate. Wood charcoal impregnated with soda ash gave excellent results, and could be used over and over again indefinitely, giving a saturated case even after a month's daily use. Nitrogenous compounds and cyanides were unnecessary.

With the charcoal and soda ash composition, the carbon content of the case showed even gradation from 1·050 per cent. on the surface to 0·205 at a depth of 0·1 in. It was observed that the process was effective even when the mixture was not in actual contact with the steel.

For tempering, an electric welder presented advantageous features, being particularly useful for local softening or tempering, and leaving the core softer than the outside. The author also described a number of ingenious instruments for testing the hardness of case-hardened articles, and stated that a solution of alcohol 1 litre, distilled water 1 litre, and pure nitric acid 100 cm.^{3}, was useful for staining the surfaces of hardened articles; this test at once revealed spots that had been splashed before quenching, and superficial tempering due to faults in grinding, besides indicating any lack of uniformity in a number of hardened articles.

Mr. A. M'Cance dealt with the subject of hardening steel, describing an experimental investigation into the properties of steels of different carbon content quenched at different temperatures, and a theoretical inquiry into the actions taking place during quenching.

Mr. F. Müller described a process of dry-cleaning for the purification of blast-furnace gas, involving the use of cloth filter-bags, after the manner of the dry air filters used with turbo-generators. The process has been in experimental use for some years, and is now suitable to meet the requirements of practical working. The gas is of a higher purity than has ever before been obtained, and the working costs are said to be very low, owing to the low power and water consumption. The purified gas contains about 3·5 mg. of dust per m.^{3}, and when the gas is cooled with water for use with gas engines the dust falls below 1 mg. The power consumption is 1·91 H.P. per 1,000 m.^{3} of cleaned gas (*sic*). A wet-cleaning plant, which required 350 H.P., was replaced by a dry-cleaning plant taking 70 H.P., and the dust content of the gas was reduced from 2·5 to 1 mg. per m.^{3} The first cost of the plant is about £175 per 1,000 m.^{3} of gas (*sic*), but the working cost is low, about 1d. to 1¼d. per 1,000 cm.^{3}, not including capital charges. The plant occupies little floor space, and the dust is removed in the dry state, and can be utilised in the manufacture of cement, &c., effecting a saving of about 20 per cent. of the working cost of the plant.

The author pointed out that the use of highly cleaned gas enabled gas engines to be run with a minimum of stoppages and repairs—from ¼ to ⅙, as compared with wet-cleaned gas—and cheaper lubricating oils could be used. Altogether there are in actual operation plants aggregating 1,886,000 m.^{3} per hour, and nearly as much is in course of construction or on order.

The magnetic properties of iron compounds now always figure in the papers of the Iron and Steel Institute; they were touched upon by Mr. M'Cance, and two papers—one by Sir R. A. Hadfield and Prof. B. Hopkinson, the other by Prof. Carl Benedicks, of Stockholm University—were largely devoted to this subject. The substance of these papers, however, is mainly of metallurgical interest and beyond our scope. An interesting improvement in the apparatus was mentioned by Prof. Benedicks, due to Mr. Malmborg, who carried out a systematic investigation into the capacity of different materials in damping vibrations. It was found that for efficiency a resilient material such as felt was required, filled with a viscous fluid, which absorbed the energy of the vibration. A recording instrument which when standing on a wall bracket showed a vibration [illegible] was placed on a rigid plate resting on a [illegible] layer of felt measuring 10 × 30 cm., which was saturated with syrup; the oscillations then fell to [illegible] division.

The second paper was based on experimental work carried out during about three years at Sheffield and Cambridge, and dealt mainly with the manganese steel which Sir R. A. Hadfield invented in 1883, and which has therefore been under investigation for over 30 years.

Messrs. E. Humbert and A. Hethey described experiments which they had conducted with a view to producing steel direct from ore, avoiding the introduction of such impurities as oxygen, phosphorus, sulphur and silicon, and thus obtaining a material equal to the unsurpassed steels of Damascus and Toledo. For their purpose the electric arc furnace offered pre-eminent advantages; one of the Héroult type was used, having a capacity of [illegible] tons and working with single-phase current. Particulars were given of numerous samples of steel produced by the direct reduction of iron ores, with directions as to the lines which should be followed in developing the process. The outstanding quality of the steel produced was its toughness. The authors conclude that the economic manufacture of steel direct from ore is a practical possibility with the aid of the electric furnace and that the material produced will have properties of the greatest importance and value. They gave a list of economic advantages of the process as compared with the methods at present in vogue.

LEGAL.

OSGOOD *v.* SUNDERLAND.

IN the King's Bench Division on Wednesday, May 6th, Mr. Justice Bailhache commenced the hearing of this action, which was brought by Mrs. Irene Osgood, an authoress, of Guilsborough Hall, Northampton, against Mr. Leo Sunderland, electrical engineer, trading as Leo Sunderland & Co., at 17, Victoria Street, Westminster, to recover damages for breach of contract in respect to an electric light installation at the plaintiff's house.

Mr. Hutson, K.C., and Mr. A. Inman appeared for the plaintiff, and Mr. Holman Gregory, K.C., and Mr. Poyser for the defendant.

MR. HUTSON, in opening, said the work was done at the mansion in 1904, and it was not until 1912 that defects were discovered. The defence now set up was, first of all, that the work was properly done, and secondly, the Statute of Limitations was pleaded. It was also said that the plaintiff ought to have discovered the alleged fraud before. It was not, continued counsel, an ordinary case of scamping work. It was work which must have been deliberately concealed by someone, although he did not suggest that it could have been known to the defendant himself. The matter now complained of was limited to the wiring, and nothing arose with regard to the plant, dynamos and engines that were set up. The way the work should have been done was by putting the wires under the floors and other places in wooden casing, so as completely to insulate the wire; and it had also to be covered in proper casing in the walls and other places. What was in fact done was this. Defendant's men had naturally to take up floor boards here and there to lay the wires. Where these boards were taken up the work was properly cased, and it was also cased for a distance on each side of the boards that were taken up, so that anyone looking at it from above would think at once that the work was properly done, and there it was properly done. But directly one got a foot away underneath the floor it appeared that all the wires were left bare, and they were fished through until they were brought to the place where the light was to be. There were other cases in which the wire was bare. That was the condition of things which was discovered in 1912, and although there had been one or two slight alterations from 1904 to 1912, there never was any material alteration to the wires. Further than that, the defendant was employed by Mrs. Osgood to report half-yearly as to the condition of the wiring and the installation generally. There had been minor defects discovered from time to time. They were put right, and up till 1909 he reported that the wiring was satisfactory. When the defects were found in 1912 the defendant's attention was called to them. He came down and inspected the work, which had then been opened up, and he was shown three or four of the places where the bare wires were found. He said he could not defend it, and when they offered to point out other places, he said he had seen quite enough and left. He afterwards wrote a letter, making an offer to put the work right, but it was upon conditions that Mrs. Osgood was unable to accept. The contract, added counsel, was made by tender and acceptance. As far as the plaintiff was concerned, there was no skilled supervision whatever, and nobody with any electrical knowledge. She left everything to her agents, and was abroad when the actual work was done.

HIS LORDSHIP: In view of the plea of the Statute of Limitations, it will be necessary to show that this work was fraudulently done; will it not?—Yes.

And that the defects could not have been discovered before?—Yes.

MR. F. W. ASHMAN, employed by Mr. T. J. Digby, electrical engineer, of Shaftesbury Avenue, W.C., gave evidence that he had examined the wiring of some of the rooms at Guilsborough Hall. He found the wires protected in some cases and in other places, which could not easily be seen, they were unprotected.

Cross-examined, Witness said he knew that there had been a great advance in electrical science since 1904. It was customary in 1904 to use rubber but wooden casing was also employed. He thought lazy workmen would do the work as it had been done in order to save time and trouble.

His Lordship: The difficulty is that they did put casing in some places. It not only wants a lazy workman, but one who wants to pretend he is a diligent workman.

Counsel: A man trying to deceive his master might do this sort of thing?—Witness: Yes.

Mr. A. Edwards, another employé of Mr. T. J. Digby, said he examined the installation, and found rubber tubing where it ought not to have been used, while a great deal of the wire was bare.

Cross-examined: There was not an unusual quantity of rubber tubing used, but rather a small quantity. In going through the rooms he did not find the wires had been displaced.

Mr. W. C. Mansell, electrical engineer, of Northampton, said he inspected the wiring on the instructions of an insurance company. A great many wires, he found, were without tubing, and had hardly any casing. It was a very bad job. Where the work could be easily seen it was all right, but where it was not easily reached it was bad. He had never seen anything like it. In the case of the steel tubing under the floor, there were very few fittings.

Counsel: What would be the effect of leaving the wires uncovered?—It would cause leakage and waste.

Would it be safe?—No; in the condition they were in there might have been a fire at any time.

Mr. E. Phillips, employed by a firm of hot-water fitters, said they were engaged at Guilsborough Hall in 1909 in effecting alterations to the hot-water installation.

Counsel: It is suggested that you stripped off the casing from hundreds of feet of wire.—We have never stripped any or had any stripped. We found some of the wires hanging from joist to joist, in most cases uncovered.

Witness added that he was engaged in further repairs in 1912, and found the wires in substantially the same condition.

Defendant, giving evidence, said the men whom he sent down to Guilsborough Hall to do the work had been in his employ for years, and the foreman, Brown, was specially selected for the job. Witness went down himself on eight occasions and passed through the rooms to see if the men were doing the work according to contract. The contract was exclusive of the taking up of boards, &c., that being done by Messrs. Waring, who were engaged in a very large contract there.

Counsel: Were your instructions to your men to cover the wires? Certainly.

All wires? Certainly. The wires had to be enclosed in wood casing and on the walls, where it was to be new work they were to be enclosed in steel tubes. Mrs. Osgood refused to take partitions down, and then we enclosed the wires in tubes where possible. In some cases that might have been found impracticable, and then rubber tubing was used. He computed, continued witness, that 10,900 ft. of casing was done, and he thought that which had been since supplied was some 800 ft. only. Messrs. Waring's work was under the superintendence of a Mr. Skinner, and the defendant's men had to work under his directions as to the position of the lights. After they had done their work defendant's men left the boards up for Warings to replace them.

Witness said that when he went down to the house in 1912 he found the wiring had been dismantled, and there was, in places, no rubber tubing or casing. He noticed, in this connection, there were signs of work on the hot water apparatus. It would have been impossible to put these pipes in without interfering with the wires. He had no recollection of using the words, "He could not defend the work," to Mr. Wilkins, the plaintiff's steward. When he went down to Guilsborough Hall in 1912 to inspect the work, he lunched with Mr. Wilkins, and told him the work was not as he had left it. Mr. Wilkins then asked, "Do you defend it?" and witness replied, "It was entirely different." After he had finished the contract, he continued to undertake half-yearly inspections. One of these he made himself, leaving the remainder to Mr. Pillinger, who was in his employ. If the work in 1904 had been in the condition in which it was found in 1912, it would not have gone so long without a fire or something else happening.

Mr. Hudson (cross-examining): Do you take the view that what you saw in 1912 was badly done?—What was pointed out to me was not in good condition. I did not say the work was badly done.

When did you come to the conclusion that your work was good in 1904, but that damage had been done to it since?—After Mr. Pillinger's report in 1908.

You supplied reports half-yearly upon the state of the installation?—No. The reports were as to leakages and the proper running of the plant. There was no intention to say whether any wires were damaged or not.

Mr. H. C. Pillinger, in the defendant's employ, said he made the half-yearly reports. There was nothing wrong until October, 1909, when he reported that there were leakages, due to disturbance through installing hot-water pipes. In some cases the pipes rested hard on the wires, and the casing had been broken away, and in others the wires were hard upon the pipes.

Employés of the defendant, who had been engaged in the work in 1904, said nothing was put in without covering, and the work throughout was done in a proper way. There was no shortage of material, and no scamping whatever.

Mr. Leonard Tate, electrical engineer, general secretary of the Electrical Contractors' Association, said the difference in the cost of doing the wiring properly and as described by the plaintiff's witnesses [illegible] slight and small [illegible] at the outside. Further, there would be no advantage to the men in doing it in the way the plaintiff alleged. His experience was that when workmen engaged in fitting hot-water installations found piping &c., in the way, they simply slung it aside.

Addressing the Judge, on behalf of the defendant, Mr. Holman Gregory said his client viewed the case as very important, especially on the question of fraud, and apart from himself, there was the character of his workmen.

His Lordship: That really seems the whole importance of the case. The amount is considerably small.

There was no suggestion, went on counsel, that Mr. Sunderland himself was a party to anything that was alleged. What his Lordship was asked by the plaintiff to say was that a number of workmen had conspired together to scamp this work and defraud their master and the plaintiff. If they had laid the wires in the way alleged, they would have known that anybody who had anything to do with the house would discover it. Therefore, the probabilities of their doing such a thing were very small. It was alleged against them that where the work was done properly the boards were screwed, and where it was not properly done, the boards were nailed. As to that, the evidence was conclusive that the defendant's men had nothing to do with the putting down of the boards, and that that was done by Messrs. Waring's men.

His Lordship, in giving judgment, said it was admitted that if the work was done in the way the plaintiff alleged, it was bad workmanship. It appeared that the proper thing to do after a wiring installation had been carried out in a house was to screw down the boards where the main wire ran, and to screw down little patches of boards here and there where it was convenient to have inspection holes, and it was said in that action that the workmen, desiring to conceal what they had done, had so arranged their work that anybody who took up the screwed boards would think the wiring and the casing had been properly carried out. If the condition of 1912 was the same as when the work had been done in 1904, there was no doubt it had been scamped. In deciding whether the work was left in that condition in 1904, he had to remember that it was very difficult for Mr. Sunderland to produce exact evidence to show what was done in 1904. In 1909 Mr. Philips, the hot-water engineer, came upon the scene, and, for the purpose of his work, had to open up certain floors in order to put his hot-water apparatus underneath. He said he found the wiring, as far as the casing was concerned, in an unsatisfactory state. Mr. Pillinger was sent down from the defendants, and he reported, after examination, that leakages had been found, and that these were due to the conductors and tubes having been disturbed in consequence of the putting in of hot water pipes. It was strongly contended on the part of Mr. Sunderland that what was seen in 1912 was no fair test of how the work was left in 1904. As to that some strong observations could be made. One was that if the work in 1904 was as bad as it was in 1912 it was very strange that no fusing of the wires and no fires took place at Guilsborough Hall during those years, because it was common ground that if the wires throughout the time were as bad as they were in 1912 they were in a dangerous state. Then the workmen said it was not to their interest to do this badly, and the trouble and labour of putting in short lengths of tubing were every bit as large as the trouble of putting in long lengths. Moreover, they were paid by the hour, and there seemed to be no sort of reason why they should have scamped the work in the way alleged. Then it was said that the hot water installation put in in 1909 was sufficient to account for all the mischief found in 1912, and it was pointed out for the defendant that, with the exception of the dining room, in practically all the places where the installation was seriously challenged there had been these new hot water pipes in 1909. As against all this there was evidence on the other side from a man who was there when the work was done, and he said it was scamped in the way described. Then there was the evidence of Mr. Phillips that in 1909, before he began the hot water installation, the wiring was in many places bare. What was of the most significance was that it was said that the wires were only completely bare where in the ordinary course of things they would not be seen. Upon the whole, and with very much reluctance, his Lordship continued, he had come to the conclusion that he must say that the work was badly done, and that steps were taken to conceal it. He had very anxiously weighed the the evidence as to disturbance of the wires. He would quite accept it that persons laying down a hot water system would not be tender and careful about electric wires or bell wires they found in the way. But he was satisfied that there were these short lengths of tubing attached to the main lines, and he could not formulate any theory which would square that fact with the suggestion that what was found was due, or mainly due, to interference by hot water pipes. He had at one time thought the explanation of the trouble might be that the wires had been tinkered with by the plaintiff's man, who was put in charge of the plant when the work was finished, but after careful consideration he had abandoned that supposition. He (the Judge) bore in mind that Mr. Sunderland was, from time to time during the progress of the work, down at the job. He had not forgotten that other people were employed at the time, including a number employed by Messrs. Waring, but he had taken all these things into account, and was unable to get over the difficulty which some of the evidence for the plaintiff had presented. He was confirmed in his view as to the facts of this case by a letter which Mr. Sunderland wrote to Mrs. Osgood in April, 1912, after he had been called down to see the condition of the installation. He (the Judge) did not treat Mr. Sunderland as having made any admission of liability when he went there, or saying that the work could not be defended, but the letter he wrote had weighed very strongly in his (the Judge's) mind, and had been one of the deciding factors in the case. Mr Sunderland having been called down to Guilsborough Hall wrote this letter "I find the work was carried out in the early months of 1904 nevertheless, provided I am not placed among or beneath other contractors or engineers I am prepared to overhaul the wiring installation and deliver it up in accordance with the requirements of the fire offices provided that Mrs. Osgood agrees to certain terms." There were two explanations of that letter his Lordship proceeded. One was that it was the letter of a man who knew that the work which he thought had been well done had, in fact been badly done, and he was practically offering to put it right. The other suggestion was that it was the letter of a business man to a good customer and rather than lose the custom he was quite prepared to pay a little money in putting right the matter of which she complained. He (the Judge) took the former view. He thought that Mr. Sunderland, when he wrote that letter, believed that the work when it had been left by his men in 1904 had not been left in a satisfactory condition. He did not in terms say so nor did he suggest the contrary, but it seemed that his frame of mind at the time was that his men had scamped the work, and he was prepared to put it right. He (the Judge) came with great reluctance to the conclusion at which he had arrived. He did not think the supervision of the work was efficient, and he thought advantage was taken of the lack of supervision in the way he had described. He assessed the damages at £170

His LORDSHIP then proceeded to consider the question of law. It was said by Mr. Holman Gregory, he said, that the Statute of Limitations, which was pleaded by the defendant, was an answer to the case. It was obvious that if the Statute of Limitations did apply, the action was out of time, the work having been done in 1904. He thought the action was a common law action for damages for breach of contract, and the only reason why fraud had been alleged in the statement of claim was to meet by anticipation the plea of the Statute of Limitations. Having gone at length into the point, his Lordship said that although he had found upon the facts in favour of the plaintiff, yet he must find in favour of the defendant upon the plea of the Statute of Limitations. The result was that there would be judgment for the defendant, with costs, but the plaintiff would have the costs of the issues upon which she had succeeded.

SPLITDORF ELECTRICAL CO. *v.* F. W. BAKER.

IN the Shoreditch County Court, on May 7th, before his Honour Judge Cluer, plaintiffs, of 6, City Road, E.C., sued the defendant, Mr. F. W. Baker, of the Motor Works, Stourbridge, a director, with reference to a guarantee when making a sale. Mr. Hatch appeared for the plaintiffs, and Mr. G. D. Turner for the defendant. Mr. Alfred Blackmore, who was in the employ of the plaintiffs, said the claim was for the supply of a complete electric light outfit for a motor car—the front, side, and tail lights. It was called the Aflo lighting system, and had only just been introduced into this country. The system was supplied in September, on one month's account, but it was not until the following January that he attempted to pay anything. The account was £24 5s. 2d., and he paid £21 5s. 2d., leaving £3 owing, and then made a complaint as to the battery. Witness said defendant told him he picked up the battery by the lead terminals, and it all fell to pieces, as it naturally would. It had been used wrongly, as there was a handle to pick it up by. He brought the terminals with him to show the witness. Mr. Hatch: Is there a guarantee? Witness: There is no guarantee with a battery, it says so in the catalogue which I gave him myself. Judge Cluer: Don't talk rubbish. You couldn't be so silly as to say we guarantee all our goods to be imperfect, which is what it amounts to if there is no guarantee of any sort. The law gives an implied guarantee, anyway. In cross-examination, the witness admitted that the battery was faulty when it was shown to him, but he considered that it had been caused by the way it had been worked. After further hearing, Judge Cluer said the defendant was entitled to succeed, as it had been used properly, and had fallen to pieces. In an ordinary commercial transaction, an article was warranted to do what was reasonably expected of it, and this had not come up to that. There would be judgment for the defendant, with costs. Judgment was entered accordingly.

CORRESPONDENCE TUITION.

AT Accrington County Court, on May 7th, an action was brought by the International Correspondence Schools against Arnold Bassinder, of Accrington, for 7 guineas, arrears under an agreement for tuition. Bassinder was to receive instruction in electricity, but he only had a few lessons. The defence put forward was that Bassinder was a minor, and that by reason of delay the father's surety had lapsed.

His HONOUR found for plaintiffs for the full amount.

AN UNPROTECTED BELT.

AT Gateshead Police Court on May 7th, Messrs. Wood, Skinner and Co., Ltd., shipbuilders, Bell Quay, were charged under the Factory and Workshops Act with not having securely fenced a driving belt driving a flanging machine from an electric motor. Mr. W. B. Lauder, H.M. Inspector, stated that the belt ran on a pulley 6½ ft. in diameter at 120 R.P.M. The bottom of the pulley was 4½ ft. from the ground, and on February 23rd John Robert Noble was showing a lad how to do some work, and was passing under the pulley when he seemed to have raised his head quickly, with the result that the belt caught him, and inflicted fatal injuries. For the defence it was argued that the wheel had been running for four years, and had the Inspector notified any danger it would have been immediately fenced. A fine of £5 and costs was imposed.

A STOCKBROKERS' CLAIM FOR COMMISSION.

(Concluded from page 790.)

BEFORE Assistant Judge Jackson and a jury, in the Lord Mayor's Court, last week, the hearing was continued of the claim made by Messrs. Lindeck, Cahn & Co., stockbrokers, of Austin Friars, E.C. against the Dubilier Electrical Syndicate Ltd., and another.

When the case was previously before the Court an adjournment was granted in order to enable the plaintiffs to consider their position, owing to Mr. Maclean not having been served with the Court's process. Mr. Morton Smith, on behalf of the plaintiffs, applied to withdraw the proceedings as against Mr. Maclean. That course was objected to by Mr. Palmer on behalf of the defendants.

The ASSISTANT JUDGE said he was of opinion that the proceedings as at present constituted were wrong. He should, therefore, discharge the jury, which he did with regret, after the time spent over the case. He ordered that the costs should be costs in the cause, and whoever was unsuccessful in the end would have to pay the costs of the abortive proceedings.

DAVIS *v.* BAXTER & CAUNTER LTD.

IN the Chancery Division on May 7th, before Mr. Justice Astbury, plaintiff sought an injunction and damages, the defendants having copied from his book, *The Electrical Engineer's Diary*, some pages of original matter, and printed them in their catalogue entitled "Everything Electrical." Defendants admitted the copying in respect to a number of the pages mentioned, and counsel said that he was not to defend the action. Their manager thought that the matter referred to was matter commonly known to the trade, and did not know that there was any infringement of copyright. Defendants' counsel gave a perpetual undertaking, and counsel for the plaintiff said that he would not insist then on an injunction. An amount of £50 (including the money in Court) was agreed upon as damages. The Court made an order accordingly embodying the undertaking and giving judgment for the agreed damages, and the costs of the action.

ATTORNEY-GENERAL *v.* LONG EATON URBAN DISTRICT COUNCIL.

ON Tuesday MR. JUSTICE SARGANT delivered his reserved judgment in this case, which was fully reported in the ELECTRICAL REVIEW for April 17th, p. 649. He said in his judgment plaintiff was entitled to a declaration that the differentiation proposed by the circular of September 25th, 1911, between those consumers of over 6,000 units per quarter for power who did and those who did not take their lighting exclusively from the Council, was in contravention of Secs. 19 and 20 of the E.L. Act, 1882. There would be liberty to apply for an injunction if necessary. If the defendants determined to appeal, no such application would be made while the appeal was pending. The defendants must pay the costs of the action.

We shall report the judgment more fully next week.

PARLIAMENTARY.

Electric Lighting of Kingstown.

A SELECT COMMITTEE of the House of Commons, presided over by Sir Edward Cornwall, concluded their consideration on May 6th of the Bill promoted by the Dublin and Southern District Electric Supply Co., for power to supply electricity for lighting purposes in the district of the Kingstown U.D.C. Mr. Vesey Knox, K.C., and Mr. Browne represented the promoters; Mr. J. D. Fitzgerald, K.C., and Mr. C. H. Campbell, the Alliance and Dublin Gas Co.; Mr. Macassey, K.C., and Mr. P. White, the Dublin Corporation; Mr. W. D. Harbinson, the Kingston U.D.C.; Mr. W. M'Grath, the Blackrock U.D.C.; and Mr. J. Kenny, the Dalkey U.D.C.

MR. VESEY KNOX explained that there were two competing Bills. The Bill of the Dublin and Southern District Electric Supply Co. was a Bill to confirm the Provisional Order granted by the Board of Trade in 1913 for the Electric lighting of Kingstown, and the Alliance and Dublin Gas Co. also had a Bill under which they sought to obtain powers for the electric lighting of Kingstown and Dalkey. The Kingstown Urban District Council opposed both Bills. Mr. W. M. Murphy was really the promoting company. In 1896 the Kingstown Town Commissioners obtained a provisional order, but neither they nor their predecessors, the Urban District Council, had been able to do anything with it, and, finally, the Board of Trade revoked the order. In 1911 an informal committee of members of the U.D.C. was formed to see if anything could be done, and they approached Mr. Murphy, the chairman of the Dublin Tramways Co., which company had electric mains running through the urban districts for the tramway service. It appeared, however, that the Tramways Co. were bound by certain clauses in their Bill put in at the instance of the Dublin Corporation, not to supply current for electric lighting either inside or outside that city. He wished to make it clear that the Tramways Co. was in no way associated with the promotion of the Bill, but it was solely Mr. Murphy's affair. In 1912 Mr. Evans, who was a member of the Kingstown U.D.C., took the matter up and obtained the assent of the U.D.C. to a proposal for breaking up the streets and the lighting of the district by a non-statutory company. Mr. Evans then approached Mr. Murphy, who came in for the first time. Mr. Murphy declined to have anything to do with a non-statutory authority, and steps were then taken to obtain powers in the ordinary way, and a company was formed with a nominal capital of £40,000 Mr. Murphy, Mr. Murphy, junr., and Mr. Evans were the directors, but the latter had no substantial interest in the company. The Urban District Councils of Kingstown and Dalkey had consented to the scheme, but Blackrock refused and was struck out The proposal came before the Kingstown Council in January, 1913, who approved the scheme. Subsequently the Board of Trade refused a clause to the effect that the undertaking was only to be purchaseable as a whole by a Committee of the Kingstown and Dalkey Councils, as they did not think they had power to vary the purchase clause of the 1888 Act, and as the promoters did not desire to run the risk of having the Dalkey portion of the undertaking left on their hands they struck Dalkey out of the scheme.

Mr. W. M. Murphy gave evidence and bore out the opening statement of counsel. He said that if the Bill was passed he was prepared to carry out the scheme with, or without, assistance.

In answer to Mr. Fitzgerald, Witness said he had the option of a site for a generating station at Kingstown. It was true that he would like to use the large generating station of the Tramways Co. in Dublin for other purposes, but he was prohibited from doing so and had no idea of doing so in this case.

Replying to the Chairman, Witness said he believed the best way of getting the electric current for Kingstown would be from the Tramways Co.'s generating station, but as he had said there was no power to supply. Another way would be to get a supply from the Dublin Corporation. When he entered on the undertaking he had the goodwill of the Council and people of Kingstown and had he thought it was going to cost him £20,000 in Parliamentary costs he would never have entered into the matter. However, now he had started, he was prepared to carry it through.

Mr. Tatlow, electrical engineer, explained the scheme for the lighting of the district, and expressed the firm opinion that it would be financially successful. He gave the opinion that it would be possible to extend the system afterwards by agreement to Dalkey and Blackrock without having to come to Parliament for fresh powers.

Mr. Fitzgerald dissented from the view that such a thing could be done.

Mr. Vesey Knox said that the opinion of Sergeant Matheson had been obtained, and he gave it as his opinion that under the existing law in Ireland local authorities had the power to consent to the erection of poles and standards on the highway for the purposes of electric lighting. Personally, he must say frankly he had difficulty in following that opinion, but as he was not a member of the Irish bar it would be presumptuous for him to set up his opinion against that of Sergeant Matheson.

Evidence was given by Sir T. Robinson, ex-chairman of the Kingstown U.D.C., and Mr. W. A. Evans also gave evidence in support of the Bill.

Mr. Fitzgerald, K.C., next presented the case for the Alliance and Dublin Gas Co., which company, he said, had power to supply electric light. He submitted that Dalkey could not get an electric supply without Kingstown, as it was too small to supply itself, and the Gas Co. had come to an agreement to supply the district. The Gas Co. had its works close to the harbour, and they proposed to work the dynamos by gas engines. Further, they were in a position to begin the work at once, whereas Mr. Murphy would first have to look for a generating station.

Mr. Cotton, secretary and manager of the Gas Co., gave evidence in support of the scheme, and said that it was proposed to use overhead wires for the supply to Dalkey. The Gas Co. had large capital powers, and was in an established position, whereas Mr. Murphy's capital had not yet been subscribed.

The Committee rejected the Bill of the Gas Co., and passed the preamble of the Dublin and Southern District Electric Supply Co., but suggested that the promoters and the Kingston U.D.C. should come to an agreement.

Mr. Vesey Knox subsequently brought up the heads of an agreement arrived at, to the effect that the powers in the Bill should not be exercised for a period of six months without the consent of the Urban District Council, unless within that period (or such other period as the Board of Trade might allow), the undertakers had transferred the undertaking to the Urban District Council. There were also clauses for the payment to the undertakers of the promotion expenses, &c., if the order was transferred.

Mr. Harbinson (for the Urban District Council) said the Council desired to undertake the scheme at the earliest possible moment. If the U.D.C. did not take the transfer in the time prescribed, Mr. Murphy would go on with the scheme.

The Committee also passed a clause binding the undertakers to give Dalkey and Blackrock a supply in bulk, if required.

Hightown Gas and Electricity.—Lord Clinton's Select Committee of the House of Lords has passed a Bill for incorporating the Hightown Gas and Electricity Co. with powers to supply Hightown, near Southport.

Third Reading.—In the House of Commons on Monday the Norwich Electric Tramways Bill was read a third time.

Manchester Electricity Supply.

After four days' consideration, the Select Committee of the House of Lords, presided over by Lord Barnard, came to a decision with regard to the most contentious part of the Bill promoted by the Manchester Corporation dealing with the supply of electricity. The Bill was of an omnibus nature, and contained a large number of clauses conferring various powers on the Corporation, and the powers sought included the erection of a large generating station at Davyhulme, the extension of the area of supply of electricity by taking in portions of Davyhulme and Stretford, the connection of the proposed new stations with existing stations, and the purchase of the electric light station owned by the Trafford Power and Light Supply (1902), Ltd.

Mr. Clode, K.C., in outlining the powers sought, dwelt on the past history of the Manchester electricity supply, snd said the powers of the Corporation had been increased four times, and they had taken over the orders of supply of Audenshaw, Denton, Droylesden, Failsworth and Heaton Norris. At the present time there were three generating stations at Dickinson Street, Bloom Street and Stuart Street. The total capacity of the first two stations was 14,000 kw., and of Stuart Street 55,500 kw. The two first-named stations could supply an area of about 1½ miles, and there were 22 sub-stations, covering an area of 46 miles. They had now 455 miles of mains, and were supplying 750,000 persons. They had further undertaken to give a bulk supply to Middleton, and it was anticipated that a million units would be required for that supply during the first year. The field of operations was by no means exhausted, and hence to carry on their operations the Corporation had to contemplate the erection of a new power station. The site chosen was a most convenient one. It was near the Corporation sewage station at Barton, and adjoined the Ship Canal and the railway. The landowners did not oppose, but the Barton U.D.C. had presented a petition, which he did not think was very serious. The Stretford U.D.C. also opposed the Bill, not as to the site of the generating station, but with regard to other proposals. Amongst the powers sought was to purchase the undertaking of the Trafford Park Power Co., and to exercise the powers of supply now exercised by that company. When the development of Trafford Park was commenced part of the agreement in the letting of sites was that the lessees should take their electricity from the lessors. The Corporation proposed to purchase the undertaking, and, of course, to take over these rights, but the Stretford U.D.C., in whose district Trafford Park was situated, objected to this as being an interference with their rights as the electrical undertakers for the district. As a matter of fact, the U.D.C. never had supplied Trafford Park, and were not in a position to provide a supply. He submitted that the Manchester Corporation was the only body capable of giving an adequate supply. A further point was that at present the Trafford Park Co. supplied some of the docks of the Manchester Ship Canal with electricity by agreement, and as these docks were in Salford it meant that, in taking over and exercising the powers of the Trafford Park Co. the Manchester Corporation would be supplying in the Borough of Salford. He submitted that at present the Salford Corporation could not give a satisfactory supply, but the Manchester Corporation were willing to transfer that part of the undertaking by arrangement to the Salford Corporation if in the future the latter body were in a position to satisfactorily meet the demand.

Mr. S. L. Pearce, electrical engineer for the City of Manchester, gave evidence, and said that whether they extended the area of supply to include the Trafford Park Estate or not, a fourth generating station would be absolutely necessary in the near future. The estimated cost of the new station was £1,200,000. They expected to produce at the cost of ⅛d. per unit. The original idea of using overhead wires had been abandoned. Excluding Glasgow, the electricity undertaking of the Manchester Corporation was almost twice as large as any other two municipalities in the kingdom. The plant of the Stretford Council was of limited capacity, and could not be economically extended, whilst the voltage was a lower pressure than that of the Trafford Park Co. Stretford declined to purchase the Trafford Park undertaking in 1901—they owned the tramways but leased them to Manchester. A large portion of Trafford Park was not in the Stretford district at all.

Cross-examined by Mr. Wedderburn, K.C. (on behalf of the Stretford U.D.C.), Witness said he was not aware that the U.D.C. were prepared to purchase the Trafford Park Co. at an arbitration price, and he doubted the capacity of the Council to do it. If they did they could not supply the estate at anything like so low a price as Manchester. If Stretford wanted to discard their present plant and have a fresh large instalment, they would have to go to the Local Government Board, and he doubted if they would permit such a speculation, as they would have to come on the rates at once to pay off the old capital.

In answer to Mr. Coward, K.C. (for the Salford Corporation), Witness said that the new generating station would be necessary in any case, and the Corporation would not have thought of entering Salford but for the fact that they were taking over the company which was now supplying in the Salford area. From a practical point of view, there would be no difficulty whatever in excluding that part from the proposals.

Replying to the Chairman, Mr. Coward said that the entry of the Trafford Park Co. into the Salford area was the result of an agreement between the Ship Canal Co. and the Trafford Park Co. in 1901. Until the previous day Salford had no knowledge of the agreement.

The Chairman suggested that some agreement might be arrived at between the parties, as the whole case seemed to be the overlapping of local authorities. He had been impressed with the difficulty of providing a sufficient supply of electricity without overlapping, but still if possible they ought to try and agree, and so save the great expense of fighting the matter out.

In re-examination, Mr. Pearce said that the Trafford Power Co. had made gross profits of £4,205 in 1910; £8,049 in 1911; £7,274 in 1912; and £10,653 in 1913. Therefore the company was not piling up losses, but reducing the losses made in former years. The Trafford Co. entered the Stretford area without any permission from the Stretford U.D.C., as such permission was not required, and they installed their plant by agreement with the owners of the estate.

Witness was questioned about the supply to the docks in the Salford area, when

Mr. Tyldesley Jones, for the Manchester Corporation, repeated that if Salford would take over the obligation, Manchester did not desire to supply a single unit.

Mr. Coward said that in 1900 the Trafford Co., entirely unknown to Salford, put a cable under the canal for supplying certain docks, and at that time the law was such that Salford could not have prevented it. Now Manchester came, and without any communication with Salford, until the Bill was deposited, proposed to constitute themselves the lighting authority in the area, on the ground that they had purchased the undertaking of the Trafford Co., which, according to the law now, would be acting legally.

Mr. Tyldesley Jones submitted that in supplying the docks the Trafford Co. acted perfectly legally. The Canal Co., in 1900, asked for tenders for the supply of the docks from Manchester, Salford and Trafford, and the offer of Salford was rejected as being prohibitive. Unless the Canal Co. determined the agreement, they were entitled to insist on a supply on the present terms.

Mr. J. F. C. Snell, President-elect of the Institution of Electrical Engineers, was called by the promoters, and questioned the ability of Salford to supply the docks.

Mr. Tyldesley Jones, amidst considerable amusement, read an extract from a speech which the Mayor of Salford delivered at a dinner of electrical engineers in February, in which he referred to electricity having been the bane of their lives, and said their only notable achievement had been the blowing up of their works, and their regret was that the whole of the works had not been demolished.

Witness said he was present at the dinner, and would prefer to make no comment.

Mr. C. P. Sparks, electrical engineer, also gave evidence in support of the proposals.

The Chairman intimated that he did not see what Salford wanted more than the promoters had promised.

Mr. Coward promised to consult his clients on the matter.

A large number of witnesses having works at Trafford Park gave evidence to the effect that in their opinion it would be most advantageous for the Manchester Corporation to supply electricity in the district.

Mr. Atkinson, a director of the Trafford Power Co., said that 80 per cent. of the capital of the company was held by people who had their works at Trafford Park, or were interested in the land. They had entered into an agreement with the Estate Co. to give a cheap supply on a purely industrial basis, and the Ship Canal, the Estate Co. and the Power Co. were the three factors which had made the Park. He considered that the sum offered by the Manchester Corporation—viz., £146,000—was fair and reasonable. If the present arrangement fell through, the Power Co. would go on supplying as at present, and raise further capital for the purpose. He did not think they would sell to Stretford at arbitration price. They were bound to supply the industrial area of Trafford Park at the same price as Manchester.

Mr. Wedderburn, K.C., on behalf of the Stretford U.D.C., pointed out that so long as the Trafford Power Co. gave the supply Stretford would not compete, but he submitted that this agreement was personal and would not apply to anyone to whom the company assigned their business. Manchester was expecting to make a large profit out of the monopoly in Trafford Park, and it was suggested that Stretford was to be robbed for all time of this important industrial area. Such a proposal involved the startling principle that whenever a large area was able by reason of its size and wealth to produce and supply electricity more cheaply than its smaller neighbour, the large area was to be entitled to take away from the smaller area all its best customers to the detriment of the supply of electrical energy to the rest. If the Committee sanctioned such a dangerous principle then the municipal basis for the supply of electricity was wrong.

On Friday, Mr. Balfour Browne, K.C., said that Manchester and Salford had come to an agreement which would be embodied in the following clauses:—(1) The Salford Corporation and the Ship Canal Co. to enter into an agreement as to the supply of electricity by the Salford Corporation in the area on the north side of the Canal now supplied by the Trafford Power Co.; (2) the Canal Co. then to release the Manchester Corporation from any obligation to supply electricity to the Canal Co. under the contract between the Canal Co. and the Power Co.; (3) Manchester Corporation then to hand over to the Canal Co. the electric cable used for distribution on the Canal Co.'s property.

After consultation, the Chairman said the Committee were not prepared to grant the Corporation of Manchester the additions to their area of supply in the township of Davyhulme and that part of the urban district of Stretford known as Trafford Park.

Mr. Wedderburn submitted that in this decision Clause 33 confirming the agreement with the Trafford Park Co. must go.

After legal argument, the Committee struck out Clause 33.

Birmingham Tramways Bill.—The Select Committee of the House of Commons has further considered this Bill. The Committee, as reported in last week's Elec. Rev., intimated that they would consent to the Corporation having powers to construct certain of the suggested lines on condition that the powers were not exercised until Broad Street was widened. It was left to the parties to submit a clause to carry out this condition.

Mr. Freeman, K.C., submitted the following clause:—

Provided that Tramway No. 1 shall be constructed only subject to the following conditions:—(a) No part of the tramway shall be constructed until so much of Broad Street as is situate between its junction with Baskerville Place and the junction of Easy Row has been widened so that the width of the street is not less than 90 ft. and the width of the road is not less than 80 ft. between the kerbs; (b) At the termination of the tramway a junction shall be formed with Tramway No. 2 authorised by this Act.

The Committee accepted the clause, with an amendment that the tramways in question should be completed within a period of eight years from the passing of the Act.

Reading Corporation Bill.—The Unopposed Bill Committee of the House of Commons has passed the preamble of this Bill, which amongst its provisions includes powers for the expenditure of £3,100 on tramways, £6,800 on trolley vehicles, £6,000 on electrical equipment of trolley vehicles, £3,500 for motor-'buses, and £2,400 for depôt accommodation. The Committee amended the clause dealing with the attachment of advertisements to the tramway standards to provide that no advertisement for which the Corporation received payments should be attached unless they related to the tramways undertaking.

Stone Gas and Electricity Bill.—The North Staffordshire Railway Co. appeared before the Court of Referees last week to establish their claim to be heard against the Stone Gas and Electricity Bill. Mr. Szlumper, K.C., for the petitioners, asked that they should be allowed to petition against the electric lighting clause in the Bill, but the Court, after hearing Mr. Balfour Browne, K.C., in opposition, decided that the railway company had no *locus standi* in the matter, and their claim to appear as petitioners against the Bill was therefore disallowed.

Second Reading.—In the House of Lords on May 6th, the Shropshire, Worcestershire and Staffordshire Electric Power Bill was read a second time.

Pressure upon our space compels us to hold over several Parliamentary matters.

BUSINESS NOTES.

Book Notices.—The *Britannic Review* is a new monthly magazine (1s. net). The first number (May) contains various articles of Empire interest, including one by Mr. Hugo Hirst on "Organisation of Imperial Trade." The necessity for "co-ordinating the Empire's trade" is urged, and such matters as the unification of company law, co-ordination of patent law, compilation of statistics, classification of dutiable goods, Tariff Reform, and the taxation of commercial travellers, are briefly discussed by the author of this article.

"Telegraphy." By the late Sir W. H. Preece and Sir J. Sivewright. Revised by W. L. Preece. London: Longmans, Green and Co. Price 7s. 6d. net.

"Year-Book of Wireless Telegraphy and Telephony, 1914." London: Marconi Press Agency. Price 2s. 6d. net.

"*Proceedings* of the American Society of Civil Engineers." Vol. XL, No. 4. April. New York: The Society.

"*Journal* of the Western Society of Engineers." Vol. XIX, No. 3. March. Chicago: The Society. Price 50 cents.

"Form of Model General Conditions recommended for Use in Connection with contracts for Electrical Works." Issued by the I.E.E. London: E. & F. N. Spon, Ltd. Price 1s.

"Installations Electriques de Force et Lumière." By Adr. Curchod. Paris: Dunod & Pinat. Price 7 fr. 50.

"*Bulletin* Trimestrial de l'Association des Elèves et Ingénieurs Diplomés de l'Institut Electrotechnique de Bruxelles." Vol. I, No. 1. April. Brussels: 70, Rue Bosquet. Price 1 fr.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol. XXXI. April. Brussels: E. Bruylant. Price 1 fr. 75.

"Die Volkswirtschaft Ungarns Finanzielles und Nationalokonomisches Jahrbuch, 1913." By Béla Katona. Berlin: Puttkammer and Mühlbrecht. Price 5 M.

"Practical Ironfounding." By J. G. Horner. Fourth edition. London: Whittaker & Co. Price 5s. net.

"X-Rays." By G. W. C. Kaye. London: Longmans, Green and Co. Price 5s. net.

"Camp Co-operation." Book of Proceedings. New York: The Roycrofters. Price $1.25.

"Science Abstracts." Sections A and B. Vol. 17, Part 4 April 27th. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Journal* of the Society of Engineers." Vol. 5, No. 4. April. London: The Society. Price 2s. net.

"*Journal* of the South African Institution of Engineers." Vol. XII, No. 9. April. Johannesburg: The Institution. Price 2s.

"The School of Mines Quarterly." Vol. XXXV, No. 2. January. New York: Columbia University. Price 50 cents.

"The Physical Review." Vol. III, No. 4. April. Lancaster, Pa.: The American Physical Society.

"*Journal* of the American Society of Mechanical Engineers." Vol. 36, No. 5. May. New York: The Society. Price 35 cents.

"*Bulletin* of the Association des Ingénieurs Electriciens." Vol. XIV, No 1. January. Liége The Association. Price fr. 8.50.

"*Bulletin* de la Société Internationale des Electriciens." Vol. IV, No. 34. April. Price 2 fr. 50. Also "*Annuaire*" of the Society for 1914. Paris: Gauthier-Villars et Cie.

"Electric Switches for Use in Gaseous Mines." By H. H. Clark and R. W. Crocker. "The Action of Acid Mine Water on the Insulation of Electric Conductors." By H. H. Clark and L. C. Ilsley. Washington: Government Printing Office.

"*Bulletin* de l'Association des Elèves des Ecoles Spéciales." Vol. XVI, No. 5. March. Liége: Lahaye & Co. Price 1 fr.

Private Arrangements.—G. Braulik, electrical engineer, 8, Lambeth Hill, Queen Victoria Street, London, E.C.—The creditors interested herein were called together recently, when a statement was presented which showed liabilities of £21,772. The indebtedness to creditors on open accounts was £6,481, and there were bills payable for £3,954. The London, City and Midland Bank were scheduled for £242, while Mrs. Braulik was put down as a cash creditor for £4,503. In addition, Mr. C. V. Braulik was a cash creditor for £7,592. The assets were estimated to realise £21,602. The assets consisted of cash at bank, £111; book debts, £9,280, estimated to realise £8,930; lease, £375; furniture, £82; shares in Victoria Electric Works, £1,000; and stock in trade, £11,104. It was pointed out that as the liabilities included Mr. Braulik's capital of over £6,000, and a cash claim by Mrs. Braulik for £4,503, the estate really showed a very large surplus. The claim of Mrs. Braulik was for money lent, and she was secured to the extent of £2,500 by a mortgage over the book debts executed in October, 1911. The mortgage included future book debts. The mortgage was executed when about £2,500 was borrowed from the bank, and Mrs. Braulik deposited the title deeds of her own property. The bank's claim had since been discharged, but she had lent other money to her husband, to the extent shown in the statement. The debtor started trading over 20 years ago, and in 1903 he had a capital of more than £19,000. Up to that date he traded very successfully, but in 1904 he made a loss of nearly £2,000, and in 1905 there was a loss of over £600. In the following two years profits were made, but since then losses had been sustained. Since 1904 losses aggregating £18,900 had been made against profits of £4,500. The result was that during the period there was a net loss of over £14,000. In 1907 the debtor was concerned in an action over the alleged infringement of an arc lamp patent, and that crippled him to some extent. Proceedings had been commenced by certain creditors. The drawings of the debtor had been at the rate of £750 per annum, but latterly he had reduced his expenses. It was decided to accept a composition of 10s. in the £, payable by instalments, Mrs. Braulik withdrawing her claim until that amount had been paid.

Catalogues and Lists.—*The Mazda House News* for March-April has been issued by the British Thomson-Houston Co., Ltd., of Upper Thames Street, E.C.

Messrs. Adnil Electric Co., Ltd., Artillery Lane, London, E.C.—Illustrated catalogue of "Century" single-phase self-starting motors of the repulsion induction type. Full information is given respecting the motor itself, and numerous pictures showing its applications to various classes of service appear. Copies of this publication will be sent on application.

The Adamant Diamond Tool Co., 12, Lower Park Row, Bristol.—Illustrated card dealing with their Diamond tools, which they are about to put on the market, for turning and dressing abrasive wheels of all kinds. Hints are given regarding grinding generally and diamond stones. A special study has been made of rough diamond stones and a variety of qualities for the varying grades of abrasive wheels have been obtained.

"Attracta" Electrical Co., 75, Fetter Lane, London, E.C.—Eight-page illustrated price list of "Attracta" metal and wood letter signs, "Lenslite" signs, "Diaphanad" patent signs, picture theatre and shop signs.

Armorduct Manufacturing Co., Ltd., 6, Farringdon Avenue, London, E.C.—Leaflets relating to the "Guinea" pipe bender for conduits, &c., and "Outside Association" cable.

Messrs. Ralph H. Haylock & Son, 63, Queen Victoria Street, London, E.C.—Price leaflet of 600-megohm grade cable, bell and flexible wires.

Messrs Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—Sixteen-page pamphlet, No. 381, giving illustrations and prices of a variety of bowl and reflector fittings for semi-direct and indirect lighting with "Radiolux," Onyx, Carrara marble and other shades.

The Fuller Accumulator Co., Ltd., Wick Lane, Old Ford Road, Bow, E.—Eight-page illustrated catalogue containing particulars and prices of their electric equipment for motor-boat and yacht lighting, including block accumulators, the Fuller dynamo, hand and navigation lamps, interior fittings, &c. Copies of the list will be sent to motor-boat owners on application.

The British Central Electrical Co., 6 and 8, Rosebery Avenue, E.C.—Catalogue of electrical necessities, including a variety of lamps, accumulators and complete electric lighting sets for motor-cars, as well as a number of electric lighting accessories.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Illustrated leaflet, H 1,810, giving descriptive notes relating to, and prices of, the Nightingall automatic electric cookers.

The Diamond Coal Cutter Co., Stennard Works, Wakefield.—Illustrated leaflet describing their patent gate-end switch, fuse and underground joint-boxes for mines.

Trade Announcements.—D. Stevens, plumber and electrical engineer, 15, Howe Street, Edinburgh.—The business of George McLaren (conducted as D. Stevens), now deceased, was transferred on April 28th to his son, Mr. D. A. McLaren, who will carry on the business under the same name.

The Director of the Physical Laboratory National Electric Lamp Association, of America, announces that the laboratory will in future be known as Nela Research Laboratory (National Lamp Works of General Electric Co.), under which name its abstract-bulletin and other publications will appear.

Mr. Guy C. Midwinter, formerly trading as G. C. Midwinter and Co., at 25, Red Lion Street, Holborn, asks us to state that he disposed of his business in August last, and has now no connection with the firm trading in that name, having accepted an appointment with Messrs. Lovell & Christmas, Ltd.

Messrs. Fraser & Chalmers, Ltd., of London, have opened a branch office at 90, Deansgate, Manchester, owing to the extension of their business as power plant engineers. The company have a large volume of turbine orders (Rateau patents) in hand, and further extension is expected in the Lancashire district.

Mr. Bertram B. Fenn, formerly of the Fenn Mirrograph Co., Ltd., has resigned his connection with the business, and is carrying on business under the style of B. B. Fenn, Ltd., electricians, at 36, Shaftesbury Avenue, W.

Dissolutions and Liquidations.—The Nottinghamshire and Derbyshire Tramways Development Co., Ltd.—This company is winding up voluntarily with Mr. G. D. Prince, of 24, Tierney Road, Streatham Hill, S.W., as liquidator. A meeting of creditors is called for May 20th. Claims should be sent by May 31st.

J. W. Fletcher & Co., electrical and mechanical engineers, 7, Wedmore Street, Upper Holloway, N.—Messrs. C. F. Collins and J. W. Fletcher have dissolved partnership. Mr. Fletcher will attend to debts and carry on the business.

The Rose Automatic Target Co., Ltd.—This company is winding up voluntarily, with Messrs. H. R. Bower and W. Cantor as joint liquidators.

The Leicestershire and Warwickshire Electric Power Syndicate, Ltd.—A meeting will be held at 34, Coleman Street, E.C., on June 9th, to hear an account of the winding up from the liquidator, Mr. J. W. Holland.

J. Musgrave & Sons, Ltd.—A meeting will be held at 10, Acresfield, Bolton, on June 15th, to hear an account of the winding up from the liquidator, Mr. H. Mather.

Electricity in Dentistry.—Referring to the article under this heading in our issue of May 8th, the Electrical Co., Ltd., write that for some years they have supplied electrical sterilisers of various sizes for dental and surgical instruments, which are illustrated in their List No. 21 of January last. The apparatus is fitted with a tray to receive the instruments and a separate immersion heater with three regulations of heat. The tray allows the instruments to be removed while hot, and the heat regulation effects economy in energy. They have paid special attention to the application of electricity to dental and medical apparatus, including, amongst others, incubators for delicate infants, and have also supplied hot-air douches, fitted with special conical nozzles for drying teeth previous to filling, thus superseding the usual heated tube and rubber bulb.

Patent Restorations.—Orders have been made restoring the following patents:—

Bertram & Eustace Thomas:—"Electrically controlled brakes for cranes and the like"; No. 15,544, 1909. "Improvements in electric switches"; No. 15,681, of 1909. "Improvements in electric collectors for maintaining connection between stationary and moving conductors"; No. 15,682 of 1909.

E. C. R. Marks, "Improved process for cleaning the combustion spaces in internal combustion motors"; No. 14,503 of 1908.

An order has also been made restoring Patent No. 9,537 of 1908, for "Improvements in and relating to metallic fittings for electric continuity system," granted to Messrs. C. Vaughan and C. Birch.

For Sale.—Mr. F. G. Bowen, 62a, Aldersgate Street, E.C., will sell by auction, at 1 o'clock on May 21st, the stock of a manufacturer's agent, including wire, cable and other electrical stores. Also the stock and office furniture of an electrician, including radiators, fuse-boxes, switchboards, &c., particulars of which are given in our advertisement pages to-day.

Electric Locks.—We are informed that the New British Ever-Ready Co., Ltd., of Hercules Place, Holloway, N., are placing on the market the Lavigne unpickable electric locks, which we described and illustrated on p. 526 of our issue of March 27th.

Shipping, Engineering and Machinery Exhibition.—For this Exhibition at Olympia the number of exhibitors is now 170 British and general foreign which with the Dutch exhibitors, makes a total of about 220.

Fire.—A fire occurred at the works of Messrs. W. Beardmore & Co., Ltd., Parkhead Forge, Glasgow, on 5th inst., and according to Press reports, damage to the tune of £10,000 was done.

LIGHTING and POWER NOTES.

Ashton-under-Lyne.—Year's Working.—There was a profit of over £2,000 on the electricity undertaking for the past year. Of this £750 will go to the relief of the rates, £750 to the reserve fund, £250 to insurance, and the balance will be carried forward

Australia.—A conference was recently held at North Sydney, when schemes for the E.L. of North Sydney, put forward by Mr. Forbes Mackay, on behalf of the Sydney City Council, and by Mr. W. H. Gosche, for the North Sydney E.L. and P. Supply Corporation, were discussed. The City Council was prepared to distribute current in North Sydney at the same rates as were in force in Sydney, and the 21 or 22 suburban Councils supplied by it, and did not favour a bulk supply. The contract would be for 10 years, when North Sydney would have the option of purchasing the plant installed within its area at cost price, less 3 per cent. per annum depreciation. The proposed annual charges for street lighting were:—50-c.p. lamps, £3 2s. 6d. each; 100-c.p. lamps, £5 each; and 200-c.p. lamps, £9 each. It was proposed to use overhead mains, to hire out motors, and to transmit the energy through cables under Sydney Harbour. The company also proposed to supply at the same rates as the Sydney Council, and pointed out that under its scheme the power station would be situated locally, and consumers would not be charged an additional 5 per cent. if the mains were rated, or the 20 per cent. per annum interest on services. Another proposal stated that the municipality would save £720 per annum by adopting the scheme, and could purchase the undertaking at a price mutually agreed upon at any time after a certain period. In a third proposal the company was prepared to install the system on a time-payment basis, charging 5 per cent. interest on outstanding capital.

Aylesbury.—L.G.B. Inquiry.—Mr. T. C. Ekin has held an inquiry into the application of the U.D.C. for power to borrow £21,323 in connection with the E.L. scheme. The application was opposed by a number of ratepayers.

Bacup.—Loan Sanction.—The T.C. has received sanction from the L.G.B. to a loan of £1,000 for electric street-lighting purposes.

At a conference between representatives of Bacup and Rawtenstall, the former made a proposal for Rawtenstall to continue the management of the Bacup E.L. undertaking until September 30th, 1914, so as to allow the Bacup Committee to properly consider what arrangements should be made for the future. The Bacup T.C. agreed to pay £50 for the services rendered by Rawtenstall for the period from March without any regard to the profits.

Bicester.—E.L. Scheme.—The U.D.C. has consented to the assignment from Messrs. Rees Bros. to Messrs. Harrison and Furneaux, of Westminster, of the rights of the former under their agreement with the Council, upon the Council being satisfied as to the financial stability of the company to be promoted, and of its intention to proceed with the generation of electricity within a specified period.

Birkenhead.—New Tariff.—The T.C. has fixed a special rate of £6 per kw., plus ·55d. per unit, to consumers of at least 25,000 units per annum at one place, as from July 1st next.

Blackburn.—The Electricity and Tramways Committee is considering the question of supplying electricity to Great Harwood and Rishton.

Bradford.—The Electricity Committee has approved of the holding of an electrical exhibition in the city in the autumn of the present year.

Bray.—Year's Working.—The results of the past year's working of the U.D.C. electricity undertaking show 186,123 units sold, as against 172,377 in the previous year. Owing to the introduction of a second Diesel engine set, the fuel cost per unit sold fell from 1·17d. to ·44d. The credit balance was £296, as against £30 deficit the year before. During the year a sum of £320 was debited to revenue for improvements carried out, otherwise the surplus would have been £616. This result is clearly traceable to the use of Diesel instead of steam plant.

Brighouse.—Year's Working.—The revenue of the T.C. electricity department for the past year shows an increase of £505 over the previous year, and the gross profit increased from £701 to £894. The units sold numbered 361,571, an increase of 48 per cent.; £350 has been placed to the relief of rates, and £45 to the reserve fund.

Burton-on-Trent.—Year's Working.—The surplus on the electricity undertaking for the past year amounted to £3,055, as compared with £1,189 in the previous year. The sales of current for heating and cooking purposes increased by 62 per cent.

Bury (Lancs.).—L.G.B. Inquiry.—On Tuesday Mr. H. R. Hooper held an inquiry into an application of the T.C. for powers to borrow £62,502 for the extension of the electricity works and the provision of mains. The original application was for £55,000, but the increased demand for current for power purposes since the application was made caused the Council to think it would be advisable to carry out further extensions.

Year's Working.—For the year ending March 31st, 1914 the total output of the electricity department was [illegible] units, compared with 5,076,364 in the previous year There was a profit of £2,185, as compared with a deficiency of £612 in the previous year.

Canterbury.—Year's Working.—The income of the T.C. electricity department for the year ended March 31st last, was £11,151, against £10,660 in the previous year. The expenditure amounted to £5,737, against £5,706, and the net profit was £1,436, against £972. The units generated for the first time exceeded 1 million.

Continental Notes.—Norway.—The question of heating houses by electricity has been under discussion for a considerable time, and is now going to be tested at Christiania by a house owner. The Board of Electrical Works has recommended this application for approval as a useful experiment, and fixed the price for current at 6½d. per unit during the winter six months, between 7 and 9 a.m. and 4 and 8 p.m.; at other times of the day and during the summer season the price will be somewhat less than ½d. per unit. The expense for connecting the electrical heating plant in the house is to be borne by the owner of the house.

Belgium.—La Société de l'Electricité du Pays de Liége has just given out a contract for the supply of a new 5,000-kw. steam turbine and alternator, which will bring the capacity of its plant up to 15,700 kw.

France.—Arrangements are in hand for an Electrical Exhibition to be held in Nancy from October 24th to November 15th next.

Spain.—La Sociedad de Altos Hornos de Vizcaya has decided to replace the electrically-operated cranes at its loading station on the Bilboa River with similar cranes of greater range and power.

Germany.—The Vorgebirgs Station of the Rheinisch-Westfälische Elektr.-Werke, near Essen, is being extended by the addition of a 15,000-kw. steam turbo set and three three-phase transformers each of 12,000-k.v.a. capacity, wound for 110,000 volts.

Crewe.—Year's Working.—The surplus on the year's working of the electricity undertaking amounted to £1,120, of which £600 has been allocated to the relief of the rates.

Croydon.—S. Suburban Gas Bill.—As the clause relating to the generating of electricity has been withdrawn from the S. Suburban Gas Bill, 1914, the T.C. has decided to cease its objections to the Bill.

Dartford.—Bulk Supply.—On the advice of Mr. J. F. C. Snell, the U.D.C. is to enter into an agreement with the West Kent Electric Power Co., for a supply of electricity in bulk for the Crayford district, and to seek the approval of the B. of T. to the draft agreement. The Council has also decided to place forthwith orders for rotary converters, switchgear, and h.t. cables.

Fareham.—Mains Extension.—The U.D.C. has decided to lay a new feeder, at a cost of £750, to Catisfield, with the object of supplying the village with electricity.

Gillingham.—Vehicle Charging Tariff.—The T.C. has decided to make an all-round charge of 1d. per unit for the charging of the batteries of electric vehicles, and to make no charge for standing.

Hayward's Heath (Sussex).—A site for an electricity generating station has been secured in Queen's Road, and it is hoped that a supply will be available by the end of the year.

Hereford. — Loan Sanction. — The L.G.B. has sanctioned a loan of £1,500 for electricity mains.

Hightown.—E.L. Bill Passed.—A House of Lords' Committee has passed the Hightown Gas and Electricity Co.'s Bill, which proposes to supply gas and electricity to Hightown and Little Crosby, near Southport. The Bill was opposed by a Mrs. Greig, who has expended £1,200 on an electricity undertaking, and supplies current in Hightown.

Horwich.—Proposed E.L.—The Lancashire E.P. Co. and the South Lancashire Tramways Co. are to be asked upon what terms they would be prepared to supply electricity to the U.D.C.

Hove.—Aldrington Supply.—The Lighting Committee is recommending the T.C. to place the Aldrington electricity undertaking under the control of Mr. C. B. Smith, the Council's electrical engineer.

London.—With reference to the note in our last issue (page 783) respecting the increase in price of electricity in Camberwell, we understand that the information as given does not relate to the County of London Electric Supply Co., Ltd., which is one of the companies supplying in the district.

Southwark.—Proposed Loan.—The B.C. Finance Committee proposes to take up a loan of £10,087 from the L.C.C. in order to meet capital expenditure.

Stepney.—Year's Working.—The total revenue of the B.C. electricity department for the year ended March 31st, 1914, amounted to £86,477, an increase of £8,043 on the previous year. The total expenditure was £42,053, an increase of £2,845. The number of units sold increased from 14,580,982 to 16,197,123. The net profit was £14,177, as compared with £11,507 last year; £5,000 has been carried to the reserve fund, which now stands at £26,000.

Loughborough.—Cottage Lighting.—The T.C. has requested the electrical engineer to prepare a scheme for supplying electricity to cottages and villas at a fixed charge per week.

Lurgan.—Prov. Order Granted.—The B. of T. has granted the prov. order for E.L. for which the T.C. applied.

Maidstone.—Proposed New Boiler.—The Electricity Committee has recommended the T.C. to apply to the L.G.B. for sanction to a loan of £1,766 for the purchase of a boiler, of the same type as the existing ones.

Manchester.—The Trafford Park Scheme.—The proposal of the T.C. to extend its electrical undertaking into Trafford Park has been rejected by a House of Lords' Committee; as a result of the decision arrived at, further developments in regard to Trafford Park will require the consent of the Stretford Council.

Middleton.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £7,160, for extensions at the electricity works.

Nuneaton.—L.G.B. Inquiry.—An unopposed inquiry was held last week relative to the application of the T.C. for a loan of £7,000 for electricity purposes.

Reigate.—The T.C. has received sanction to supply electricity to Margery Hall, Kingswood, which is outside its area, subject to Mr. Gilbert Allom, the promoter of an E.L. scheme in the rural districts, having the right to take over the supply when his mains are laid in the neighbourhood.

Saddleworth.—Proposed E.L.—The U.D.C. has applied to the Oldham Electricity Committee for terms for the supply of electricity to the district, and the chairman and assistant engineer have been deputed to obtain further particulars, and, if necessary, to wait upon the Saddleworth Council.

South Africa.—The annual report of the Johannesburg electricity department shows the output for the year ended June 30th, 1913, was 22,362,803 units, an increase of 2,447,262 units over the previous year. The revenue amounted to £232,664, against £269,833. The maximum load was 9,500 kw., an increase of 900 kw. The generating costs in December were ·508d. per unit, a decrease of ·041d. as compared with the lowest figure reached in 1911-12. The generating plant capacity was 11,400 kw. It is expected that this rate of progress will continue during the coming year, and several large industrial works are about to be connected to the mains.—*S. A. Mining Journal.*

Southend-on-Sea.—Loan Inquiry.—An unopposed inquiry was held last week into the application of the T.C. for a loan of £1,350 for an electric crane, tramway, &c., in connection with the new loading pier on the Marine Parade.

Steeton-with-Eastburn.—Proposed E.L.—At a meeting of ratepayers it was decided not to oppose the proposed application of the Keighley T.C. for a prov. order to supply electricity to the district.

St. Annes.—Year's Working.—The total sales of the U.D.C. electricity department for the past year were 1,051,815 units, against 939,333 units in the previous year. The number of consumers is now 1,453, an increase of 169, and the supply for domestic heating, &c., increased by 70 per cent.

The electrical engineer has been instructed to visit the Birmingham electricity works to obtain information prior to obtaining the plant required for the supply of electricity to Lytham.

Stafford.—Year's Working.—The revenue of the T.C. electricity department for the past year was £6,379, and the gross profit £2,445, a decrease of £35, compared with the previous year. The net profit was £257, as against £407 in the previous year. The E.L. Committee states that the output is increasing, and with more efficient working, better results are expected.

Stockport.—Plant Extensions.—The borough electrical engineer has been instructed to prepare specifications for the installation of a third A.C. generating set.

Stone.—The R.D.C. has agreed to the request of the Southampton T.C. for permission to lay E.L. mains in the parish of Millbrook.

Tunbridge Wells.—In granting the T.C. power to supply electricity to premises at Sandown Park, the B. of T. asked the Council to consider, if it desires to supply any further premises in the rural area, the advisability of applying for a prov. order to authorise a general supply in the district. The Council has deferred the matter pending an interview with the B. of T.

Turton (near Bolton).—Proposed Loan.—The U.D.C. is to apply to the L.G.B. for sanction to a loan of £2,568, for the purpose of extending the electricity supply to Harwood. The amount is made up as follows:—Mains extensions, £1,460; overspent on original loan, £1,108.

Wallsend.—For the electrification scheme at the Wallsend and Hebburn mines of the Wallsend and Hebburn Coal Co., referred to in our issue on May 1st, Mr. C. W. Fairweather, of Newcastle-on-Tyne, has acted as consulting engineer.

Walsall.—New Power Station.—The T.C. has adopted a report of the Electricity Committee, which proposes to erect a power station, at a cost of about £80,000, with a nominal capacity of 9,000 kw. in three units of 3,000 kw. each, the first to be installed by June, 1915, the second by August, 1916, and the third when required. The expenditure necessary during the next three years will be £59,000. The approximate total cost of the H.T. mains required is estimated at £15,000. The T.C. has decided to obtain sanction to a loan of £74,850 to cover the cost of the installation of the first 6,000-kw. of plant.

Warrington.—The R.D.C. has consented to the T.C. supplying electricity to Great Sankey and Penketh, on the same terms as in the borough.

Wath-on-Dearne.—E.L. Scheme.—The U.D.C. has decided to go forward with the electric light scheme in connection with the Dearne Valley Light Railway, even if the Wombwell Council is excluded from the lighting scheme by the B. of T.

Wednesbury.—Proposed Extensions.—The T.C. has confirmed a proposal to borrow £5,100, £3,000 of which is required for electricity purposes.

West Hartlepool.—Year's Working.—The revenue of the T.C. electricity department for the past year amounted to £16,190, and the expenditure to £9,667. Interest, redemption, and sinking fund charges amounted to £8,535, leaving a deficiency of £1,878, which is to be met out of the reserve fund. Last year the fuel cost was £3,225, and it is estimated that this will be reduced to about £1,000 this year, when the waste-heat scheme will be in full working.

TRAMWAY and RAILWAY NOTES.

Ashton-under-Lyne.—Year's Working.—The T.C. tramways for the past year show a net profit of £4,000, the highest previous surplus being £2,000. £3,000 has been transferred to the relief of the rates.

Australia.—The Brunswick and Coburg (Vic.) Tramways Trust has been formed for the purpose of establishing electric tramways within the district.—*Tenders.*

Bournemouth.—Railless Scheme Rejected.—On the grounds that the case of the promoters had not been proved, a House of Lords' Committee has thrown out the Bill for the provision of a system of railless electric traction for Branksome Park, Canford Cliffs and the Poole Sandbanks.

Bradford.—Workmen's Fares.—After considering a report by the general manager, the Tramways Committee has agreed that it would be better to increase the length of the penny stages rather than to issue return tickets to workmen at reduced rates.

Rate Relief.—The Finance Committee of the T.C. proposes appropriating £10,000 from the tramway profits, as against £17,200 last year, and £5,000 from the electricity undertaking for the relief of rates.

Burton-on-Trent.—Year's Working.—There was a net surplus on the electric tramways undertaking for the past year of £1,163, as compared with £529 in the previous year.

Canada.—The Ontario Government has voted $5,000,000 for the advancement of hydro-electric railways in the province.—*Canadian Engineer.*

Continental Notes.—Germany.—The electrified portion of the main line between Dessau and Bitterfeld has been extended from Dessau to Zerbst and from Bitterfeld to Leipzig. The line equipment is erected, and trial runs are about to be commenced.

Dover.—The Dover, St. Margaret's and Martin Mill Light Railway Co. has applied to the B. of T. for an extension of time for constructing the railway.

Edinburgh.—Proposed Extensions.—The T.C. has requested the burgh engineer to report as to the probable cost of extending the tramways, by single and double tracks respectively, from the Craiglockhart Road terminus to the Colinton Mains Hospital, using self-propelled tramcars.

London.—Marylebone.—Electric Vehicle.—The B.C. has accepted the offer of Councillor Duncan Watson to present a chassis, which is to be fitted with battery, tires, &c., at a cost of £80, for the use of the electric supply department. The E.S. Committee had already decided to purchase a 10-cwt. electric vehicle, at a cost of £200.

On Monday morning an L.C.C. tramway car proceeding over Blackfriars Bridge collided with a stationary car at the corner of the Embankment. Fifteen passengers were injured, and both cars were considerably damaged.

Newcastle-on-Tyne.—The T.C. having been successful in its opposition to the Bill of the N.E. Railway Co., which proposed to run railless trolley vehicles over the High Level bridge between Newcastle and Gateshead, it is proposed to apply for running powers for cars over the bridge next year.

Southport.—Year's Working.—The total number of passengers carried on the T.C tramways during the past year was 4,663,579, an increase of 262,243 on the preceding year.

West Ham.—Loan Sanction.—The T.C. has received the sanction of the B. of T. to the borrowing of £15,000 for the purchase of 16 new tramcars.

West Hartlepool.—Year's Working.—The income of the T.C. tramways department for the past year amounted to £17,613, an increase of £2,400 on the previous year, and the working expenses to £11,633. The net profit was £1,663, which has been carried to the reserve fund.

Wigan.—Proposed Extension.—The T.C. has decided to apply to the B. of T. for sanction to borrow £1,558 for the construction of tramways in Wallgate, from the L. & N.W. Railway entrance to the Union Bank, and for the reconstruction of the tramway from the Union Bank to the Market Place.

TELEGRAPH and TELEPHONE NOTES.

Japan.—A conference between representatives of the Russian and Japanese Telegraph Departments is about to be held in Tokio, when the question of direct telegraphic connection between the two countries will be discussed. If a satisfactory agreement is reached at the conference, the rates for telegraphic messages not only between Japan and Russia, but also between Japan and Europe, will be greatly reduced, and the telegrams will be transmitted more quickly.

Hull.—The Corporation of Hull, on Wednesday last week, completed the purchase of the Post Office telephone system in the borough area, the price being £192,423.

New Zealand.—Two wireless stations, said to be the largest in the Southern Hemisphere, have been opened, at Awanui and Awarua, the extreme north and south of New Zealand. The working range is 2,000 miles, and the stations will form links in the Imperial chain.

Panama Canal Zone.—The United States Government has placed a contract with the Childers Construction Co., of Columbus, O., for the erection of three steel towers in the Canal zone for the wireless station. The towers will be 600 ft. high, with a 150-ft. triangular base, tapering to 10 ft. at the top, and will require 1,000 tons of steel. They will be spaced 90 ft. apart, on a site near Gatun. The cost of erecting the towers (not the material) will be £10,000.—*Elec. Review and W. Electrician.*

Singapore.—The work of laying a new telegraph cable between Singapore and Aden has just been completed by the cable steamer *Colonia.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—May 21st. Corporation. Small steam coal for 12 months, for the Electricity Department. Specifications from Mr. J. A. Bell, Electrical Engineer.

Australia.—May 26th. Adelaide Tramways Trust. Overhead tramway equipment and construction. Board of Trade Commercial Intelligence Department in London.

Sydney.—July 20th. Box compound, meters, maximum-demand indicators, arc lamp carbons, and straight-stem insulators, for the Council. Specifications for each section 10s. 6d., from City Electrical Engineer, Town Hall.

Melbourne.—May 20th. 1, 32,000 arc lamp carbons, for City Council. See "Official Notices" May 1st.

Victoria.—The Prahran and Malvern Tramways Trust proposes to invite tenders for 25 new electric cars at an estimated cost of £25,000.—*Tenders.*

Victorian Railways Commissioners.—August 26th. Electric cranes. Specifications at the Railway Offices, Spencer Street, Melbourne, and at the Board of Trade Commercial Intelligence Department, London.

Tasmania.—July 20th. Telegraph and telephone material, for Postmaster-General's Department. See "Official Notices" to-day.

Bedford.—May 28th. Laying a 21-in. conduit from the river to the electricity works, and constructing a screening chamber and cold well extension. Mr. R. W. L. Phillips, Borough Electrical Engineer.

Belgium.—June 13th. The municipal authorities of Lokeren are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the town.

May 18th.—The municipal authorities of Thimister (province of Liége) are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the town.

Birkenhead.—May 18th. 12 months' supply of rough slack and small coal for the electricity stations. Mr G. P. Shallcross, Borough Electrical Engineer.

Blackpool.—May 20th. Clean rough slack (12,000-15,000 tons) for the Electricity and Tramways Committee. Mr. C. Furness, Borough Electrical Engineer.

Bootle.—May 20th. Electricity sub-station at corner of Atlantic Road, by Pacific Road. Mr. B. J. Wolfenden, Borough Engineer.

Bridlington.—May 29th. Coal (2,000 tons) for the Corporation Electricity Works; Mr. A. J. Beckett, Electrical Engineer.

Bury.—May 20th. Corporation. Floor girders, stanchions, &c., for the electricity generating station. Specification from the Borough Electrical Engineer, Bank Street.

Cardiff.—May 28th. Corporation. Pipe work and feed tank. See "Official Notices" May 8th.

Cheltenham.—May 21st. Corporation. Rough steam coal, for the Electricity Department. Specifications from the Town Clerk.

Cleckheaton.—May 23rd. U.D.C. 2,000 yards of concentric cable and 2,000 yards of three-core pilot. See "Official Notices" May 8th.

Clifton Junction.—May 20th. Electric power station for the L. & Y. Railway. Engineer's Office, Hunt's Bank, Manchester.

Colchester.—May 19th. Corporation. 12 months' supply (5,000 tons) steam coal, for the electricity works. Forms of tender from Mr. W. Frisby, Borough Electrical Engineer, 36, Osborne Street.

Dublin.—May 25th. Corporation. A.C. slot meters. See "Official Notices" to-day.

Durham.—The County Education Committee has approved of the provision of apparatus required for fitting up an electrical laboratory at the Johnston School, Durham, at a cost of £343.

Edinburgh.—May 18th. Installation of electric light at King's Park School, for the Edinburgh School Board. Specification from Messrs. Crawford & Cumming, 41, George Street.

France.—June 12th. The French State Railway authorities (2me. Division du Service Electrique) in Paris (43, Rue de Rome) are inviting tenders for the installation of the secondary distributors for the transmission of current for lighting and power purposes at the railway station and workshops in the town of Rennes.

Germany.—June 8th. The Prussian State Railway authorities at Paderborn. Supply and installation of four electrically-operated cranes for lifting locomotives and other loads up to a weight of 45 tons at the railway workshops at Paderborn.

Hastings.—May 18th. E.L. installation at several schools for the T.C. Borough Electrical Engineer, Earl Street.

Hindley.—May 18th. U.D.C. Four-core L.T. paper-insulated lead-sheathed armoured cable, c.i. joint boxes and feeder pillars. See "Official Notices" May 8th.

Keighley.—May 25th. Corporation. One 750-KW. converting plant, for A.C., three-phase, 6,600 volts to D.C. 500 volts. See "Official Notices" May 8th.

London.—Fulham. May 27th. B.C. 9,000 tons of coal for electricity works. See "Official Notices" May 8th.

St. Marylebone.—May 18th. B. of G. Wiring, complete, Infirmary at Rackham Street, Ladbrock Grove, W. See "Official Notices" May 8th.

Stepney.—The B.C. Electricity Committee. 2,000 tons of Welsh smokeless coal, steam and house coal and coke; 12 months' supply of meters, demand indicators, time switches and carbons.

Battersea.—B.C. Electricity Committee. Telpher plant for handling coal to be installed at Lombard Road generating station in place of present plant.

L.C.C.—May 19th. Supply of 160,000 tons of steam coal, for the generating station (Tramways Department), East Greenwich. Particulars from the Clerk to the Council, Spring Gardens, S.W.

June 4th. Installation, 760 wiring points, 900 lights; telephones, call and fire bells; at Furzedown Training College and Hostels, Tooting, S.W. See "Official Notices" to-day.

Hammersmith.—May 27th. B.C. Air-cooled static transformers, earthenware cable ducts. See "Official Notices" to-day.

Loughrea (Co. Galway).—May 30th. Gas engine and suction plant, dynamo and motor booster, storage battery, switchboard, overhead lines and street lamps, for Loughrea Electric Power and Lighting Co. See "Official Notices" to-day.

Maidstone.—May 15th. Corporation. 12 months' supply of coal for the electricity works. Forms of tender from the Electrical Engineer, Fair Meadow.

Manchester.—May 19th. Corporation. Electrical and engine-room stores for 12 months, for the Electricity Committee. Particulars from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Margate.—May 22nd. E.L. sign. Pavilion and Winter Gardens for the T.C. John E. Saxby, Entertainments Office, Pavilion.

Newcastle-on-Tyne.—May 20th. Electrical stores for six months, for the Tyne Improvement Commissioners. Forms of tender from the Engineer, Clarendon House, Clayton Street West.

New Zealand.—Wellington.—July 9th. City Council. Electric chassis for a 2,000-lb. parcels delivery van, and an electric car, for the Electric Tramways Department. Specification may be seen at the Board of Trade Commercial Intelligence Department in London.

June 1st.—Public Works Office. Oil-break switches for the Lake Coleridge hydro-electric power scheme. Specification can be seen at the Board of Trade Commercial Intelligence Department, London.

July 27th.—New Plymouth B.C. (2) Overhead wiring and permanent way (5 route miles). (3) Sub-station equipment (converting plant, battery, booster, switchboard, &c.). (4) Rolling stock (six complete cars) for electric tramways. Specifications from Mr. F. Black, Consulting Engineer, Wellington, or B. of T. Offices, London. Deposit (2) £4 4s.; (3) £2 2s.; (4) £2 2s.—*N. Z. Shipping and Commerce.*

Norway.—May 20th and 28th. Christiania Municipal Authorities. Copper wire and insulators for the H.T. electrical connection which is to be established between Kykkelsrud, Solbergfos and Christiania. Specification can be seen at the Board of Trade Commercial Intelligence Department, London.

Nottingham.—May 21st. (*a*) 650 tons of steel tramway rails; (*b*) 11 tons of steel tie bars. City Tramway Committee. Specifications, &c. (£1 1s. each), from Mr. A. Brown, City Engineer.

Oldham.—Corporation. Two 3,000-KW. high-pressure steam turbines and A.C. generators, with surface condenser, pumps, &c., water-tube boiler, feed pump, cooling towers. See "Official Notices" to-day.

Plymouth.—May 21st. Corporation. 9000 tons steam coal for use with mechanical stokers for the Electricity Department. Mr. E. G. Odell, Borough Electrical Engineer, Electricity Works, Prince Rock.

Salford.—May 18th. Supply, erection and maintenance of intercommunication telephones in the police department, Salford Town Hall. Specifications, &c., from the Borough Electrical Engineer, Frederick Road, Pendleton.

Shanghai.—May 28th. H.T. three-phase switchgear for a sub-station, for Municipal Council. See "Official Notices" to-day.

Spain.—May 30th. The municipal authorities of Bercero (Province of Valladolid) are inviting tenders for the concession for the electric lighting of the town.

Tunbridge Wells.—E.L. wiring at cemetery buildings, for the T.C.

Warrington.—May 26th. Corporation tramways. (1) 100 tons tram rails (Sandberg steel). (2) Special track work. Specifications, &c., from Tramways Manager, Car Sheds, Mersey Street.

Warwick.—June 1st. B.C. Manholes, chambers, sedimentation and storm-water tanks, and other works. See "Official Notices" to-day.

West Ham.—May 16th. Corporation. 15 double-deck bogie tramcars and one four-wheel single-truck double-deck tramcar. Specifications from Mr. J. S. D. Moffet, Tramways Manager, Greengate Street, Plaistow, E.

CLOSED.

Aberdeen.—The Corporation Tramways Committee has accepted tenders, amounting in all to £4,029, for the construction of the new car sheds, &c., at the King Street tramway depôt.

Australia.—Sydney.—The following tenders have been opened by the City Council :—

For paper-insulated cables :—

Siemens Bros. Dynamo Works, Ltd.	£431
B.I. & Helsby Cables, Ltd.	617
W. T. Henley's Telegraph Works Co., Ltd.	683
Noyes Bros., (Sydney), Ltd.	683
Western Elec. Co. (Aus.), Ltd.	737

For bare copper cable :—

Standard Cable Co. (Steffens & Noelley, Ltd.)	£5,217
B.I. & Helsby Cables, Ltd.	5,403
Grand & Vincent	5,632
W. T. Henley's Telegraph Works Co., Ltd.	5,756

—*Tenders.*

Bacup.—The Electricity and Tramways Committee has accepted the following tenders :—

W. T. Glover & Co., Ltd.—Cable for Todmorden Road and Tong Lane.
Simpson Bros. (Hapton), Ltd.—Supplying and fixing overhead distributor to Brandwood Quarries.

Barnsley.—The Education Committee has accepted the tender of Mr. Jas. Taylor for installing the E.L. at Park Road Schools, at £66 10s., Mr. A. Brown having withdrawn his accepted tender owing to an error.

Bedford.—The Education Committee has accepted the tender of Messrs. Wilton, for the electric lighting of Ampthill Road School, and that of Messrs. Bacchus, for the lighting of Clapham Road and Goldington Road Schools. The teachers, it is stated, are to be consulted as to where the lights shall be put.

Belfast.—The Corporation has accepted the tender of Messrs. Dick, Kerr & Co., for the reconstruction of the permanent way of the tramway undertaking during the year ending March 31st, 1915; also the tender of Messrs. Craig & Paton, Ltd., for maintaining the electrical installation in Ulster Hall for 12 months.

Belgium.—Seven concerns—one French, one Belgian, one Austrian, and four German—last week submitted tenders to the Belgian Post and Telegraph authorities for the supply and laying of a quantity of telephone cables in the Brussels district, the lowest offer (£8,820) being that of the Société Industrielle des Telephones, of Paris.

Bradford.—The Sites and Works Committee of the Bradford Education Committee has accepted the tender of Messrs. A. R. Farrar & Co., of Bradford, for electric lighting required at Odsal house, for £139.

The Electricity Committee has accepted the tender of the Phœnix Dynamo Manufacturing Co., Ltd., for three motors required for driving the new induced draught fans to be installed at the Valley Road Electricity Works, for £1,087.

Bridlington.—The T.C. has accepted the tender of Mr. J. V. Levett for electrical work on the new Spa during the coming season.

Burnley.—The Electricity Committee has accepted the following tenders :—

British Thomson-Houston Co.—Electric motors and starters for a year.
Phœnix Dynamo Manufacturing Co.—Two motor-driven pumps, £445.
Dorman Long & Co., Ltd.—Steel girders for foundations of the new central station plant, £70.
Galloways, Ltd.—Lancashire boiler, £555.
Siemens Bros.—Cable, £150.

Canada.—The Prince Rupert (B.C.) City Council has awarded a contract for power-house equipment to the Canadian General Electric Co., at $17,565.—*Canadian Engineer.*

Canterbury.—The T.C. has accepted the tender of Messrs. Wm. Corry & Son for Rochester house coal screenings for the E.L. works, at 18s. 4d. per ton.

Devonport.—The tender of Messrs. James Howden and Co., Ltd., for a 1,250-KW. Howden-Siemens turbo-alternator, and that of Messrs. Bruce Peebles & Co., Ltd., for motor converters, has been accepted by the Corporation.

Glasgow.—The T.C. Electricity Committee recommends the acceptance of the following tenders (the lowest in each case), for rotary converters for sub-stations :—

British Thomson-Houston Co., Ltd.—Three 1,000-KW. rotary converters, £6,472.
British Westinghouse Co., Ltd.—Three 500-KW. rotary converters, £3,799.

The following tenders for stores for the Electricity Department for 1913-14, are recommended :—

Cast-iron joint boxes, section pillars, &c.—Jas. Allen, sen., & Son; Carron Co.; Falkirk Iron Co., Ltd.; Lion Foundry Co., Ltd.; M'Dowall, Steven & Co., Ltd.
Wooden troughing and cover.—Brownlee & Co., Ltd.
Malleable iron tubes and fittings.—Scottish Tube Co., Ltd.
Single, concentric and triple-concentric cables.—Callender's Cable Co., Ltd.
Extra H.T. cables.—W. T. Glover & Co., Ltd.
Rubber-covered cables.—Craigpark Electric Cable Co.
Carbons.—Sloan Electrical Co., Ltd.
Carbons (yellow flame).—C. W. Webster.
Electricity meters.—Chamberlain & Hookham, Ltd.; Ferranti, Ltd.

The T.C. is to be asked by the Tramways Committee to approve of the following tenders for the year :—

Steel forgings for car trucks.—Brush Electrical Engineering Co.
Steel wheels.—John Baker & Co., Ltd.
Steel tires.—Brown Bayley's Steel Works, Ltd.
Steel axles.—Glasgow Railway Engineering Co., Ltd.
Bolts and nuts, &c.—Rivet, Bolt and Nut Co., Ltd.; P. & W. MacLellan, Ltd.
Chilled-iron brake bolts.—Miller & Co., Ltd.
Iron castings.—R. Howie & Co.; James Allen, sen., & Son, Ltd.; David King & Son.
Steel castings.—Dickson & Mann, Ltd.; Carntyne Steel Castings Co., Ltd.
Malleable-iron castings.—Alex. Shanks & Son, Ltd.
Rubber and asbestos goods.—North British Rubber Co., Ltd.; Rubber Co. of Scotland, Ltd.; J. T. Goudie & Co.; and Geo. M'Lellan & Co.
Springs.—G. Turton, Platts & Co., Ltd.; L. Sterne & Co., Ltd.
W.I. tubes and fittings.—Stewarts & Lloyds, Ltd.; Scottish Tube Co., Ltd.
Galvanised steel wire.—Wm. Bain & Co., Ltd.
Maintenance of weighing machines.—A. & W. Smith & Co., Ltd.
Iron and steel scrap (for disposal).—P. & W. MacLellan, Ltd.; David Smith.

The following other offers are also recommended :—

Glass floor round new turbine, Pinkston.—Maclean & Co.
Gold and aluminium leaf.—Philip Watson & Co., Ltd.
Step tread-plates.—W. C. Yuille & Co., Ltd.
Scrap lead and lead-covered cable (for disposal).—Trainer & Allison.
Scrap zinc, brass dust, motor field coils, dry cells.—R. M. Easdale & Co.
Scrap brass, copper and armature coils.—Pegler Bros.
Scrap V.I.R. cable.—Shearer Bros.
Scrap rubber.—John Wilson.

Gloucester.—The T.C. has accepted the following tenders for the electricity and tramways departments:—

B.I. and Helsby Cables, Ltd.—Cables, £630.
Gorton & Shapcott.—Coal bunkers, £129.
Conway, Jones & Co., Ltd.—Oils, turpentine, gold size, &c.
Tyne Metal Co., Ltd.—Brake blocks.
Vacuum Oil Co., Ltd.—Grease.
S. J. Vinson & Co.—Iron and brass screws.

London.—Messrs. Siemens Bros. Dynamo Works Co., Ltd., have received from the Controller of the Stores of the General Post Office, acceptance of their tender for the supply of "Wotan" drawn wire lamps embracing all types up to and including 50 c.p.

Manchester.—The Corporation Electricity Committee has accepted the following:—

Two sets of soot cleaning apparatus.—British Vulcan Soot Cleaner Co., Ltd.
L.T. switchboard for Stuart Street station.—Edison & Swan Co., Ltd.
Cable.—Western Electric Co., Ltd.
H.T. sub-station switchboard.—Electric Construction Co., Ltd.

The tender of Messrs. W. P. Theermann & Co., Ltd., for electric lighting at the Manchester Summerseat Special School, and also at the North Manchester Secondary School has been accepted by the Education Committee; for the electric lighting of the Heald Place Municipal School, the tender of Messrs. Doughty & Co. has been accepted.

Peterborough.—The T.C. has accepted the tender of Messrs. Ashton, Frost & Co., for piping for a new generating set, at £129.

Rotherham.—The E.L. Committee has accepted the tender of Messrs. Herbert Morris, Ltd., at £309, for an overhead crane at the Electricity Works; also the tender of Messrs. W. Thornton & Son, at £1,566, for extending the buildings at the generating station.

Salford.—A 28-35 H.P. Daimler chassis is to be purchased from Mr. E. Hardinge, at £75, for the tramways overhead equipment department.

Torquay.—The T.C. has accepted a tender of Messrs. Babcock & Willcox, at £3,352.

Tunbridge Wells.—The T.C. has accepted the following tenders for coal for the Electricity Works:—

Harris, Hardman & Co., Ltd., up to 2,000 tons Scotch peas, 16s. 4d. per ton.
Medway Coal Co., up to 1,000 tons South Hetton coal, 17s. 4d. per ton.
Cory & Sons, up to 1,000 tons washed peas, 16s. 4d. per ton.

Walsall.—The Corporation has accepted the following tenders:—

British Westinghouse Co.—Switchboard extension panel, £41.
Walsall Electrical Co.—Switchgear at three sub-stations, at £45, £46 and £16 respectively.

Wolverhampton.—The Corporation has accepted the tender of the Electric Construction Co., Ltd., at £181, for motors.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued:—

Friday, May 15th.—"D" Company. Infantry drill, 7.30 to 8.30 p.m. Technical instruction, 9 to 10 p.m. Miniature range instruction, 8.45 to 9.30 p.m.

Saturday, May 16th.—All Companies. Annual course of musketry at Purfleet Rifle Ranges. Members should notify early on the postcards supplied the date on which they intend to fire; every endeavour should be made to fire as early as possible. Headquarters will be open for regimental business from 10 a.m. till 12 noon.

Monday, May 18th.—"A" Company. Infantry drill, 7 to 8 p.m. Technical instruction, 8.15 to 10 p.m.

Tuesday, May 19th.—"B" Company. Infantry drill, 7 to 8 p.m. Technical instruction, 8 to 10 p.m.

Wednesday, May 20th.—All Companies. Rating examination, 7 to 10 p.m. Annual course of musketry, Purfleet Rifle Ranges.

Thursday, May 21st.—"C" Company. Infantry drill, 7 to 8 p.m. Technical instruction, 8 to 10 p.m.

Friday, May 22nd.—"D" Company. Infantry drill, 7 to 8 p.m. Technical instruction, 8 to 10 p.m.

Saturday May 23rd.—Headquarters will be opened from 10 a.m. till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

The Centenary Exhibition of Norway.—To-day, May 15th, an Exhibition is being opened at Kristiania. It is one of the largest and most important features of the festivities with which it is intended to celebrate the dissolution of the Union with Denmark in 1814. This Exhibition is of a strictly national character, and may possibly for this reason be more interesting, because it will present a picture of the whole country and the stage of development which it has reached. The Exhibition comprises an area of 500,000 square metres, and the Industry Hall alone covers an area of 11,000 square metres. There are in all 10 sections, that devoted to the electrical and electrometallurgical industries being the most likely one to interest electrical visitors from abroad. The Exhibition will be closed on October 15th.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, May 15th. At 8 p.m. At 39, Victoria Street, S.W. Lecturette on "A Few Notes on the Design of Surface Condensing Plant," by Mr. W. [illegible].

Saturday, May 16th. At 2.30 p.m. Visit to Southwark Bridge Widening Works.

Monday, May 18th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "[illegible] Transformers, their Design and Application," by Mr. [illegible].

Friday, May 22nd. At 8 p.m. At 39, Victoria Street. Discussion on "The Neglected Steam-Car," lead by Mr. R. [illegible].

(North-Western Section).—Thursday, May 21st. At 7.15 p.m. At Java Cafe, 26, Corporation Street, Manchester. Paper on "Pattern Making," by Mr. T. R. Schofield.

Institution of Electrical Engineers (Newcastle Students' Section).—Monday, May 18th. At 7.30 p.m. At Armstrong College. Annual general meeting and smoking concert.

Royal Institution of Great Britain.—Thursday, May 21st. At 3 p.m. At Albemarle Street, W. Lecture (II) on "Identity of Laws in General and Biological Chemistry," by Prof. Svante Arrhenius, Hon. F.R.S.

Chemical Society.—Thursday, May 21st. At 8.30 p.m. At Burlington House, Piccadilly, W. Ordinary meeting.

Illuminating Engineering Society.—Thursday, May 21st. At 7.30 p.m. At Royal Society of Arts. Paper on "The Nomenclature and Definitions of Photometric Quantities," by Mr. A. P. Trotter.

Physical Society.—Friday, May 22nd. At 5 p.m. At Imperial College of Science, South Kensington. Ordinary meeting. Papers "On a Null Method of Testing Vibration Galvanometers," by Mr. S. Butterworth, "Experiments with an Incandescent Lamp," by Messrs. C. W. S. Crawley and S. W. J. Smith, and other subjects.

Association of Engineers-in-Charge.—Saturday, May 23rd. Visit to Leiston Works, Leiston, Suffolk.

NOTES.

London Association of Foremen Engineers.—The 61st annual banquet of this Association was held on Saturday, May 2nd, at the Cannon Street Hotel. Over 300 were present including Mr. W. B. Bryan, chief engineer, Metropolitan Water Board (chairman), Sir W. H. Dunn, alderman and lieutenant, City of London, Mr. G. W. Humphreys, engineer, L.C.C., Sir G. R. Askwith, Judge Atherley Jones, Sir George Riddell, and representatives from kindred associations in other cities.

A most enjoyable evening was spent, everyone being in jovial mood. The musical programme was excellent and the songs of Mr. Clifton Yates and the humour of Mr. Ben Osborne were much appreciated, while Mr. Alderton the campanologist exhibited quite a fairy touch, and even "old boys" joined in the chorus of Miss Elsie Redfern's encore. Mr. W. B. Bryan, the chairman, referred to the Association's history of 62 years and its growth from 188 members in 1853; he announced that Mr. Walmisley, the Dover Harbour Board engineer, was making arrangements for an early visit to the works with which he is associated.

It is well to remember that this Association was established for bringing together just that class of men who are really responsible for the character of the machinery and products turned out by their respective firms. The draughtsman must work out designs not by himself, but largely by the aid of the shopmen who should be able to influence design to the extent of suiting this to the shop equipment. And to the shop foremen attaches the responsibility for the good or bad behaviour of the machinery thus made. But not only is this a technical association, it is also benevolent and gives aid to aged or incapacitated members. Kindred associations exist in Leeds, Middlesbrough, Newcastle, Woolwich Arsenal, Birmingham, Glasgow and West of Scotland, and Nottingham. The secretary is Mr. Jas. Harrington, 85, Salisbury Road, Harrow.

Foreign Trade in April.—The following are the electrical and machinery figures given in the official returns for April:—

	Month of April	*Inc. or dec.*	*Four months, 1914.*	*Inc. or dec.*
	£	£	£	£
IMPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	123,658	− 8,148	553,387	+ 47,242
Machinery	749,647	+ 71,408	2,717,862	+205,731
EXPORTS.				
Electrical goods and apparatus, excluding machinery and uninsulated wire ...	282,612	− 93,417	1,046,121	− 870,164
Machinery	2,994,339	−350,255	12,984,287	+1,049,630

The Easter holidays fell in March last year, so that the figures for April, 1914, are for three working days less than those for the corresponding month of 1913.

Fatality.—Our correspondent states that the death occurred in hospital at Cape Town, on April 18th, of a young coloured man named J. P. Fortuin, who had met with an accident at Salt River a few days previously. It appears that the deceased was in the employ of the Tramway Co. Whilst working on the top of a repair trolley wagon he received a shock from a live wire, and, losing his balance, fell to the ground, sustaining a fractured skull and other injuries. He never recovered consciousness.

E.T.U. Dance.—A social and dance, which is to be made one of the annual functions in connection with the Belfast Branch of the Electrical Trades Union, was held on Thursday evening last week. The Belfast Branch has now a membership of nearly 300. The dance was held in aid of one of the members, who, for a considerable time, has been laid aside through illness.

Institution and Lecture Notes.—The Association of Supervising Electricians.—A general meeting was held at St. Bride's Institute, London, E.C., on May 7th, and considered the rules which had been formulated by a Committee appointed at the inaugural meeting. It was decided that the headquarters should be at St. Bride's Institute. The membership of the Association is confined to foremen, supervising engineers and managers in the electrical contracting trades, and the intention of the founders to admit only men of undoubted qualifications is safeguarded by the appointment of an investigating committee, acting directly under a board of control. A subscription of 10s. per annum, payable 2s. 6d. quarterly in advance, with an entrance fee of 5s. on nomination, was decided upon for London members; country members who permanently reside and whose business address is outside a 20-mile radius of headquarters, are admitted at 5s. per annum, payable in advance. Honorary members are eligible at a subscription of not less than one guinea per annum. It was resolved that a Benevolent Fund should be formed, and honorary members' subscriptions and all special donations should be placed to a reserve fund available for the benefit of members requiring assistance. It was also decided to keep a register of vacant situations, and to insert advertisements in the trade journals for all members when out of employment. Letters were read by the secretary from firms inquiring for capable charge hands. A resolution was unanimously passed that the Association should not take part in any trade disputes.

The general rules, together with nomination papers, may be obtained from the Honorary Secretary, 14, Pulborough Road, Southfields, S.W. The objects of the Association are as follows:—

To assist members in obtaining information of situations.

To form a technical library for the use of the members.

To form a benevolent fund for the assistance of members in distress.

To endeavour by means of lectures and visits to large works to maintain a high standard of efficiency of all members.

To foster the apprentice system for learners in the electrical trade.

To endeavour to extend the attendance of electrical workers at evening schools, both technical and practical.

To arrange for the reading of papers on electrical subjects by members or visitors invited from other societies.

To arrange periodical social gatherings to promote knowledge and good fellowship amongst members.

Institution of Electrical Engineers (Birmingham Local Section).—The report of the Committee for the Session 1913-14 shows that the membership amounts to 437, a reduction of 10. The Committee elected for the new Session is as follows:—

Chairman, Dr. A. H. Railing.

Vice-chairmen, Dr. W. E. Sumpner and Col. J. F. Lister.

Ordinary members of Committee:—Messrs. S. T. Allen, G. Barnard, F. W. Carter, H. Foulds, C. C. Garrard, S. H. Holden, H. R. Hudson, A. Home-Morton, N. B. Rosher, F. W. Schiller, C. M. Shaw, T. F. Wall, A. Willmott.

Honorary secretary, J. D. Morgan.

At the annual meeting of the Scottish Local Section in Glasgow the following office-bearers were appointed for the ensuing year:—Chairman, Mr. James Lowson; vice-chairman, Mr. David A. Starr; hon. secretary, Mr. Joseph Taylor: assistant hon. secretary, Mr. W. F. Mitchell; and to vacancies on the Committee, Prof. MacCormack and Messrs. James E. Sayers and W. F. Mitchell.

Institute of Metals.—The annual May lecture of the Institute was delivered by Prof. E. Heyn, of Berlin, on Tuesday last. In his lecture the author dealt specially with the internal strains produced by the cold working of metals (cold-drawing, cold-rolling, cold-hammering, &c.). He showed that by these operations under unfavourable conditions internal strains might be set up in structural members which came close to their resisting power, so that even trifling additional strains caused by external forces or other circumstances (scratching of the surface, unequal heating or cooling, slight corrosion by certain agents which were contained in the atmosphere or by certain paints) might lead to unforeseen fracture. He discussed the means for removing or diminishing such dangerous internal strains, and illustrated his lecture by numerous samples taken from the domain of practical engineering.

Victorian Institute of Electrical Engineers.—On March 26th the annual meeting of the Institute was held at Melbourne; the Council reported that the membership was 189, and the balance-sheet showed £125 to credit. Prof. Payne was elected President, Messrs. W. H. Alabaster and F. A. M'Carty vice-presidents, and Mr. E. H. W. Westwood hon. secretary.

Institution of Civil Engineers.—On Tuesday the annual dinner was held in the Great Hall of the Institution; Mr. A. G. Lyster, President, was in the chair, and there were about 200 diners.

Association of Mining Electrical Engineers.—At the annual meeting of the East of Scotland Branch on Friday last at Dunfermline, office-bearers were elected for the ensuing session as follows:—President, Mr. Neil A. Wilkie, Bowhill Colliery; vice-President, Mr. H. J. Humphrys, H M. Inspector of Mines, Dunfermline; Secretary and Treasurer, Mr. R. W. Peters, Lochgelly. It was announced that the membership of the Branch now stood at 65, while there was a substantial credit balance.

Royal Society.—On Wednesday the annual conversazione of the Royal Society took place, the President, Sir William Crookes, receiving the visitors. The exhibition of apparatus included but a few items of electrical interest; we will refer to these in a later issue.

At the meeting last week Sir Joseph Larmor read a paper on lightning rods, in which he suggested that the top of the building itself, not of the lightning conductor, attracts the discharge; and the function of a single rod can only be to lead it more safely away. But a number of rods distributed over the roof and effectively connected to earth by a conductor, can lift the most intense part of the field from the top of the building to the region around their summits, and so obviate or mitigate the danger of discharge from above to the building which they cover. —*Times.*

The Association of Engineers-in-Charge have made arrangements with Messrs. Richard Garrett & Sons, Ltd., to visit their engineering works at Leiston, Suffolk, on May 23rd.

Standardisation of Electricity Supply in China.—The Committee appointed to consider the above subject has arrived at the following decisions and recommendations:—

Generation and distribution generally shall be on the three-phase system at 50 or 60 cycles per second.

Distribution shall be carried out generally on the four-wire three-phase system with grounded neutral at a pressure of 250 volts between one phase and neutral, *i.e.*, 440 volts (approximately) between phases.

The standard pressure for domestic lighting and similar supply shall be 250 volts.

When it is not desirable or economical to use a four-wire three-phase supply, then a three-wire system with neutral grounded, or a two-wire system with one side grounded, shall be adopted; in all cases the pressure to ground shall be 250 volts.

The use of direct-current systems shall not be allowed over 50 kw.

No fuses or switches shall be allowed in the neutral wire.

Where direct-current systems are essential, the generation and distribution shall be on the three-wire system at 500 volts between outers, the neutral being grounded.

The following pressures shall be considered as standards for high-tension transmission:—

2,200 volts, 3,300 volts, 6,600 volts. Pressures above 6,600 volts to be as required by local and other conditions.

The decision to allow both 50 and 60 cycles as standard frequencies was arrived at as it was considered that a single standard of 50 cycles would not receive support from American manufacturers, and the use of 60 cycles would allow of cheaper plants where first cost was of paramount importance.

Practically all cities in China having electric supply systems use overhead mains, almost to the exclusion of underground cables.

A Torpedo in Shoreditch.—On Monday last, at the invitation of Mr. C. Newton Russell, borough electrical engineer, we attended a demonstration of the half-ton "Torpedo" electric van at the Coronet Street works. This is a light three-wheeled vehicle, with the motor mounted in the hub of the front wheel, as described in our issue of October 31st, 1913; it is exceedingly handy for manœuvring in traffic, and capable of tackling gradients up to 1 in 8 fully loaded. We understand that eight such vehicles are being used by a firm of dairymen in the West End, in the charge of unskilled drivers; the working range is 50 miles a day, and the cost of energy is trifling—the whole cost of maintenance, it is stated, including upkeep of battery and tires, as well as energy and repairs, is well under 2d. a mile. We are glad to see the battery vehicle movement being fostered by the municipal authorities, and trust that Mr. Russell will soon have many of the vehicles charging from his mains.

Electrical Extraction of Benzin from Coal.—A new electrical process for extracting benzin from coal has recently been invented by a Swedish engineer, Mr. Vidstrand, of Stockholm; the costs of manufacture are said to be considerably lower than those of the methods now employed. The product is said to be as good as any other fuel for motor-cars. The process has been patented in 18 countries, and the inventor is carrying on negotiations with a group of Norwegian financiers with the view of disposing of the patent rights for Norway. It is the intention to form a company for the purpose of erecting a large manufactory in a suitable place, where sufficient energy is available for carrying on the manufacture on a large scale.

Association of Consulting Engineers (Inc.).—The annual general meeting of this Association will be held at Caxton Hall, Westminster, on Monday, May 25th, at 4.30 p.m., when the report of the committee and the accounts for the past year will be presented.

B.E.A.M.A. Resignation.—The Union Electric Co., Ltd., of Park Street, S.E., notifies that it has decided to resign its membership of the British Electrical and Allied Manufacturers' Association, and accordingly has so notified the secretary of the Association.

Railway Employés visit Germany.—Under the auspices of the A.E.G., of Berlin, about 40 workmen of all ranks employed by the L.B. and S.C. Railway left for Germany on Wednesday evening, to study the electrical development in that country, and the organisation and shops of the A.E.G., in Berlin.

Educational Notes.—The members of the University of Birmingham Engineering Society concluded their annual special visit by visiting, on May 1st, the engineering works of the Edison & Swan United Electric Light Co., Ltd.

Inquiry.—A correspondent wishes to hear from makers of specially light dynamos with laminated fields.

Walking Race.—The first annual 20 miles road walking championship of the Hackney Walking Club was held on Saturday (May 9th) over a measured course, starting and finishing at Edmonton milestone "7 to London." Eight entered and started amongst the prominent members who failed to enter being S. H. Smith, W. L. Dawson, and A. R. Edwards, but as the winner, H. V. Wallington, beat the course record of 3 hr. 19 min. 8 sec. put up by Smith on Boxing Day, his title as first champion cannot be disputed. At half distance Newstead led Wallington by 41 sec. in 1 hr. 37 min. 31 sec., Gregory being third. Shortly after this Wallington took the lead, which he retained to the finish, Gregory being a very creditable second. Result :—H. V. Wallington (Harringay), 3 hr. 17 min. 40 sec. first; H. Gregory (Crypto Electrical Co.), 3 hr. 20 min. 57 sec., second; O. H. Malivoire (Crypto Electrical Co.), 3 hr. 33 min. 38 sec., third; E. F. Newstead, (Ilford), 3 hr. 42 min. 57 sec., fourth; S. C. Haynes (Associated Fire Alarms, Ltd.), 3 hr. 48 min. 5 sec., fifth. E. A. Root and L. G. Short retired at 7 miles, and A. E. Brennan at 16 miles. Newstead, who finished fourth, has a very nice style, and with Wallington, Smith, Gregory, Malivoire, Newstead and others all in the Whit Monday walk to Southend, an excellent race is promised.

The Smoke Nuisance.—The President of the Local Government Board has appointed a Departmental Committee "to consider the present state of the law with regard to the pollution of the air by smoke and other noxious vapours and its administration, and to advise what steps are desirable and practicable with a view to diminishing the evils still arising from such pollution. The Committee will include, amongst others, the Right Hon. Russell Rea, M.P., Lord Newton, Capt. H. R. Sankey, Mr. B. Duncomb Sells and Sir Aston Webb, with Mr. E. A. Faunch, of the Local Government Board, as secretary.

Strike at Keighley.—Our local correspondent writes :—"In connection with the strike of engineers at Keighley there appears to be a disposition on the part of some firms affected to grant the concessions asked for by the men. Following the lead of Messrs. Summerscales, Ltd., the Keighley Engineering Co. have acceded to the men's demand, and the workers have returned to their employment."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Stockport Corporation, upon the recommendation of the Electricity Committee, has appointed Mr. R. H. Lee, the resident engineer, as chief assistant engineer.

Mr. G. F. Naylor, who was provisionally appointed Nelson's electrical engineer and tramways manager some 12 months ago, has now been given the position at a salary of £250 per annum.

On the recommendation of the Electricity Committee, the Weymouth T.C. has decided to increase the salary of Mr. Baker, of the electricity staff.

Mr. F. Barlow has resigned his position with the Salford Corporation as superintendent of the electrical testing and motor department, to take up a position on the staff of Messrs. Crompton and Co., Ltd., at their Manchester branch.

On Tuesday the Walsall Corporation confirmed the appointment of Mr. H. A. Howie, chief assistant electrical engineer at Sheffield, to the position of Corporation electrical engineer, in succession to Mr. A. S. Barnard (recently resigned), at £500 per annum.

Mr. M. H. Vipond, assistant mains engineer at the Leith Corporation electricity works, has been appointed mains engineer to the Worksop Corporation electricity works, and takes up his new duties on 19th inst.

Tramway Officials.—The Highways Committee of the L.C.C. recommends that the services of Monsieur A. Mariage, Directeur-General, Compagnie Generale des Omnibus de Paris, be obtained to assist the Council with regard to the schemes which have been prepared for the consolidation and linking-up of the Council's tramways. The conditions attaching to passenger traffic in Paris approximate as nearly as possible to those which obtain in London. The cost to the Council for the services of M. Mariage (including an assistant at £75) will be £325.

The York Corporation has appointed Mr. J. W. Horton, Walsall, to the position of tramway traffic superintendent.

The salary of Mr. C. Burgess, manager of the West Hartlepool Corporation Tramways, has been advanced by £50, from £200 to £250 per annum.

Mr. Rees Gordon Rees, overhead superintendent of the Rhondda Tramways Co., Porth, who is taking up a similar position at Bolton, has been presented by the staffs with a purse of gold, an ebony walking stick, and a case of brushes.

On Saturday evening last Mr. William McHugh, who has been appointed chief accountant in the Dublin United Tramways Co. in place of the late Mr. James Pollock, was entertained to dinner in the Imperial Hotel, Dublin, by the members of the official, electrical and traffic staffs.

Derby T.C. has increased the salary of Mr. F. Harding, tramways manager, from £300 to £350 per annum.

Mr. H. J. Nesbitt, general manager to the Rhondda Tramways, Ltd., Porth, who is leaving for Torquay, has been presented by the staff with a rose bowl.

General.—On Saturday last, at the annual meeting of the South Wales Branch of the Association of Mining Electrical Engineers, Mr. Sydney F. Walker was presented with a testimonial, in the shape of a gold watch, by the members of the branch, "as a token of their esteem and respect," in connection with his presidency for the first four years of the existence of the Association. The watch was presented by the president of the Branch, Mr. Godfrey Williams, of Aber Pergwm, a large colliery owner in Glamorganshire.

It is stated that Mr. C. S. Gilman, who recently resigned the managership of the Accident Branch of the Norwich Union Fire Insurance Society, has been appointed a director of the Westminster Electric Supply Corporation, Ltd.

Mr. George Nicolson, chief assistant electrical engineer, Weymouth, has been awarded the "Cecil" Silver Medal and £5 prize by the Dorset Field Club for his essay on "The Utilisation of Natural Forces for the Economical Production of Electricity for Lighting, Heating and Domestic Purposes, having Special Reference to Dorset and the Neighbouring Counties." This is the second time Mr. Nicolson has been awarded this distinction.

Mr. W. J. P. Orton, late assistant superintendent to the switchgear and control department of the British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, has been appointed manager of the switchgear and transformer department with Messrs. Johnson & Phillips, Ltd., Charlton.

Mr. R. Blackmore, engineer-in-chief of the Stalybridge Joint Tramways and Electricity Board, has been appointed consulting electrical engineer to the Oldham Corporation.

Obituary.—Mr. O. Jones.—The death is notified of Mr. Oscar Jones, head of the firm of Oscar Jones & Co., electricians, High Street, Beckenham. Deceased was 41 years of age.

M. Paul Heroult died on Saturday last in his 53rd year. As the inventor of a process for the electrical manufacture of aluminum in 1887 he first attained to fame; continuing his work as an engineer and metallurgist, he invented the electric arc furnace for the manufacture of steel which bears his name, and which has become widely used by steel works.

Will.—The late Mr. J. F. Macartney (Macartney, McElroy & Co , Ltd.), left £64,984 net personalty.

CITY NOTES.

Shanghai Electric Construction Co., Ltd.

The accounts for the year 1913 show a profit of £34,726, compared with £24,728 for 1912. Including £1,974 brought forward, the total standing to the credit of profit and loss account before making any appropriations was £36,700. There has been transferred to reserve for renewals account £10,000, and there has been applied in reduction of the preliminary expenses account £3,000, leaving a disposable balance of £23,700. A dividend of 7 per cent. for the year (less income tax) is recommended, absorbing £22,400, and leaving £1,300 to be carried forward.

The loss by exchange on subsidiary coinage in 1913 was £25,881, which is over 8 per cent. on the capital. Two new motor cars and 10 new trailer cars were brought into use last year. Including these, 15 motor cars of a new type have been completed and brought into use. A further 10 motor cars and 15 trailers will shortly be ordered, and it is anticipated that some or all of them will be ready in time to deal with the heavier traffic which usually occurs during the second half of the year. The original equipment, which consisted of 65 motor cars, will then have been increased to 90 motor cars and 55 trailers. The delay in initiating railless traction in Shanghai has been disappointing. Under the terms of the contract for the supply of the cars, a date for delivery was fixed which should have permitted of the service being started during March. None of the seven cars has, however, yet been shipped. The contractors are under penalties. After lengthy negotiations with the Municipal Council, revised rates for electric current purchased by the company from the Council were agreed, with effect from 5th March, 1913. The new scale shows a material reduction from the rates previously paid by the company. The benefit of the revision, so far as the past year is concerned, has been incorporated in the accounts now submitted. Through running over the company's system and that of the French company has been in operation throughout the year, and about 30 per cent. of this company's receipts were derived from through cars. It is expected that the through services will be increased shortly. Mr. R. S. Portheim offers himself for re-election as a director.

The meeting was held in London yesterday.

New British Ever-Ready Co., Ltd.—The directors announce a second interim dividend at the rate of 7 per cent. per annum on the preference shares for the half-year ended March 31st.

Constantinople Telephone Co.

The directors' second annual report, which is to be submitted at the annual meeting at Constantinople on June 4th, states that during the year ended December 31st, 1913, the installation work proceeded steadily, despite delay occasioned by the non-delivery of material and stores in consequence of the war. Owing to this cause, it became necessary to obtain an extension of the period of construction fixed by the Convention, and on October 16th, 1913, official sanction was obtained to postpone the opening of the service at the three large exchanges at Stamboul, Pera and Kadikeuy until February 28th, 1914, and of the smaller exchanges until one year from that date. By the date arranged, February 28th, 1914, the three principal exchanges were successfully opened for public service, and reports from the general manager bear most gratifying evidence of the growing popularity of the service, which the directors are satisfied will rapidly develop. They regard the success of the undertaking as absolutely assured, and already it has become necessary to make arrangements to increase the plant in the Pera exchange. It is anticipated that all present subscribers will be connected up, and the sub-exchanges opened, by the end of October, 1914. The submarine cables across the Golden Horn and the Bosphorus in order to give junction service were successfully placed in position before the opening of the exchanges, and the submarine cable work which was necessary to connect up the islands in the Marmora has also been finished. Three large exchange offices have been built on sites purchased by the company. Of these Stamboul has switchboard equipment for 3,560 subscribers' circuits, and can be extended to take over 8,000. Pera exchange has switchboard equipment for 4,100 circuits, and Kadikeuy 1,600 circuits, and in both of these there is room for extension. Each of these buildings is of ferro-concrete, specially designed and constructed for telephone service, thoroughly modern and fire-resisting. Land has also been purchased at each of the places where sub-exchanges are to be opened and buildings particularly adapted for telephone service have been erected thereon. The work of manufacturing the switchboards for these sub-exchanges is already well advanced, and installation will commence almost immediately. At the opening of the service on February 28th, 1914, the company had obtained orders for 4,318 stations, and since then the rate at which new orders have been received has materially increased. At the end of March, orders for 4,605 stations had been obtained. A satisfactory staff of operators has been organised, and an operating school has been opened at the Pera exchange. The company's relations with the authorities continue to be most friendly, and the directors bear testimony to the excellent work performed by the general manager and the staff during the year. In order to raise additional capital, the directors offered for subscription £200,000 6 per cent. obligation bonds in February last, and by this means obtained the required working capital.

Chiswick Electricity Supply Corporation, Ltd.

The report of the directors for 1913 states that the returns from the undertakings owned by the corporation continue to make progress, and the increase in the number of consumers added during the year is satisfactory. During the year £1,924 has been expended on capital account, and £312 has been written off for depreciation.

Year.	Consumers.	Revenue.	Profits.
1911	2,237	£16.338	£7,863
1912	2,418	£18,322	£7,902
1913	2,606	£19,440	£8,243

The profits for the year after paying sinking fund premium and trustees' fees were £8,243, out of which interest on first mortgage debenture stock amounting to £3,600 has been paid, leaving £4,643 to the credit of the net revenue account. The increase in the revenue is £1,118, and in the profits £341. This disproportionate result is chiefly due to the very high cost of fuel, while the assessment for rates has again increased on the Chiswick undertaking. The Diesel engine, which was installed at Chiswick at the end of the year, is taking its full share of the load, and will effect a considerable saving in the cost of fuel during the current year. Out of the above £4,643 the directors propose to write off the preliminary expenses, amounting to £543, to pay a dividend on the shares at the rate of 6 per cent. for the year, and to carry £333 to depreciation reserve fund account.

Calcutta Electric Supply Corporation, Ltd.—The directors recommend the payment of a final dividend on the ordinary shares of the company, for the six months ended December 31st, 1913, at the rate of 11 per cent. per annum, making 9 per cent. for the year. The dividend is payable on 28th inst. £42,000 is placed to the credit of the depreciation and renewals fund, £5,000 to reserve, and £7,447 will be carried forward.

Insurance Amalgamation Dropped.—According to the *Financial Times* the National Boiler and General Insurance Co. has issued a circular announcing that the proposed amalgamation of that company with the London and Lancashire Fire Insurance Co., Ltd., has been abandoned.

Mirrlees, Bickerton & Day, Ltd.—The directors recommend a dividend of 7½ per cent. on the ordinary shares for the year ended March 31st.

Hindhead & District Electric Light Co., Ltd.

In their report for 1913, the directors record the death of Mr. John Grover, the founder and chairman of the company. Mr. Wm. C. Marshall has been appointed chairman. Extensions of mains have been made, and the total length is now about 31 miles. The number of units sent out on the mains has increased by 23,380 units. During the year £2,070 has been received on account of share capital. The total receipts, including meter rents, amount to £4,196, as compared with £3,611 in 1912, and £3,186 in 1911. The net profit, after deducting all expenses, including the cost of considerable renewals to the Diesel engines, amounts to £2,378, as against £2,071 in 1912. The final dividend for last year has been paid. Debenture interest, income-tax, and an interim dividend of 2½ per cent. have been paid; £717 has been added to depreciation account, increasing the total written off to £8,305, and £100 has been written off goodwill account. Including £246 brought forward, there remains £1,045. The directors recommend a final dividend of 3½ per cent. for the half-year (making a total of 6 per cent. for the year), absorbing £766, and leaving £279 to be carried forward.

At the annual meeting held at the end of April, the Chairman (Mr. W. C. Marshall) said that the profit and loss account showed under receipts an increase of £584, or 16 per cent. In regard to the increase in working expenses fuel was £132 more, and repairs cost £124 more than in 1912. The extra amount for repairs was more than accounted for by the re-lining of the Diesel engines, which cost £230. The chairman said that there was no reason to anticipate any check to the progress of the company.

British Thomson-Houston Co., Ltd.

The directors' report for 1913 states as follows:—

Works at Rugby.—The buildings and machinery of the company have been maintained in first-class condition during the year. The one-storey building to be used for the manufacture of heavy apparatus, mentioned in the last annual report, is very nearly completed, and some of the machinery installed, and the pattern storage building, which was also referred to, has been completed, and is now in use.

Works at Coventry.—There have been no new developments at these works during the year under review.

Works at Willesden.—It was stated in the last annual report that the manufacture of switchboards and appliances for the same would be concentrated in the Willesden factory. This was carried out during the summer of 1913, with satisfactory results. This factory is admirably adapted for the purpose, and is now in full operation.

Metallic-filament Lamps—The most important advance made in this department during the year has been the introduction of the gas-filled incandescent lamp with drawn-wire filament, now generally known as the "half-watt" lamp. This invention was made in the research laboratories of the General Electric Co., of Schenectady, New York, from which company the British rights were acquired.

During the year under review the orders received by the company showed a large increase over the previous year, resulting in a marked improvement in the company's profits.

The profit for the year, after deducting all expenses and charges other than interest on debenture stock and loans, was £121,508, plus £8,590 brought forward; the amount paid for interest on the debenture stock and loans during the year was £53,054, leaving a net profit of £77,044. Of this amount the directors have thought best to appropriate for depreciations and reserves £64,100, so as to further strengthen the company's position, and carry forward £12,944 to new account.

Under the terms of the trust deed securing the issue of the company's debenture stock, the company has this year to pay to the trustees the sum of £4,452, to be applied by them in redeeming debenture stock at 105 per cent. by drawings. Since the closing of the books the debenture stock of the par value of £4,240 has been redeemed, making the total par value of stock retired to date £25,785, and leaving a net amount outstanding at the date of this balance sheet of £186,215. The amount outstanding at December 31st, 1913, was £190,455.

The directors have followed their usual practice in making reserves to cover risks in connection with bad debts, depreciation of shares held by the company and other contingencies.

During the year Mr. O. Oliven retired from the board, and the vacancy thus created has not been filled.

West London and Provincial Electric Supply Co., Ltd.—The report of the directors for 1913 states that the accounts, including the dividends on the shares of the Chiswick Electricity Supply Corporation, Ltd., the whole of which are held by the company, and revenue from other sources show a balance at the credit of the profit and loss account in the balance-sheet of £3,454. It is proposed to apply this balance to writing off the preliminary expenses, amounting to £483, and to the payment of a dividend on the cumulative preference shares at the rate of 6 per cent. per annum for the year.

Algeria.—The Compagnie des Tramways Electriques de Constantine is the name of a company which has lately been formed in Constantine, with a capital of £20,000, to construct and work a short electric tramway in that town.

Lisbon Electric Tramways, Ltd.

The directors report that the result of the company's operations for 1913, after deducting interest and amortization due on the debentures of the "Companhia Carris de Ferro de Lisboa" and after the payment of £25,650 for interest on and redemption of the debentures of this company and also the payment of London office expenses and directors' remuneration, shows a net profit of £103,686, plus £1,637 brought forward. From this amount £35,000 has been placed to depreciation reserve and £5,000 to the credit of exchange reserve account. After providing for the above there remains an available balance of £65,321, out of which the usual preference dividend, amounting to £25,533, has been paid. A final dividend of 3 per cent. is recommended on the ordinary shares, making 6 per cent. for the year. £1,719 has been carried forward.

No further labour troubles have arisen during the year to affect the operation of the tramways, but the fall in the average value of the rate of exchange from 48½d. to 46.199d. has reduced the profits by approximately £5,700. During the year further improvements and extensions have been carried out in the power house which will shortly be finished. The work of reconstructing and electrifying the lines of the Nova Companhia dos Ascensores Mechanicos de Lisboa, in which this company holds a considerable interest, was begun in 1913 and is now being proceeded with, and satisfactory progress has been made. It is anticipated that all the lines of that system will be in operation before the close of the present year. Since 1905 the company has held an option of purchase on the Santa Justa Elevador, which has hitherto been worked under an agreement of lease. It was considered advisable to exercise this option in 1913 and the purchase was accordingly carried out. Further negotiations were carried on during the year with the municipality in order, if possible, to arrive at a settlement as to the interpretation of certain clauses in their contracts, but no final solution has so far resulted. The board regret to announce the death of the General Manager, Mr. A. S. Giles, which occurred last October. Mr. Alfred Oscar Kolkhorst has been appointed to succeed him as general manager and chief engineer. He was previously general manager of the Chilian Electric Tramway and Light Co. in Santiago, and comes to the company with a great experience in tramway management. The board record their appreciation of the services rendered by the directors of the local board in Lisbon and by the entire staff.

The annual meeting was held in London on Wednesday.

Electric Construction Co., Ltd.

In accordance with the resolution passed last year, the accounts now submitted cover a period of ten months only, and the net profit (after providing £5,667 for debenture interest and £5,000 for depreciation) is £27,126. Including £6,899 brought forward there is available for distribution £34,025. Deducting the interim dividend of 7 per cent. per annum on the preference shares paid 1914, £2,197, there remains £31,828, and the directors now recommend a dividend at the rate of 7 per cent. per annum on the preference shares for four months ended 31st March, 1914, £1,465, dividend at the rate of 6 per cent. per annum on the ordinary shares for ten months ended 31st March, 1914, £11,210, transferring to general reserve fund (which will then amount to £58,000) £12,000, carrying forward £7,153.

"The demand for electrical machinery has been well maintained. The directors are also pleased to be able to report a further substantial increase in profits—the results for the ten months being almost equal to those of the previous twelve months. The expenditure on new plant and buildings consists of an important extension to the works at Wolverhampton, which, when fully equipped, will not only enable a larger volume of business to be undertaken, but will tend to more expeditious and economical handling of the company's manufactures."

The annual meeting will be held on May 21st.

Sunderland District Electric Tramways, Ltd.

The annual meeting was held on Tuesday at Winchester House, E.C., Mr. H. R. Hogg presiding.

In proposing the adoption of the report (see Elec Rev., p. 751), the Chairman said the accounts represented the first year's working since the directors had had the management in their own hands from the Receiver. One of the first things necessary was the provision of a number of new cars. They had received a delivery of sixteen during the year from the Brush Company, which had enabled the manager to do away with the last of the old French cars, which for a long time past had given trouble. They had now in good working order their whole stock of 33 cars. During the year the district served by the company had been free from strikes, and the net traffic returns showed a satisfactory increase of over £3,000 as compared with the previous twelve months. As no depreciation had been written off for some years previously during the continuance of the receivership, the board had thought it right to put aside a substantial sum for that purpose. A heavy amount was also incurred during the year in respect to law charges, caused chiefly by the [illegible] of the company from whom they obtained their power, which rendered it necessary for them to make a fresh agreement. The amount set aside for that purpose would not recur again. Further, they lost the royalty on the [illegible] charge which they received for the first time last year in cash, as the price obtained for the works when sold did not suffice to pay the debentures in full, and they were therefore unable to get anything as damages for breach of contract. Owing to the funds taken over from the Receiver they had still in hand at the close of the financial year a large proportion of the prior lien loan, which was raised to pay off the old prior lien bonds and provide for renewals of the track and rolling stock. The former had always been kept well up to the mark, but it was necessary that they should keep a substantial balance in hand to meet any sudden expenditure that might be called for. It must be borne in mind that as rails wore out an increasing quantity had to be replaced year by year. Fortunately for the company, when money was difficult to get, the same position had helped them to get a higher rate of interest, and they had received in interest nearly as much as they had had to pay on the prior lien loan. Taking into consideration the uncertainties of the future, the board had thought it wise, as the past year had been a good one, to make ample provision for contingencies. They had commenced a reserve, which it was hoped they would not have to trench upon, but it would be something in hand to secure an even distribution in years to come. The board felt sure that the shareholders would appreciate the manner in which the company's staff of officers and men had performed their work during the year, and he would ask them to mark that appreciation by confirming the increase in wages which the board had granted. It was the company's aim to enable all their employees to live under conditions as comfortably as was compatible with the circumstances of business, and therefore the question of providing suitable housing accommodation for the staff had been receiving the serious attention of the board. The manager had been provided with a house near the company's works, and land had been purchased conveniently close to the car-sheds on which to build cottages which could be let to their employees who still had difficutly in finding suitable accommodation for themselves.

Mr. R. Taylor seconded the motion and the report was adopted.

Potteries Electric Traction Co., Ltd.

The directors report that the capital expenditure during the year 1913 amounted to £3,774. The total receipts amounted to £126,590. The traffic receipts, which amounted to £109,925, show an increase of £9,279 as compared with the previous year. After deducting all expenses chargeable to revenue, including £11,227 for debenture and other interest, there remains £38,529, as compared with £35,189 for 1912. Adding £545 brought forward, there is a balance available for distribution of £39,074. The directors recommend that there be put to depreciation and reserve account £2,000, to renewals account £15,500, a dividend of 5 per cent. on the preference shares £12,250, a dividend of 3½ per cent. per annum on the ordinary shares £8,575, carrying forward £749. The depreciation and reserve account will then stand at £23,000, and there will be a credit balance on the renewals account of £24,168.

	1912.	1913.
Passengers carried	18,575,558	21,610,714
Average receipts per pas.	1.23d.	1.22
Average working expenditure per pas.	.71d.	.70
Proportion of expenses to receipts	57 p c.	57 p c.
Cars in stock	110	110

United River Plate Telephone Co., Ltd.

Mr. Geo. Franklin presided on May 7th, at Winchester House, E.C., over the annual meeting.

In moving the adoption of the report (see Elec. Rev., p. 796), the Chairman said that the result of that year's working was in the circumstances to which he would allude entirely satisfactory. Last year the accounts were for nine months, and so to get an adequate comparison they had to add three months on to the 1912 accounts. The receipts from subscriptions, rentals, sales, etc., in the River Plate were £599,548, and compared with the adjusted figure for the preceding twelve months of £533,424, there was an increase of £66,124. The expenses were £425,202 as compared with an adjusted figure of £375,286—an increase of £49,916. The percentage of increase in the net earnings had been maintained, notwithstanding the somewhat adverse conditions prevailing during the past year. Included in the expenses were amounts for the maintenance and renewal of plant, the latter item having absorbed £110,000 during the year—an increase of about £40,000 over the nine months period of the previous year. They debited against the reserve for renewal of plant the sums spent each year in the replacements and renewals, which amounted in the past year to £19,441. A reserve of £403,147 still remained available for this class of expenditure. That was what they had written off out of their profits and placed as a liability of the company ready for and to meet contingencies when they arise. When they considered the growth of subscribers they found it nearly 14 per cent. over the previous year, and it indicated a rate of progress somewhat below the normal; but already there were evidences that the depression had been merely temporary and was gradually passing away. With regard to the balance sheet, the capital had been increased to £270,000, and on the adjusted figures they were this year paying in ordinary dividend £24,744 more than last year. On the asset side of the balance sheet the capital expenditure on exchange equipment lines, instruments and purchase of business had absorbed £364,304, whilst there had been an expenditure on real estate and buildings of £24,671. The stock of material, £203,163, was an increase of £2,084. This was an item which had had the serious consideration of the directors, and when it was borne in mind that they had a growing business situated 7,000 miles away from the seat of manufacture it was evident that an efficient and varied supply of stores was necessary. On the other hand, the existence of a large stock of materials liable to depreciation required the vigilance and greatest care of the board. The reserve fund account now amounted to £266,138, and after that meeting would stand at £296,138, and this constituted a very satisfactory second line of defence if and when the reserve for the renewal of plant should become exhausted. These reserves made the company strong and able to meet developments as they arose. The appropriation account provided for a first distribution of 5 per cent., which, with the interim dividend, made a total distribution of 8 per cent. free of income tax. After making provision of £30,000 for the reserve fund, and a grant of £2,000 for the staff provident fund for the staff in Buenos Aires, they carried forward £6,357 as compared with £5,804 last year. In the telephone business they had to look a long way ahead, and it required the expenditure of money on plant which might not come into full use for years, and this involved heavy charges on revenue in order to economically and efficiently meet the problem of the growth of the business. The policy of the directors had been to assume the continuance of the development and to go forward, and when it was remembered that the size of the company's undertaking had increased threefold during the past ten years the bearing of this development problem would be better understood. It was impossible in this country to realise the development in building which was going on in Buenos Aires and the large number of extremely high buildings which were being erected all over the country—buildings which must require many times the number of telephones which would be required by the older one or two-storey type Spanish buildings. The Chairman proceeded to deal at some length with the trade and money conditions of the past year, and said that although the Argentine had been affected by the monetary stringency in Europe, a drought, and trade depression, yet there seemed no doubt that the worst was now over and that gold was returning to the country. The maize crop, which was now safe, would be the largest the country had produced, and the Argentine Government had decided on making large economies in their budget proposals. The prosperity of the company was bound up with that of the country, and they had felt some effect of the depression in the latter part of the year, but they had not slackened in their efforts to provide a good service and to put themselves in a position to effect prompt connections for all comers. In Buenos Aires they had spent large sums in underground work and in increasing the number of their distribution points, and this served a double purpose. It did away with long overhead wires, which constituted a weak part of their equipment, and it enabled them to connect up new subscribers quickly. In some other towns the extensions of electric light and tramways had given rise to induction troubles where they had had single lines, and they had been called upon to do a large amount of metallic circuiting which, whilst it increased the expense and did not increase their revenue, still greatly improved the service. In 1912 they had 5,303 complaints with regard to their service, and last year only 3,485. They were told in England that the reason complaints did not go up was that they received no attention, and that the service was past praying for, but he hoped that was not the case with their service. They had carried out underground work in several of the larger towns, and in more than one case had been granted favourable concessions so as to undertake the work. Several of their common battery switchboards were approaching the limit of their capacity, and they had just secured a piece of land in the centre of Buenos Aires on which to erect a new exchange, and they were waiting a favourable opportunity to buy two other pieces of land for exchanges. At present they were engaged in building new common battery exchanges in Flores and Lomes in the Buenos Aires district, and at La Plata. They had fixed new multiple boards in three different provincial exchanges and had had to make additions to the existing boards in seven others. They had obtained permission to open exchanges in Hurlingham, Merlo and Ville Devoto, in the neighbourhood of the capital, and were almost ready to open up in Alvear and Tapalque, two towns in the centre of the Province. They had opened up new exchanges in several towns near Cordoba and had connected them with that city by trunk lines. They had also acquired the plant and undertaking of two small local enterprises at Belville and Rio Vuarta in the Province of Cordoba, and had incorporated them with their system. They had purchased sites in seven different provincial towns where their business was established. They had installed a new automatic exchange at Cordoba, of which the most gratifying reports had been received, and a second exchange of the same type, the Strowger, was on order for the City of Rosario. Mr. David Smith, their managing director had just returned from a visit to Argentine and had reported in high terms not only as to the prospects of the country but also of the business with which they were immediately concerned.

Sir F. Green seconded the motion and the report was adopted.

Cuba Submarine Telegraph Co., Ltd.

Mr. Geo. Keith (Chairman) presided on May 6th, at 58, Old Broad Street, E.C., over the annual meeting.

In moving the adoption of the report (see Elec Rev., p. 750) the Chairman said they had to record the death of their esteemed colleague Mr. Robert Kaye Gray. Mr. Gray was a director of the company for twenty years, and he was a sound adviser and would be much missed by all of them. The report and accounts covered the whole of 1913, in accordance with the change agreed to last year. The monthly traffics for the past year came out considerably under what they were in 1912. In 1912 the price of sugar was higher, and owing to exceptionally fine weather the sugar grinding season continued longer than usual, and this was favourable to business generally in Cuba and led to a considerable increase in the local traffic passing over their cables. There were also interruptions on competing lines, which brought to their cables traffic outside their usual business. During the year under review they were not so fortunate in this respect, but, everything considered, he thought they had reason to be satisfied with the result of the year's business. The revenue account showed a decrease for the year in actual receipts of £4,697, and an increase in interest of £391. The total revenue, including transfer fees, amounted to £38,490, being £4,304 less than in 1912, £975 less than 1911, and about the same as in 1910. On the debit side of the account, London office expenses were rather more. Station expenses were £253 down. While there were increases in salaries and travelling expenses, there were decreases in stationary and repairs to shallow-water cables, which latter were £500 less. The main cables had continued in good working order with the exception of one of the Batabano cables, which became interrupted last December on the bank of the Diago Pieretz, where it passed from the shallow water into the deep water. It had since been repaired and the cost would appear in the current year's accounts. The exceptional expenses in connection with the explosion at Cienfugos in February last year amounted to £756. They would remember that their Cienfugos office was completely wrecked and the staff were all more or less seriously injured. He was extremely glad to say they had all recovered from their injuries and they were now all back in the office doing their duties as before the disaster. The insurance had been paid and a new building was in course of erection and was expected to be completed at the end of next month. The other charges were more or less the same as usual, and the total expenditure amounted to £15,473, or £553 more than in 1912. The figures in the balance sheet were all favourable. The general reserve fund now stood at £98,000, and the pension fund at £7,812, which included the interest accruing from the same. The investments remained the same as last year, their market values having appreciated since the end of the year, and it was hoped that further appreciations might take place during the present year. As regarded the present year, their cables were all working well and giving an efficient service. Business generally continued good and prosperous, but competition was increasing and there was a prospect of their through rates being further reduced, which it was hoped would be recouped by bringing increased traffic to their cable.

Mr. C. W. Parish seconded the motion, and the report was adopted without discussion.

Anglo-American Telegraph Co., Ltd.

The annual meeting was held on Friday last at Winchester House, E.C., Mr. F. A. Bevan presiding.

In proposing the adoption of the report (see Elec. Rev., p. 792), the Chairman said that they had received in due course from the Western Union Telegraph Co. the regular quarterly payment, which enabled them to pay the dividends in accordance with the provisions of the lease—that was 3¾ per cent. on the ordinary stock, 6 per cent. on the preferred stock, and 1¼ per cent. on the deferred stock. Besides that, they had also received as interest on bank balances and loans £2,696, while the total amount of interest accrued to 31st March last was £4,317. That amount belonged to the holders of ordinary and deferred stock, but until the sum was considerably larger it was not worth while to distribute it. £61,189 had been charged to the renewal fund for expenditure upon repairs to cables. Under the conditions of the lease with the Western Union Co. the balance of the renewal fund, after paying for the new cable purchased by that company, was to be used for renewals of the Anglo Co.'s cables, and also, if required, to purchase a new cable ship. As he intimated last year, the directors, after considerable negotiation, came to an arrangement with the Western Union Co. that in respect of the renewals of cables the Anglo Co. should bear the cost of the material for new cables whilst the Western Union Co. was to pay all expenses in connection with maintaining or repairing broken cables. Up to March 31st, 1913, the cost of cable so inserted amounted to £40,533. Deducting that from £61,189 appearing in the renewal fund account, it would be seen that an additional sum of £20,665 had been expended during the present year, as against which they had received from the Western Union Co. their annual contribution of £20,000 to the renewal fund in accordance with the terms of the lease. To find the money for that expenditure they had had to sell some securities, and that sale, owing to the depreciation, had resulted in a loss of £1,617. Since the accounts were prepared they had had a visit from Mr. Newcome Carlton, the President of the Western Union Co., and they had a considerable amount of conversation with him upon the question of purchasing a new cable ship. The *Minia* had been working for something like forty years, and it was absolutely necessary that they should have a new ship. Whilst Mr. Carlton was here they arranged for the building of a new vessel, which would cost about £75,000, and in addition to that they agreed with him that they would have a considerable amount of cable in stock. Eventually they purchased a length of 335 miles of stock cable which would cost, approximately, £50,200. They would therefore see that the renewal fund would be practically wiped out, but that was not really a matter of importance, because they always knew that would be the case, and now the expense of renewals would have to be borne by the Western Union Co. As to the cable in stock, as it was taken out of stock and used for renewals it would be charged against the renewal fund, and in future the balance of the renewal fund, instead of being represented by securities, would be represented by the cost of the cable in stock. He was glad to be able to inform the shareholders that the board were working on most friendly terms with the Western Union Co. Their policy of cheap telegraphic communication between this country and the United States and Canada had resulted in a very great increase of traffic; but he could shed no light upon the financial results. There had been little questions between them, and for their settlement the board thought it wise that Mr. Miles, the Secretary, should pay a visit to Canada. He went there and everything had been arranged on a basis which was satisfactory to both sides.

Mr. R. H. Benson seconded the motion.

Replying to questions, the Chairman said that the question of new cable was one which was settled by agreement between the two companies. Also in regard to the new ship they had ordered, they were both agreed about that, and it was a matter that had long been in the minds of the directors of the Anglo Co.

The report was adopted.

River Plate Electricity Co., Ltd.

In their report for the year 1913 the directors say that though extreme competition continued throughout the whole year at Tucuman, entirely absorbing the profits of their Tucuman business, there has been some advance in the profits of the whole undertaking. The net revenue, after providing for administration expenses, bad debts, and all necessary depreciations, amounted to £52,201, plus £10,416 brought forward, making £62,617. Interest on the 5 per cent. debenture stock required £10,000, leaving an available surplus of £52,617. The 6 per cent. preference dividend absorbed £7,500, 10 per cent. for the year upon the ordinary stock required £15,000, addition to general reserve £15,000, income tax reserve £1,000, directors' commission £1,055, and there is to be carried forward £13,062. The general reserve will now stand at £160,000. Owing to the increased plant recently laid down, it has been necessary this year to charge £10,650 against the year's revenue for depreciation of plant. That sum will increase the reserve for depreciation of plant to £55,522, and will, with the carry forward of £13,062, bring the total reserves of the company to over £228,500. The important additions to the generating station at Ensenada were finished at the end of the year, and since then the work of generating has been mainly carried on at Ensenada. Good progress has been made with placing the company's cables and electric connections underground in the leading streets and squares of the City of La Plata, and it is expected that this work will be completed early in 1915. An arrangement has been made with the Cordoba Central Railway Co., Ltd., the holders of the majority of the shares of the Hidro-Electric Co. of Tucuman, to bring to an end the excessive competition which has prevailed in Tucuman from November, 1912, until practically the present time. Under the agreement come to there was a partial restoration of rates at the end of March, and it is hoped that the arrangement proposed will be finally completed by 1st June, when a new company, which has been incorporated under the name of the Tucuman Tramways, Light and Power Co., Ltd., will take over and work the competing interests. The River Plate Co.'s interests in Tucuman will be satisfied in cash and debentures of the new company. The new ordinary shares, issued in 1912, have been converted into stock, and are now quoted as part of the ordinary stock of the company. The fifth annual payment on account of the amortization of the 5 per cent. obligations of the German-Trans-Oceanic Electric Co. (Series I.) held by this company, viz.: £2,000, was duly made on 1st April, 1913, reducing the amount outstanding to £140,900.

Mr. M. W. Mattinson, K.C., presided on Tuesday, at 62, New Broad Street, E.C., over the eleventh annual meeting. He said that for the fourth year in succession the board recommended a dividend of 10 per cent. on the ordinary stock. The proposed carry forward was considerable, but not more than was necessary in the present position of business generally in Argentina. He thought there was some exaggeration in the statements as to Argentina having gone through a great commercial crisis, although undoubtedly there had been financial stringency, and hence they adopted the policy of keeping their resources well in hand. Seeing that they had suffered a total loss of income from one source from which in previous years they had derived a profit, the shareholders would expect it was a matter for congratulation that they had come through the year so well as they had. The explanation was the prudence they had exercised in the past, and that policy would be maintained so long as the present board had control. The first and main item of revenue was the net revenue of £55,761 derived from the La Plata, Ensenada, and Tucuman stations which compared with £53,878 last year. This was distinctly satisfactory seeing that they had no revenue return from Tucuman for which they knew the reason. More than a year ago the Hidro-Electric Co., of Tucuman, completed its installation up to the point that it was able to take on consumers in Tucuman and it immediately commenced an active campaign against the Electrica de Norte and this company, who in friendly alliance up to this time had divided the lighting business in Tucuman. The Hidro-Electric Co. cut the tariff and at first took a considerable number of their consumers, and the Electrica de Norte and the River Plate Electricity Co. had no alternative but to cut the tariff still further, with the result that current was sold at a price considerably below cost. They had no option but to do this because had they not do so their business in Tucuman would have been wholly gone, and there would have been a total loss of capital and goodwill invested in that district. Moreover, if they had succumbed to the threat of competition they would by their weakness have invited competition in other places where they had more important interests. The effect of cutting rates was that by the end of the year they had as many customers as when the competition started, although the prices were wholly unremunerative. Under the terms of their agreement with the Electrica de Norte they had a share of the tramway profits in Tucuman, business which was outside the competition, and also a share in the lighting of the town of Santiago del Estero, and the profits of these reduced the loss on the sale of current, with the result that at Tucuman they were just about level, although of course they lost the profits they had derived in previous years. Last year they earmarked £15,000 as a fund to be applied if necessary in meeting losses at Tucuman, but it had not been necessary to draw on that and it still remained a part of the general reserve. Well, on the working of all their stations they were £850 better off than last year. In the last few years they had spent a good deal at La Plata and Ensenada, but the money had been carefully and economically spent and he thought upon a wise plan. Sound progress had been made with the underground installation at La Plata which greatly improved the appearance of the town and also made their lighting service more permanent and satisfactory. Some 50 or 60 arc lamps had been erected under the revised contract for public lighting, and by the end of the year the greater part of the added service of 240 lamps would be installed and give some return on their expenditure. Administrative expenses were £2,278 against £2,770, but on the other hand depreciation on fixed plant had gone up from £8,450 to £10,650. The final result on the revenue account was that they had £52,201 to their credit as against £51,175 last year, and after providing for the depreciation on fixed plant they came out with a final net improvement on the whole account of £1,026. The reason for that meeting having been held later was so that the board might inform the shareholders of the agreements made in regard to Tucuman. In July they were approached by the interests controlling the Hidro-Electric Co., of Tucuman, who he supposed recognised that there was no possibility of crushing them, but that, on the contrary, the boot was on the other foot. Before any agreement was arrived at the whole position was changed owing to the Cordone Central Rly. Co. acquiring the majority of the share capital of the Hidro-Electric Co. He did not suppose the Cordones Co. had any wish to go into the electric lighting business, but the Hidro-Electric Co. had certain concessions for light railways and tramways in the territory of the Railway Co., which might be prejudicial to the Railway Co. On the one hand it was obvious that the financial position of the Hidro-Electric Co. became much improved, whilst, on the other hand, the board had now to deal with responsible people in England whose interest it was to bring the disastrous state of things at Tucuman to an end as soon as possible. Negotiations were resumed and there was a good try on both sides to arrive at an arrangement. An arrangement had now been come to and unless something unforeseen occurred would be completed on June 1st. The Cordova Railway Co. had organised a new company registered in England to be called the Tucuman Tramways, Light and Power Co., Ltd., and that company would issue £400,000 five per cent. debentures and £600,000 share capital. It would acquire the electric lighting stations and the business carried on by the River Plate Co. in Tucuman and also the share of the Company Electrica de Norte, which meant the lighting business and tramway carried on by that company in Tucuman;

and, further, the greater part, if not all, the share capital of the Hidro-Electric Co. of Tucuman. There was likewise a working agreement with the latter company under which its hydraulic system would be worked at a rental. The effect was to invest the whole lighting and electric interests of Tucuman in the new company, the power for which would be generated by the Hidro-Electric Co., aided, if necessary, by the steam plant of the two other companies. Lighting rates had been raised from the non-remunerative level to which they had fallen to a point which it was calculated would give a fair return. A considerable amount of new cash would be brought into the new company and used to extend the tramways and improve the lighting, and also in some respects to improve the hydraulic system. The Electrica de Norte and the River Plate Electricity Co. would receive £100,000 in cash and £200,000 in five per cent. debentures of the Tucuman Tramways Light and Power Co. As between the Electrica de Norte and themselves, the money and debentures coming to them was to be divided in the proportion of one-third to the River Plate Electricity Co. and two-thirds to the Electrica de Norte. The business at Santiago was to be transferred to an English company being formed called the Argentine Electricity Co., the share capital of which would be held as to one-third by the River Plate Co. and as to the remaining two-thirds by Mr. Seguin, who was the sole shareholder of the Electrica de Norte and had been their good and valued ally throughout the troublesome times in Tucuman. The result to the River Plate Co. was that they obtained £33,000 in cash, £66,000 in five per cent. debentures in the Tucuman Tramways, Light and Power Co., and one-third of the share capital of the Argentine Electricity Co. Book debts and stores were excluded from the sale, but the precise sum they would return he could not say at the moment. Speaking broadly, he was satisfied that the cash and debentures and shares they obtained in exchange for their property at Tucuman would fully represent all the capital they had invested in that part of their undertaking, including the goodwill of the business there. The new securities they obtained carried interest as from June 1st, so that they would only benefit to a limited extent in the current year, but he thought the arrangement as a whole was a very satisfactory outcome of a situation which during the last year or so had been most serious and might easily have ended disastrously so far as Tucuman was concerned.

Mr. R. Miller seconded the motion, and after a shareholder had warmly congratulated the Board on the result of their negotiations the report was adopted.

Eastern Extension. Australasia and China Telegraph Co., Ltd.

The directors report that the gross receipts for 1913 amounted to £738,129, against £747,230 for the previous year. The working expenses, including £63,462 for maintenance of cables, absorbed £354,864 against £321,012, leaving a balance of £383,265. £10,088 is deducted for income tax, and £30,096 for interest on debenture stock, leaving £343,081 as the net profit. After adding £27,536 brought forward there is an available balance of £370,617. A final dividend of 1¼ per cent. makes the total dividend 5 per cent., and it is proposed to pay a bonus of 2 per cent., making a total of 7 per cent. for the year. £130,000 has been transferred to general reserve fund, and £30,617 is to be carried forward. A further sum of £201,761 has been charged against the general reserve fund on account of the cost of the Colombo-Penang cable, together with £264,245 in part payment of the new Penang-Singapore-Hong Kong cables. £65,052 has also been charged against the Fund for partial cable renewals, together with £77,156, the loss incurred on sale of investments during the year, and £17,260 has been credited to the fund in respect of the Tasmanian picked up cable and stores. The new cables between Colombo, Penang, Singapore and Hong Kong have now been successfully laid and opened for traffic. Additional cables have also been laid by the Eastern Co. between Suez, Aden and Colombo, and a new alternative route to the Far East, *viâ* Colombo, is thus added to the system. The company's local, and through tariffs with the Far East were considerably reduced on 1st July and 1st September last respectively. A revised arrangement for week-end letter telegrams exchanged with Australasia was also introduced on 1st instant, by which these telegrams are now transmitted throughout by telegraph, if it is necessary in order to secure delivery on the Tuesday, and the minimum charge is reduced from 18s. 0d. for 24 words to 15s. 0d. for 20 words. From the same date the system was extended to the Straits Settlements.

The annual meeting was held on Tuesday, at Electra House, E.C., Sir J. Wolfe Barry, K.C.B., presiding.

The Chairman said that the gross receipts for 1913 were down by £9,000. That result might be considered not unsatisfactory, seeing that all their local tariffs in the Far East, and many of their through tariffs, were extensively, and very substantially, reduced during the last six months of the year, by which a loss was estimated to take place in the event of the traffics not immediately responding to the tariff reductions. The full effect of the lowering of the tariffs would be felt in the current year, and, it was to be hoped that the considerable reductions would, in the future, result in a correspondingly larger volume of traffic. Fortunately, some of the traffics which were not included in the tariff reductions showed a substantial increase during the past year, which in a large measure counteracted the effect produced by the tariff reductions. The working and other expenses showed an increase of £34,000, nearly one-half of which was caused by their cable repairs being more numerous and costly than in the previous year, and most of the remainder of the increase was due to the employment of additional staff to meet traffic requirements, automatic and other staff promotions, and to their having to provide half the cost of the new station opened by the Eastern and Eastern Extension Companies at Colombo in connection with their new alternative route to the Far East. Unfortunately, the cost of living in the Far East and elsewhere had greatly risen in recent years, and they had found it necessary since the close of the year to further revise and improve some of their staff scales of salaries and allowances. The general reserve fund had been credited with £147,000 and debited with £608,000, leaving the fund at the end of the year with a balance of £730,000. Since the close of the year further investments had been realized to provide for the balance of payment for the new cables, and the loss thereby incurred would be deducted from the provision, shown in the balance sheet, of £200,000 for investment fluctuations. At the end of the current year that account would be properly adjusted. The new cables between Colombo, Penang, Singapore and Hong Kong had been successfully laid and opened for traffic, and with the additional cables laid by the Eastern Co. between Suez, Aden and Colombo a new alternative route to the Far East had been established, *viâ* Colombo, which should materially assist them in efficiently dealing with increased business. In regard to the revised arrangement for week-end letter-telegrams exchanged with Australasia which was brought into force on the 1st inst. the Eastern and Eastern Extension Cos. endeavoured to provide those improved facilities throughout their systems some time previously, but, from causes beyond their control, had been unable to do so. Where they had had a free hand, as, for instance, with South Africa, week-end letter-telegrams were started in November, 1912, or two months before the service was inaugurated with Australasia. As stated in the evidence before the Dominions Royal Commission, they were quite prepared and indeed anxious that those telegrams should be delivered on the Monday morning, and not on Tuesday, but up to the present time they had been precluded from bringing this desired reform into operation. Those week-end letter-telegrams were quite a new development and it remained to be seen how the thing would work out. He thought such messages were appreciated for social as well as for business purposes.

Sir J. Denison Pender seconded the motion.

Replying to questions the Chairman said it was perfectly true that the reserve fund had been largely diminished from various causes, and one no doubt had been the serious depreciation in the stocks from the prices at which many of them were bought. A very large quantity of the reserve fund securities were bought when consols were very high and at a time when anybody was glad to get 2¾ or 3 per cent. for his money. The depreciation in all gilt-edged securities had been by common repute very severe, and some years ago they put aside a sum for providing for the depreciation when they came to be sold. In order to keep up their service to the Far East they had had to draw very seriously upon their reserve fund and that had forced them to put in operation a process of realising their securities at a very bad time and the loss had been very considerable. The cost price of their investments on December 31st, 1913, was £1,079,232, and they were making provision for fluctuations in them of £200,000, foreseeing that it might be necessary to still further sell some of their stocks. He was afraid those were disagreeable facts which could not be blinked. The depreciation on 31st December last was £179,000, but on 20th April it was only £154,000. They thought it best to still keep the £200,000 as provision for future depreciation, and all he could say was he hoped it would not be required, but that some of it would be required was pretty obvious if they had to spend their reserve fund for laying new cables, for which purpose it was specifically set up. Regarding wireless telegraphy, so far it had not affected the revenues of the company prejudicially in the least—what little effect it had had upon them had been to help them, by giving them a few messages which came from ships as they passed their station at Cocos, which they afterwards forwarded over their cables at ordinary rates. Of course neither he nor anybody else could say what the future might have in store, but, personally, he did not think that the company was ever likely to suffer from the competition of wireless.

The report was adopted.

West Coast of America Telegraph Co., Ltd.

The annual meeting was held at Electra House, E.C., on Tuesday, Sir J. Denison-Pender, K.C.M.G., presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev., p. 792), called attention to some special items in the accounts which had last year, unfortunately, re-acted on the company. The revenue for the year was practically the same as that for 1912, having been £53,646 against £53,738. The expenses, exclusive of cable repairs, showed an increase of £1,590, of which £629 was due to an increase in salaries,

£265 increase in travelling expenses, and £656 in stationery. With low rates and increased traffic, although the revenue had not increased as much as they could have desired, they had no cause to complain of the receipts except that the hope which all cable companies had of greatly increasing their revenue had not been realized. He had often pointed out at those meetings that where they had received in the past any special credit or been benefited by the repairs being low, too much stress should not be laid upon that point by the shareholders because of the re-action which might take place. Unfortunately in 1913, in their own case, the cost of cable repairs mounted up to £6,185. They had in the Molendo Lima cable no fewer than eight breaks caused by earthquakes. Consequently the cost of repairs had exceeded that of the previous year by something like £2,000. They would therefore see what had compelled them this year to pass the dividend; not only had there been the extra cost of cable repairs but the main cable was down for two months in the past year against 23 days in the previous year, and that meant a daily loss of revenue. There was one other point he wished to refer to and that was the reserve fund. In the past questions had been raised by shareholders as to whether the directors were not putting too much to reserve. He thought, however, that last year's account would show that the Directors were perfectly right in their action in the past in not increasing the dividend but strengthening the reserve. They had a reserve of £83,000, the greater part of which considerably over £50,000—was invested in first-class securities, whilst the balance was held in cable and stores on the coast, so he thought they were protected against any contingencies in the future as far as it was humanly possible.

Sir Albert J. Cappel, K.C.I.E., seconded the resolution and the report was adopted.

Kent Electric Power Co.

The accounts for 1913 show that the total revenue from the sale of electrical energy, etc., was £19,328, less £12,458 for working expenses, leaving £6,870 profit. Interest on debenture stock, interest on loans, and directors' and auditors' fees absorbed £4,661, leaving £2,209, plus £2,331 brought forward, making a total available for dividend of £4,540. The directors propose to pay all arrears of dividend to December, 1912, on the 6 per cent. cumulative priority shares, which will take also the full dividend on the priority shares for 1913, which requires £1,083, thus bringing the dividend on these shares right up to date and leaving £155 to be carried forward.

As a result of the Kent Electric Power Act, 1913, the issued ordinary share capital has been reduced from £225,004 to £64,300. This has enabled the directors to write down, and in some cases to write off, certain of the items which formerly appeared on the balance sheet, and by this means to make suitable provision for depreciation. Since December, 1913, the arrangements referred to in the last report for the provision of further capital for additional plant and mains extensions, and for the discharge of the amounts due to creditors shown on the balance sheet have been satisfactorily completed.

Anglo-Portuguese Telephone Co., Ltd.

The directors' report for the year ended 31st December, 1913, states that the assets and liabilities in Portugal have been made up at the Exchange ruling on that date. Provision has, as usual, been made to safeguard the company from any serious consequences arising from fluctuations in exchange during the current year. The profit and loss account shows a gross revenue of £67,894, of which operating, management and general expenses absorbed £39,380, and royalties to the Portuguese Government £1,978, leaving a gross profit of £26,536. After providing for debenture interest £2,080, sinking fund £1,754, and income tax £940, the amount available for disposal, including £5,609 brought forward, is £27,370. As in previous years, the profit and loss account was credited only with the proportion of subscriptions for which the company had actually rendered service during the year. The proportion of the year's subscriptions unearned at December 31st, amounting to £29,399, has been treated in the balance sheet as a liability of the company. In October last the directors paid an interim dividend of 4 per cent. free of income tax amounting to £4,000. They now recommend the shareholders to declare a further dividend of 4 per cent., which will absorb £4,000, and still leave to be dealt with £19,370. During the past year a re-valuation has been taken of the company's land, buildings, and movable property, with the result that the directors feel justified in recommending the shareholders to declare an extra dividend or bonus of 20 per cent. for the year ending 31st December, 1913. This will absorb £20,000, of which £12,500 will be provided out of the year's profits and £7,500 appropriated (if the shareholders so approve) from the reserve fund, which will then amount to £55,000. The balance of profit carried forward to the credit of the current year's accounts will be £6,870. At the last general meeting the shareholders were informed that a suitable site at Lisbon had been acquired for a new exchange. During the past year the building of the exchange has been completed and a fully-equipped switchboard, giving a capacity for installing some 6,000 additional subscribers, has been ordered. The greater part of the equipment is now in Portugal. During the past eight years the company has expended on capital account [illegible], the greater part of which has been met from reserve, whilst the balance [illegible] in the balance sheet [illegible]. In order to discharge the above [illegible] and provide for further contemplated expenditure the directors propose to issue 50,000 new £1 shares, which will be offered to the members of the company for the time being in the proportion as nearly as possible of one new share for every two shares now held. The new shares will be issued at par, and will rank in every respect *pari passu* with the shares already issued as from 1st January, 1914, except that they will not participate in the dividend and bonus to be declared at the forthcoming general meeting.

Continental.—France.—Among the new electric light undertakings recently formed in France are the Société Hydro-Electrique de Tencin, formed at Brignoud (Isère), with a capital of £18,000, to establish a plant to utilise certain available water-power, and the Société d'Electricité de Wambaix, to establish a small central electric lighting station in the little town of Wambaix (Nord).

Societe Anonyme Westinghouse.—According to the financial Press this company reports that a considerable improvement took place in the company's business as compared with the results of previous years. Profits amounted to 1,583,236 fr., from which has to be deducted the debit balance of 1912—namely, 217,338 fr. The balance of 1,465,897 fr. is to be applied to amortisation and reserves, with the exception of 362,667 fr., which is carried forward.

Germany. The *Times* Berlin correspondent says that the directors of the Siemens Elektrische Betriebe Co. have decided to increase the share capital from £875,000 to £1,500,000, the increase being to a large extent for new business.

Spain.—At a meeting of the London Chamber of Commerce on April 23rd, Mr. E. D. Trowbridge, consulting engineer, gave an address on the hydro-electric and other developments of the Barcelona Traction, Light and Power Co., Ltd. Mr. Faithfull Begg, M.P., presided.

General Electric Co. (U.S.A.).—According to the *Electrical Review and Western Electrician*, the business of this company in 1913 exceeded in volume the record of any previous year. The value of orders received was $111,819,142; the amount of sales billed was $106,477,439. The net results were: Profits from sales, $10,269,605; income from other sources, $3,796,184; a total of $14,065,790; less interest and discount on debentures and notes payable, $1,007,911; dividends paid, $8,149,204; carried to surplus account, $4,908,675. More than 600,000 orders were received, and the tendency toward an increase in the number of orders and a reduction of their average value continued during the past year. The number of employés engaged in factories, offices and subsidiary companies on December 31st exceeded 65,000. During the year additional manufacturing floor space to the amount of 1,740,000 sq. ft. was provided, making a total manufacturing floor space available at the end of 1913 of over 13,900,000 sq. ft. Quarterly dividends at the rate of 8 per cent. per annum were paid during the year.

Stock Exchange Notices.—The Committee has ordered the following to be quoted on the Official List:—

Auckland (City of)—Scrip, fully paid, for £224,500 Electric Power, additional loan, 4½ per cent. debentures.

Compania de Elect. de la Prov. de Buenos Ayres, Ltd.—175,000 7 per cent. cum. part. pref. shares of £1, fully paid, Nos. 1 to 175,000.

Application has been made for an official quotation in—

Cuban Telephone Co.—£200,000 additional 5 per cent. first mortgage conv. bonds.

STOCKS AND SHARES.

Tuesday Evening.

That the present week was going to be an uncomfortable one for the Stock Exchange, most members realised before it came. The long-protracted falls have had their inevitable effect of weakening resources and crippling finance. All kinds of rumours have taken advantage of the general uneasiness, and have reared their ugly heads, more or less regardless of the truth. Ordinarily, they would be dismissed as merely silly; but when the Stock Exchange is in a jumpy kind of mood, it lends attentive ear to any idle story.

Lombard Street, Mexico and Brazil, have played their parts in bringing about fresh falls in prices, fresh blows at confidence. In the markets with which our notes are concerned, the alterations on the whole, where they are in the downward direction, may be ascribed to the necessity for money to be realised by those who have to meet liabilities elsewhere. It is rather surprising that such purely investment shares as those in the electric lighting market, for instance, should have managed to hold their ground so firmly in the face of all the surrounding circumstances. Relief arrived on Tuesday, when the heaviest part of the forced selling was finished. Markets made material recoveries from the worst prices, and buyers once more appeared for Consols.

The printers might keep a line set up in type for weekly use, to the effect that affairs in Mexico have gone from bad to worse, because it is seldom that the legend would be inappropriate. Last week, of course, there was a recovery in most Mexican issues; but this turned out to be merely a flash in the pan, and nearly all the securities connected with Mexico have suffered during the past few days. The main drop is one of 7 points in Mexican Light and Power Common shares; the Preferred fell 3, the First Mortgage bonds 2. Mexican Electric Light First Mortgage bonds are also 2 lower. Monterey Debenture stock deserves a nimbus of its own, for having a rise of a point to its credit on the week. Mexican Trams shed 6 points, and the General Consolidated bonds are easier.

The Canadian group is uncertain. Shawinigan Water rose 2 to 135, but Canadian Generals gave way to the same extent, the latter movement being associated with the renewed depression that has fastened upon most things Canadian. Heavy sales have been forced during the past week or so, railway and industrial securities suffering impartially. The trouble has been as much financial as physical, but the times are too unsettled for the prophet to forecast the near approach of the end of the wood, though the prospect is certainly less black than obtained a few days ago.

Brazilian descriptions are generally steady, the reason for which is that there is so little market in most of them that prices are left as they stand. Where any activity still remains, as in Brazilian Tractions, the tendency has been to put down prices, and the Common shares of this company shed a point. Para Electrics are steady, the market being resigned to the probability of reduction in the forthcoming dividend. Rio de Janeiro Tramway First Mortgage bonds continue to dwindle, although the shrinkage is not much this week. Anglo-Argentine Tramways Second Preference and the company's 4 per cent. Debenture stock have given way a little.

The Indian group is dull. Calcutta Electric Supply Ordinary and Preference have both declined, notwithstanding an increased dividend of ½ per cent. on the former, and Calcutta Trams fell $\frac{3}{16}$ to 6⅝. On the other hand, Colombo Debenture stock and Bombay Electric Second Debenture are both a point higher.

The Home Railway market, although depressed, cannot be said to have experienced any severe shock by reason of the threatened competition of the flying railway at 300 miles an hour. The invention has naturally caused a good deal of talk, mingled, if it may be allowable to say it, with more than a shade of scepticism. Falls of ½ in Metropolitans and of a point in Surplus Lands are due, however, to stock being pressed for sale by weak holders who had in some cases taken it up through their bankers. Although no large account existed in the Stock Exchange, it became evident from the character of the sales that holders were being forced to realise. Districts dropped ½ in sympathy, and Underground Electrics have been a little dull, in consequence of the idea that compliance with the men's demands, formulated in their charter, will prove costly to the company; there is also further talk of making the omnibuses contribute to the upkeep of the roads, and a threat of a strike on the City and South London. In the British Electric Traction group several falls of a point have occurred, and Potteries Ordinary went back to 7s. 6d. Yet the report shows that the Potteries Company has made £2,300 profit more than in the previous year, and the Ordinary dividend is maintained at 3½ per cent.

London's Electricity supply shares are a trifle lower where changes have occurred on the week, but these are comparatively few. City of London Ordinary and Preference are both ¼ down, and falls of ⅛ occurred in Edmundsons' Preference and Westminster Ordinary. St. James's and County Preference both rose ⅛, and, amongst provincials, this week it is the turn of Folkestones to improve. The market, on the whole, is exceedingly quiet, little disturbed by the troubles in other parts of the Stock Exchange.

Movements in the Telegraph market are divided fairly equally amongst rises and falls. Indo-Europeans at 57½ are *ex* the dividend and bonus of £2 12s. 6d. West India and Panama Telegraphs fell ⅛, and West Coast of America shares are still weak in consequence of the passing of the dividend on the Ordinary shares. The Eastern group is very firm, the reports recently issued showing the companies to have done prosperously during the past year. Cuba Telegraphs Preference rose ¼, but Anglo-American Deferred and Direct United States Cable shares are both easier. The West African Telegraph Company maintained its dividend of 4 per cent., but the reserve is £7,000 down at £6,000. The Constantinople Telephone Company has just issued its second report, which, allowing for the impediment thrown in the way of the company by the Balkans war, is not at all bad; the price of the shares is steady at 4¾. Marconis have hardened to 3$\frac{3}{16}$, showing $\frac{1}{16}$ advance on the week, and the market is distinctly firmer; not much public buying would be required to bring about sharp improvement. The Preference are also $\frac{1}{16}$ up. The selling of Mackay shares from the other side has ceased, but Commercial Cable Debenture stock is a point lower.

The Manufacturing group remains very quiet. The Electric Construction Company has just declared a dividend at the rate of 6 per cent. per annum in respect of the 10 months for which the company's year was made to run, after the alteration in the date of its making-up accounts. Statements reach the mere layman that other manufacturing companies are doing exceedingly well; Cromptons, for instance, being named as one of these, the British Westinghouse as another. Quiet dealings are taking place in the shares of the former company on the basis of 5s. 6d. for the Ordinary and 11s. 6d. for the Preference. Henleys are good, the Ordinary gaining 10s., while the Preference and Debenture are both harder. General Electric Debenture rose 2. Prices in the rubber market weakened appreciably upon a revival of the old synthetic scare, and on Monday in this week something like a slump occurred in the leading issues. A subsequent rally ensued upon bear purchases, added to which there was a small amount of public support.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, May 13th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	5/-	..
a	„ Nitric	„	22/-	..
a	„ Oxalic	per lb.	2⅞d.	..
a	„ Sulphuric	per cwt.	5/6	..
a	Ammoniac Sal	„	42/-	..
a	Ammonia, Muriate (large crystal)	per ton	£29	..
a	Bleaching powder	„	£6 5	..
a	Bisulphide of Carbon	„	£15	..
a	Borax	„	£17 10	..
a	Copper Sulphate	„	£21 5	10s. dec.
a	Lead, Nitrate	„	£30 10	..
a	„ White Sugar	„	£27 10	10s. dec.
a	„ Peroxide	„	[illegible]	..
e	Methylated Spirit	per gal.	2/6	..
a	Potassium, Bichromate, in casks	per lb.	8½d.	..
a	Potash, Caustic (88/90 %)	per ton	£32 10	..
a	„ Chlorate	per lb.	8¼d.	..
a	„ Perchlorate	„	8¾d.	..
a	Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7¼d.	..
a	Shellac	per cwt.	70/-	5s. dec.
a	Sulphate of Magnesia	per ton	£4 10	..
a	Sulphur, Sublimed Flowers	„	£8 10	..
a	„ Recovered	„	£5 10	..
a	„ Lump	„	£5 5	..
a	Soda, Caustic (white 70/72 %)	„	£10	..
a	„ Chlorate	per lb.	3⅝d.	..
a	„ Crystals	per ton	£2 5	..
a	Sodium Bichromate, casks	per lb.	8d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots	per ton	£80	..
b	„ Wire, in ton lots (1 to 14 S.W.G.)	„	£107 6 8	..
b	„ Sheet, in ton lots	„	£112	..
p	Babbitt's metal ingots	„	£50 to £221	..
c	Brass (rolled metal 2" to 12" basis)	per lb.	7⅛d.	..
c	„ Tube (brazed)	„	9⅜d.	..
c	„ „ (solid drawn)	„	7⅞d.	..
c	„ Wire, basis	„	7⅛d.	..
c	Copper Tubes (brazed)	„	9¼d.	..
c	„ „ (solid drawn)	„	9¾d.	..
g	„ Bars (best selected)	per ton	£78	£2 dec.
g	„ Sheet	„	£78	£2 dec.
g	„ Rod	„	£78	£2 dec.
d	„ (Electrolytic) Bars	„	£66 5	..
d	„ „ Sheets	„	£84 5	..
d	„ „ Rods	„	£71 15	..
d	„ „ H.C. Wire	per lb.	8¾d.	..
f	Ebonite Rod	„	4/6	..
f	„ Sheet	„	4/-	..
n	German Silver Wire	„	1/10	..
h	Gutta-percha, fine	„	8/-	inc.
h	India-rubber, Para fine	„	2/10	1½d. dec.
l	Iron Pig (Cleveland warrants)	per ton	51/4½	4½d. inc.
l	„ Wire, galv. No. 8, P.O. qual.	„	£14	..
g	Lead, English Pig	„	£18 15 to £18 17 6	5s. inc.
m	Manganin Wire No. 28	per lb.	6/6	..
g	Mercury	per bot.	£7	..
e	Mica (in original cases) small	per lb.	6d. to 8s.	..
e	„ „ „ medium	„	3/6 to 6/-	..
e	„ „ „ large	„	7/6 to 11/-	..
o	Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p	Phosphor Bronze, plain castings	„	1/1 to 1/8½	..
p	„ „ rolled bars & rods	„	1/0¾ to 1/2	..
p	„ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o	Platinum	per oz.	185/-	..
d	Silicium Bronze Wire	per lb.	10⅜d.	..
r	Steel, Magnet, in bars	per ton	£56	..
g	Tin, Block (English)	„	£154 10 to £155 10	£3 10 dec.
n	„ Wire, Nos. 1 to 16	per lb.	2/4	..
p	White Anti-friction Metals	per ton	£44 to £194	..
k	Zinc, Sh't (Vieille Montagne bnd.)	„	£25 2 6	10s. dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

R. Waygood & Co., Ltd.—At an extraordinary general meeting, held last week, Mr. H. C. Walker presiding, a provisional agreement for acquiring the interests of the American Otis Co. in the Otis Elevator Co., Ltd., of London, was unanimously approved. The chairman said that they had found that the competition of the Otis Co. had been quite a serious factor in business in this country and the Colonies, and there was the prospect of that competition becoming still keener, and it was for these reasons that they concluded that the present proposal was eminently desirable. It was intended that the whole of the machines supplied by the united company for all British territories should be manufactured in Great Britain, and would embody all the advantages of both systems, which would give them an additional output, reduce the cost of manufacture and enable them to compete on favourable terms with other manufacturers. The management of the combination would be in the hands of those who had so successfully built up the Waygood Co., with the strength of new directors added.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 12th.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	5/16 — 5/8	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	14½ — 16½	—1	..
Do. Do. Deferred ..	100	..	..	5½ — 7½	—1	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	88 — 91		6 11 10
Do. 7 % Non-Cum. Pr'f.	100	3	..	55 — 58	—1	5 3 8
Do. 5 % Perp. Deb. ..	100	5	5	92 — 94	1	5 6 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 80 xd	..	5 12 9
Central London Railway, Ord. ..	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	83 — 85	..	4 14 3
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1903	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88 xd	..	4 11 0
Hastings Trams, 6 % Pref. ..	1	6	6†	½ — ¾	— 1/16	8 0 0
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord. ..	1	..	..	3/16 — 9/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	17/32 — 21/32	..	7 12 8
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	78 — 83	..	5 8 5

NAME.	Stock or Share.	Dividends for		Closing Quotations May 12th.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	58 — 60	..	6 13 4
Metropolitan Railway Consol. ..	100	1⅝	1⅝	40½ — 40¾	— ¼	3 19 9
Do. Surplus Lands	100	2¾	2¾	62 — 64	— 1	4 6 0
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ %, Con. Pref.	100	3½	3½	80 — 82	..	4 5 4
Metropolitan District Ord. ..	100	Nil	..	26½ — 26¾	— ½	Nil
Do. 6 % Deb.	100	6	6	138 — 141	.	4 5 3
Do. 4 % Deb.	100	4	4	92 — 94	—1	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97 xd	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	84 — 87	..	5 3 6
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	87 — 90	.	5 0 0
Do. 5 % Deb.	100	5	5	85½ — 88½	.	5 13 0
Potteries, Ord.	1	3½	3½	5/16 — 7/16	1/16	8 0 0
Do. 5 % Pref.	1	5	5	17/32 — 21/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	3 — 3½	¼	Nil
Do. "A"	1/-	..	..	7/16 — ½	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	114 — 116	..	5 3 5
Do. 4½ % Bonds	100	4½	4½	99½ — 101½	..	4 8 8
Do. 6 % Income	100	6	6	89 — 90	— ½	6 13 4
Yorkshire (West Riding), Ord. ..	5	Nil	..	⅝ — ⅞	..	Nil
Do. 6 % Pref.	5	3	4	4⅜ — 4⅞	..	4 2 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends 1912.	Dividends 1913.	Closing Quotations May 12th.	Rise + or Fall	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅝ — 4⅞	..	5 12 10
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 7/16	— ⅛	6 4 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4½ % Deb.	100	4½	4½	98½ — 101½	..	4 8 6
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 — 106	..	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	99 — 101	+1	4 19 0
Brazilian Traction, Light and Power	$100	6	6†	77½ — 79½	—1	7 11 6
Brisbane Trams Invt., Ord. ..	5	8	8	7½ — 8	..	5 0 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 — 101	..	4 9 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	111 — 115 xd	..	6 19 4
Do. Pref. Ord.	100	6	6	104 — 108	..	5 11 1
Do. 5 % Pref.	100	5	5	103 — 105	..	4 15 2
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	96 — 99	..	4 11 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	93½ — 95½	+ ½	4 9 1
Calcutta Trams, Ord.	5	7½	9½	6⅝ — 7	— 3/16	6 15 9
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5¼ — 5½	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	+1	5 8 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie El. Trams 5% A Deb.	100	5	5	84 — 89	..	5 12 4
Do. 6% B Deb.	100	3	..	10 — 20	..	Nil

NAME.	Stock or Share.	Dividends 1912.	Dividends 1913.	Closing Quotations May 12th.	Rise + or Fall	Present Yield p.c.
La Plata Elec. Trams, Ord. ..	1	..	..	¼ — ½	..	..
Do. Pref.	1	4¾d.	6	23/32 — 31/32 xd	..	6 5 0
Lisbon Elec. Trams, Ord. ..	1	6	6	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	95 — 100	..	5 0 0
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
„ Elec. Tr. (1904), Deb. ..	100	5	5	101 — 103	..	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	78 — 81	..	6 3 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ — 100½	..	4 19 6
Mexico Trams Com	$100	7	7	61 — 64	—3	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	76 — 80	—1	6 5 0
Do. 6 % Bonds	100	6	6	74 — 77	..	7 15 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	3⅞ — 4⅜	..	11 8 6
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	89 — 92	..	5 8 8
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	94½ — 96½	— ½	5 3 8
Do. 5 % Mort. Bonds	100	5	5	88 — 90	..	5 11 0
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	96 — 100	..	5 0 0
Singapore Trams, 5 % Deb. ..	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	92½ — 95½	..	5 4 9
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends 1912.	Dividends 1913.	Closing Quotations May 12th.	Rise + or Fall	Present Yield p.c.
Bournemouth & Poole, Ord. ..	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10⅜ — 10⅞	..	5 10 4
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 9
Brompton & Kensington, Ord. ..	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91½ — 94½	..	4 4 8
Charing Cross, West End & City	5	5	6	4⅞ — 5⅜	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	93 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10	16 — 17	— ¼	5 17 8
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	— ¼	4 9 0
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 7 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 — 103	..	4 8 1
County of London, Ord.	10	6	7	11¾ — 12¼	..	5 14 3
Do. 6 % Pref.	10	6	6	11¾ — 12¼	+ ⅛	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	103 — 106	..	4 5 8
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	5/16 — 9/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅝ — 4⅛	— ⅛	7 5 5
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	5 — 5½	+ ⅛	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9

NAME.	Stock or Share.	Dividends 1912.	Dividends 1913.	Closing Quotations May 12th.	Rise + or Fall	Present Yield p.c.
Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 8	..	5 12 0
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅜ — 1¾	..	5 2 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	92 — 95	..	4 4 1
Metropolitan	5	4½	4½	3¼ — 3¾	..	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 — 101	..	4 19 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford..	5	7	7	5 13/16 — 6 5/16	..	5 11 0
St. James' and Pall Mall, Ord. ..	5	10	12	9½ — 9⅝	..	6 4 8
Do. 7 % Pref	5	7	7	6¾ — 7¼	+ ⅛	4 16 7
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2¾ — 3⅜	..	6 10 4
Do. 5 % First Mort. Deb. ..	100	5	5	99 — 102	..	4 18 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	Nil	..	5/16 — 9/16	..	
Do. 5 % Cum Pref.	5	3‡	4	2½ — 3	..	6 13 4
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	—1	5 13 6
Westminster, Ord...	5	10	10	8¼ — 8¾	— ⅛	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4 13/16 — 5 1/16	— 1/16	4 6 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 12th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 11 7
Calcutta, Ord.	5	8½	9	7 3/16 — 7 7/16	— ⅛	5 14 3
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	— 1/16	4 17 7
Calgary Power, 1st Mort. Bds. ..	100	5	5	90½ — 92½	..	5 8 0
Canadian Gen. El. Com.	$100	7	8	105 —110	—2	7 5 6
Do. 7 % Pref.	$100	7	7	117 —122	..	5 18 10
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 — ⅝	..	7 12 0
Do. 5 % Deb.	100	5	5	87 — 90	..	5 11 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87 — 89	..	6 14 10
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ — 95½	..	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	4	¼ — ½ xd	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 —105	..	4 15 2
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	.
Melbourne, 5 % 1st Mort. Deb. ..	100	5	5	104 —107	..	4 13 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	58 — 63	—2½	7 18 10
Mexican Lt. & Power, Common	$100	4	4†	23 — 28	—7	..
Do. 7 % Cum. Pref.	$100	7	7	67 — 72	—3	9 14 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	69 — 74	—2	6 15 2
Do. 5 % 2nd Mort. Bonds ..	100	5	5	60 — 65	..	7 13 10

NAME.	Stock or Share.	Dividends for		Closing Quotations May 12th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	50 — 54	+1	..
Montreal, Lt., H. and Power ..	$100	9	10†	220 —225 xd	..	4 9 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	..	246 —255	..	3 18 5
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	103 —108	..	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital ..	$100	5½	6	133 —137	+2	4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	101½ —103½	..	4 7 0
Toronto Power, 4½ % 1st Deb. ..	Do.	4½	4½	98 —100 xd	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 — 89	..	5 12 4
Victoria Falls Power, Pref. ..	1	6	6	23/32 — 25/32	..	7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	102 —104	..	5 15

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 12th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	23/32 — 27/32	..	8 5 0
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	6 17 2
Babcock & Wilcox	1	16	16	2 15/16 — 3 1/16 xd	..	5 4 7
Do: Pref.	1	6	6	1¼ — 1⅜ xd	..	4 7 6
British Aluminium, Ord. ..	1	..	5	29/32 — 1 1/32	— 1/32	4 16 10
Do. 6 % Cum. Pref.	1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Prior Liens Debs. ..	100	5	5	97 —100	..	5 0 0
Do. Deb. Stk.	100	5	5	88 — 93	..	5 7 6
B.I. & Helsby Cables	5	10	13	9½ — 9¾	..	6 13 4
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	101 —104	..	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref. ..	2	Nil	5	1 5/16 — 1½	..	6 13 4
Do. Deb.	100	4	4	73 — 75	..	5 6 8
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	49 — 53	..	8 10 0
Do. 4½ % Second Deb. ..	100	4½	4½	29 — 33	..	13 12 8
Callender's Cable	5	15	15	11¾ — 12¼	..	6 0 0
Do. Pref.	5	5	5	5 — 5¼	..	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	22½	2 23/32 — 2 27/32	..	7 18 2
Do. Deb.	100	4½	4½	104 —107	..	4 4 1

NAME.	Stock or Share.	Dividends for		Closing Quotations May 12th.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	⅜ — ⅝	..	..
Do. Pref.	1	6	6	23/32 — 25/32	..	7 13 4
Edison & Swan, A, £2 paid ..	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	1	6	6	17/32 — 21/32	..	9 4 8
Do. Pref.	1	7	7	15/16 — 1 1/16	..	6 11 7
Greenwood & Batley, Pref. ..	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref. ..	10	6	6	10¼ — 10½	..	5 14 3
Do. Deb.	100	4	4	87 — 91	+2	4 8 0
Henley's, Ord.	5	15	20	14 — 15	+ ½	6 13 4
Do. Pref.	5	4½	4½	4⅞ — 5⅛	+ 1/16	4 7 10
Do. Deb.	100	4½	4½	101½ —103½	+ ½	4 7 0
India-Rubber, G. & T.	10	7½	7½	10 — 11	..	6 16 5
Do. Pref.	10	5	5	8¾ — 9¼	..	5 5 8
Telegraph Construction	12	20	20	36½ — 38½	..	6 4 7
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	64 — 68	..	5 17 8
Do. B 4 % Cum. Pref. ..	100	..	..	43 — 47	—3½	..

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 12th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾ — 6¼	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	122 —126	+1	6 7 0
Do. Collat. Trust	$1000	4	4	90 — 93	..	4 6 0
Anglo-American Telegraph ..	Stock	3	3	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	108 —109	— ½	5 10 1
Do. Def.	Do.	30/-	30/-	23⅛ — 23⅜	— ⅛	6 7 0
Anglo - Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7⅜ — 7⅝	..	5 5 0
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	—1	4 18 9
Cuba Telegraph	10	6	6†	8¾ — 9¼	..	6 8 1
Do. 10 % Pref.	10	10	10	16 — 17	+ ½	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7½ — 8	..	6 5 0
Direct United States Cable ..	10	4	4	6½ — 7	— ⅛	5 14 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	+1	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	133 —136	..	5 3 0
Do. 3½ % Pref. Stock	Do.	3½	3½	77½ — 79½	+ ½	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96 xd	..	4 3 4
Eastern Extension	10	7	7	12⅞ — 13⅜	..	5 4 9
Do. 4 % Deb.	Stock	4	4	94½ — 96½	..	4 3 0
Globe Telegraph and Trust ..	10	6	6†	10⅞ — 11⅜	— ⅛	5 5 4
Do. 6 % Pref.	10	6	6	12½ — 13	..	4 12 4
Great Northern Telegraph ..	10	20	20	31 — 33	+ ½	6 1 1
Indo-European Telegraph ..	25	13	13	56½ — 58½ xd	..	5 11 1
Mackay Companies Common ..	$100	5	5	81 — 84	..	5 19 1
Do. 4 % Cum. Pref.	$100	4	4	68 — 71	..	5 12 7

NAME.	Stock or Share.	Dividends for		Closing Quotations May 12th.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph ..	1	20	20	3⅛ — 3¼	+ 1/16	6 3 1
Do. 7 % Cum. Partic. Pref. ..	1	17	..	2½ — 2¾	+ 1/16	6 3 9
Monte Video Telephone, Ord. ..	1	6	6	13/16 — 15/16 xd	..	6 8 0
Do. 5 % Pref.	1	5	5	23/32 — 27/32	+ 1/16	5 18 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98¼ — 99¼ xd	..	4 11 0
Oriental Telep. and Elec. ..	1	10	10	2 1/16 — 2 5/16 xd	..	4 6 7
Do. 6 % Cum. Pref.	1	6	6	1 5/32 — 1 7/32	— 1/32	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	8½ — 9½	..	10 10 6
Submarine Cables Trust	Cert.	6	6	126 —129	+ 1	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 —100	..	4 10 0
United River Plate Telephone	5	8	6†	6⅜ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅝	..	4 9 0
West Coast of America	2½	2½	Nil	1 — 1¼	..	5 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	1½	2⅛ — 2⅜	+ ⅛	5 5 3
Do. 6 % Cum. 1st Pref. ..	10	6	6	9⅞ — 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref ..	10	6	6	8⅞ — 9⅛	..	6 11 6
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd. ..	10	7	7	13⅜ — 13⅞	..	5 1 11
Do. 4 % Debs.	Stock	4	4	95½ — 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	93 — 96	..	4 13 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

The Electric Vehicle Committee.—At a meeting held on April 24th, Mr. E. W. Curtis, jun., vice-president of the General Vehicle Co., of Long Island, U.S.A., was elected a member during his stay in England; it was also decided to invite Mr. Beauchamp, West Ham, and Mr. K. Bowen, Cedes Electric Traction Co., Ltd., to become members of the committee. In regard to electric supply tariffs for battery charging, it was reported that a number of undertakings had already signified their decision to come into line with the suggested tariffs. A design for the earthing contact was provisionally decided on, which is to be fitted to a standard charging plug ready for the Committee's inspection at the next meeting. As to maximum carrying capacity, it was decided to have heating tests made, the acting hon. secretary of the Technical Sub-Committee, Mr. J. Christie, undertaking to make tests for this purpose.

The Technical Sub-Committee has been considering the possibility of standardising battery trays, but there appear to be difficulties in the way, and they decided to obtain, through the B.E.A.M.A., the views of battery makers as to the feasibility of, as a commencement, standardising the height and width of lead battery plates.

A proposal is on foot to hold a vehicle demonstration at Birmingham, during the M.E.A. convention.

DIFFICULTIES ATTENDANT UPON THE WORKING OF ELECTRICAL APPARATUS IN MINES.

By SYDNEY F. WALKER.

(*Concluded from page 800.*)

The coal conveyor that has been introduced at the face during recent years, and which is largely driven by electric motors, also presents considerable difficulties; perhaps not so great as those involved in driving coal-cutting machines. The motor driving the conveyor is usually fixed in a gate road, where space is comparatively abundant. A point that should be mentioned in connection with the working of coal-cutting machines, is the very small amount of head room in which some of the machines have to work. The coal-cutting machine has enabled seams of 18 inches thickness and upwards to be worked economically, where it was absolutely impossible by hand labour. The cost of hewing, or undercutting the coal by hand, in some of the very thin seams, was so great, that the coal could not be put upon the market for the price obtainable. The adoption of coal-cutting machines so reduced the cost of undercutting, that many seams, previously unworkable, were able to be put upon the market. But the difficulty of head room and space for working remains. Usually the thin seams lie between an underclay and a hard roof. The hard roof is good, as it does not easily fall; but it makes it expensive to provide additional head room, and hence the working has to be carried out by men in very cramped positions. When anything happens to the motor of a coal-cutting machine, whoever is to repair it not only has to find his way to the machine, but also has to work under the confined conditions ruling there. The machine may have stopped in the middle of the face, some distance from the gate road, and the electrician will sometimes have to crawl or wriggle along the face, to reach the machine; he will have to carry out all the repairs that are necessary, in many cases lying on his side or his stomach. Bearing in mind how very poor the light is, and how very easily it may be extinguished, in the case of the old oil safety lamp, the conditions of working in thin seams at the face will perhaps be appreciated. At least one fatal accident has occurred at "the face" in thin seams, while a coal-cutting machine was being adjusted.

Another important matter which arises from the irregularity of the roads, and from the peculiar manner in which coal seams lie, is the physical effort required to go from the shaft bottom to the face and back in a great many mines. The coal seams lie in basins. There is sometimes a fairly level portion of the seam at the bottom of the basin; but in a large number of collieries, the road from the shaft to the face lies on a very steep incline. To save expense, it has become the practice to sink the shaft at or near the highest point of the seam within the royalty, and to reach the boundaries of the royalty by inclines. A mile or two miles are quite common distances between the shaft bottom and the face of the coal; and in some of the older collieries, which have large royalties, even four miles has to be traversed. The main roads, the intake and return airways, are necessarily kept in fairly good repair; but their floors are always in such a condition that walking along them is very exhausting, even to those who are more or less accustomed to it, and when they are on the level. Walking down an incline of say one or two miles of very rough road, with wagon rails and sleepers occupying the larger portion of the road, and walking back again, after having carried out some repair, is somewhat heavy work. In some metalliferous mines the going is even heavier. Modern mines on the Rand have cages, in which the men descend and ascend; but the roads along the levels are as rough as it is possible for roads to be, and more or less encumbered with pieces of rock, often with sharp edges, the whole way. In older mines too, in Cornish mines, for instance, a good deal of the going up and down has to be done by ladders; or in some of the very deep mines by the "man engine."

A mining engineer, who was employed in Mexico, told the writer that descending and ascending Mexican mines which he had visited, was done by means of poles, which took the place of the ladders in Cornish mines; notches were cut in the sides of the poles for the feet to rest on.

In the coal mines of the United Kingdom that were at work down to about 30 years ago, the conditions of temperature and humidity were not uncomfortable. But as the shallower seams have been exhausted, those lying at greater depths have had to be worked; and at the present time, depths of 1,000 yards from the surface are quite common in many coal mines in the United Kingdom; while in some metalliferous mines, the deepest levels may be 5,000 feet below the surface. Temperatures of 80°F. are quite common; and temperatures of 90°F. and upwards are met with. But it is not the temperature so much as the humidity that tells. In a temperature of 80°F. with dry air, work can be carried on in a mine fairly comfortably; but a temperature of 70°F., with a high percentage of humidity, renders work very exhausting indeed. In modern coal mines the provisions of the Coal Mines Regulation Act necessitate a very large air supply, but it does not always follow that comfortable conditions rule. In some mines in Scotland, for instance, notwithstanding a good ventilating air current, the dry and wet bulbs showed 83°F. and 80°F. respectively, a condition of things in which it is very difficult indeed for men to work. The air has very little capacity indeed for absorbing moisture, and the heat is absolutely unrelieved. In metalliferous mines, until recently, little or no trouble was taken about the ventilation, and in addition to the humidity and the high temperature the fumes from the explosives vitiated the atmosphere to a considerable extent.

The irregularity of the roads is most trying to the cables, and to joint, switch, and connecting boxes. It is often exceedingly difficult to know where to fix a cable, so that it shall have the least liability to accident. If the cables are suspended from the props which support the roadways, there is a very good chance of a heavy fall either breaking the cables, driving the armour through the insulation to the conductor, or in the case of twin and three-core cables, making a "short" between the cores. The natural preventative for this would be burying the cables by the side of the road; this has been recommended, and has been done in some cases. Compressed-air pipes are fixed in that way, but the difficulty arises that the pipes and cables may be lost. Compressed-air and water pipes have actually been lost, that have been fixed by the side of the road; and a great deal of trouble and expense has been incurred in finding them. In the working of the mine, they have been simply buried. In some up-to-date mines, the main cables have been protected by building stone walls specially to support the roof, and arranging the cables either under special ledges, or in such a manner that it is practically impossible for any damage to come to them. Arrangements such as this, however, are quite exceptional.

The working of the haulage systems in all mines has a very important bearing upon the maintenance of the cables, and on the facility for looking after them and executing repairs when they are required. In modern mines the tendency is to adopt the endless-rope system, with which the road is twice as wide as with the "main and tail" system, and there is plenty of room to get out of the way of mine wagons that are going in either direction. There is the danger even with the endless-rope system, of a man who is busy repairing a connecting box for instance, forgetting about an advancing mine wagon, or forgetting that a rope close to his feet is in motion. It is often almost a matter of gymnastics to get out of the way of the rope and the wagons, to keep the light exactly upon the spot where one suspects the fault to be, and to loosen screws, etc.

With "main and tail" haulage the conditions are far more severe. The "journeys" of wagons only run at certain intervals, but when they do run, their speed is in the neighbourhood of ten miles an hour, and there may be anywhere from three or four wagons up to ten or twelve. There is usually very little room between the wagons and the side of the road, and it becomes necessary, when a "journey" is heard coming, to escape as quickly as possible to the nearest refuge. Work upon a switch or connecting box, or even a cable, is not so easily carried on, when one ear has to be open for the "journey" of wagons, and when a bolt has to be made for safety.

The maintenance of switch boxes, connecting boxes, etc., also presents considerable difficulties. On opening the switch, any explosive mixture that is present may be fired. The remedy is to arrange joint boxes, switch boxes, connecting boxes, etc., so that any flame which arises within the box, say by the ignition of an inflammable mixture, cannot pass out. Many switch boxes are designed by men who have never seen a mine, and who have absolutely no conception of what it means to work underground; and it is quite easy, if you leave out all the difficulties, to design cheap apparatus. The very best protection between the atmosphere inside of a switch or connecting box, and the atmosphere outside, is a wide flange between the cover and the body of the box, the flange to be very carefully machined, and to be very carefully cleaned every time it is closed, and the two surfaces to be screwed into close contact. Such a box has also, in the writer's experience, the great merit that it will exclude moisture.

Outside of all this, there is the constant danger of shock. Under present conditions, except in a very few mines, where the plant has been very carefully laid out indeed, and where reasonable expense has not been spared, it is very difficult to ensure that some metallic body, such as a haulage rope, a haulage pulley, a signal wire, or something of that kind, which should be perfectly innocent, may not have become connected with some part of the service, and have become alive. In the fatal cases that have occurred, either one conductor of the trailing cable has become connected to the carcase of the machine, or some other part of the insulation has broken down, and the machine has become connected to the circuit. The whole machine being alive, the haulage rope is itself alive, and the man who handles the rope, standing on the ground, may receive a shock sufficient to kill him. Shocks have been obtained from touching signal wires and by men who were pushing empty mine wagons on to the rails, often placing their bare backs against the edge of the wagon, and so on. In all cases it is a question of preserving the insulation intact, and this means the constant patrolling of the service. It is very difficult for an electrician, not having the hereditary home-like feeling in a mine which the miner has, to carry out the patrol in the time that is available, taking into consideration the number of electricians that are usually employed.

It appears to the writer that the accidents in mines from electricity, and the difficulty of working electrical apparatus in mines, might be very considerably reduced, if the general body of the workmen received a certain amount of education in electrical engineering. In every district there are now lectures on mining, and the writer sugests that any education that can be imparted to the whole body of the miners, at the expense of the mine owners, will be money well spent. There are numerous cases where the possession of a comparatively small amount of knowledge would have prevented fatal accidents. If it only made the working miners careful—if it only instilled into them a respect for the electrical apparatus—something would have been done. But if, in addition, all the men working coal-cutting machines, for instance, and all the men engaged on haulage roads, were instructed in the dangers attendant upon the use of the different apparatus, and how to avoid them, a great deal would have been done, and the writer believes a great deal of money would be saved.

COMPARATIVE ECONOMICS OF TRAMWAYS AND RAILLESS ELECTRIC TRACTION: A CRITICISM.

[COMMUNICATED.]

The paper by Mr. Gribble, of which an abstract was published in Electrical Review of May 1st, 1914, instituted a comparison between the construction and operating costs of tramway and railless electric services, based entirely upon equality of headway and car mileage per mile of route or per annum. The assumption is made quite definitely that the earning capacity of the two vehicles is equal, and consequently no comparison of earning power is made in the paper.

The assumption of equal earning power seems to be based upon a statistical figure of average "passengers per car mile" taken from the Board of Trade returns which is between nine and ten, but raised in the published abstract to "average number of passengers carred on British Tramways, which does not exceed 13," and as the seating capacity of the trackless vehicle singledecked is 28, the suggestion is that that is ample to deal with an average of 13 passengers.

This assumption is fallacious. In the first place, "passengers per car mile" is a figure having no relation by itself to the average occupation of a car. The correct figure is obviously "passenger miles per car mile," which simplifies to "passengers per car." A very simple illustration suffices on this point. A train runs, say, from Victoria to Brighton, non-stop, with 105 passengers in it. This is two passengers per train mile. Obviously it has no relation to the seating capacity required in the train. An approximation to the required figure for tramways can be got in some instances by a comparison of the takings per car mile, the average fare per passenger, and the average length of ride given for the fare paid by the majority of passengers. Such an approximation gives too low a figure wherever workmen's fares form a large part of the earnings, and in any case it is only an average. In the case of Glasgow tramways this comparison gives the average occupation of the cars as 23.6 persons in the last year available. The average fare per mile in Glasgow is 0.44d.

In London, on the south side of the Thames at least, the average fare per mile is no higher than in Glasgow, but the average fare per passenger is considerably higher, and as the earnings per car mile are higher, so is the average carrying per car. As Glasgow and London together account for 812 million passengers out of the 3,220 millions for the whole country given by the Board of Trade Returns for 1912-13, *i.e.*, for over 25 per cent. of the whole, they may perhaps suffice to give some idea of the relation between the 9½ passengers per car mile, which Mr. Gribble seems to have relied on, and the actual average carrying of the tramcar.

But the fallacy is wider than this because, in a tramway or any other public transport service, it is not the average that must be provided for, but the maximum demand. The bulk of the income on a tramway is earned during the rush hours when every available car and every available seat is occupied during a large percentage of every round trip, and unless the equipment permits the earning of that revenue, the service can neither satisfy the public nor prove remunerative. So the carrying capacity to be provided must be equal to the maximum demand; if it is only equal to the average, it fails both as to facilities afforded and earning power.

Anyone who wishes to see an illustration of this point as regards facilities afforded, should stand at the Tooting Broadway tramway terminus between say, 7 and 7.30 a.m. In that time about 30 cars and five trailers leave in the "up" direction, with about 2,600 passengers on them, passengers who pay each 1d. only for a journey of about five miles. The motor cars carry 78 each, the trailers 50 each, and the return trip is made practically empty. These are workmen's fares, and as the earnings on the round trip are only about sevenpence per car mile, they no more than cover working expenses. Where would the Railless be on such a service? Take it—and it is a great stretch—that a railless car can be built to carry 39, so that two of them equal one L.C.C. tramcar, the round trip would produce 3.9d. per car mile, perhaps half the actual running costs. With trailers on, the comparison comes out even worse. So that to give such a workmen's service without serious loss, there is no comparison between the railless and the tramcar. On the other point of revenue earning, the crowded condition of the cars in any populous district at the rush hours—morning and evening, Saturday afternoons, or football matches, apart from workmen's fare hours—will speedily convince any observer that the earning capacity is conditioned by maximum carrying capacity, and that the average has not much to do with it.

It is because the tramcar has this large earning capacity, because it is utilised during the hours when needed, and because the additional cost of running an additional car mile is so low, that a tramway administration can, and does, afford to give an excellent frequent service during the hours when the traffic is relatively slack. It is this very high carrying and earning capacity therefore, a virtue from every point of view, which results in the average earnings per car mile being brought down to about 10d. or 11d. in most cases. The maxima are very often nearer two shillings than one, but it is an axiom of traffic management that average earnings of one shilling per car mile indicate that an insufficient service is being run, and that "money is left on the road."

It may be noted in this connection that the L.C.C. Tramways' Department run into their depôts 40 per cent. of their cars between 10 a.m. and 4 p.m.; so that in their case the rush hours require 66 per cent. more seating capacity than the dull hours, and they are putting on order 150 trailer cars, which will increase the proportion. In London, specially favourable field as it is for motor 'buses, the average loading of the tramcar is 1.6 times that of the omnibus.

The upshot of all this is that in comparing the two modes of traction, the car miles of the trackless vehicle must be multiplied by some factor certainly not less than 1.6, and not greater than the ratio of the seating capacities (28 for a single-deck—38 claimed by Mr. Gribble for a double-deck—car, against the 56 to 78 for an average tramcar), say 2, in order to provide equivalent earning power.

Taking the lower factor of 1.6 applied to the railless traction ordinates in fig. 2 on p. 735 (Electrical Review, May 1st, 1914), it will be found that for every headway more frequent than 25 minutes, the tramway gives a lower total annual cost. That is, for equal earning power or equal facilities to the public, the tramway is less costly whenever a service of, say, 20 minutes or less is needed.

This is not all that might be said in criticism of Mr. Gribble's paper.

In the costs of construction he has ignored the fact that two trolley conductors per line must be provided; and a double system of trolley feeders. The latter item becomes very heavy on widely extended systems, or with dense services, and would have to be met by more frequently spaced substations in some cases. Working expenses are increased by either provision.

No allowance is made for road surface improvements. Whether any is needed or not depends of course upon the class and condition of road to be run on. At Dundee, after about 1½ year's experience on a route of less than 1¼ miles, with only two cars, it has been found necessary to spend £6,000 in concrete bottoming a portion of the road, and it is estimated that £14,000 will have to be spent on the whole route; half of this is to be charged to the Tramway Department. It is quite clear that this route would have been amply served by a single track with a central passing place, which could have been very amply constructed for £7,000, and would have given the Tramway Department the benefit of the lower working costs and uniformity of rolling stock.

Then as to cost of road maintenance, Mr. Wakelam, surveyor to the Middlesex County Council, recently stated that petrol motor omnibuses do damage to the value of 2d. per car mile on the Middlesex macadamised roads. Although the railless single-deck car weighs 5 tons against the 3½ tons of the petrol vehicle, there is good reason to credit the electric drive with much less damaging powers, but this credit is amply satisfied by a discount of 50 per cent, or, say, 1d. per car mile. Whoever pays this, it is a part of the cost of running the service, and must go against the railless vehicle in a full consideration of its economics. On the other side the tramway not only pays for the maintenance of its own "road," *i.e.*, the rails, but contributes to the general road maintenances by keeping in repair the paving between rails and the 18-inch margins, a very onerous liability, of which the equity is not well established, and which is a part of its working costs.

It may of course be said that the roads requiring a public service of passenger vehicles should be made good enough to carry the service, at the expense of the road authority, *i.e.*, the public. This is substantially in accordance with English highway law, but it has not been applied in the case of the tramways, and in any complete comparison such cost must either be properly allocated to each of the methods compared or to none of them. That it is a very serious item is well shown by the great expense to which the London road authorities are now put to remake their road bottoms with 9 to 12 inches of concrete, the 6 inches standard hitherto in use proving insufficient to carry motor omnibuses and similar traffic. That expense must be debited to the motor omnibuses in any true comparison between the cost of tramways and of motor services, whether electric, petrol, or steam.

Leaving aside the figures taken by Mr. Gribble for tramway costs, whether construction, working, or renewals, all of which invite adverse criticism to a greater or lesser extent, it is perfectly clear, on his own figures, when put against actual earning capacity, and actual capacity for public service, that the economic utility of the Railless Traction scheme is limited to services of comparative infrequency, say, not more often than twenty minutes. It has long been recognised that under average British conditions, a tramway is not worth working unless the traffic justifies a twenty-minutes service at least, so that the railless system, with such costs as Mr.

Gribble puts forward, comes in very well to supplement and feed tramways in the more populous districts; or, to afford a transport service in less populous districts where a tramway service is not justified by the traffic prospects, yet where a public service would be a great boon.

The field thus open to the Railless System is a very wide one. There is hardly a main road outside the industrial districts, along which such a service would fail to meet a public want, and a very large extent of roads on which it would evidently be remunerative, if the question of road bottoming maintenance can be satisfactorily met.

There can be no doubt that the movements for the improvement of rural conditions of life, for better utilisation of the land, for the encouragement of home industries in rural districts, will demand better transport facilities along the roads, both for passengers and for goods, and it seems that railless electric traction, combined—as it might well be—with distribution of electric power for small industries for agricultural purposes, should play a very useful part in the near future in the furtherance of these beneficial movements.

A PEAT FUEL CENTRAL POWER STATION.

With a view to advancing the much discussed peat fuel problem, the Prussian Crown authorities decided, some six years ago, to erect an electric power house on a site near the centre of the Wiesmoor peat deposits in Eastern Friesland, from which the peat for fuel was to be obtained.

The so-called German system of high cultivation was to be adopted, that is to say, the bogs were to be laid dry by means of canals, and the surface, when it had become fit for cultivation, was to be rented to the peasantry.

The work of laying dry the surface was carried out from a small temporary station, where steam engines and dynamos for actuating electric pumps were installed, the peat cut from the canals supplying the fuel. The main canal, carried right through the peat district from north to south, connects the Ems-Jade Canal with the North-Georgs-Felm Canal, thus bringing Emden, Wilhelmshaven, and Leer into direct connection by water with the central power station.

The central station was started in 1908, when a steam-driven generator set of 200 horse-power, for 5,000 volts pressure, was installed by the Siemens-Schuckert Co., who contracted to carry on the work on the Crown Authorities undertaking to buy a certain proportion of the peat and of the energy generated.

The work progressed rapidly, and by the end of 1910, the plant had grown to a capacity of 5,400 horse-power, and the central station now consists of boiler, machinery, and transformer houses, in the first of which are placed the boilers for driving the three turbo-generators supplying alternating current at 50 periods and 5,000 volts pressure, the aggregate output being equal to 4,000 kw. The switching gear and three transformers, each wound for 1,250 k.v.a., and 5,000/20,000 volts, are placed in the third house.

The peat is worked by machinery, and after being closely ground, is exposed for drying on part of the land levelled and drained for the purpose. During this operation the quantity of water in the peat is reduced from about 90 per cent. to about 25 per cent. of the weight of the peat.

The work is naturally entirely dependent upon the weather, and the drier the summer the more peat, and peat of better quality, can be dried, for properly sun-dried peat does not again absorb moisture whilst imperfectly dried peat does so readily. Drying operations have therefore to cease comparatively early in the year in order that the peat may become quite dry before the winter sets in, as peat which has not been fully dried quickly freezes and is then useless for fuel purposes.

Tests have shown that 1 kg. of the peat converts 3.1 kg. of water into steam at 12 atmospheres pressure, and in the ordinary everyday working of the installation it is found that 2.75 kg. of peat yields 1 kw.-hour, which, at the present price of the peat, works out at 0.16d. per kw.-hour.

Allowing for an annual consumption of 20,000,000 kw.-hours, or about 2½ times the present output, it is estimated that the Wiesmoor peat deposits will last for about 450 years.

THE ELECTRIFICATION OF RAILWAYS AS AFFECTED BY TRAFFIC CONSIDERATIONS.

By H. W. FIRTH, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 30th*, 1914.)

The electrification of a tube line or similar property where the whole of the business is of one character is comparatively simple; but the traffic problems which have to be considered in the case of trunk lines—problems almost, if not entirely, independent of the system of electric traction adopted—are complex and not easy to solve.

The main difficulty arises from the fact that traffics of widely varying character have to be handled over the same rails. There is not only the working of goods trains involving shunting and marshalling, and requiring to be handled over the same roads as passenger services, but there is a very great diversity in passenger business alone.

The working is rendered more difficult in some cases by being largely seasonal. In the summer-time the seaside or other holiday expresses are more numerous. In some instances the time of maximum pressure of this traffic occurs at or about the same time as that of maximum pressure of suburban business.

A difficulty experienced in the case of local traffic is the fact that rolling stock cannot always be reserved for one service only. A train may have to operate on one trip as a slow train, calling at stations the average distance apart of which is less than one mile, and it may be desirable on other trips to run the same train at a higher maximum speed for considerable non-stop runs.

The widely varying speed characteristics of these services render it necessary to give very careful consideration to the motor characteristics and gear ratio, and the author would suggest that the attainment of a more flexible speed characteristic of the motor, either by partially shunting the series field of the ordinary series motor as has been suggested, or by some other means such as separate field control, is very desirable.

This question of the use of rolling stock in different services is a very important matter for lines having both a heavy suburban business and also a heavy seaside excursion traffic. On some railways the mileage thus run by suburban stock in non-suburban trips is as large as 80,000 or 100,000 miles per annum. Under steam conditions this flexibility in the user of rolling stock is of course easily attained, and any kind of carriage can be handled by any kind of locomotive. To electrify the whole of the suburban trains may therefore necessitate the provision of spare stock for such trips as those mentioned above, unless the more important sections of the seaside traffic nearest to London are themselves electrified.

The nearer seaside resorts—those 50 or 60 miles from London—are becoming increasingly popular as residential neighbourhoods for London business men, and a large residential traffic is being built up. The conditions mentioned above may in the author's opinion have some weight in causing the electrification of such seaside traffic to be considered.

The term "main-line services" has been used by different authors and speakers for totally different things. The present author is of opinion that the term "main-line traffic" or "main-line service" should be strictly limited to those services serving widely scattered communities quite distinct from each other and having no regular, all-the-year-round, residential, social, or amusement, traffic.

To speak of such services as London-Brighton, London-Clacton, London-Southend as "main-line" is not in the author's opinion correct. They are all services which have—

or can be made to have—the characteristics of suburban traffic, *i.e.*, a large season-ticket residential business with a flow of traffic largely "up" in the morning and "down" in the evening. It is the *character* of the traffic which is of importance, not merely the distance.

The author considers that the true main-line business, as above defined, cannot be profitably electrified at present except under exceptional circumstances, but the outer suburban traffic must be carefully considered whatever its length of run, because in many cases there may be great possibilities of obtaining by electrical means a considerably increased revenue, apart from the residential regular daily business, at comparatively small extra cost, especially in the case of seaside resorts with considerable traffic "down" in the morning and "up" in the evening.

With few stops and an irregular and infrequent train service electric traction cannot show much superiority in operating characteristics; but if the stops are at short distances apart or the service demands great flexibility in seating capacity to meet widely varying passenger numbers, the operating conditions then demand two features which electric traction can give: High acceleration, and multiple-unit train formation. Where the requirements of traffic are such as to make these demands, electric traction is the proper means of adequately meeting these requirements, and it then remains to investigate the financial aspects of the change.

Under present conditions not only do the trains on one branch or portion of a system differ in make-up from those on another, but frequently almost every individual train will have a particular formation. Some trains must have dining-car sets, and some must have more than the usual number of brake vans as they deal with special traffic such as mails or milk. The result is that the particular vehicles forming an "up" train due in a terminus at say 4 p.m. most likely cannot form, as might be thought, the 4.30 p.m. "down" train to some other point, even if up to time, as its formation is not suited to the particular requirements. Consequently it has to run out to the car sidings as empty cars, and return to the terminus also as empty cars at some other time for a down journey suitable to its formation, or else it has to be split up and re-formed at the car sidings.

There are three results from this:—

1. Low mileage of vehicles in profitable work.
2. Considerable light (unprofitable) mileage and cost of haulage.
3. In congested terminal districts very serious occupation of the limited line accommodation by non-paying car trains to the exclusion of paying passenger trains.

If electrification of this class of traffic takes place the situation is—financially—more serious. It is impossible to consider installing expensive electric equipment on cars so utilised for only a fraction of the possible time. The use of electric locomotives instead of multiple-unit equipments may be suggested as a remedy for this, but many of the extra-suburban services —to places 40 or 50 miles distant—really call for multiple-unit working if the full operating advantages of the electrification of these services—particularly at crowded termini—are to be reaped.

The solution, if one be possible, must be looked for in two directions:—

1. Standardizing the trains on different services as much as possible.
2. A bold re-timing of trains to eliminate a good proportion of the same.

Re-timing of suburban trains is not easy, as the exigencies of business demand the arrival in town of large numbers of people at a more or less fixed time. More flexibility of timing of purely main-line trains can be allowed, but the re-timing of the general traffic of an important line is not to be lightly undertaken.

When once a clear track has been arranged all down the run for an express train leaving a terminus or starting-point at a given time, it is far easier to let two or three more similar expresses follow at a few minutes' interval than to arrange for a similar clear track some time later. There is therefore a tendency to run main-line trains in bunches. The re-timing of such bunches of trains would not only relieve the terminal working, but give an improved service of greater regularity to main-line points. To enable main-line traffic to be re-timed many sidings may have to be converted to facing-point sidings, an alteration which it is not always possible to carry out.

A suburban train can arrive at and depart from any one of a number of platforms, and no difficulty therefore arises in making an incoming train serve as an outgoing train from the same platform; but with the main-line trains the conditions are different. As far as possible important main-line trains must arrive at one of a number of special arrival platforms, and cannot easily again be dispatched from the same platform as "down" passenger trains.

If any satisfactory results from a traffic point of view are to be obtained by electric traction, it appears imperative to electrify at any rate all suburban and local passenger traffic within a certain zone in order to standardize the acceleration and schedule speed of these classes of traffic and thus get by uniformity the greatest capacity out of a given line. There seems no good reason at the moment to anticipate the electrification of the main-line business in the congested area. Where, however, it is impossible to prevent a general intermingling of traffic of varying speed characteristics in the densely crowded area, it may be necessary to consider what may be termed terminal electrification, *i.e.*, the electric handling of all traffic within a certain zone, as in the case of the New York Central Railroad.

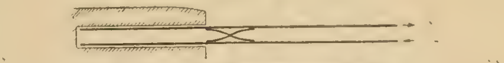
On a line where all the traffic is of much the same character, where the rates of acceleration and braking are of the same order, and the length of the train unit is fairly regular, a service of trains at very close intervals can be maintained and the block signalling can be designed very closely for these conditions. On stretches of line, however, which have to accommodate at various times high-speed expresses of perhaps [illegible] tons at 60 or 70 miles per hour, long heavy goods trains of say 400 yards in length, or light suburban or local trains of only a few coaches, the block sections must be so proportioned as to give ample distance, having regard to gradients, curves, junctions, and other features, for the pulling up of the longest and heaviest trains.

Although in parts of the more densely crowded systems the lines are usually doubled or trebled, it is a matter of the greatest difficulty to sectionalize the traffic. The suburban business of some of the biggest suburban traffic-carrying lines entering London has a comparatively bad load factor, heavy "up" traffic for two or three hours in the morning and heavy "down" traffic for two or three hours in the evening, with the worst rush for a very short time on Saturdays between 1 p.m. and 2.30 p.m. or 3 p.m., and consequently suburban traffic overflows to other adjacent main or local lines. Even if the lines can be sectionalized so as to keep the varying traffics more or less apart, the lines allocated to suburban business must still be so signalled as to be capable of accommodating other trains.

The minimum length of block sections is primarily dependent on the distance required for braking. If one can restrict the speed to 30 miles per hour instead of 60 miles per hour, one can nearly double the carrying capacity of a line per unit time at a corresponding sacrifice of the schedule speed.

This may operate in an important way in the case of electrification of a railway where the main-line and suburban passenger trains have to run over the same metals for part of the journey. There are many lines carrying a dense service of trains of varying speed characteristics over sections originally signalled for high speeds, where a speed limit of say 30 or 40 miles per hour on main-line trains would enable a much greater frequency of trains to be operated, without reducing the average speed of these main-line trains by more than a small amount. If properly signalled and graded as to speeds, one line in the busy section where speeds cannot be high may adequately feed two branching sections of line in the outlying area where speeds can be high.

FIG. 1.



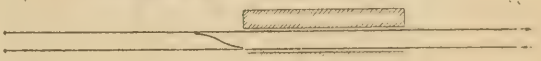


FIG. 2.

These principles could in many cases be applied so as materially to increase the capacity of our present lines whether electrically or steam operated.

If the traffic characteristics of any of our big suburban systems be investigated, it will be found that a very large part of the difficulty in getting the trains through, or in getting more trains through, lies in the number of complex junctions and cross-over roads over which the trains serving widely branching systems have usually to run, thus conflicting with other trains.

Some lines, like the Great Northern, and the London and South-Western, are fortunate in having many flying junctions by which much confliction of trains is avoided, and in these cases the increased train frequency possible with electric traction, owing to superior acceleration, can be taken full advantage of. Where mixed traffic has to be worked over flat junctions it is not possible to have so high a frequency, hence the size of train unit must be increased.

In the author's opinion there are many cases where it will be found that the introduction of flying junctions and the consequent simplification of working, will enable electric traction to give a satisfactory and paying increase in facilities, where at the present time with flat junctions the expenditure of capital for electrification would not give a reasonable return.

It is axiomatic that a service of electric trains should be as frequent as possible and that the train should be as short (and therefore light) as possible consistent with giving adequate seating accommodation. The shorter the train the shorter the block section can be made; but although this will give great frequency of trains it does not give the greatest seating capacity per hour. Because although longer trains require more time to clear sections and can therefore not be operated at such frequent intervals, the time required for one train to follow another does not increase in proportion to the length.

With trains about 150 metres long the maximum number of trains possible on a line excluding flat junctions and dead-end termini may safely be assumed as about 40 per hour. For a terminus such as is shown in fig. 1, consisting of two platform roads used alternately, the number of electric trains which it is possible to run at this terminus under working conditions is 33 per hour, compared with the 40 possible on the intermediate sections. The reduction from 40 to 33, is the measure of the disability of the terminus. This ratio may be conveniently called the "terminal factor," and in this case is 33/40 = 0.825.

The possible number of steam trains on the basis of 140-metre trains and an acceleration of 0.22 metre per sec. on the through sections is given as 32, while the number which can be worked into a terminus such as fig. 1, is given as 21. The "terminal factor" in this case is 21/32 = 0.656.

Comparing the numbers on the through sections, the reduction by use of steam is 8 in 40, or 1 in 5. But in the terminal working the reduction is from 33 to 21, *i.e.*, 1 in 2.75, thus showing the great superiority of electric working over steam for terminal business. This comes about through the requirements of the locomotives.

If the terminal arrangement shown in fig. 2 can be adopted, where the crossing takes place not at the entrance to the platforms but beyond them, theoretically the "terminal factor" for electric multiple-unit trains can be made unity, *i.e.*, no limitation of frequency exists; but it requires one more train to perform the schedule and the shunting increases the number of non-remunerative train-miles.

For an urban line carrying passengers only, the time during which the train is at rest at the platform in fig. 1 is sufficient for station purposes; but with a trunk-line suburban service there is the requirement of dealing with milk, parcels, mails etc., and the lay-over given is not always sufficient. Apart from this the time required for emptying a platform of people arriving by a train to some extent governs the lay-over necessary if the same train is to operate as a passenger train in the reverse direction.

Bearing in mind what has been said above, the author is of opinion that with trains of 450 ft. length, 30 per hour in each direction on a double line is about the maximum possible over lines where flat junctions are introduced, and where all the trains at the busy end of the system have to be dealt with in a terminus where it is not possible to extend the platform lines as shown in fig. 2 beyond the platforms and thus do away with the "terminal factor." In the majority of our big stations this is well-nigh impossible.

Under steam conditions it is not economically possible to run on a double road more than 16 trains per hour each way. The size of these trains is, however, in many cases very large, and the number of seats in some cases exceeds 1,000 per train. In the case of Liverpool Street Station (which handles probably the biggest steam suburban passenger business in the world) in one hour, on one pair of roads, in each direction 15 trains, having a total seating capacity *for one direction* of over 13,000 seats, are worked into and out of the terminus.

The maximum frequency of electric trains at the present time is about 42 per hour on the District Railway, with 50 mentioned as a possible development when the Earl's Court flying junctions are fully in use. Assuming 50 per hour, the seating capacity of each train must be 260 in order to obtain a total of 13,000 per hour. The seating capacity of a District or Metropolitan train of usual size (6 cars) is approximately 300 seats, so that on one pair of roads and in each direction 50 ordinary Metropolitan or District trains per hour will only give 15,000 seats per hour, as against 13,000 now provided by steam trains. Thus, although 50 such trains per hour (could they be operated) would give an increased frequency of service to the various branches of the suburban system, only a small increased seating capacity would accrue, and as all the steam trains are well filled the seating capacity must be increased in order to provide for the extra business which may be expected to be obtainable.

Over the roads and junctions now existing on any general trunk-line system 50 such trains could not be operated per hour, so that for the solution of problems of this nature a much greater seating capacity per train must be provided at "rush hours" than is usual for electric trains, and hence the capital cost of electrification is considerably increased, as an increase of the weight of the train has a greater effect on the capital cost than an increase of frequency of shorter trains.

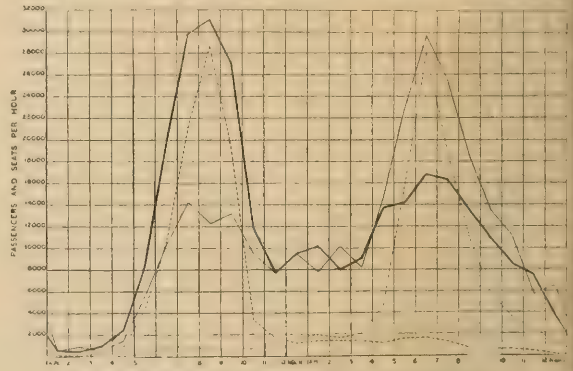
Assuming that 30 trains per hour can be run on one line (which in the author's experience is about as high as can be dealt with continuously under the circumstances beforementioned), the seating capacity per train must be about 435 in order to equal the existing facilities for passenger travel on the steam line quoted above. To give an increase of 33⅓ per cent. in the seating capacity—a very reasonable requirement—a train having in round figures 580 seats must be provided. This means a train, allowing for luggage compartments and motormen's cabs, at least 325 ft. long, weighing, without electrical equipment or passengers, some 160 tons, giving about 3.6 seats per ton weight, or 1.8 seats per foot-length of train. The seating capacity of the ordinary side-door compartment cars is higher than that of the end-door type. One seat per foot-run of train may be taken as almost exactly the figure for end-door saloon cars such as are used on urban railways generally. The specially wide cross-seat corridor car of the Lancashire & Yorkshire Railway has a seating capacity of 1.62 seats per foot-run.

The side-door compartment cars can be filled and emptied more quickly than end door cars, and to maintain a frequent service with a short station stop the time of loading and unloading is of very great importance. If the station stop be excessive, say more than 30 seconds, the resulting reduction in frequency may be as much as, or more than, that due to a junction. The use of the last possible means to reduce the station stop is justified.

One point in the use of side-door compartment cars which does not appear to have been referred to, so far as the author recollects, is the question of shutting carriage doors of long trains. With the high acceleration of electric working this is no easy matter, a larger staff must therefore be provided to deal with the door shutting, or else longer station stops will have to be allowed.

The train unit must be so chosen as to be capable of being split up into smaller units for times of lighter traffic, keeping a due proportion of luggage space and accommodation for various classes in each section unit.

Fig. 3 shows the week-day suburban passenger traffic of Liverpool Street Station and gives not only the number of passengers per hour but the seats per hour also. It shows incidentally that, over a period of one hour, a greater number of seats is provided than is required, but it must not be taken from this that there is not some overcrowding of individual trains. Whatever system of traction be employed there are almost bound to be some trains which are overcrowded. This is especially the case with the last of a series of trains arriving at the terminus before a given time in the morning and by which cheap fares are available. The last of these is certain to be overcrowded even if a frequent service be given immediately before.



Seats provided per hour: Up trains —— Down trains ——
Passengers per hour: Arriving - - - Departing - - -

Fig. 3.—G.E.R. Liverpool Street Terminus: Suburban Load Curves.

The curve shows the bad load factor of London suburban traffic. It is the average daily business and does not in fact deal with what is the worst period, Saturday between 1 p.m. and 2.30 p.m. Liverpool Street Station, for example, deals with in round figures 200,000 passengers per day on average week-days, approximately 100,000 arrivals and 100,000 departures, *i.e.*, an average of say 4,150 per hour in one direction; but in the busiest hour, 1 p.m. to 2 p.m. on Saturdays, the number of outward suburban passengers is approximately 36,000, dealt with of course not on one line of rails but to some extent on three. The inward traffic at that time is small and the maximum number of passengers in our hour "up" and "down," main-line and suburban, is about 38,000. The "daily passenger load factor" of Liverpool Street Station is therefore:—

$$200{,}000 \times 100/38{,}000 \times 24 = 22 \text{ per cent. approx.}$$

The load factors of other similar termini are of the same order, and in some cases lower.

In the case of motor omnibuses the "rush hour" service is not much greater than the service during normal hours; the number of seats run at average times is 90 per cent. of the number run at peak time. The omnibuses evidently do not lay themselves out to cater for peak-load business.

Suburban passengers fall into two great classes: Season ticket holders and ordinary passengers; broadly speaking the season-ticket traffic is peak-load traffic, whilst the "non-rush hour" traffic is very largely ordinary ticket passengers. It is the latter traffic which has suffered most severely by road competition, for two reasons:—

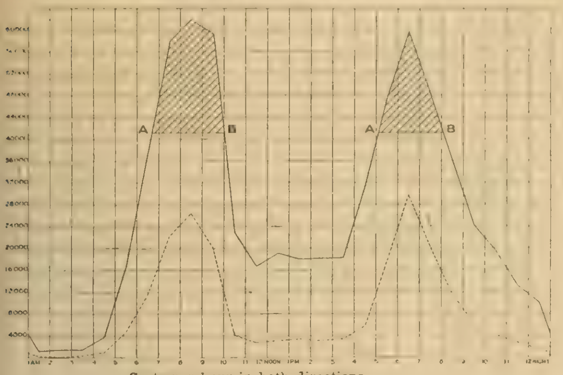
1. The poor and infrequent steam service given on some lines at "non-rush hours."
2. The lack of through-running to shopping and amusement centres.

It is in this section of the suburban business that trunk railways have lost ground, while the season-ticket business tends steadily to increase.

The return of the investment necessary for electrification must be looked for in the increase of the "non-rush hour" traffic far more than in any further development of the peak, involving greater capital expenditure and worse operating conditions. If the railway traffic which is illustrated in fig. 4 be electrified, its power demand will be represented by a similar curve and load factor (really rather worse, as car movements will increase the peaks).

Fig. 4 is a curve for Liverpool Street Station showing combined "Up" and "Down" passenger movements for suburban services, as well as the combined "Up" and "Down" seats run both in booked passenger trains and in car trains. It emphasises the very large unremunerative peak of empty car movements which must of necessity be run at "rush hours," and shows how this dormitory business of London employs for two limited periods per day a seating capacity otherwise largely idle, and even during these peaks there is a large amount of light mileage, as the traffic is almost all in one direction and the trains therefore run empty in the other direction.

The improvement of the load factor of suburban services depends, in the author's opinion, largely in the possibility of developing through-running; and also on the provision of a frequent and quick service during "non-rush hours," which can be given economically only by electricity.



Seats per hour in both directions ——
Passengers per hour in both directions ···

FIG. 4.—COMBINED UP AND DOWN SUBURBAN TRAFFIC CURVES.

An interesting experiment in what electrical engineers would call "restricted-hour service" is the institution by the Metropolitan Railway of ladies' season tickets available only after 10.30 a.m. when the morning peak is over.

In considering the increased traffic obtainable by electrification, two factors must be considered:—

1. The frequency and convenience of the existing steam "non-rush hour" service.
2. The nature of the business, particularly whether urban or terminal.

It must not be assumed that the excellent results as regards increased traffic that have been shown on some electrified lines can be reproduced in all cases, as in some of these cases the steam all-day service previously given was very irregular, infrequent, and slow.

Where the business is urban in character, or where through-running on to an urban system can be achieved, the increase in all-day business can undoubtedly be made very great by adequate facilities; but where the service is terminal the increased business obtainable even by increased frequency is not likely to be of quite the same magnitude.

The broad distinction in operating features between steam and electric traction is that steam is expensive in running costs but cheap in capital charges, while electricity has the reverse characteristics.

As steam can deal economically with rushes and electricity economically with steady high-load-factor traffic, the logical solution of a traffic problem such as is presented by the curve in fig. 4 would appear to be to perform the lower solid part of the curve electrically, leaving the peaks to be dealt with by steam. Such a solution could only be considered in the case of a line operating a considerable steam business apart from its suburban traffic.

A train of 780 seats will weigh, with passengers and electrical equipment, some 320 tons. Such a train operating at a schedule speed of 22 miles per hour with station stops 0.9 mile apart, will demand an average load at the power house of 500 KW. The 28 trains necessary to run the bottom portion of the curve below A.B. in fig. 4 will therefore make an average demand of 14,000 KW. The momentary peak load will be say 17,500 KW.

With 12 additional trains running (assuming the lowest number required for the peak), *i.e.*, a total of 40 trains, the figures will be:—

Average load at power station ... ... 20,000 KW.
Momentary peak at power station, say ... 25,000 KW.

An increase in the number of trains from 28 to 40 necessitates an increase in the momentary peak of 7,500 KW., or 43 per cent. It may therefore be taken that additional plant of about 8,000 KW. capacity would be required, which would cost say £10 per kilowatt, or £80,000. Interest and depreciation at 10 per cent. is £8,000 per annum. The number of train-miles run by these 12 trains during peak times is 336,000. The capital charges on the extra power station plant are therefore 5.7d. per train-mile.

The capital charges on the electrical equipment of the rolling stock, on the basis of 28,000 miles per train per annum, are 8.6d. per train-mile. The total capital charges may therefore be stated as 14.3d. per train-mile.

A 320-ton train will require about 25 units of electrical energy per train-mile. Assuming the cost of energy to be 0.3d. per unit (excluding capital charges) the cost of energy per train-mile will amount to 7.5d. Adding the cost of the motorman's wages and the repairs and maintenance of the rolling-stock electrical equipment at say 4.0d. per train-mile, the operating cost per train-mile will be 11.5d., so that, including the following:—

1. Rolling stock equipment capital charges ... 8.6d.
2. Power station equipment capital charges ... 5.7d.
3. Operating cost ... 11.5d.

the total cost per train-mile at peak times equals 25.8d., or approximately 26d. This figure is obtained without including any capital charges for sub-station plant or transmission cables, or for third rail or other contact conductors, or any operating cost for the maintenance of the third rail, etc., and it is therefore unduly low.

The cost of operating by steam such a peak service would not be more than 15d. per train-mile, so that electrical operation at peak time shows an increase of 11d. per train-mile without charging to it all the items that it should bear. On 336,000 train-miles per year the additional cost in round figures is £15,000 per annum.

As regards the steady portion of the curve the position is obviously quite different. For example, the charges on rolling-stock equipment, assuming 60,000 train-miles per train per annum, are reduced to 4d. instead of 8.6d. Power station capital charges would be reduced in approximately the same proportion, while the cost (per unit) of generating the energy would be considerably lower than at peak time.

By electric operation during "non-rush" hours (so far assumed as performed by trains of the same length as those used at peak times) the cost of operation can be reduced by shortening the trains where possible while retaining the same frequency.

Such comparatively good-load-factor working as results from leaving the peaks to steam can therefore be made at small extra cost much more attractive by electric working, at any rate at an extra cost almost certain to be more than wiped out in any average conditions by the increased earnings due to the more attractive transport. In this kind of work electric traction can make an unanswerable challenge to steam working from the operating and financial point of view, but on "rush hour" traffic of intense character for a short time the figures given show that the electrification of peaks of a traffic load curve such as is shown in the figure can scarcely be a financial success at present fares on the basis of providing a seat for every passenger at "rush hours."

Assuming the possibility of operating a mixed suburban service of steam "rush hour" trains superimposed on a regular electric service, the financial aspect of such a proposition in cases of abnormal peak traffic appears to be more favourable than in the case of total electrification. It has the merit of still leaving rolling stock available for Sunday and Bank Holiday excursion traffic.

DISCUSSION.

Mr. **ROGER SMITH**, in opening the discussion, pointed out the paramount importance of the traffic question in electrification schemes. Mr. Aspinall had said that to get success the right locality must be chosen, and he thought the author had this in mind. It was important to have definitions of service in traffic and not engineering terms, and he thought that "train" or "seat load-factor" would be misunderstood by railway men and that "utility-factor" would be better.

The ideal of a special road for electrically worked traffic with special signalling had been pointed out, but its advantage depended on the relative value of main and local traffic. The North-Western found it worth while to provide separate slow tracks for surburban traffic, but the Great Eastern did not. The wisdom of working the traffic peaks by steam trains depended on the accuracy of the figures taken. According to Mr. Aspinall, the locomotive of a stopping train required 100 lb. coal per mile as against 80 lb. for a non-stopping train—representing 6¾d. per mile extra for the stopping service—this in reference to the sandwich service on the Southport line. He asked whether the author's 15d. per train mile was from actual costs; including about 7½d. per mile for coal, he (the speaker) thought 15d. too low. Capital charges at 10 per cent. appeared too high; he suggested 7 per cent.; he also noticed that the author included capital charges on the electric service, but omitted them in the case of steam. It was important to have such figures as nearly correct as possible. The author's suggestion as to separating terminal steam and electric services was being carried out in practice in the case of the Great Central steam non-stop and Metropolitan electric stopping services on parallel lines to Harrow; the G.W. Paddington (terminal) and Ealing—Central London electric services; and the L.N.W. Euston (terminal) and through tube electrical connection to the Elephant and Castle.

Mr. O'BRIEN pointed out that while the author emphasised the enormous peak loads at some London termini, it was possible for the traffic people to improve the utility-factor by endeavouring to fill up the non-rush hours. The Liverpool-Southport traffic during steam days had similar characteristics, but a very large non-rush traffic had been since developed and the utility-factor was no doubt much higher than that shown. He did not think it would be practicable to sandwich steam and electric trains, using the same platforms, at rush hours, as there would be great difficulty in disposing of locomotives. He suggested that the peak-traffic difficulty could be got over by running trains with the maximum number of coaches, and dropping them off when not required. Although this might be expensive in one way, when short trains were in use there would be a gain in acceleration. He thought the economical time in a power station was on the peak nowadays, owing to the characteristics of modern plant. The acceleration rate would, he thought, influence the length of the block section employed; the actual time occupied at stations did not differ much as between side and end door trains; with the former the traffic flow was haphazard, while it would be regulated with the latter. Experience on the L. & Y. Railway was that the most popular seaside trains were of the corridor type, and it was quite possible to withdraw trailer cars for such services.

Mr. H. Burge said that on the Continent practical comparisons had been made in service between two coaches fitted with series-parallel and booster control respectively, which showed that the former consumed 25 per cent. more units per train mile than the latter. The increased train weight was only 3 per cent.

Mr. Bowden thought the author had not made out such a strong case for electrification as he could have done. Steam traction did not provide a seat for every passenger at rush hours, and he did not see why electric traction should do so. When the Metropolitan and District lines were electrified they were subject to many limitations, but these had been gradually removed as the necessity arose. It seemed that the older lines would have to deal with more passengers and face electrification. Following the poor utility-factor came a bad load-factor, but the hollows in the load curve would to some extent be filled up with shunting and goods haulage.

Mr. W. M. Mordey drew attention to the poor efficiency of present electric traction methods; the allowance of 80 watt hours per ton ought to be much reduced in the future, thus bringing the peak figures for steam and electricity somewhat nearer together.

Mr. H. G. Drury said he thought the author was not quite so optimistic as he was some years previously, when the speaker discussed the traffic side of the question with him. Steam operation presented no difficulty when there was no rush traffic, and he doubted whether there would be an adequate return from electrification.

The Author, in replying, said it was all very well to have separate tracks for suburban electric services only, but that would introduce a line which would not be available for other traffic as a relief load, and be too expensive for a low load-factor line. The 15d. per train mile represented an average figure for all classes of steam trains, and was applicable to traffic which was largely non-stop. In arriving at 26d. per train mile—cost for peak electric service—he had not debited all costs which could really be set against it, and which would more than off-set the locomotive capital charges omitted, which averaged out at quite a small figure. He did not propose mixing steam and electric services in the same platform, and thought the use of a large number of trailers in proportion to motor coaches would result in inefficient operation during a great part of the day.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A Polish-grinding Machine.

A polish-grinding machine, similar in type to one illustrated by us in June last, has been placed on the market by Messrs. Goodchild & Macnab, of 56, Eagle Street, Southampton Row, W.C It consists of a 4-in. endless emery band running over two overhung pulleys mounted on ball bearings; a special spring device adjusts the position of one pulley so as to maintain the correct belt tension, and means are provided to reduce the tension when the machine is standing. The band, which runs at 5,000 ft. per min., can be slipped straight off the ends of the pulleys for replacement. A steady-rest is fitted to the machine, which has a table 10½ in. × 5 in., and weighs about 70 lb.

An Electric Sign.

The accompanying illustration shows a sign recently erected in Leicester Square by the Franco-British Electrical Co., Ltd., of 50, Oxford Street, London, W., with a new patent letter which the company has recently brought out. This letter is made up completely of leaded sheet steel, and when the shape has been formed, a fired vitreous enamelled iron letter is applied to the face, holes having been cut in it to correspond with the lampholders, which have previously been fitted to the metal skeleton. The enamelled face is kept in place by means of beading attached to the skeleton, this beading being aftewards gilded. The feature of this enamelled face letter is that besides presenting a highly glazed surface, it is absolutely indestructible, and by simply wiping it over with a damp rag, the primary brilliancy is obtained.

The sign erected for the *Evening News* is illuminated with nearly 900 lamps, the frame surrounding the sign being green and illuminated with real green glass metal-filament lamps.

In the bottom left-hand corner is a replica of the well-known red shield, illuminated with real ruby metal-filament lamps. In the centre of this shield are specially designed monograms with which any number can be obtained. This is actuated by special mechanism which at night operates the monograms in the shield, so that the exact time is shown. Every minute the sign changes, say 12.45 changing to 12.46 and so on. The actual time taken in changing from one minute to the next is only one-fifth of a second. Should the sign be switched on temporarily at any time during the day, the correct time will always appear on the monogram. An electrical service from Greenwich has been installed in order that perfect synchronisation may be obtained.

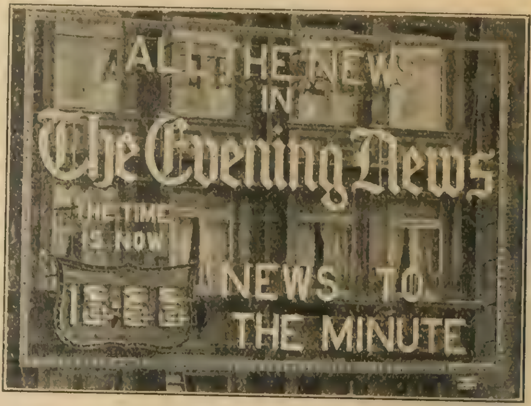


Fig. 1.—A Large Electric Sign.

Above the shield at night time is shown a sign reading "The Time is Now." After the sign is switched off (which is done by one of the company's electrically-wound time switches of large capacity), this sign slowly drops down behind the shield, so that during the daytime it is totally obscured. When the sign is switched on this portion of the lettering becomes alight and slowly rises to its position above the shield. The special apparatus controlling this required very careful designing, the difficulty being that after the whole of the sign was switched off, a period was required in which current was available to operate the motor to lower the sign behind the shield. The whole of the mechanism employed is placed on the outside of the building behind the shield. The invention of the sign, together with the manufacturing and erection, have been wholly carried out by the Franco-British Co., and the sign is said to be practically the largest in London.

The Electric Drive in a Printing Establishment.

The illustrations reproduced herewith show the Vickers motor-drive operating printing and other machinery in the premises of Messrs. W. & G. Baird, Belfast. As the Vickers drive was adopted when the machines were installed, Messrs. Baird are to be congratulated on having escaped all the worries and inconveniences inseparable from other forms of drive, but which in the electric drive are noticeable by their absence.

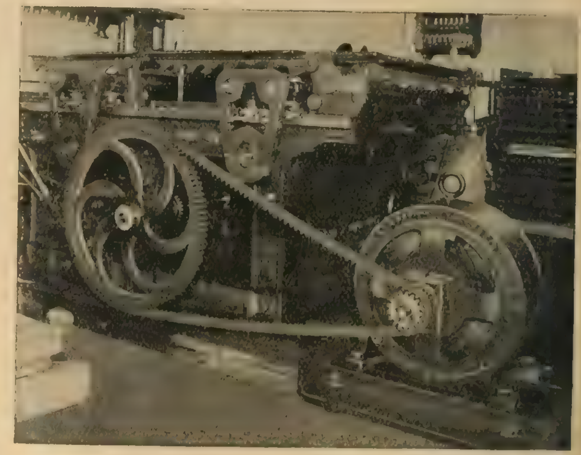


Fig. 2.—8-h.p. Motor Driving Press.

Fig. 4 shows a Vickers 1½-h.p. d.c. 220-volt motor, 700 r.p.m., driving a matrix dryer for paper type. The dryer consists f a gas-heated revolving cylinder capable of drying up paper ype, which is used as a mould for type in connection with ewspaper printing. After the type for each newspaper heet has been set up, an impression of it is taken on special paper oard in a damp condition. To remove all trace of moisture, the oard is placed in the matrix dryer, and the gaseous heat, combined vith the centrifugal action, drives out all the moisture. After he drying, the board is used as a mould for casting the actual ype required for newspaper printing; the page when finished esembles a half cyclinder, and two of these are fixed at the same ime in the printing press.

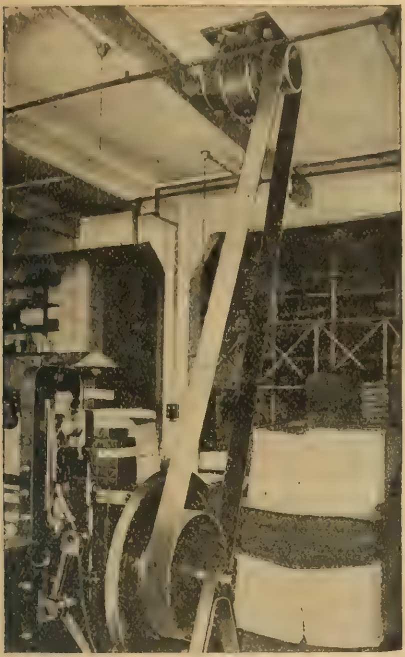


Fig. 3.—3-h.p. Motor Driving Guillotine.

Fig. 2 shows a Vickers 8-h.p. 220-volt d.c., variable speed motor, 70-740 r.p.m., operating a two colour quad-crown letterpress achine.

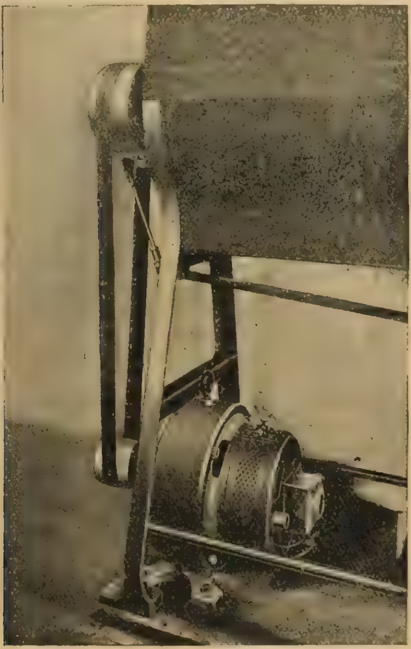


Fig. 4.—1½-h.p. Motor Driving Matrix Dryer.

Fig. 3 shows a 3-h.p. Vickers 220-volt continuous-current motor, 00 r.p.m., driving a 42-in. guillotine cutting heavy blocks of paper p to 5 in. thick. In this view it will be noticed that the notor is hung in an inverted position from the ceiling, and is connected to the guillotine by means of belting. This method of drive gives greater floor space, which can be used for production purposes.

We understand that the motors have given continuous satisfaction, and that the adoption of the motor drive has led to most pleasing results.

Pump Motors for Mining Work.

The British Thomson-Houston Co., Ltd., of Rugby, have recently developed a line of motors for driving turbine pumps to meet the arduous conditions met with in underground mining work. The high speed which is permissible in this class of work has made it possible to reduce the size of the machine to the absolute minimum, which is a distinct advantage.

Fig. 5 shows the general appearance of a 700 h.p. motor of this type; it is designed on turbo-alternator lines, totally enclosed and cooled by induced ventilation. Fans on the ends of the rotor draw air through the ducts in the base plate shown, drive it through the windings, and eventually discharge it through the openings at the top of the frame. The motor illustrated is installed in a return airway, and the ventilating air is drawn through a pipe about 60 ft. long from the intake airway. The enclosing covers afford complete protection from splashes or dropping water, but they are easily detachable for examination of the windings or air gap. The slip-rings and brush-gear are enclosed in a cast-iron case, fitted with sheet-iron covers, to enable an examination of the slip-rings to be made at any time. Since these machines are generally required to run continuously for long periods, they are fitted with a brush-raising and short-circuiting device, the operating lever of which is mounted on the side of the collector case, the whole of the mechanism being inside.

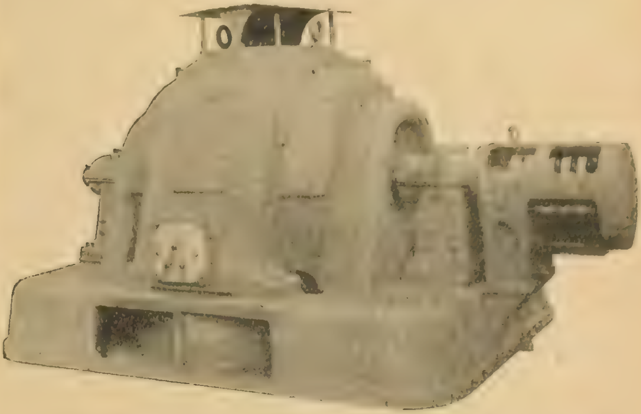


Fig. 5.—General View of 700-h.p. 1,500-r.p.m. 2,500-Volt 50-Cycle Mining Pump Motor. Slip-ring Covers and Stator Trifurcating Box Removed.

The rotor of this machine is constructed in a manner similar to that used for turbo-alternators. The shaft is of large diameter and great strength, swelled out at the centre and milled down to a triangular shape, thus providing air passages between the shaft and the punchings which are mounted directly on it. The air-gap is more than double that of a moderate speed motor of equal diameter, and this, together with the exceptionally rigid shaft, ensures immunity from trouble due to rubbing between stator and rotor. At the same time the efficiency and power factor are exceptionally high. Fig. 6 shows the results of a series of test taken on a 700-h.p. 1,500 r.p.m. machine of this type, in the pre-

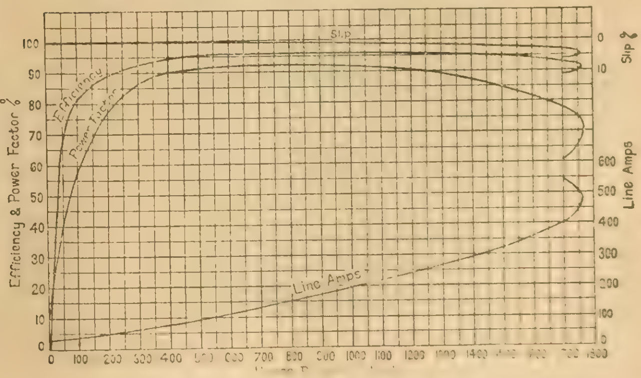


Fig. 6.—Results of Tests on 700-h.p. 1,500-r.p.m. 2,500-Volt 50-Cycle Mining Pump Motor.

sence of Dr. R. Herzfeld, consulting engineer to the Kent Collieries, Ltd., to whose specifications the machine was manufactured. The efficiency is maintained at over 95 per cent. from 600 up to 1,400 H.P. The temperature rise after a full-load run of four hours' duration, the temperature being then constant, was under 30° C. (54° F.).

The stator is intended for use on a 2,500-volt, 50-cycle, three-phase circuit. Both stator and rotor are fitted with trifurcating boxes. The cable is brought in through a gland by means of which a watertight joint may be made, and is opened out and connected to the terminals inside the box. This protects both cable and terminals from injury due to moisture.

The British Thomson-Houston Co., Ltd., have recently supplied two similar machines to the one described above to the Powell Duffryn Co., one to the Fife Coal Co., two to the Kent Collieries, Ltd., and have further machines in the course of construction.

Toilet Accessories.

There is a ready market for electrical appliances for use in connection with the toilet and for other domestic purposes, and the neat little "Pioneer" massage and manicure machine which has been introduced by the Radium Electric Co., of 82, Hatton Garden, E.C., is likely to receive a hearty welcome from ladies who desire to preserve and augment their physical attractions. It consists essentially of a tiny motor enclosed in a polished metal case which forms the handle, the whole weighing only ¾ lb. The motor is wound for 100-125 volts, and runs on alternating as well as direct current; where the supply pressure is 200 to 260 volts, the same motor is employed, with a small lamp resistance in circuit, and the apparatus is so devised that it can be connected up to any lampholder, or to a wall-socket, without fear of mistake. Even if it were connected to a 200-volt supply without the resistance in circuit, no harm would be done, but the excessive speed of the motor would call attention to the error. The machine never gets hot, being provided with an internal ventilating fan; it is controlled by a little switch, the handle of which projects through the case. Both ends of the shaft protrude from the case; one end runs true, and to it can be attached little sand-paper disks for trimming the nails, a carborundum disk for grinding off hardened skin, leather and felt polishing disks, &c. The other end of the shaft is slightly eccentric, and can be fitted with a rubber sponge, ball, and other applicators, which revolving and vibrating are used for massaging the skin. The apparatus is perfectly safe in the hands of the most unskilled user, and is very nicely finished. Another useful appliance supplied by the company is the "Rapid" hot-air douche, a pleasant and convenient means of drying the hair; the motor takes very little power, and the air current can be either cold or hot as desired.

Electric Advertising.

One of the most attractive exhibits at the recent Holland Park Advertising Exhibition was that of the Graham-King Advertising Co., Ltd., of 453-4, Bank Chambers, High Holborn, W.C.

This firm were showing the "Auto-Electric Advertiser," a machine for the purpose of displaying a succession of posters or printed matter, and comprising a casing of attractive design, with a magazine to contain a number of ordinary paper posters and mechanism adapted to present the posters in turn behind a glazed aperture in the casing which gives the exhibited poster the appearance of a framed picture.

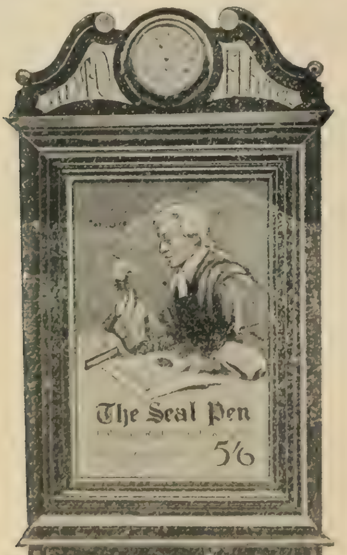


Fig. 7—The Auto-Electric Advertiser.

The movement is operated by a 1/40-H.P. motor, and night illumination is provided by Osram Striplite lamps. A time-switch is arranged for completing the motor and lamp circuits, as necessary.

Fig. 7 shows a machine for displaying 32 posters, but multiple machines for exhibiting a much larger number are constructed, and were shown at the Exhibition.

A brief outline of the method of working may be of interest.

In the first place, the posters are mounted on rods at top and bottom, for the purpose of being retained in a guide or magazine, which is arranged immediately below a continuously-revolving drum (fig. 8), actuated by the small motor.

Working in conjunction with this drum are movable arms, which lift the posters from the magazine on to the revolving drum, which carries them into the position for exhibition opposite a glazed aperture, and at the same time returns the posters previously displayed to the magazine.

The arms are directly operated by a cam device, and sufficient time is allowed between each movement to permit the exhibited poster to remain on view for a predetermined period. During this interval, to provide illumination for night working, Striplite on either side of the aperture is automatically switched on.

A series of posters is placed in the magazine alternately in the correct exhibiting position, and inverted and reversed. With each change of picture a pair of posters from the back of the magazine are carried over—(*a*) one to be shown, which is correctly placed, and (*b*) behind it an inverted poster with its white back so placed as to reflect the light through the picture in front of the window.

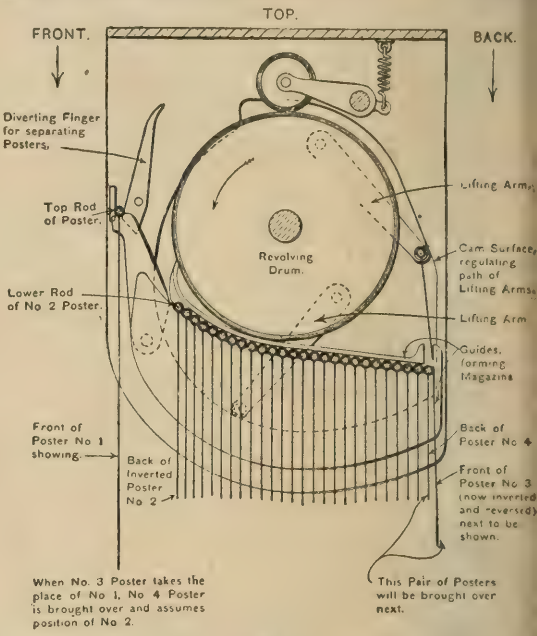

TOP.
FRONT.
BACK.
Diverting Finger for separating Posters,
Top Rod of Poster.
Revolving Drum.
Lower Rod of No 2 Poster.
Lifting Arms
Cam Surface, regulating path of Lifting Arms.
Lifting Arm
Guides, forming Magazine
Front of Poster No 1 showing.
Back of Inverted Poster No 2
Back of Poster No 4
Front of Poster No 3 (now inverted and reversed) next to be shown.
When No. 3 Poster takes the place of No 1, No 4 Poster is brought over and assumes position of No 2.
This Pair of Posters will be brought over next.

Fig. 8.—Showing in outline, Mechanism of Auto-Electric Advertiser.

Reference to the diagram (fig. 8) will show that the two rear posters are caught up in turn by the arms, and that the one originally reversed comes down correctly for showing, while the other, falls into the magazine in the reversed and inverted position, and between the poster on view and that last shown.

The apparatus is started and stopped by a switch actuated by the clock shown, and is manufactured by Messrs. Alfred Graham and Co., of Crofton Park, who are well-known specialists in telephone work.

Automatic Street Lighting.

An extremely interesting method has been adopted by Mr. C. J. Turner, chief electrical engineer to Hoylake U.D.C., for turning the electric street lamps on and off at the proper times. Obviously the "proper times" are those moments when the natural illumination respectively falls below, or rises above, a definite minimum value, and bear only an approximate relation to the calendar and the time of day. Mr. Turner, therefore, has discarded these artificial standards, and has made use of Nature's own phenomena to effect his purpose. Small selenium cells have long been available on the market in connection with other applications of electricity; one of these is mounted in a glass bulb above the electric lamp, and is connected to a relay in a box fixed at the top of the standard, as shown in the accompanying illustration, fig. 9.

So long as daylight reigns, the resistance of the selenium cell (which is connected to the relay in circuit with the street mains) is low enough to allow sufficient current (less than two watts) to pass through to operate the relay, which keeps the lamp switch open; but when the light fails the resistance of the cell increases enormously, and the relay drops, switching the lamp on. The sensitiveness of the device depends upon its adjustment; it can be made to operate when a black cloud passes over the sun, or to remain inactive until dusk. Lighting the lamp by simply covering the cell with a hat is a simple and striking method of demonstrating its effectiveness. The cost of the selenium cell and relay is quite small, and the latter, n the case of the lamps experimentally fitted at Hoylake, is oused in the switch-box already provided on the pole. The nergy consumed during the day is also very small. On the ther hand, the economy effected by dispensing with lamp-ighters, and by having the lamps alight only when they are eally required (on moonlight nights they do not light up till ate) is very considerable. Steps are being taken to place the pparatus on the market, when it will no doubt be welcomed by he authorities responsible for public lighting.

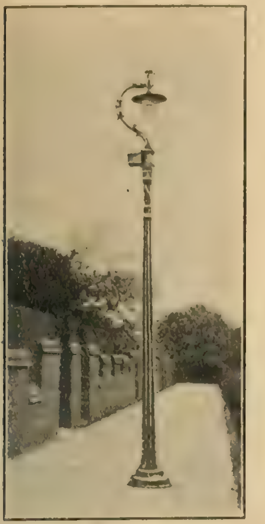


FIG. 9.—STREET LAMP FITTED WITH AUTOMATIC LIGHTER.

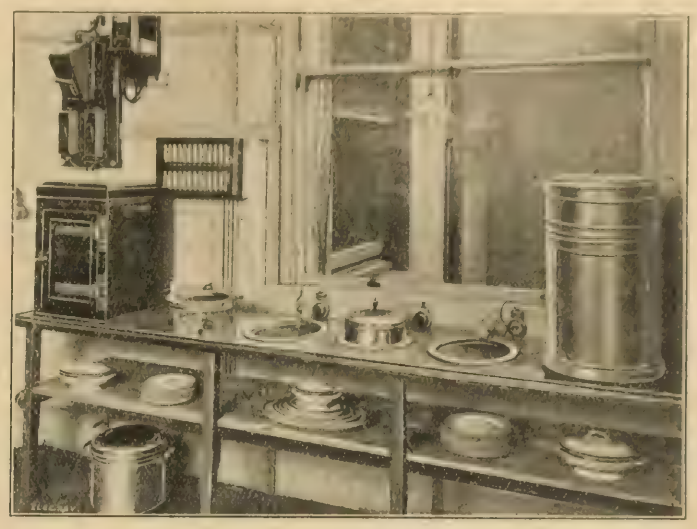


FIG. 11.—VENNER ELECTRIC KITCHEN.

New Cooking Apparatus.

We recently mentioned that we had inspected the new electric ooking apparatus which is being introduced by MESSRS. VENNER ND CO., and had personally tested its performance from the astronomic point of view (p. 746). We are now enabled to eproduce photographs of the utensils employed on that occasion, nd to give some particulars of their construction.

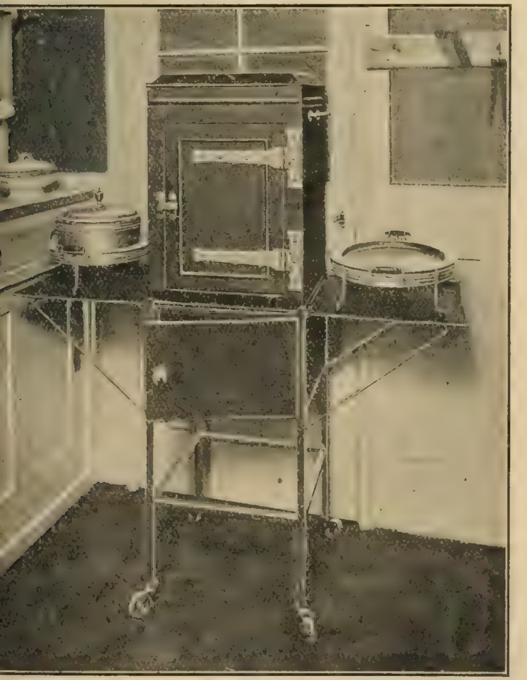


FIG. 10.—VENNER ELECTRIC COOKING APPARATUS.

The leading feature of the system is the grill, for which patents ave been, and are being, obtained both at home and abroad. The rill consists essentially of two stamped metal dishes, firmly ttached to one another round their circumference, and containing etween them a quantity of a special kind of oil, having a flash oint upwards of 670° F. The dimensions are such that the oil lways completely fills the space between the bottom of the upper ish and the lower dish, while ample room for expansion is provided in the annular empty space round the edge of the vessel. The heating element is immersed in the oil lying at the bottom of the space; one form of element consists of nichrome tape wound over flat strips of mica, with asbestos thread wound over the tape in the opposite direction of lay so that the nichrome tape cannot possibly make contact with the metal of the grill. The heat generated in the element and imparted to the oil sets up powerful convection currents in the latter, which carry the heat up to the working surface, and thus raise the temperature of the latter to 420° F. in about three minutes from switching-on, the loading of the 9-in. diameter grill being 400 watts, and that of the 13½ × 10-in. grill 500 watts. Both types of grill are shown in the illustrations; the smaller one stands on legs with heat-insulating feet; the larger ones are let in flush with the surface of the glass-covered table. The oil has been tested for over two years to provide against carbonisation, and we understand that since the first three months of experiment, no cooker of this type has ever broken down, even when empty and overloaded by more than 50 per cent. The surface of the iron dish is finished with a special black oxide, which is practically proof against rusting, and possesses the additional advantage of preventing the food from sticking to the dish when bread-crumbed fish and other specially-coated viands are in preparation. Special attention has been given to the terminals, which are of patented design, excluding the possibility of leakage of the oil; insulation between the collar and the pin is provided by a special enamel, having the same coefficient of expansion as the metal parts. From continuous observation of the whole process of cooking fish, sausages and omelettes on these grills, we formed the opinion that they were exceedingly convenient and effective.

A similar utensil is the stewer, which is used for deep frying, slow stewing, or rapid grilling. One of these is shown in the illustrations, covered with a lid. With this a great variety of dishes can be cooked for a number of persons, even on the breakfast or dining table, without unpleasant smell or any other inconvenience whatever.

Joints, however, require an oven, and this also has been provided. While taking only 500 watts, the oven illustrated will cook a 4-lb. joint, rolls and bread, potatoes and puddings, to perfection, taking about the same time as a gas cooker such as would be installed in a six-roomed flat. The oven proper (fig. 11) is a bright metal cylinder, with a sliding door of novel and exceptionally convenient design; this is provided internally with brackets for shelves, &c., and may be surrounded by a sheet metal cover, with an air space between, the cover, as will be seen (fig. 10), in appearance resembling the customary type of coal or gas oven, as a concession to the prejudices of the house-wife or domestic servant. The outer cover has a hinged lid, which, when raised, discloses the lid of the oven proper; this can be removed, a steamer being fitted in its place, so that both meat and vegetables can be cooked simultaneously.

Ovens of larger dimensions are made, loaded up to 1,300 watts, on similar lines, and still larger sizes can be built to suit the requirements of restaurants. The outfit illustrated in fig. 11 is easily capable of cooking a full-course dinner for a table of 12 to 16 persons.

One of the great advantages of the Venner system is derived from its essential feature—the immersion of the elements in oil. Owing to this fact, the elements can never be over-heated, and are therefore indestructible. Moreover, the oil is a most efficient vehicle for conveying the heat from the element to the cooking surface, without fear of burning the food; fish is beautifully browned, and an omelette brought to a most attractive complexion. It appears, too, from evidence laid before us, that the apparatus consumes a minimum amount of energy when in use regularly for family cooking over a period of many months. Mr. Venner is to be congratulated on bringing his invention up to a high degree of perfection, and we trust that his work will contribute materially to the popularising of electric cooking.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

10,350. "Electrical apparatus for stopping trains." B. H. Thrupp. April 27th.

10,364. "Automatic impulse transmitters." H. Pfannenstiehl. April 27th. (Convention date, April 29th, 1913, United States). (Complete).

10,366. "Sparking-plugs or the like." H. G. Longford, W. W. Longford and W. A. Clark trading as Sphinx Manufacturing Co. April 27th.

10,380. "Cam ring for the interrupter of electric ignition devices." R. Bosch (Firm of). April 27th. (Convention date, March 5th, 1914, Germany). (Complete).

10,385. "Receiving-arrangements for wireless telegraphy." T. W. Stratford-Andrews, and A. Orling. April 27th.

10,387. "Electric incandescence lamps." A. Heller. April 27th. (Convention date, April 25th, 1913, France). (Complete).

10,395. "Portable electric-lamp supports." A. Fornander and W. R. Green. April 27th. (Convention date, August 5th, 1913, United States). (Complete).

10,415. "Electric resistance furnaces." J. Davies and A. Gallenkamp & Co., Ltd. April 27th. (Complete).

10,417. "Prepayment meters." H. Aron. Elektricitatszahlerfabrik G.m.b.H. April 27th. (Convention date, October 24th, 1913, Germany.) (Complete).

10,435. "Electric railway signalling." A. J. Downes. April 28th.

10,440. "Electric cables." R. R. Stell. April 28th.

10,445. "Current motors." M. M. Cook. April 28th. (Complete).

10,468. "Thermo-electric generators." P. Ferra. April 28th.

10,478. "Connecting-device for the leads from portable secondary batteries." R. Bosch (Firm of). April 28th. (Addition to 7,686/14. Convention date, March 24th, 1914, Germany). (Complete).

10,480. "Electro-mechanical starting-gear for internal-combustion engines." J. A. Boursin. April 28th. (Convention date, May 22nd, 1913, France). (Complete).

10,493. "Rotary transformers." Siemens Schuckertwerke G.m.b.H. April 28th. (Convention date, April 29th, 1913, Germany). (Complete).

10,504. "Electric relay." W. R. Sykes Interlocking Signal Co., Ltd., and R. W. Tarrant. April 28th. (Complete).

10,505. "Dynamo-electric machines; regulating-device for giving automatically varying outputs at constant pressure under varying speeds." W. S. Jeal. April 28th.

10,511. "Thermal apparatus for limiting the charge of accumulators." E. Moulin. April 28th. (Convention date, September 13th, 1913, France). (Complete).

10,516. "Electric safety control apparatus for steam engines and other prime movers." R. Campbell. April 28th. (Complete).

10,523. "Mercury-vapour lamps." W. A. A. Steinmann. April 28th. (Convention date, April 29th, 1913, France). (Complete).

10,531. "Electric motor control systems." British Thomson Houston Co., Ltd. April 28th. (General Electric Co., United States).

10,532. "Alternating-current track signalling." B. H. Peter. April 28th.

10,533. "Alternating-current track signalling." B. H. Peter. April 28th.

10,534. "Electrically-operated point or signal actuating mechanism." B. H. Peter. April 28th.

10,548. "Electrical coupling-devices." G. St. John Day. April 29th.

10,549. "Relays connected with electric signalling in mines and the like." H. Davies. April 29th.

10,562. "Alternating-direct current-converter also applicable as double current generator for generating direct current and alternating current at the same time." Jens Lassen La Cour. April 29th. (Convention date, April 30th, 1913, Sweden). (Complete).

10,610. "Electric switches and the like." A. R. Muller. April 29th.

10,616. "Galvanic cells." E. Achenbach. April 29th. (Complete.)

10,619. "Electrical system for transferring cars." T. F. Mullaney. April 29th. (Complete.)

10,623. "Automatic electric controlling-devices." A. H. Curtis, A. H. Mackley & Igranic Electric Co., Ltd. April 30th. (Addition to 27,563/12.) (Complete.)

10,632. "Frogs used in connection with electrically-driven tramcars." C. Morgan. April 30th.

10,655. "Plug-and-socket connections for electric circuits." H. Lucas and F. Jenkins. April 30th.

10,674. "Protecting-device on electric miners' lamps." W. Rossow. April 30th. (Convention date, July 14th, 1913, Germany.) (Complete.)

10,683. "Interrupter for the electric ignition of internal-combustion engines." Robert Bosch (Firm of). April 30th. (Convention date, March 5th, 1914, Germany. (Complete.)

10,695. "Detachable electric cable junctions." H. D. Marr. April 30th.

10,696. "Magnetic separators for separating metals from granular pulverulent and like substances." H. D. Marr. April 30th.

10,697. "Spark gaps for radio-telegraphy and radio-telephony." W. T. Ditcham. April 30th.

10,707. "Time alternate-current meters." Compagnie Pour la Fabrication des Compteurs et Materiel d'Usines a Gaz. April 30th. (Convention date, July 8th, 1913, France.) (Complete.)

10,716. "Printing-telegraph receivers." A. F. Dixon. April 30th. (Convention date, October 14th, 1913, United States.) (Complete.)

10,727. "Electric storage of variable power." W. P. Perry. May 1st.

10,728. "Electric regulator." E. O. Persson. May 1st.

10,733. "Electric-light switches shining in the dark." G. S. S. D. Cerda. May 1st. (Convention date, June 5th, 1913, Italy.) (Complete.)

10,742. "Electro-magnetic train stop for steam or electric trains." J. Doyle. May 1st.

10,770. "Electric contact-makers." M. B. Cooper. May 1st. (Divided application on 20,502/13. September 11th.)

10,775. "Telegraph transmitting apparatus." S. Lyle. May 1st.

10,788. "Electric signalling." A. Orling and Orling's Telegraph Instruments Syndicate, Ltd. May 1st.

10,794. "Duplex telegraphy." F. Ryan and Eastern Telegraph Co., Ltd. May 1st. (Complete.)

10,807. "Transmission systems." Western Electric Co., Ltd. May 1st. (Franklin Tuthill Woodward, Belgium.) (Complete.)

10,822. "Operation on alternating or direct-current distributing systems." A. G. Collis and Crompton & Co., Ltd. May 2nd.

10,823. "Remote-control electrical apparatus." Chalmers Penfield Wells. May 2nd. (Convention date, July 9th, 1913, United States.) (Complete.)

10,848. "Automatic electro-magnetic lock for railway carriage doors." H. M. [illegible]. May 2nd.

10,853. "Registration of calls and messages on telephone systems." H. [illegible] and H. J. [illegible]. May 2nd.

10,868. "Electrical condensers and the process of manufacture thereof." G. Giles. May 2nd. (Convention date, July 3rd, 1913, Switzerland. (Complete.)

10,884. "Speed control of electric clocks, motors, and the like." E. R. Clarke. May 2nd.

10,885. "Electro-deposition of iron." S. O. Cowper-Coles. May 2nd.

10,886. "Process for coating metallic or other surfaces with metals." S. O. Cowper-Coles. May 2nd.

10,887. "Coating metallic or other surfaces with metals." S. O. Cowper-Coles. May 2nd.

10,888. "Electrolytic process and apparatus for the production of tin plate and tin-plate substitutes." S. O. Cowper-Coles. May 2nd.

10,889. "Production of tin plate and tin-plate substitutes by electrolysis." S. O. Cowper-Coles. May 2nd.

10,890. "Electro-plating metallic sheets." S. O. Cowper-Coles. May 2nd.

10,895. "Electrical condensers and the manufacture thereof." G. Giles. May 2nd. (Convention date, May 29th, 1913, Switzerland.) (Complete.)

10,898. "Electric sale apparatus." L. J. J. Van der Hoorn & S. Wouda. May 2nd. (Complete.)

10,899. "Dynamo-electric machines." A. Rolfe. May 2nd.

PUBLISHED SPECIFICATIONS.

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1913.

1,222. Field Magnets. A. Rolfe. January 15th.

5,938. Telegraphones. T. McKenna. (Fankhauser.) March 10th.

8,679. Starting and Igniting Systems for the Engines of Motor Vehicles. R. Varley. April 12th.

8,792. Electrical Installation for use of Motor Vehicles driven by Internal Combustion Engines. E. V. Hartford and L. Mastrangel. April 14th.

8,831. Telephone Exchange Systems. E. R. Corwin. April 15th.

8,968. Arc Lamps for Projection Apparatus. T. F. Bryen, E. A. Golding and H. J. Pearce. April 16th.

9,094. Brush Holders of Dynamo-electric Machines and other Electric Machinery. W. White and T. H. Bacon. April 17th.

9,100. Cut-outs for Electrical Instruments, Glow Lamps and the like. A. J. Downes and J. Venning. April 17th.

9,212. Enclosed Electric Switches. V. Hope and E. Thomas. April 19th.

9,260. Variable-speed Dynamo-electric Machines. L. J. Hunt and Sandycroft, Ltd. April 19th.

9,261. Alternating Current Dynamo-electric Machines adapted for Synchronous Working. L. J. Hunt and Sandycroft, Ltd. April 19th.

9,893. Electrically-operated Drill of the Percussion Type. T. F. Wall. April 28th.

9,904. Loud Sound-reproducing Telephone. W. E. Jennings. April 28th.

10,460. Machines for Reproducing Patterns, Pictures, or the like with the aid of Electric Current. A. G. Bloxam. (Oesterreichische Siemens-Schuckertwerke & Regal Patente Ges.) May 3rd.

12,809. Generators for High-frequency Currents. E. Girardeau. June 2nd. (June 3rd, 1912.)

14,049. Electrical Driving of Reciprocating Machinery. British Thomson-Houston Co. and G. M. Brown. June 17th.

14,487. Circuit Arrangements for Automatic and Semi-Automatic Telephone Systems. Siemens & Halske Akt. Ges. June 23rd. (July 22nd, 1912.)

17,562. Variable Electric Resistance Device for use in Microphones and for like purposes. W. P. Thompson. (Soc. Anon. des Telegraphes Edourd Belin.) July 31st.

18,663. Electric Transformers. British Thomson-Houston Co. (General Electric Co.). August 16th.

22,943. Calling and Contact-actuating Relays for Weak Undulating Currents. R. Haddan (Reineke). October 10th.

24,130. Electric Candle Lamp. H. Garde. October 24th. (Divided Application on 24,971/12. April 30th, 1913.)

24,347. Process of Heating Electrical Furnaces, more particularly applicable to the Manufacture of Aluminium Nitride. Soc. Générale des Nitrures. October 27th. (December 14th, 1912.)

25,591. Duplex and like Telegraphy. Eastern Telegraph Co., and F. Ryan. November 8th.

26,358. Automatic Signalling-devices for Road Vehicles. P. C. Johnson. November 17th.

27,175. Radio-telegraph Stations. W. P. Mellersh-Jackson (Signal ges). November 25th.

28,707. Rear End Signals for Vehicles. C. F. Marston and F. C. Kelly. December 12th.

29,049. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt. Ges. December 16th. (December 18th, 1912. Addition to 12,651/13).

29,259. Method of Protecting the Electrodes in Electric Arc Furnaces. J. I. Bronn and W. Schemmann. December 18th. (December 18th, 1912).

29,864. Call Registering Telephone. F. D. Fader, J. Tibb and J. W. Tibb. December 29th.

1914.

119. Starting and Ignition Systems of Internal-combustion Engines used on Motor Vehicles. R. Varley. January 2nd. (Divided Application on No. 8,679/13. April 12th).

1,792. Circuit Arrangements for Telephone Systems. Siemens & Halske Akt. Ges. January 22nd. (January 25th, 1913. Addition to 22,013/10).

4,523. Suspension and Tension Arrangements for Electric Trolley Wires or Contact Lines. Siemens-Schuckertwerke Ges. February 21st. (March 20th, 1913.)

5,505. Electric Regulating Switches. L. Miller and L. Boothman. March 4th. (Divided Application on 6,371/13. September 13th).

An Electrical Hospital.—Though established only a year, the Nottingham electrical hospital has abundantly justified its existence, and an excellent record of work was reported at the annual meeting last week. Dr. Bolton (hon. medical officer) stated that Nottingham was the pioneer city in establishing such a hospital for the poor. Since the date of the opening 260 patients had presented themselves for advice or treatment, and many of them were deeply grateful for the benefit received. The less chronic the disease the better had the results been. Many of the patients expected apparently to be cured by electricity at one sitting, or at most by five or six treatments, and failing in this, they ceased to attend. This was much to be regretted, for electricity would produce excellent results only on those who persevered in the treatment.

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(J. A. Berly's).

1914 EDITION

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THE INSTITUTION AND THE ELECTRICAL INDUSTRY.

"THE Council have to report that the Industrial Committee has been dissolved." In these words we read the epitaph of a notable experiment, which unfortunately has resulted in failure. The Industrial Committee was one of the first-fruits of the Broader Policy which took its rise under the Ferranti *régime*, when the Institution shook itself together and appeared to be about to do something. It was "framed so as to secure the widest representation of the industry, and with a view to the accomplishment of effective work by utilising the organisation and influence of the Institution." Fourteen meetings were held during the 12 months of the Committee's brief existence; and then, finding that the Council was unsympathetic, the Committee declared its unanimous opinion that it was "not only desirable, but of importance to the electrical industry, that an organisation should exist which is capable of protecting and promoting the legislative and industrial interests of the industry"—what a satire on the Institution!—and that the constitution and powers of the Industrial Committee were not such as to enable it to perform useful work. The Committee desired to ascertain whether the Council would entrust it with the necessary powers and authority to do such work, or whether the Council considered that industrial questions came within the province of the Institution. And then the Council, without replying to the latter question, applied the extinguisher.

Incidentally, the Council, *apropos* of nothing in particular, took the opportunity to point out "the grave difficulties which arise if questions are dealt with which involve matters of a political character or in regard to which the interests of various sections of the membership may be in conflict," and concluded with protestations of its devotion to the interests of the industry and of its impartiality towards all sections of it.

We must confess to keen disappointment at this futile ending to the high hopes that were entertained when the Council appeared to have shaken off its lethargy. For is it not the end? Note well that the Committee was framed *to secure the widest representation of the industry.* It follows, therefore, that the industry, through its representatives, recognised and chosen as such by the Council, has found the Council unable or disinclined to act in co-operation with it; not a single item of the major propositions placed by it before the Council has received the approval of the latter.

So far as we have been able to ascertain the facts regarding the inner working of the Committee, the policy adopted by it, on the initiative of the chairman, was to attack one problem, and one only, in the first instance, and to carry that matter through to a finish before attempting any other task. The subject considered to be of the most pressing urgency, as affecting not only the parties themselves, but also the whole industry, was the long-standing dispute between the municipal supply engineers and the contractors. After many meetings with the representatives of the bodies concerned, involving the expenditure of much time and labour, a compromise was agreed upon, and the Committee reported accordingly to the Council. The latter, however, observing that the terms of the agreement alluded to such sordid details as the payment of trade discounts, declined to associate itself with the arrangement on the ground that it was undignified to deal with money matters. The negotiations were thus abruptly ended, and a magnificent opportunity of healing an industrial dispute was sacrificed to the "dignity" of the Council.

The Committee, though rebuffed and grievously disappointed, did not lose heart, but turned its attention to the relations of the Chicago Underwriters' Testing Laboratories to our trade with Canada. (As a digression at this point, we may remark that Mr. Dana Pierce, Chief Electrical Engineer of the Chicago Laboratories, is at present in this country for the purpose of ascertaining from British manufacturers wherein they regard themselves as unfairly treated by the Code, and of discussing specific points, in the hope that by compromise the elimination of grounds for objection may be effected.) The subject was investigated, and after correspondence with British and Canadian authorities, the Committee decided that a similar testing institution was needed in this country, to deal not only with exports, but also with electrical apparatus and accessories for home use. A scheme with this end in view was formulated and submitted to the Council, but the latter regarded the proposal as having a "political" tendency, and on that ground refused to support it. The matter, therefore, was dropped, and the ultimate dissolution of the Committee became a foregone conclusion. Our sympathies are with the gentlemen who, in the hope of benefiting the industry, gave freely of their valuable time and thought, all to no purpose but to demonstrate the fact that the Council's present attitude towards "industry" differs radically from that adopted by Dr. Ferranti, who laboured to drive home the realisation that times had changed, and to galvanise the Institution of Electrical Engineers into renewed activity, so that it might take its rightful place at the head not only of the electrical engineering profession, but also of the electrical industry of this country.

The *personnel* of the Committee was published in our issue of November 22nd, 1912; it was, in fact, announced by Dr. Ferranti, the originator of the new forward policy of the Institution, as the last act of his two years' presidency. The members numbered 26, including the new president, Mr. Duddell, and the chairman, Mr. Hugo Hirst, and other well-known gentlemen, and may be classified approximately as representing the following interests:—Manufacturers, 11; public companies, 7; consulting engineers, 4; municipal undertakings, 3; contractors, 1.

A natural consequence of the appointment of the Committee was the voluntary dissolution of the "Committee for the Protection of Electrical Interests," which we recorded in our issue of January 3rd, 1913. It was expressly stated that the work of this body had been handed over to the Industrial Committee, which also undertook that of the Parliamentary Committee of the I.E.E.

Is it conceivable that a committee including such men as Duddell, Ferranti, Hirst, Siemens, Merz, Stanley—to name but a few—put forward proposals which invariably were unworthy of the attention of the Council, or hopelessly beyond the scope of its functions as representing the electrical engineering industry of this country? We should have thought that a Committee thus constituted could be counted upon to weigh well its proposals and put forward no scheme unsuitable for the consideration and support of the Council. If this be granted, why has the Council adopted this *non possumus* attitude, and how does it square its present line of inaction with the bold progressive policy to which it stood committed two years ago? Above all, if inaction is to be its future policy, how will it justify the campaign in which it was then engaged, for the purpose of increasing the membership and securing funds to carry out numerous reforms?

The tendency to form external Associations for the purpose of carrying out work that should be done by the leading body, and could be done by it with vastly greater efficiency, is still in existence; two new Associations have recently been formed to protect the interests of electrical engineers. The "Committee for the Protection of Electrical Interests" resigned in favour of the Industrial Committee, which also swallowed up the Parliamentary Committee of the I.E.E., and now is dead. Is the industry going to leave it at that? It is not likely. The Institution, after a spurt which revived the hopes of its supporters and members, appears to have exhausted its fleeting energy. There is reason to fear that the Council is drifting back into the condition of a purely academic and scientific body without an industrial backbone; a body to which the idea of trade and shopkeeping is in the last degree distasteful. We live by trade, however, and without trade we cannot even be scientific. All are agreed that industry cannot thrive without the aid of science; but it should not be forgotten that the advancement of science is equally dependent upon the prosperity of industry, and the Council will commit a very grave error if it attempts to ignore these facts for the sake of a musty tradition.

Many questions of urgency and importance in the electrical industry are pressing for solution, and new ones are continually arising; pending their settlement the development of the electrical industry in this country is retarded. Twenty or thirty years ago the electrical industry was mainly concentrated in or near London, and was controlled by a number of great engineers, who worthily occupied the presidential chair; there were no really great businesses and no very prominent commercial leaders in those days. But now, as Dr. Ferranti has pointed out, the conditions are very different; the industry has grown, and has completely changed its character, being now in the hands of business men as distinguished from the engineers, men to whom the younger generation look as the arbiters of their future. The Articles of Association were altered in 1912, *inter alia*, expressly to admit such men. The Council of the Institution, however, with the traditions of the past around it, endeavours to continue to act as though the old conditions still obtained, and appears to regard business, trade, &c., as undignified matters, unworthy of its attention *as a Council*. Ferranti, as a celebrated engineer, was able for a time to induce the Council to profess allegiance to the policy of industrial progress, but since he left the presidential chair his influence has waned, and the extinction of the Industrial Committee appears to mark the end of the "broader policy." The Industrial Committee was undoubtedly in the right when it declared that there was a need for an organisation capable of protecting and promoting the legislative and industrial interests of the industry, and if the Institution cannot, or will not, take the lead, another body will doubtless be formed to occupy that position. A somewhat similar situation arose in the United States, with the result that last year the "Society for Electrical Development" was formed, with a fund of £40,000, to educate the public in the possibilities of electrical applications, and the membership in February last was already 1,300. We have referred to its formation on several occasions, and in our issue of December 26th, 1913, we fully explained its objects and organisation. Such a society is wanted here. The centre of gravity of the electrical engineering industry has shifted from the scientific to the commercial side, and the leaders of commerce are not the men to let the matter rest where it is. The outcome will be precisely that foretold by Dr. Ferranti in 1911—namely, that if the Institution did not wake up, and look after *all* electrical interests, it would degenerate into a technical debating society.

In closing our comments, we cannot refrain from directing attention to the weakness of the penultimate paragraph of the Council's report on this subject, which we have quoted above. "Grave difficulties" arise—what are difficulties made for but to be overcome? The Council dare not even *touch* questions which some of its members regard as "political"—but cannot they distinguish between party politics (for which we share their dislike) and the "art of government" which is the true politics in which every citizen is concerned? Again, what can we say of a Council which dare not meddle with matters "in regard to which the interests of various sections of the membership may be in conflict"? Surely it is the function of the Council to reconcile those interests, not to neglect them for want of courage. The policy of *laissez-faire* commands no man's admiration.

A GERMAN ELECTRICAL AUTHORITY ON CURRENT PROBLEMS.

A certain amount of interest will probably be manifested in a report of an interview which a representative of the *Berliner Tageblatt* had at the beginning of May with Herr Emil Rathenau, who is one of the directors of the A.E.G., of Berlin, in regard to questions pending in the German electrical industry, and also in relation to that company in particular.

The first point to receive attention was that appertaining to the state of trade. On this subject the director is inclined to think that the bottom level of the general depression in Germany has now been reached, if it has not already been passed; the electrical industry has not remained untouched by the decline, but there is no perceptible retrogression in the degree of activity. This is so because instead of being hampered by the economic stagnation electrical works and improvements in industrial establishments are sometimes assisted by such conditions, as manufacturers, faced with reduced profits, endeavour to effect economies in the cost of production, which can best be done by the increased use of electricity. In addition, a large number of great industrial enterprises have been equipped with the latest technical methods in recent years, whilst the erection of large power stations has also assured the electrical industry of an abundance of work. Nevertheless, the course of business in the electrical industry has become quieter, the impetuous upward movement which existed until last year having slowed down. In the case of the A.E.G. in particular, the present activity in normal business is about the same as in the corresponding period of 1913, but a considerable increase has to be recorded if the orders are included which relate to the High-speed Railway Co. for Berlin, which has been formed by the company. The reduction in the number of workmen employed in recent months is solely due to the adoption of more modern labour-saving methods applied through specially constructed machinery. The new schemes of extension, for which sites have already been secured, have merely been postponed until better times arrive, and a certain quietness also prevails in regard to the undertaking of important technical experiments. But such pauses are by no means prejudicial to development; they are, indeed, requisite for the purpose of establishing internal order.

Herr Rathenau declared that the company had succeeded in manufacturing lamps having a consumption of half a watt per candle not only in sizes of 200 c.p., but also for small powers down to 50 c.p., and even 25 c.p., rendering their use possible for the lighting of ordinary rooms. He is doubtful whether the gas interests will be able to overtake this advance in electric lighting; in any case with the new types, the electric light will become indisputably the cheapest source of light. The consumption of energy will be reduced to such a small amount that the supply for lighting purposes will play a still smaller part in generating stations in the future, and the decrease in this department will only be equalised by the greater use of electrical energy for power purposes; the latter again will only be possible by a considerable cheapening of the charges for supply. In this connection Herr Rathenau expressed the opinion that very cheap energy for power purposes can only be produced in works of a size far in excess of the largest stations at present existing in Germany. The total consumption in Berlin now amounts to about 300,000,000 kw.-hours per annum, whereas it is probable that twice this quantity will be used by the Prussian State Railway authorities in the operation of full regular traffic on the small main-line section between Dessau and Bitterfeld. It is consequently entirely natural that the Prussian State, especially in connection with a progressive conversion of main lines, will have to erect power stations which will greatly exceed the capacity of the largest local works and overland central stations. As the cost of production progressively diminishes as the size of the plant and the output increase, and as State works are not able fully to utilise their capacity, as well as the indispensable reserve capacity at any time, it is also natural that they should proceed, as they have already done, to supply outside consumers. As a matter of fact, one State works recently submitted a tender to deliver 30,000,000 kw.-hours per annum.

If, then, it is possible for local electricity works to obtain energy cheaper from a gigantic State works than the rate at which the former can produce it on their own account, Herr Rathenau sees no reason why the supply works should be so capricious as not to avail themselves of such a supply. The works would simply purchase energy instead of coal, and utilise their own stations for the purposes of distribution. The technical possibilities of the production of electricity on the whole are almost unlimited. It would be quite possible, the director remarked, to produce the whole of the requirements of Europe in electrical energy in one place, and the long-distance transmission lines would be able to send the current all over Europe, and still further away. In practice, of course, such an extensive concentration will not take place, but it will be necessary to proceed beyond the existing system of decentralisation.

As to the question of an Imperial monopoly in the supply of electricity, it is considered that such a scheme would scarcely be practicable for Germany, now that individual States, such as Bavaria and Baden, have already regulated by separate legislation the production of energy with the aid of water power. It would, however, be conceivable that Prussia might reach a monopolistic position in the generation of electricity under State leadership or co-operation. The necessary correlative for such a grand regulation of production must of course be formed by an expropriation law for electrical works, particularly for the installation of cables through private and public property, whereas at present complicated private agreements, which are often rendered difficult through trivial motives, are essential to secure wayleaves.

Another matter covered in the course of this very interesting interview was the future position of the Diesel engine. Herr Rathenau expresses the A.E.G. conviction when he says that that company has continued to devote undiminished attention to the construction of turbines for electrical works, though he believes the Diesel engine to have a good future in such directions as locomotives, heavy motor-vehicles, auxiliary machines, ships, &c.

Rubber. The market has had a quiet tone on the whole since last writing, and prices of fine hard Para have slipped back moderately with buyers indisposed to do much. The price of plantation sorts has also eased down, and the tone has been somewhat despondent, with heavy quantities to be negotiated at the auctions being held this week. At the early May sales about 1,150 tons were offered, and, with not much animation amongst consumers, prices fell a little, and the tone has since then been influenced by the knowledge that heavy quantities are to be handled at the auctions now proceeding. This has, indeed, proved rather a drag upon the general tendency of sentiment. The increased shipments from the Federated Malay States continue, the April total being 2,151 tons, which brings the aggregate for the four months up to 9,475 tons, compared with 7,251 tons in 1913 and 4,829 tons for 1912. As usual, the April shipments showed a reduction compared with the preceding months of the year, but there seems to be little reason to apprehend any falling off in the aggregate amounts coming forward over the 12 months. As regards the consuming trades, advices lately have been of a more cheering character, more especially in connection with the tire trade, though fair activity is noted in some other directions. As for the electrical sections, however, reports are not uniformly satisfactory, there being some falling-off of new business reported in certain quarters, which it is feared may extend.

The very unsatisfactory situation which has grown up in Brazil, as the result of the depression of the rubber trade in respect of prices, is still causing much searching of hearts for the discovery of ways and means of setting things upon a better basis. In the State of Para, for instance, a couple of co-operative societies have been formed for the protection of the rubber industry, and also of the general trade of the State, and the operation of these organisations is expected to be of material benefit. Whether they can be of any real utility as regards the raising of prices, is, however, quite another matter, for the output of plantation rubber is steadily increasing as new trees get into the bearing stages, and is likely to increase further in the near future, though possibly not at any alarming rate. In the long run the actual cost price of collecting wild rubber must have an effect upon the selling prices of the plantation product, and there are good judges who take the view that for some years to come selling rates are not likely to fall on the average much below 2s. 6d. a lb., this being the figure generally regarded as representing the average cost of the bulk of the wild material. Certainly the cost must be somewhere about this price, and at it therefore the world's consumers should absorb all the product of the plantations until this becomes excessive. Any sustained advance upon this figure would naturally lead to an extension of efforts to put wild rubber on the market, but the outlook hardly encourages any very sanguine views of much over 2s. 6d. a lb., being the average selling price for a good while to come.

A Question of Charges.

We had almost thought that the lapse of time had softened the asperities of the old - time contest between gas and electricity, and that nowadays these two agencies for the distribution of light and power were content to exist in friendly rivalry. A recent case in the Chancery Division, however, tends to show that where electricity is supplied municipally attempts may be made to bear down the competition of the local gas company with a strong hand. Fortunately, however, for the gas company concerned, certain sections of the Electric Lighting Act of 1882 came to its assistance.

To state the facts in a few words, the defendants (the Long Eaton Urban District Council) were a local authority authorised to supply electricity by an order made under the Electric Lighting Acts, 1882 to 1888. They supplied electrical energy for the purposes of power and light. On September 25th, 1911, they issued a circular giving notice of their intention to alter their charges for electricity by increasing the charge for power to consumers who took power only, or power and partial lighting, the charge for power remaining unaltered at the lower rate for consumers who took power and all their light from them. The relators, the Long Eaton Gas Co., who were ratepayers within the district, claimed that this alteration in charges was an undue preference, and contrary to Secs. 19 and 20 of the Electric Lighting Act, 1882, and brought this action to restrain the defendants from supplying at these altered rates.

Mr. Justice Sargant held that in these circumstances there was a differentiation in contravention of Secs. 19 and 20 of the Electric Lighting Act, 1882, and that the plaintiffs were entitled to succeed. The *ratio decidendi* of this case is to be found in the following passage in the judgment :—"It would seem that A must not be charged less than B merely to overcome a greater reluctance on the part of A to become a customer, or induce A to become a customer in respect of another supply, although either of these reasons might be a good commercial reason for charging less to A were the public undertakers merely carrying on any ordinary commercial business. On the other hand, any circumstances which render it less costly, or otherwise more profitable, to supply A than B, constitute a legitimate reason for making a lower charge to A for the same supply." He went on to point out that the defendants had not satisfied him that it was cheaper or more economical for them to supply consumers who took all their supply both for power and lighting from the defendants.

Although we should naturally approve of every legitimate attempt being made to extend the sale of electricity, there is an old saying that "Fair play's a jewel." Moreover, it is to be remembered that if it is complained against a consumer that he is using gas for driving his machinery, and having recourse to the local supply of electricity merely as a standby, a remedy is now provided by the Electric Lighting Act. We should point out that the judgment of the learned Judge in this case, which we report fully elsewhere, is a most valuable exposition of the true meaning of the "undue preference" sections in the Electric Lighting Act.

A letter from Mr. Charles Carpenter, of the South Metropolitan Gas Co., which we print in our "Correspondence" columns to-day, opportunely points the moral of the Long Eaton case, and shows a friendly spirit which we welcome. The possibility that in the future the gas and electricity supply authorities will find it advantageous to join forces in amicable co-operation has on various occasions been ventilated in our columns; it is a logical consequence of the enlightened views now held regarding the more economical utilisation of the riches embodied in our stores of coal. In this respect the gas manufacturers are many years ahead of the electricity works; they have eliminated waste to such a degree that the gas itself is almost a by-product in comparison with the many other valuable materials extracted from the coal. Dr. Ferranti, in his famous presidential address in 1910, urged the necessity of using coal to better advantage in the generation of electricity, and the recovery of by-products will inevitably become a feature of future electricity works practice. Our only example at present of its successful operation in a self-contained plant is that of the Accrington Corporation, but waste-heat-recovery plants are increasing in number, and it is well known that there are no insuperable difficulties in the way of progress in this direction. It may be, therefore, that at no distant date the gas engineers, experts in by-product recovery, will be working in co-operation with the electrical engineers, to the great advantage of the community.

A Means of Discovering New Diseases.

The medical fraternity must be under a debt of gratitude to the Workmen's Compensation Act, which seems to have been the means of causing a number of diseases to reveal themselves. We have recently heard of one of these "statutory complaints" being brought to light in a case at the Norwich County Court. In 1912 Judge Mulligan awarded compensation to a farm labourer named Page, who had sustained an injury owing to a piece of iron entering his thigh. In May of last year the Judge reduced the amount payable to 5s. a week, on the ground that the man could do light work. Recently, however, the employers sought to have the compensation terminated altogether, on the ground that he had not willed either to ask for or to do light work.

It was upon this application that it came to light that since the original award the man had suffered from a specific form of malady sometimes named "paralysie générale des aliénés." We presume that this is French for general paralysis of the insane. Let us see what the learned judge had to say on the connection of this disease with the failure to work. After reviewing the evidence, his Honour said he found that:—

1. A constitutional predisposition rendered Page more prone to succumb to the malady than a man of normal condition.
2. The accident preyed on his mind and set up over-excitement of the brain, which either formed part, or was an offspring, of the original injury.
3. The worry worked on the over-susceptible brain, and was the exciting cause of the malady.
4. The malady had destroyed conscious volition, and thereby incapacitated the man for work, for he was bereft of will power by the accident.
5. Had it not been for the enforced idleness consequent on the accident and for the attendant privations and worries, multiplied as they were by the unjust stoppage of all compensation in January, 1913, Page would now, in all probability, be doing his usual work.

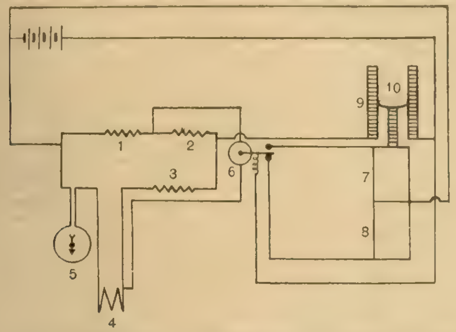
In the result, the employer had to continue the payment of compensation.

We are convinced that this case, in which, apparently, the learned judge endeavoured to assist the workman so far as he legitimately could, will do more harm than good to the working classes in the long run. It brings to light and to the knowledge of employers a fact which has heretofore been hidden in medical text-books, namely (to quote from one of them): "certain it is that, in a person predisposed to nervous weakness, an injury or shock is apt to precipitate the progressive degeneration of general paralysis, which ends fatally within a year or two." Having seen this statement, there will of necessity be a tendency on the part of employers to weed out all but the sound and strong from amongst their workers.

THE ROYAL SOCIETY SOIRÉE.

Whatever may have been the excellence of the display of scientific apparatus and discoveries at the Royal Society's conversazione last week, in other fields than those with which we are immediately concerned, it is unfortunately the fact that in the latter there were very few items of sufficient interest to place before our readers.

First on the list of these is the "Caleometer," an instrument invented and patented by Prof. Leonard Hill, F.R.S., and Mr. O. W. Griffith, B.Sc., of the London Hospital; it is designed to measure the degree of comfort in a room, or a public hall, or a factory in so far as that depends on the rate of cooling of the human body. When it is desired to measure the effect of convection and evaporation in producing cooling, the "coil" is enclosed in a thin-walled copper case covered on the outside with an absorbent material, which is kept moist as in an ordinary wet-bulb thermometer. Usually, that is in places where the atmosphere is not abnormally dry or moist, the convective cooling of the body is so much greater than the loss of heat by evaporation, that it is sufficient to observe the changes in convection in order to ascertain and to regulate the comfortable conditions of the surrounding air. Hence the coil is ordinarily employed freely exposed to air currents. The accompanying figure illustrates the principles governing the action of the Caleometer. The "coil" 4, which is made of a wire having a temperature coefficient, forms one arm of a Wheatstone bridge, the other arms 1, 2, 3, of which are made of constantan wire. The bridge is balanced when the temperature of the coil 4 is approximately that of the human body, the heating current being supplied from accumulators or from the main supply at about 8 volts. The galvanometer 6 of the bridge forms a relay through the pointer of which a portion of the main current passes. This relay actuates one or other of the electromagnets 7, 8; when the coil tends to cool, the lower electromagnet draws down the rheostat arm 10, and so lowers the resistance in the battery circuit. An increased current then restores the coil to its equilibrium temperature. Should the coil tend to increase in temperature, the upper electromagnet is brought into action, thus increasing the resistance in the rheostat and diminishing the current.



1, 2, 3, balancing coils; 4, caleometer coil; 5, indicator; 6, relay; 7, 8, electromagnets; 9, rheostat; 10, rheostat contact arm.

Fig. 1.—The Caleometer.

The indicator 5 shows at any instant the number of calories per minute supplied to keep the temperature of the coil constant. It will be seen from the diagram that a compensating arrangement allows the coil to be placed at any distance from the indicating apparatus. Any number of coils distributed over a building can be switched on in succession, and so the state of the ventilation in any room can be instantly observed, or when the indicator is a self-recording one, permanently recorded. By the simple manipulation of a switch the coil will also register the temperature of the room in which it is placed. Under ordinary comfortable conditions the pointer of the indicator swings slowly about a mean value of 30 calories per minute. A low steady reading indicates monotony and oppressiveness; violent oscillations about a high mean reading indicate unpleasant draughts. At the Royal Society's soirée last week in Room 1, at 9 o'clock, with only two or three people in the room, the reading was 30 with slow oscillations. At 10 o'clock, when the room was packed full of people witnessing some gyrostatic experiments, the reading was 8, and steady. By 11 o'clock the room was empty, comfortable conditions had been restored, and the reading was again 30.

The Caleometer has been successfully used in testing the ventilation of the House of Commons.

The instrument can also be arranged so that it can automatically regulate the speed of a fan, or the current in electrical radiators, in order to produce and preserve comfortable conditions. It is manufactured by Mr. R. W. Paul, of New Southgate.

Mr. S. Cowper-Coles exhibited a collection of specimens and microphotographs of electro-deposited lead, showing the effect of varying the current density and the temperature, and of the addition of organic salts to the bath.

Mr. W. Duddell, F.R.S., showed the water model of the singing electric arc, which he used in his presidential address last year; the model has been improved, and admirably represents the phenomena of the arc. The essential feature of the device is a mushroom valve so arranged that the pressure tending to reseat it diminishes very rapidly as the valve lifts; this control is provided by a small electromagnet below the valve. Thus, when the flow of water is increased through the valve, the difference of pressure between its two sides decreases, just as the potential difference across the electric arc decreases when the current increases. When a steady flow is established, and a column of water having a definite periodic time is connected to the valve, oscillations can be set up similar to those obtained with an electric arc—the cross-sectional area of the column of water representing capacity, and the mass of the water inductance, while the tap used to control the water supply corresponds with the resistance necessary to ensure the stability of the arc. As a convenient and simple analogue of the arc, the model should prove useful in lecture demonstrations.

The Silica Syndicate, Ltd., exhibited apparatus showing various applications of the new air-tight seal between quartz glass and metal, invented by Dr. H. J. S. Sand, and described in our issue of February 27th, 1914. The difficulty of making a vacuum-tight seal for leading-in wires has hindered the development of the uses of "quartz-glass" for electrical purposes, the coefficient of expansion of quartz being extremely small. Hitherto the use of mercury to seal a mechanical joint between invar steel and quartz has been commonly adopted, but this is open to many objections. The Silica Syndicate, Ltd., in 1911 patented a method of sealing-in molybdenum wire, which constituted a decided improvement, but the invention of a lead seal, for which the patents have been acquired by the Syndicate, has made it possible to effect a true seal by simple means. An ordinary seal is shown in section in fig. 2, where A is a quartz-glass tube constricted to hold wire B, C is the lead, and D is the external conductor. The diameter of the lead plug is about 2·5 mm. The seal made in this way has been applied with success to vacuum tubes, X-ray bulbs, mercury vapour lamps, &c. By similar means it is possible to join metal tubes to quartz-glass tubes, as shown in fig. 3, where E is a narrow quartz-glass tube, and F is a tinned-copper tube which is slipped over the inner tube while the lead is still molten, making a vacuum-tight joint. These devices enable the use of quartz-glass to be greatly extended.

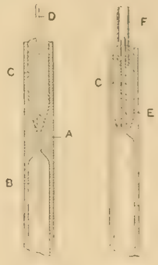


Fig. 2. Fig. 3.

Sections of Joints Between Wire and Metal Tube, and Quartz Tube.

Messrs. Chance Bros. & Co., Ltd., showed a series of glasses for spectacles, intended to absorb ultra-violet and infra-red rays and for the reduction of glare, the outcome of the work of Sir William Crookes, P.R.S.

The electrification produced by raising a cloud of dust was demonstrated by **Mr. W. A. Douglas Rudge**, and **Mr. C. J. Woodward** showed a lecture apparatus illustrating the formation of a complex wave by a combination of two or more simple harmonic waves. **Mr. F. E. Smith**, of the National Physical Laboratory, exhibited a remarkable photographic record of the variations in the horizontal intensity of the earth's magnetic field at the Laboratory, showing the variations due to the earth currents straying from the London United Electric Tramways. **Dr. J. A. Fleming**, F.R.S., showed his apparatus for the production of stationary vibrations on strings, to illustrate the laws of wave motion, and **Mr. Rollo Appleyard**, M.Inst.C.E., exhibited a simple apparatus intended to facilitate the teaching of mathematics relating to logarithms and to the important group of mathematical quantities known as "hyperbolic functions," which enter into a number of engineering, physical, and chemical problems, by presenting examples of those quantities in a tangible and connected form. The apparatus consists of a chain suspended so as to form one-half of a true catenary, and it is shown that by suitably proportioning the scale of measurement to the tensions of the chain, the various quantities required can be obtained, to a first degree of approximation, by direct measurement from the suspended chain. These quantities include the base of the Napierian logarithms; the anti-logarithms of numbers to the Napierian base; and the hyperbolic functions, sinh x, cosh x, tanh x, and sech x. Special interest attaches to the apparatus, as it is just 300 years since the invention of logarithms by Baron John Napier, of Merchiston. It is also noteworthy that during the last few years hyperbolic functions have entered extensively into the practical work of telephony, and it is by their application that the increased distance through which speech can now be transmitted has been secured. It has, however, been difficult for students to obtain an understanding grasp of the nature of hyperbolic functions, and Mr. Appleyard's extremely ingenious device should be found of great assistance in this respect.

THE "FLYING TRAIN."

The exigencies of time and space last week compelled us to restrict our references to the Bachelet "levitated train" to the most prominent objections to its practical utility, namely, the enormous cost of such a system, and the enormous power that would be required to support and propel the cars. But sufficient was said, we believe, to demonstrate the commercial impossibility of transportation by this system, and as the whole of the technical Press of necessity expressed the same opinion (except the *Engineer*, which did not even think the matter worth mentioning), we trust that the mischievous effects of the misleading statements of some of the daily papers will be mitigated, though they cannot be wholly obviated.

It is difficult enough to obtain capital for a sound and salutary engineering undertaking nowadays, without the additional reluctance that would be engendered by the failure of unsound schemes—for which, strange to say, there is always plenty of money available. Truly, Carlyle—but why blame the innocent sufferers who are induced to part with their savings by the irresponsible and uninformed declamations of Cabinet Ministers, military and naval officers, Lords, novelists and—we grieve to say it—editors of the non-technical Press? We hasten to except the *Times*, which dealt with the matter in a sober and rational way, and the *Telegraph* and *Morning Post*, which apparently declined to touch it.

As for the supporters of Mr. Bachelet, who discreetly keep in the background and concentrate the interest on the inventor, we know nothing of them, but we know that the apparatus was exhibited in the United States in 1912; it would be interesting to know why it left New York. Moreover, we should be glad to know why the first public demonstrations in London were given at a time when the technical Press was out of the way for a week. It may have been a fortuitous occurrence—but it is very certain that if the technical Press had been invited to the first demonstration, as is customary in the case of new engineering developments, the furore in the lay Press and in the public mind could never have taken place. Did Mr. Bachelet's friends know this—from previous experience? and was the date an accidental choice?

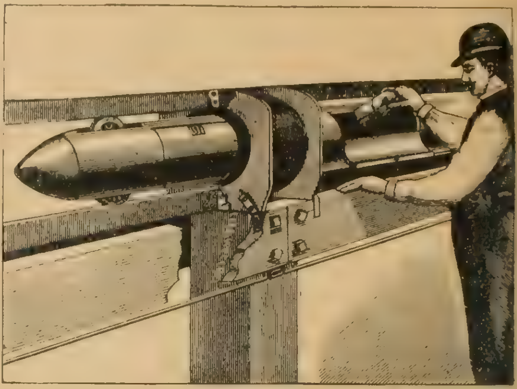


Fig. 1.—The "Portelectric" System of 1890.

Fortunately, the *Daily Express*, which with the *Standard* worked the sensation for all it was worth, and, leading the blind, has done its best to fall with them into the ditch, did us the honour to quote our statements that the invention was a "scientific toy" (the same expression that our contemporary, *Engineering*, used on the same day), and that no sane man would risk a farthing on such a scheme. These were the facts that we wished to have placed before the general public, and we are sincerely grateful to the *Express* for affording them publicity in quarters that we cannot reach directly. True, our contemporary goes on to say that "the effect of such 'criticism' as this is rather spoilt when one reads the names of the many eminent public men and engineers who have seen the invention and pronounced the verdict 'wonderful,'" and in the next line states that "A special article by Mr. H. de Vere Stacpoole, the famous novelist, on the flying train appears on page 4." Suffice it to say that Mr. Stacpoole concentrates on the repulsion experiment as something that has never been done by any man before, whereas Mr. Bachelet himself disclaimed the discovery of electromagnetic repulsion.

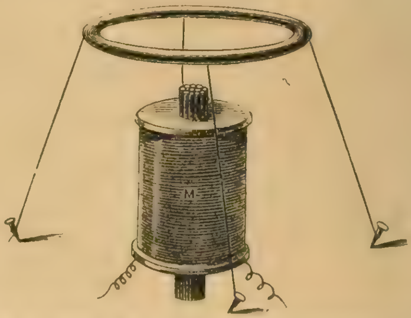


Fig. 2.—Copper Ring supported by Electromagnetic Repulsion in 1890.

In our issue of October 31st, 1890, p. 522, we published the illustration which is reproduced above, showing the "Portelectric" system as exhibited in Boston, U.S.A. A track 3,000 ft. in length was constructed, on which the carrier ran at 30 miles an hour. The car was an iron cylinder 10 in. in diameter, and 12 ft. long, weighing 350 lb., and it was intended to run at 120 miles an hour under the attraction of fixed solenoids, of which one is shown in the figure. Great hopes were entertained of the commercial future of the system, but the difficulties were too great, the mode of propulsion proposed being as hopelessly inefficient then as it is now.

Earlier in the same year, in our issue of April 25th, p. 471, we printed an abstract of a lecture by Prof. Elihu Thomson before the American Institute of Electrical Engineers, in which the author described a variety of experiments on the repulsive action of alternating-current electromagnets, some of which he had devised five years previously.

But earlier still, in our issue of June 10th, 1887, page 544, we reproduced a paper by Prof. Thomson, also read before the American Institute, in which he for the first time propounded the laws of electromagnetic repulsion. Fig. 2, taken from our issue of May 23rd, 1890, page 580, shows a copper ring supported in air by this means, the strings being used simply to keep the ring from jumping off the magnet altogether; this was shown by Dr. Fleming before the Society of Arts in London, when he reproduced Prof. Thomson's experiments. Thus the materials for the Bachelet railway were familiar to electrical men in this country in 1890.

Now let us consider the present proposition from a practical point of view. The following considerations are obvious to an electrical engineer:—The method of support is electrically so inefficient that the expenditure of power necessary is out of all proportion to the result obtained—at least 100 times the power required to overcome wheel friction.

The eddy currents upon which the effect depends necessarily heat the aluminium plate in which they circulate, so that the plate would become red-hot if the action were maintained for long (probably the chimes and other toys exhibited fulfil the useful purpose of giving time for the plate to cool between demonstrations); the cooling action of the air at high speeds would partly counteract the heating, but this does not exist when the car is at a standstill.

The magnets with which the track is continuously paved would have to be protected from the weather; no metal casing could be used for this purpose, and therefore the track must be provided with a continuous roof. The amount of copper required for the magnets of even a light parcel railway, at £80 a ton, alone would cost something like £8,000 a mile; for a full-size coach carrying passengers from London to Manchester the whole of the world's production of copper for three months would not suffice, to say nothing of the other materials or the labour of construction. The inventor himself has discarded solenoid propulsion for passenger cars, and talks of air propellers, which means that he must carry motors on the cars to drive them; if the power for these were supplied electrically, it would tax the utmost resources of the engineers to maintain contact with the line conductor at 300 M.P.H. And what would be the power required? Mr. Bachelet, we believe, says it requires 1 KW. to sustain 10 to 15 lb.; a car to carry 20 people at high speed would weigh at least 9 tons loaded, which would require, on Mr. Bachelet's own best figures, at least 1,350 KW., merely to support it. The motor to drive the air propeller has not been included in the weight; a traction motor of 250 H.P. weighs about 2½ tons, but to propel a car of this size at 300 miles an hour would require at least 2,500 H.P. Need we go further? Surely it will be obvious that the idea is a monstrosity.

But we have not referred to the track construction, apart from the magnets. Provision must be made for supporting the car in the event of failure of the levitating power, and at any speed; therefore, the track rails must be as substantial as if no levitation were employed, throughout the length of the line. Moreover, they must be so arranged as to maintain the car safely in the proper direction of motion—the provision of repelling magnets at the sides to serve this purpose would be too awful to contemplate—whether the car was floating or rolling; and, lastly, as the vertical position of the car is indefinite, there must be guard rails at the top. Thus the cost of the structure would easily amount to three or four times that of a railway of the ordinary type, even without allowing for the extra cost to cope with the forces resulting from the high speed. The construction at curves would be so costly and difficult that curves would not be permissible at all.

Returning to the electromagnets in the track, these would necessarily be of the open magnetic circuit type, and would have a power factor in the neighbourhood of 0·1; the generators supplying the track magnets therefore would have to be of enormous size compared with their effective output. It will be seen that wherever we touch the scheme, it is from an engineer's point of view fundamentally impracticable: it is no less so in the eyes of a railway traffic manager, for the amount of traffic, whether parcels or passengers, that could be carried on such a system would be ridiculously inadequate to the expenditure.

According to our contemporary, the *Engineer*, of October 18th, 1912, Mr. Bachelet himself, when the system was exhibited in New York two years ago, did not even remotely contemplate its application to passenger traffic; such a suggestion to him smacked of the ridiculous. How is it, then, that he has permitted the London Press day after day to foreshadow the carriage of passengers at high speeds? Even for parcels it is a fantastic idea, doomed to a speedy end.

POWERFUL ELECTROMAGNETS FOR LABORATORY USE.

[BY OUR BERLIN CORRESPONDENT.]

PROF. PIERRE WEISS, of the Federal Polytechnic High School, Zurich, has, during the last few years, given much attention to the problem of designing electromagnets capable of generating exceptionally strong magnetic fields for laboratory use.

In the case of the first magnets constructed according to the principles developed in this connection, the windings of the two magnet coils were arranged in a brass or bronze oil tank, the heat generated in the coils being carried away by copper cooling pipes. Since, however, the space available for the coils and pipe was necessarily limited, the cooling thus obtained was rather inadequate, and this, in some cases, resulted in serious trouble.

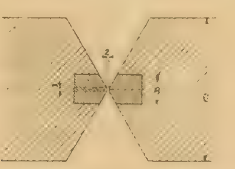


FIG. 1.—SECTION OF POLE-TIPS.

This induced Prof. Weiss to improve his system by using as conductors for his magnet coils, copper tubes traversed by cooling water, and thus carrying away immediately any heat evolved. In view of the considerable hydraulic pressure required in the case of a great number of windings arranged in series, the coils were wound in several sections, arranged electrically in series and hydraulically in parallel. The hydraulic resistance could thus be adapted to the available water head, the magnet being connected up direct to the water mains.

In each coil section the cold water, as it enters, is led direct into the interior of the coil and made to flow through all the windings of the section, thus ensuring most efficient cooling of the interior of the coil as well as the magnet core, and keeping their temperature practically constant. The temperature rise of the magnet coils in no case exceeds 50° C., and by a proper regulation of the water flow can be kept within any limits desired.

Another important fact brought out by Prof. Weiss's work is that an alloy of iron and cobalt will show a magnetic saturation 10 per cent. higher than ordinary iron. This fact is utilised by making the magnet pole-tips of this alloy.

While it has been so far impossible to obtain the alloy in sufficient quantities to allow the whole of the magnet poles to be made of this material, a distinct improvement has been realised by using cobalt-iron in manufacturing their extreme tips. Some very striking comparative tests made by Prof.

Weiss on an electromagnet designed for the laboratory of Prof. J. Becquerel, of Paris, are recorded in the following table :—

Diameter of head surfaces.	Air-gap.	Ampere turns.	Field intensity.		Power absorbed.
			Iron.	Iron-cobalt alloy.	
			Gauss.		
mm.	mm.				KW.
3·00	2·00	25,000	39,800	41,840	·34
3·00	2·00	50,000	43,540	45,790	1·37
3·00	2·00	100,000	45,780	48,020	5·5
3·00	2·00	200,000	47,570	49,990	22
3·00	1·00	200,000	52,580	55,170	22

While the extreme pole tips, made of iron-cobalt, only allowed a field intensity 5 per cent. higher to be generated, the power absorbed with a given field intensity, in the case of iron and iron-cobalt tips respectively, bears a ratio of 4 : 1.

The electromagnet of Prof. Becquerel's laboratory has been constructed by Messrs. Maschinenfabrik Oerlikon, and is represented in fig. 2. The magnet frame proper rests in a ball bearing on a threaded pillar, allowing the magnet to be adjusted at will in a vertical direction.

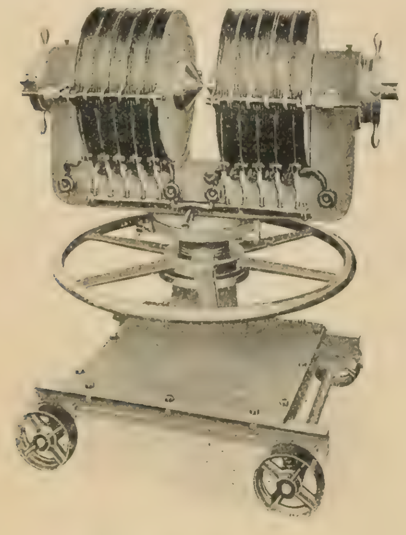


Fig. 2.—Weiss Electromagnet.

The magnet is carried on a light truck, and is readily used at any place in the laboratory. The above improvements in the design of electromagnets are patented by Messrs. Maschinenfabrik Oerlikon.

SOME POINTS IN THE EDUCATION OF THE YOUNG ENGINEER.

By W. J. CRAWFORD, D.Sc.

There are several ways in which a youth may prepare himself for the trade or profession of engineering, and I propose to say a few words about them. I do so because I am continually asked questions by young men anxious to wield the hammer and chisel, and because I find that in spite of all that has been written on the subject, parents and guardians have very little real idea as to how to start their sons upon the right road.

There can be little question that the reign of the rule-of-thumb and unscientific engineer is over. I do not mean to say that very good work was not done by this class in the past. As a matter of fact, much excellent work was done, but it was in the days when things were taken more leisurely than now, and at a time when there was not so much competition. So I think few will be found to differ when I say that the embryo engineer must consider the scientific side of things as well as the question of his actual workshop apprenticeship—a combination of the two is what is desired and required—and I think I can do no better than indicate as shortly as possible how this combination may be obtained.

A good elementary education is absolutely essential. The lad should remain at an ordinary elementary school until he has passed the seventh standard—or the sixth at least. By that time he will be about 13 years of age. The real difficulty then presents itself, What is he to do now ? How is he to proceed so that in future years he may find himself in the forefront of the fight and not lingering haltingly in the rear ? The answer depends largely upon his position in life, or at any rate the position of his father or friends. If he is well off, he will have a university course in mind; if he is not too well off he will be unable to afford the money and time required for such a course. In the great majority of cases he is not very well off. The father cannot see his way to send his son to the university, but he is very desirous of giving him a sound and advantageous training. What, then, is to be done ? Well, briefly speaking, after the elementary school is finished with, there are three courses open. The lad may attend :—

1. An ordinary secondary school.
2. A trade preparatory school.
3. An engineering shop to serve his apprenticeship.

Let us consider these separately.

1. The secondary school gives a boy a good secondary education, including something of Latin, French, mathematics and so on. This is very good training if the boy is going to the university afterwards, but not the best if the reverse is the case. It is unwise to specialise too early, but at the same time, if the university is not the objective, the tendency in the couple of years after leaving the elementary school should be on the scientific and practical side. This is seldom the case at the ordinary secondary school, although to be sure I have heard weird tales of some of them having an "engineering" side.

2. The trade preparatory school is a comparatively recent branch of the teaching art. I consider it much the best school for our lad to enter. The teaching is strongly scientific and practical, although a good English education is given. French, German, history, &c., are also taught. The course usually lasts for three years, but I think two years will be found most suitable in the majority of cases. It is astonishing what an amount of good, solid useful information can be assimilated by a boy in the two years—knowledge which enables him not only to speak the King's English, but at the same time prepares the way for an understanding of his workshop duties. And how wonderfully cheap these trade preparatory schools are ! Sixpence to a shilling per week in the majority of cases, and dozens of scholarships usually thrown in for competition amongst the most industrious.

3. The boy may enter the workshop immediately on leaving the elementary school and attend technical classes two nights a week during the winter. But this is a bad course to pursue. He will soon find himself at a disadvantage as compared with his more fortunate companions.

I strongly advise attendance at a trade preparatory school. When the lad has finished with it, he will be 15 or 16 years of age, and ready to serve his apprenticeship. He should accordingly be apprenticed at once. During the winter he should attend a technical school, where, by reason of his previous training, he will be able to take the higher classes. At the end of his apprenticeship he will find himself, if during all this time he attends regularly the technical classes, possessing a very substantial foundation for his future career as an engineer. He will have a training in the scientific side of engineering little, if any, inferior to the man who has undergone the orthodox curriculum of a university—and at a tithe of the cost.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Meetings of the I.E.E.

Letters of protest such as Mr. Farrer's in your current issue are evidence of life, and if such energy is properly directed should benefit the Institution, although many will consider that the public Press is not the place for ventilating complaints.

My habit is to consult the Electrical Review's list of "Forthcoming Events," and I do not find the absence of the postcards announcing meetings a serious matter. Mr. Farrer's ½d. has to be multiplied by 7,000 to get an estimate of the importance of the economy in stamps.

An alteration that has affected me is the withdrawal of the supply of advance copies of papers on selected subjects of interest to each member, which was based on a single request at the beginning of a session itemising the subjects one is particularly interested in.

Another room for improvement is in the organisation of the discussions on papers, and this is not limited to the I.E.E. only. It should be of sufficient importance for Members of Council who are specialists in different branches to take a personal interest in organising discussions on papers which come forward on subjects in which each is expert. They would know who are capable critics, and who are in a position to give valuable material in discussions; and, while it is not my desire to take away the opportunity for practice from inexperienced speakers, it is due to any member who prepares a paper to the satisfaction of the Examining Committee to have that paper discussed intelligently and efficiently. It ought not to be possible for a discussion to be cut short "for want of time."

Theodore Stevens.

London, E.C., *May* 13*th*, 1914.

Electricity and Gas Supply.

It has been suggested upon more than one occasion in the electrical Press that gas undertakings and suppliers of electrical energy should work in greater harmony than is customary at present. This must be my excuse for troubling you with this letter, in which I desire to point out that the decision given yesterday by Mr. Justice Sargant in the Court of Chancery upon the Long Eaton case is not likely to hinder such a consummation. However desirable it may have appeared to some suppliers of electrical energy that gas undertakings should be wiped out of existence, they were never given their statutory powers for such an object. In this fundamental respect they differ from an ordinary trader, who is free to sell his goods to any customer he chooses, and at whatever price he chooses, and to go any length in this direction, even if his avowed object be to smash up the opposition shop in the same street. If energy suppliers will but take to heart the difference between fair and unfair trading (or preference), they will get their share of the supply of light, heat and power in response to the demand the public makes for it, which was the privilege Parliament meant to bestow when it gave them their statutory powers.

Charles Carpenter.

London, S.E., *May* 13*th*, 1914.

[We refer to this letter in our leading columns.—Eds. Elec. Rev.]

Deterioration of Red Cable.

I enclose herewith two samples of 3/22 V.I.R. cable, regarding which I should appreciate your comments.

The cable was manufactured some four or five years ago by one of the leading firms in the C.M.A., and was erected in Simplex tubing in a dry but fairly warm atmosphere. The black cable appears quite sound, but the rubber on the red cable is cracked about every half-inch or so, and its insulating properties are quite negligible.

The point is that from time to time I have heard that the ordinary red cable—which is generally used as the switch wire on lighting installations—is much inferior to the black cable, owing presumably to the ill effect of the red colouring matter; and I know one or two engineers who, for this reason, will not use red cable at all.

Personally, this is the first time I have ever met a case which appears to support the above argument, and I should like to know whether any of your readers can instance similar cases of failure.

H. B.

"Schoeller" Miners' Lamp Gas Detector.

Mr. Fred. J. Turquand's letter, which appears in your last issue, only proves that Schoeller has been successful, where Mr. Turquand has failed.

I do not propose to enter into a discussion at the moment. The lamp can be left to speak for itself when the time comes.

W. Schmahl.

London, E.C., *May* 16*th*, 1914.

The Problem of the Small Consumer—1908-1914.

On opening the current week's issue, I was forcibly struck by the phrase heading this letter. It brought to my mind the sub-title of an article passing through several issues of the Review in June and July, 1908, in which I dealt very fully with "the problem of the small consumer." In that article, if I remember correctly, the majority of the principles on which "the Fixed Price Light Co." have built their scheme were enunciated. The one supply company's branch feeding by means of overhead or exposed mains a series of small consumers was one of the points which I then indicated. The provision of a transformer system was another. In the particular article referred to I suggested an auto-transformer, but with the proviso that this might not be passed by all supply authorities, and that a double-wound transformer might be necessary.

I am pleased also to notice that the diversity factor of this class of business is just what I anticipated it would be, and it certainly gives me pleasure to notice that the company are making a success of the demand from the small consumer. It does not surprise me at all that the revenue which they are obtaining "considerably exceeds the average revenue per lamp obtained from the Corporation supply as a whole." This was proved in this neighbourhood by the Clyde Valley Co. about five years ago, when they supplied a number of tenement houses somewhat on the lines of my scheme, and charged a fixed price per lamp. I trust that the company will extend their operations to other districts than Wimbledon, and I feel sure that there is a big revenue waiting for the Supply Co. which tackles the small consumer in a systematic and proper fashion.

Great credit is due to Messrs. Handcock & Dykes, the consulting engineers of the company, and to Mr. Lee of the Wimbledon Corporation, for having so fully developed the source of revenue which was all the time lying to their hand.

In view of the fact that I was one of the earliest to draw attention to this untapped source of revenue, it affords me personally a good deal of satisfaction to see that my forecasts have been so fully realised. It was certainly not "unexpected" by me.

John D. Mackenzie.

Glasgow, *May* 18*th*, 1914.

Frequency Changer.

If a direct current of suitable voltage be connected in series with an alternating current so that during half of one cycle its voltage will be added to that of the A.C. voltage and during the other half of the same cycle its voltage will be in opposition to that of the A.C. voltage, a pulsating current will be obtained at one half of the frequency.

Would some of your readers be kind enough to inform me whether this arrangement could be used for any practical purpose?

F. W. T.

[The superposition of D.C. on A.C. attracted much attention some years ago (see Elec. Rev., July 6th, 1900). We pointed out at the time that the gain in efficiency claimed for it was groundless. It may, however, be of use in some special applications.—Eds. Elec. Rev.]

Charging a Small Battery.

In reply to "H. T. B." in your current issue, he gives no facts about size except "small." To handle the problem effectively requires complete data of capacity of the cells, for a given period, and number and C.P. of lights.

For a few lights I should not regulate, though I appreciate that the brightness would vary.

If the dynamo runs all day every week day, and it is not practicable to have charging at a higher voltage, it would no doubt be cheapest to charge half at a time, and thus require only one resistance—but this requires knowledge of size of cell to estimate the value of such an economy—instead of two resistances suggested by "H. T. B."

I recommend integrating meters for input and output, and to avoid inaccuracies this would require three ampere-hour meters, one for discharge, and two for charge, one connected in each "half" (*i.e.*, 27 cells in series with one "charge" meter).

R. E. M.

London, *May* 16*th*, 1914.

An Artless Query.

The following amusing inquiry, which might interest some of your readers, was sent to our works referring to our advertisement for Century repulsion induction motors :—

> We read your advertisement of the Century motors in the *American Exporter*, and shall be glad to receive your full range of illustrated catalogues quoting terms of business and the discounts allow.
>
> You say therein that the motors are automatic in operation, and self-starting, and do not require any external starting device. Does it mean that—they do not require any electrical energy or oil engine to drive for the production of electricity, and if it be such, we shall be glad to hear from you by return your lowest price for a motor to produce electricity sufficient to light 50 lamps metallic-filament, and what would be the voltage of the motor.
>
> If such a motor which can produce electricity without the aid of an oil engine or an electric current be available, which is long felt want here, we assure you that we can buy lot of such motors for the use of fans only where electricity or such big oil engines are not available.
>
> We await you full information by return mail. Yours faithfully, (Signed) ——

Adnil Electric Co., Ltd.
R. A. MARPLES.

London, E.C., *May* 15*th*, 1914.

The Wiring of Government Buildings.

My attention has been drawn to a series of articles now appearing in the *Daily Herald*, stating that nearly all the public buildings down Whitehall are in hourly danger of fire owing to defective electrical installations. It is essential that inquiries should be made as to the truth, or otherwise, of these statements ; yet, although I have searched the columns of all the daily papers, I can find nothing dealing with the subject, either by questions in the House or in the Press. These articles seem to bear the impress of truth, although the paper itself does not appeal to one, and yet nothing is done. We have M.P.'s in the House that are connected with our industry ; surely they ought to inquire as to their truth.

If such statements are false, the persons responsible for them should be severely dealt with ; if true, they are of such a serious nature, that the technical Press, the contractors of London, together with the general public, ought to press for an inquiry, and have the electrical installations of these buildings brought up to date. Friends of mine, whose business is in the Foreign Office, tell me the whole office is in a ferment, and they certainly speak as if quite a lot of the things spoken of in these articles are true.

B. S. Sykes.

Fulham, S.W., *May* 16*th*, 1914.

The King of Denmark.—The King of Denmark on Thursday of last week honoured the Great Northern Telegraph Co. with a visit to their offices at St. Helen's Place, E.C., and went through the telegraph station there.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

THE *Journal* for May 15th contains the Report of the Council for 1913-14, which was to be presented to the annual general meeting yesterday. The Report shows that at May 1st, 1914, the membership amounted to 7,045 of all ranks, a decrease of 39 during the year. New members elected numbered 287, and 15 were reinstated ; there were 110 resignations, 187 lapsed. and 44 deaths. On the other hand, 112 candidates for Associate Membership, including 70 non-members, have been approved subject to their passing the examination (the papers for which are published in the same issue). Premiums have been awarded as follows :—Mr. S. Evershed, Institution Premium ; Mr. F. Lydall, the Ayrton Premium ; Commandant G. A. Ferrié, the Fahie Premium ; Mr. L. J. Hunt, the John Hopkinson Premium ; Mr. B. Welbourn, the Paris Premium ; Messrs. K. M. Faye-Hansen and J. S. Peck, S. H. Holden, and F. J. Teago, extra premiums ; and Students' Premiums to Messrs. E. A. Richards and D. Dunham, H. S. Ripley, J. L. Thompson, J. L. Moffett, W. S. Flight, and A. Arnold and E. L. M. Emtage. A Salomons Scholarship has been awarded to Mr. C. H. Stubbings, and two David Hughes Scholarships to Messrs. J. G. Wellings and J. Mould. Regarding the Industrial Committee, the Report says :—

The Council have to report that the Industrial Committee has been dissolved.

This Committee was constituted on March 28th, 1912, and then consisted of six Members of Council, 12 members of the Institution not being necessarily Members of Council, and six other persons not been necessarily members of the Institution. On November 14th, 1912, the members of the Committee not being members of the Institution were increased from six to 12 in number. Representatives of the Tramways and Light Railways Association, the Association of Electric Power Companies, the British Electrical and Allied Manufacturers' Association, the Incorporated Municipal Electrical Association, the Conference of Chief Officials of the London Electric Supply Companies, and the Association of Municipal Corporations, accepted seats on the Committee.

The work of the Parliamentary Committee of the Institution which had hitherto dealt with legislative and similar subjects was transferred to the Industrial Committee.

The constitution of the Committee was framed so as to secure the widest representation of the industry, and with a view to the accomplishment of effective work by utilising the organisation and influence of the Institution. The powers conferred upon the Committee were very carefully considered with a view to the attainment of the maximum benefit from its operations, and the Council hoped for much good from the Committee's deliberations and recommendations. In common with other Committees of the Institution the Industrial Committee was required to report to the Council by whom such action would be taken as they might consider advisable. The constitution and powers of the Committee will be found in the annual report for 1911-12 (*Journal*, Vol. 49, p. 664).

Fourteen meetings of the Committee have been held, at which the matters considered were the Electric Lighting Bill (1912), the National Insurance Act, the draft Census of Production Schedules, and the Sheffield Corporation Bill (1912).

On March 9th last the Committee reported to the Council as follows :—

"The Industrial Committee have carefully considered the constitution of the Committee and the powers conferred upon it by the Council of the Institution.

"They are unanimously of opinion that it is not only desirable, but of importance to the electrical industry, that an organisation should exist which is capable of protecting and promoting the legislative and industrial interests of the industry, in so far as these interests are not already represented, protected, and promoted by the various existing Associations, and also for the purpose of co-ordinating and supporting the work of these sectional associations.

"They are of opinion that the present constitution and powers of the Industrial Committee are not such as to enable it to perform useful work. They are further of opinion that the views of the Council of the Institution should be ascertained as to whether it is advisable to enlarge the powers of the Industrial Committee and give it the necessary authority effectively to carry out the work referred to ; or, alternatively, as to whether the Council be of the opinion that the consideration of these industrial questions is properly within the province of the Institution."

On the question of enlarging the powers of the Industrial Committee, the only additional powers would have been the granting of plenary authority to act independently of the Council, but no such extension of powers could be given, as the Council cannot wholly delegate to a Committee the powers or authority vested in them by the members of the Institution. Neither were the Council able to suggest any advantageous change in the constitution of the Committee, and in view of the opinion of the Committee as expressed in their report there was no alternative but to dissolve the Committee.

The Council take this opportunity to point out the grave difficulties which arise if questions are dealt with which involve matters of a political character or in regard to which the interests of various sections of the membership may be in conflict.

With regard to the Council's attitude towards industrial questions, the Council will in future, as in the past, within the provisions of the Memorandum of Association, take such action in respect of legislative or industrial matters as may conduce to the general advancement of electricity and its applications, and will give full consideration to any representations made to them while preserving impartiality to all sections of the electrical industry.

The Report goes on to state that a number of Sectional Committees have been appointed to organise meetings at which specialised subjects can be discussed by members interested in those subjects. A sum of £500 has been placed at the disposal of the Research Committee for the current year. The receipts in connection with the Kelvin Memorial Window amounted to £1,691, and the expenditure to £1,223, leaving a balance of £468; this will be applied to the establishment of a Kelvin Gold Medal, to be awarded triennially as a mark of distinction achieved in engineering work of the kinds with which Lord Kelvin was especially identified.

The Council has appointed delegates to the International Illumination Commission, and a National Committee to take part in the work of the International Scientific Radio-Telegraphic Commission; and the Electrical Section of the Engineering Standards Committee, and of the British Electrotechnical Committee, has been reorganised.

The benevolent fund amounts to £4,642, an increase of £154, and the Wilde benevolent trust fund stands at £1,846. The income for the year amounted to £19,802, and expenditure to £15,410, leaving a surplus of £4,392; after transferring amounts to certain funds, there remained a balance of £2,834, compared with £1,238 in 1912. The assets amounted to £114,001, against liabilities £44,781, leaving a credit balance of £69,220, an improvement of £4,002. In February the catalogue of the lending library was issued to members containing 634 entries, and 306 issues of books were made in two months.

BUSINESS NOTES.

Bankruptcy Proceedings.—MR. J. G. FORMAN, electrical engineer, Kilmun Cottage, Kilmun, Argyllshire, was examined in Edinburgh Bankruptcy Court in connection with the sequestration of his estate. Answering Mr. C. A. Romanes, chartered accountant, trustee on the estate, Mr. Forman said he served his apprenticeship with his father's firm in Glasgow. His father, who was Mr. James J. Forman, of Craigpark, Ratho, died in 1900. He was not assumed as a partner, but his brother was. He left his father's employment about a year prior to his father's death. His remuneration was £200 a year, and he had a free house. He went into the employment of another firm—Messrs. Hurst, Nelson and Co.—and received the same remuneration, in addition to expenses for a visit to South Africa on behalf of the firm. That visit took place in 1899, and he was there for about six or seven months. Over a year later he started business in Moffat on his own account, and left there in 1908. When his father died he received a share in his estate equal to between £300 and £400 a year. At present he was the holder of a patent for an internal combustion pump, which he undertook to hand over to the trustee, although he hoped this action would not interfere with its future value. He was at present in business in Kilmun as a consulting electrical engineer. The case was adjourned for a week.

T. L. CALLENDER (Shamrock Cycle Co.), electrical engineer, residing at Nottingham, lately trading at St. Heliers, Jersey. Last day for proofs for dividend, May 30th. Mr. E. Wynne Humphrey, trustee, 4, Castle Place, Park Street, Nottingham.

W. H. PEASE, electrical engineer, lately carrying on business at Scarborough and Doncaster, appeared for his public examination. According to his statement of affairs, debtor's liabilities expected to rank for dividend amounted to £771, and his available assets totalled £251. The debtor had not furnished a proper cash and goods account, and the examination was adjourned in order to enable him to do so.

W. BARNETT, electrician, 269, Mile End Road, E.—Trustee (Mr. E. Leadam Hough, Bankruptcy Buildings, Carey Street, W.C.), released May 5th.

F. W. SUTER, engineer and company director, 67, St. John's Park, Upper Holloway, N.—Trustee (Mr. E. S. Grey, Carey Street, W.C.), released May 11th.

H. G. PRESTED, electrical engineer, St. John's Park, Holloway. —Trustee (Mr. E. S. Grey, Carey Street) released May 5th.

The Printing Trades' Exhibition.—The Exhibition now being held at the Agricultural Hall, Islington, is considered to be the best of its kind which has been held, and so far as the display of printing machinery and accessories is concerned there is no doubt that this is the case. All the machinery which is at work is driven in some way or other by means of electric motors, and while the various electrical applications are interesting, there is very little of conspicuous novelty. One of the most imposing displays of machinery is that by Haddon & Co. in the small hall near the entrance, and this has been appropriately named "Haddon Hall." In this hall is to be seen also the best display of electric motors and switchgear, these being supplied by J. H. Holmes & Co. The machines are practically all individually driven and are equipped with automatic starting switchgear. On some of the machines is a very complete control equipment, Messrs. Holmes having adapted their rotary push button control to flat bed machinery. The control panel contains a solenoid starting switch, main clapper switch, D.P. switch and field regulator, with interlocking field contacts which ensure the shunt regulating resistance being brought in gradually after the starting resistance is cut out. The push button box contains in addition to starting and stopping pushes an inching push for obtaining slow speeds when making ready. When this push is pressed the clapper switch closes the main circuit, but immediately breaks it again on the starting rheostat cutting out the first step of resistance, hence so long as the push is pressed the clapper switch rapidly makes and breaks contact, and so effects all the inching motions necessary without any other effort on the part of the operator. A safety push is also provided which, when depressed, prevents anyone starting up the machine. We hope to refer to some of the other exhibits in our next issue.

Catalogues and Lists.—INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., Silvertown.—Catalogue No. 36 of 84 pages is devoted to Silvertown insulators, fittings, and tools for telegraph and telephone lines. Starting with iron and creosoted wood poles and structures for telephone exchanges, it particularises wires, cable suspenders, stay rods, galvanised brackets, insulators and supports for same, Post Office pattern pot-head insulators, iron hooded, ebonite, glass shackle, bobbin, reel, and other insulators, cleats, telegraph linemen's tools, &c., and several pages of diagrams show various leading-in methods employed by the Post Office.

THE CABLE ACCESSORIES CO., LTD., Britannia Works, Tividale. —Forty-eight-page illustrated brochure specially prepared for borough electrical and other engineers concerned with matters relating to public lighting. The firm specialises in lanterns for the electric lighting of public places, and in this publication it shows a range of fittings to take half-watt lamps. In addition to illustrations of the fittings, pictures also appear of streets, railway stations, &c., in various cities in Great Britain where they are in service.

THE WESTERN ELECTRIC CO., LTD., North Woolwich.—Booklet No. 105 (revised edition, 12 pages) contains particulars of the improved Blue Bell dry cell and tests thereof made at the National Physical Laboratory. Prices are tabulated.

MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne.—Revised pamphlets Nos. 114 and 144. The former deals with standard wall plugs, the prices of glands used in connection with which have been reduced. The latter shows oil switches for three-phase (50 amperes 500 volts), the prices of which have also been considerably reduced.

MR. C. FRANKLIN TUBBS, 2, Craven Terrace, Carlton Hill, Leeds. —Brief particulars, many illustrations and tabulated prices of "Nonpareil" oil immersed and other starters, A.C. brake solenoids, oil switches, single-phase starters, resistances and other manufactures of this firm are given in a series of publications just issued in an expanding cover.

THE ELECTRICAL CO., LTD., London.—The *E.C. Journal* for May has been issued. Among other articles we find a description of the A.E.G. high-tension factory and some notes on the manufacture of A.E.G. rubber-insulated wires.

MESSRS. J. H. HOLMES & CO., Newcastle-on-Tyne.—Pamphlet No. 71 contains illustrated particulars and prices of the "Castle" ammeters and voltmeters, portable testing sets, and other measuring instruments.

MR. H. LANZ, 63, Queen Victoria Street, London, E.C.—Four-page circular giving half-tone views and test particulars of superheated locomobiles made at Mannheim.

THE ARMORDUCT MANUFACTURING CO., LTD., 6, Farringdon Avenue, London, E.C.—Priced leaflet giving particulars of the "Scru-grip" continuity fitting.

Book Notices.—The publishers of Sell's "Directory of Registered Telegraphic Addresses," after a long correspondence with the Postmaster-General of the Commonwealth of Australia, have obtained official authority to publish the list of firms in Australia using registered cable addresses, and arrangements have been made for the names, together with the postal and cable addresses and other particulars, to appear in the next volume (1915) of Sell's Directory.

From Mr. Fritz Pauli, of Berlin, we have received a reprint of a long article in "Süd und Mittel-Amerika," of March 20th, on the development of the Telefunken system of wireless telegraphy in Latin America. The article is fully illustrated, and indicates that the system named has been adopted in the great majority of instances; a map is given showing the distribution not only of the Telefunken stations, but also of those installed by other concerns—a total of 365 (including ship installations)—and several of the Marconi stations are illustrated, the sectional hollow masts of the latter contrasting with the open triangular trellis construction usually adopted by the Telefunken Co.

"*Journal* of the Institution of Electrical Engineers." Vol. LII, No. 234. May 15th. London: E. & F. N. Spon, Ltd. Price 3s. 6d.—This issue contains papers on "Electrification of Railways as affected by Traffic Considerations," by H. W. Firth; and "The New Central Telegraph Office, Calcutta," by C. T. Williams, as well as the Report of the Council for 1913-14, Annual Accounts, and the papers set in the examination for Associate Membership.

"Electric Wiremen's Work," by J. H. Havelock. "Modern Workshop Practice," by E. Pull. London: Crosby Lockwood and Son. Price 5s. net each.

"*Engineering* Directory." April. London: *Engineering*, Ltd. Gratis.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 5. May. New York: The Institute. Price $1

"*Transactions* of the New York Electrical Society." New Series Nos. 1 to 6. 1912. New York: The Society.

Seaside Illuminations.—Now is the time for the authorities of popular seaside resorts to prepare attractions for their summer visitors. A good example is set by Hastings, where the bandstand and front have been illuminated with no fewer than 4,000 metallic-filament lamps, producing an excellent spectacular effect at night. The lamps used are the Pope "Elasta" British-made wire lamps, and appear to suffer no ill-effects from their exposed position.

Liquidations.—The Hove Electric Lighting Co., Ltd.—A meeting of creditors is called for May 25th. Claims must be sent to the Liquidator, Mr. F. R. Reeves, Salisbury House, E.C., by May 22nd.

Measures Bros., Ltd., 53b, Southwark Street, S.E.—Liquidator (H. de Vaux Brougham, 33, Carey Street, W.C.), released May 8th.

Trade Announcements.—Messrs. E. Oakley & Co., 38, Broad Street, Poland Street, London, W., have been appointed sole concessionnaires for the British Isles for the Deaco electric starting and lighting equipments for motor-cars.

Messrs. J. W. Greenwood & Co., electric lamp makers, Halifax, are declining business. In consequence the stock, plant, &c., are to be disposed of by auction on May 27th.

The Brimsdown Lamp Works, Ltd., have taken up the sale of special glass shades in conjunction with their Wirum lamps.

Messrs. Jas. J. Niven & Co., Ltd., have removed to 38, Lime Street, E.C.

New Underground Posters.—The Underground Co. has just issued a new series of 10 picture posters, designed in a style in general use on the Continent, but thus far little adapted for poster work in this country. They are from the brush of Paul Reith, a young German artist of the Munich Art School, and are good examples of three and four-colour work. The posters, which deal with Hampton Court, Uxbridge, the Riverside at Kew, a Barge Scene on the Brent, Box Hill, Stoke Poges Church, Epping Forest, and so on, will be displayed on the motor-'buses and the tramcars with which the Underground is associated.

Thermit Welding.—Messrs. Thermit, Ltd., London, have recently taken over the entire control of the "Thermit" patents in South Africa and India, and their chief engineer will in July proceed on an extended tour in these countries with a view to the development of the business, more especially as regards the welding of tramway rails. The company are also sending out one of their welders with the necessary plant to enable practical demonstrations of the process to be given on every system in both countries. The tour is expected to extend over a period of about nine months.

For Sale.—Messrs. Electro-Bleach and By-Products, Ltd., have for disposal a number of gas engines, dynamos and producers. Eastbourne Borough Electrical Engineer invites tenders for the purchase of arc lamps and accessories, and meters. Particulars will be found in our advertisement pages to-day.

Denmark. — The Danish Customs authorities have recently given a decision to the effect that "transformers consisting of a closed iron receptacle, stated to contain oil, copper wire, insulated parts, &c.," are to be classified under No. 301 of the Tariff, the duty being 7½ per cent. *ad valorem.*

Patent Restoration.—An order has been made for the restoration of Patent No. 18,866 of 1910, for "Hydraulic air compressor or pump," granted to Otto Heldebert Mueller.

LIGHTING and POWER NOTES.

Ashton-under-Lyne.—Works Extension Completed.—The new turbine and boiler plant extensions at the electricity works, which have cost £50,000, have been completed, and are to be thrown open for public inspection.

Atherton.—Mill Driving.—The U.D.C. has agreed to supply electricity for power purposes to the Laburnum Spinning Co.'s new mill for a period of not less than seven years, subject to sanction by the L.G.B. to a loan to meet the cost of the necessary mains.

Australia.—The Sydney City Council has been recommended by its E.L. Committee to invite offers for the acquisition by the Council of a property containing coal, which must be situated within 70 miles of Sydney, either on a waterway or within ten miles of a railway, for the use of the electricity department. The electrical engineer reported that the coal bill this year will amount to £35,000, the greater portion of which is represented by the cost of haulage, and it would be economical in the future for the Council to establish a generating station, containing very large units, on the coalfield, and transmit the energy to Sydney.—*Australian Mining Standard.*

Barnes.—Year's Working.—The net profit of the U.D.C. electricity undertaking for the year ended March 31st last was £2,353, an increase of £362 over the previous year. Generating costs decreased from ·81d. per unit to ·75d. per unit. Of the profit, £1,000 has been placed to the reserve fund, and £1,000 to the relief of the rates.

Barnsley.—Year's Working.—The annual report of the electrical engineer states that the units sold during the past year numbered 2,200,057, as compared with 2,055,570 in the previous year. The consumers connected total 1,215, as against 1,142, the equivalent in 8-c.p. lamps being 98,571, as against 91,427. The net profit was £1,469, which, with the reserve fund, makes £2,870 to be carried forward. The engineer intends, at an early date, to present a report on the plant at the electricity works, and the necessity of further extensions.

The Corporation proposes to apply to the B. of T. for authority to supply electricity in Vernon Road and to the Mount Vernon Sanatorium. The Worsborough U.D.C., which was asked to consent to the proposal, has adjourned the matter for three months.

Birmingham.—Year's Working.—The receipts of the Corporation electricity undertaking for the year ended March 31st, 1914, amounted to £346,561, compared with £300,596 in the previous year. The units sold numbered 73,767,178, against 63,250.492. The net balance was £44,634, of which £19.500 has been carried to the renewals fund, and it is proposed to place £25,134 to the relief of the rates. During the year the capital account has been increased by £160,123, including £13,567 for new buildings, £75.382 for plant, and £66.222 for mains and services, and now stands at £2,156,207.

Proposed New Mains.—The E.S. Committee has recommended the T.C. to apply for sanction to a loan of £150,000 for new E.L. mains.

Blean.—Proposed E.L.—The Whitstable E.L. Co. has applied to the Blean R.D.C. for permission to erect overhead wires to supply electricity outside the area. The R.D.C. has requested its surveyor to confer with the company's engineer on the matter, and report.

Bolton.—Rate Relief.—The Electricity Committee has decided to transfer £2,000 from the profits of the department to the relief of the rates.

Bradford-on-Avon.—Prov. Order.—The B. of T. has granted a prov. order for E.L. to Mr. J. H. Edwards, of Bristol. The area of supply includes the urban district and Limpley Stoke, Westwood, Winsley, Bradford Without, and Holt, in the area of the R.D.C.

Bury.—Overhead Wires.—The T.C. has applied to the B. of T. for permission to use overhead wires in parts of the borough for the transmission of electricity at 6,600 volts.

Street Lighting.—A sub-Committee of the Lighting Committee has been appointed to consider the automatic lighting of street lamps.

Castle Eden (Co. Durham).—E.L. Scheme.—The P.C. has adopted an electric lighting scheme, and is to take a supply of current from the Wingate Colliery Co., at £2 per light per annum, the company erecting poles and wires. The company has also undertaken to supply private dwellings at 4d. per unit.

Continental Notes.—Hungary.—What is stated to be the first large overland electricity generating station in Hungary is about to be established at Pancsova, to supply current to about 15 small towns, and for agricultural power purposes.

Russia.—The Kharkov Section of the Russian Technical Society is arranging to hold an Electrical Exhibition in the city of Kharkov towards the end of the present year. It is intended to provide sections to demonstrate the applications of electricity to mining, to small industries, to household uses, central station purposes, &c.

Italy.—The Società Imprese Idrauliche ed Elettriche del Tirso has been formed at Leghorn for the utilisation of the water power of the river Tirso, on the island of Sardinia. The share capital provisionally amounts to £140,000, capable of being increased to £480,000, and the chief undertakings interested in the scheme are the Banca Commerciale and the Italian Southern Railway Co. It is proposed to build a large dam on the river and erect plant of 20,000 h.p., and power is to be supplied to the mines in the island. The Government has granted fiscal facilities to the undertaking and financial support, and the works will pass into the possession of the State, free of charge, at the end of 45 years.

Cranbrook.—Proposed E.L.—Messrs. Saunders & Co. have approached the R.D.C. with reference to E.L. schemes for Hawkhurst and Cranbrook, and a committee has been formed to consider the question in consultation with representatives of the respective Parish Councils.

Darwen.—Year's Working.—The net profit on the Council's electricity department for the past year was £972, of which £500 has been contributed to rate relief. The units generated numbered 2,114,000, and the power load nearly doubled during the year.

Devonport.—Year's Working.—The gross profit on the Corporation electricity department for the past year was £7,878, and after paying £3,938 for interest and £3,894 to the sinking fund, the net balance of £46 has been carried to the reserve fund.

Dover.—The Postal authorities have asked the T.C. to quote terms for electricity supply to the new post office, with an anticipated consumption of 10,000 units per annum, but without any guarantee for a minimum quantity. The engineer suggests 5d. per unit for lighting and 2½d. for power for one year, and the Electricity Committee has left the matter in his hands to deal with at his discretion.

The Committee has decided to charge a minimum of £30 a year, with 2½d. per unit for current consumed, and if the demand exceeds 5 KW. to charge £6 extra for each KW. supplied, for a stand-by supply at the Hippodrome.

Dundalk.—L.G.B. Inquiry.—An inquiry was held on May 12th by Mr. P. C. Cowan into the application of the U.D.C. for sanction to borrow £20,000 for extensions to the electricity undertaking. The Council has agreed to supply the locomotive works of the G.N. of Ireland Railway Co. at ·9d. per unit up to 480,000 units, and ·7d. per unit in excess of that amount, with a minimum account of £1,800 per annum. The application was opposed by the Dundalk Gas Co.

Edinburgh.—Public Lighting Charges.—According to a statement made to the T.C. by the treasurer, the E.L. Committee proposes during the coming year to spend an additional £59,250 on capital account, £30,000 of which is the first instalment for the new generating station at Portobello. This necessitates an addition of £5,925 to the reserve fund. The estimates show that the Committee expects its ordinary revenue and the revenue from the reserve fund investments to provide for the whole expenditure during the year, and also for the £5,925 required for the reserve fund, and leave a surplus at the end of the year of nearly £5,000. The treasurer said in the face of the large surplus, it was difficult to see how the Committee could maintain the existing charge of £9 per lamp for street lighting in view of the competition of high-pressure gas, which was offered at a much lower figure. Undoubtedly the cost might be considerably reduced by substituting equally powerful gas lamps for E.L., and it was quite clear the Corporation would have to obtain much better terms from the E.L. Committee, or the Committee would lose one of its best customers. Notice of motion was given that it be remitted to the E.L. Committee to consider the charge for electricity for public lighting as from May 15th, and report.

Ellon.—E.L. Scheme.—The agreement between the T.C. and Mr. James Duncan, of Tillycorthie, in connection with the latter's E.L. scheme having been adjusted, Messrs. T. C. Smith and Co., of Aberdeen, are to start immediately with the wiring of the houses, and the whole scheme is to be finished by September.

Folkestone.—Half-Watt Lamps.—The T.C. has accepted the offer of the Electricity Co. for lighting the East Cliff with six 700-C.P. half-watt lamps, at £84 per annum.

Gravesend.—Loans Sanctioned.—The T.C. has received from the L.G.B. sanction to the following loans in connection with the electricity undertaking:—£650 for buildings and foundations; £1,600 for cables and street works; and £11,000 for machinery, plant, &c. The latter sum is to be amended, as it should be £12,500, the amount applied for at the inquiry.

Greenock.—New Plant.—The new 5,000-KW. Westinghouse-Rateau steam turbo-generating set at the Dellingburn power station was started up last week. At the ceremony it was stated that it was proposed to supply current to Port-Glasgow at a pressure of about 10,000 volts, and it was expected that the shipbuilders would take their whole supply from the Greenock T.C.

Harrogate.—The Lighting Committee has granted a number of salary increases to employés of the electricity department. It was also decided that the staff at the works on duty on Bank Holidays shall be paid at the rate of time and a half, and that any of the staff at the works working overtime on account of the illness of a fellow workman shall be paid the ordinary Trade Union rate of pay for overtime.

Hereford.—Year's Working.—The revenue of the Council's electricity department for the year ended March 25th, 1914, was £7,229, compared with £6,516 for the previous year. The units sold numbered 840,939, against 600,217, the increase being mainly for power.

Inverurie.—Proposed E.L.—The G.N. of Scotland Railway Co. has quoted 3½d. per unit for a supply of electricity to the town.

Keith.—Proposed E.L.—The company at present installing electric light in Lossiemouth, has been requested to submit three alternative methods for the generation of electricity in the town, *i.e.*, by suction gas, crude oil and steam.

Kettering.—New Loans.—The U.D.C. has taken up loans in connection with the electricity undertaking of £1,000 for assisted wiring, £1,400 for mains extensions, and £600 for services.

Leeds.—Proposed Loan.—The Finance and Parliamentary Committee has resolved to apply to the L.G.B. for sanction to the borrowing of £200,000 for extensions at the electricity works, and the purchase of land in Whitehall Road, and £12,000 for the purchase of land in South Accommodation Road, and the necessary works to adapt it for the purpose of the electricity undertaking. The Tramways and Electricity Committee has decided to supply current for the charging of the batteries of electric vehicles at 1d. per unit.

Annual Accounts.—The financial returns for the Corporation electricity undertaking, which have just been published, show total receipts for the past year £114,925, working expenses amounting to £[illegible]3,017, and a gross profit of £[illegible],907. After meeting capital charges, the net profit was £11,3[illegible], which compares with £15,50[illegible] in 1912-13. If, however, allowance is made for expenditure of a capital nature out of revenue (which is increasing year by year), the surplus would be £21,29[illegible] as against £18,261 in 1912-13. During the year over 31 million units were sold, an increase of 7,880,000 units on the previous year; power and heating accounted for 19 million units, the aggregate H.P. of motors in use being 26,812, and of heating apparatus 966 KW. The maximum load was 13,880 KW., as compared with 10,[illegible]15 KW., the generating plant capacity being 22,940 KW., which will shortly be increased to 30,440 KW. Ordinary generating and distribution costs amounted to ·42d. per unit, capital charges, &c., bringing up the total cost per unit to 1·01d., as against the average price received of 1·12d. The average units sold per 35-watt lamp installed were 19·24, and per H.P. (motors and heating) 709, giving revenues of 4s. 3d. and £2 8s. 5d. respectively.

Leigh.—L.G.B. Inquiry.—Mr. H. R. Hooper has held an inquiry into the T.C.'s application for sanction to borrow £10,225 for extensions at the electricity works. No opposition was raised.

London.—The L.C.C. has been recommended by its Finance Committee to sanction the following loans for electricity purposes:—Hackney B.C., £15,750 for plant extensions; Stepney B.C., £15,000 for mains extensions; and Woolwich B.C., £542, for the electricity undertaking.

L.C.C. Electricity Committee's Report.—Considerable discussion occurred on the submission of an estimate of £3,500 to the Council, in respect of expenses for the current year in connection with the work of the Special Electricity Committee. It was contended that the whole question of the supply of electricity in London was a matter of extreme urgency, and the Committee should take the earliest opportunity of presenting a comprehensive report, so that the matter might be discussed in detail by the full Council. Practically, the only point of importance, however, which emerged, was a statement by the chairman of the Committee that it was intended to present a scheme to Parliament next session, and that an opportunity would be afforded the Council of fully discussing its provisions.

Hampstead.—Plant and Mains Extensions.—The B.C. has decided to install additional plant at the electricity works, at a cost of £7,600, and to extend the E.L. mains from Quex Road Road to the Kilburn Empire, at an estimated cost of £2,604.

Bethnal Green.—The Council, after considering the E.L. Committee's recommendation to appoint Mr. Snell as consulting engineer, has decided to advertise for an electrical engineer at a fee of not more than 500 guineas.

Islington.—L.G.B. Inquiry.—Last week Mr. T. C. Ekin held an inquiry into the application of the Guardians to install electric lighting in certain of their institutions and offices, at a cost of £3,600. Various estimates for E.L. costs were given by Mr. Enright, as consulting engineer to the Guardians, and by Mr. H. L. Dykes, of Messrs. Handcock & Dykes, while Mr. Goodenough, of the Gas Light and Coke Co., explained the offers of the Gas Co., and incidentally criticised those for electric lighting. The B.C. had agreed to supply the Guardians at the rate of 2d. a unit for a minimum of 125,000 units during five years.

Mold.—Proposed Prov. Order.—Mr. A. O. Griffiths, of Caergwrle, has informed the U.D.C. that he intends applying for a prov. order for E.L., and to form a company for working the same.

Newport (Fife).—Purchase Proposal Rejected.—The T.C. has decided not to take over the undertaking of the Tayside Electric and Gas Light Co., which supplies electricity in Wormit, now amalgamated with Newport.

Portrush (Co. Antrim).—Proposed E.L.—The U.D.C. has decided to appoint Messrs. J. Woodside & Co. as electrical engineers to the proposed electricity works.

Pudsey.—Mill Driving.—Messrs. Richard Ingham and Co., Ltd., spinners, of Crawshaw Mills, are considering whether the textile plant in their proposed new extension shall be driven by electricity or steam.

Redditch.—Reconstruction Scheme.—The U.D.C. has adopted the scheme of Messrs. Handcock & Dykes for the reconstruction of the electricity works, and has decided to apply to the L.G.B. for sanction to borrow £18,000 for the purpose. The engineers' original report has been varied, in that a single-phase system, instead of three-phase, is to be adopted for the extensions.

Rothesay.—At a meeting of the T.C. last week it was stated that the whole of the E.L. plant required renewing; the matter will probably come before the next meeting.

Scarborough.—E.L. Purchase Deferred.—The T.C. has decided to take no further steps at present with respect to the purchase of the undertaking of the Scarborough Electric Supply Co.

Slaithwaite (Yorks).—Proposed E.L.—The U.D.C. has appointed a deputation to interview the Huddersfield electrical engineer, with regard to the construction of an electric lighting plant.

South Africa.—The Worcester (Cape Province) hydro-electric scheme has been sanctioned by the Government; the estimated cost is £15,000, and work is expected to commence next August.

The Port Elizabeth T.C. proposes to borrow £50,000 for extensions to its electric lighting plant and mains.

Springhead (near Oldham).—Proposed E.L.—The U.D.C. has asked the Oldham T.C. upon what terms it would supply electricity to the district.

Stockport.—L.G.B. Inquiry.—An unopposed inquiry was conducted on May 13th, by Mr. H. R. Hooper, into the application of the T.C. for sanction to the borrowing of £17,600, for the extension of the electricity undertaking. In the course of the proceedings, Mr. Hooper commented on the wisdom of devoting the profits to the provision of new machinery, rather than borrowing for that purpose.

Sunderland.—Loan Application.—The T.C. has approved of the expenditure of £21,972 upon sub-stations and mains in connection with the distribution of electricity, and has sanctioned an application to the L.G.B. for power to borrow £50,000, to be expended upon mains.

Swinton.—Proposed Loan.—The U.D.C. has applied for sanction to a loan of £1,500 for electricity purposes.

The electrical engineer has been instructed to report on the question of the renewal or otherwise of the bulk supply agreement between the Council and the Lancashire E.P. Co., and also on the conversion of the present system to a three-phase alternating system.

Tasmania.—The report of Mr. E. Parry, on the electrical scheme of the Hydro-Electric Power and Metallurgical Co., has been presented to the Government, and is generally in favour of Government purchase. In regard to the potentialities of the Great Lake, the report states that the rainfall would produce an average of 150,000 H.P., and a maximum of 700,400 H.P., which would probably be sufficient, with the increased storage conditions, to supply 400,000 H.P. The expenditure on the scheme to date amounts to £136,797, and the estimated cost of completing the work so as to supply Hobart is £96,449, to which £17,500 for interest on construction, and £41,450 for administration, should be added. Mr. Parry is of opinion that the whole of the energy can be disposed of in Hobart and district, for which mains extensions, estimated to cost £35,000, will be required, making a total expenditure of £300,572, equivalent to £35 12s. per H.P. for generating plant. The cost of additional plant, buildings, headworks, and transmission lines to the West and North-West Coasts, is estimated at £268,900.—*Australian Mining Standard.*

Torrington.—Proposed E.L.—The T.C. has referred the question of the electric lighting of the town to the Lighting Committee for consideration.

Waltham Abbey.—Proposed Prov. Order.—The Waltham Abbey and Cheshunt Gas Co. has asked the U.D.C. if it would support an application by the company for a prov. order for E.L. at Waltham Cross and district. The Council has appointed a deputation to discuss matters with representatives of the company.

Watford.—L.G.B. Inquiry.—Mr. T. C. Ekin held an unopposed inquiry last week into the application of the U.D.C. for power to borrow £15,150 for the extension of the electricity supply to the districts of Abbots Langley, Watford Rural District, Aldenham and Bushey Urban District, which have been added to its area.

Wolverhampton.—Electrical Exhibition.—The T.C. has confirmed a proposal of the Electricity Committee to hold an electrical exhibition at the forthcoming floral fete in the West Park, at a cost not exceeding £200.

An E.H.T. main is to be laid from Pountney Street to Goldthorn Hill pumping station, and other necessary work is to be carried out at the station at a cost of £875.

Worcester.—Sewage Pumping.—The T.C. has appointed the city engineer and the electrical engineer to report on the advisability of using gas or electric power for driving the pumps and compressor at the sewage works. At the last meeting of the T.C. the Sewerage Committee recommended the installation of a suction gas plant in place of electricity, at a cost of £711, estimating that a saving of £790 per annum would be effected; this figure was criticised by several speakers. The Sewerage Committee at present pays 1½d. per unit for electricity; if all its power were electrical it could be supplied at ½d. per unit.

Street Lighting.—The lighting of New Road is to be converted from gas to electricity.

TRAMWAY and RAILWAY NOTES.

Accrington.—Year's Working.—The revenue of the T.C. tramways for the year ended March 31st last amounted to £30,194, and the working expenses to £17,511. The net surplus was £4,733.

Aldershot and Farnborough.—An extension of time until June 4th, 1915, for the commencement or completion of the works under the Aldershot and Farnborough Light Railway Order, 1909, has been applied for by the Light Railway Co.

Birmingham.—Tramway Fares.—A report by Mr. Baker, general manager of the T.C. tramways, on the suggested readjustment of the tramway fares, states that from the financial point of view, ½d. fares are a mistake. It might be possible for Birmingham to institute ½d. fares on a limited scale, if the workmen's return tickets were abolished, but if the two were working together the profit on the undertaking would be wiped out. The 1d. fare is the backbone of the Birmingham undertaking, and to decrease the number of 1d. fares would almost certainly result in disaster. The report states that 42 per cent. of the passengers travelled less than half of the 1d. stage, and if ½d. fares were in vogue the receipts would be reduced by upwards of £90,000, to recover which 43 million additional passengers would be required.

Bolton.—Rate Relief.—It has been decided to contribute £17,500 from the profits of the tramway undertaking to the relief of the rates.

Clifton (Lancs.).—The Salford T.C. has informed the Kearsley D.C. that it cannot see its way to connect its tramway system with that of the South Lancs. Tramways Co., and the two systems will, therefore, still be separated by about 200 yards at Clifton.

Darwen.—Year's Working.—The total receipts of the T.C. tramways for the past year amounted to £14,646 on the Darwen section, and £2,145 on the Hoddlesden section. The net profit on the Darwen section was £773, and on the Hoddlesden section there was a loss of £325. The car-mileage was: Darwen 230,545, Hoddlesden 36,367.

Dundee.—Tramway Purchase.—The Dundee, Broughty Ferry and District Tramway Co. has informed the T.C. that it is prepared to sell the section of its tramways, about 1,540 yards in length, which the T.C. is to take over in August, for £15,480. The T.C. tramways manager has been instructed to report on the matter, and to prepare an estimate of what the T.C. ought to offer.

Glasgow.—Following exhaustive reports by the manager of the tramways and the chief engineer of the electricity department, the T.C. has been recommended to adopt a proposal that the Pinkston power station be left under the control of the tramways department, provided that the present arrangements be continued, whereby each department can get, by means of the interconnecting cables between Pinkston and Port-Dundas stations, whatever supply of energy can be spared whenever assistance is required by either department from the other.

London.—Bethnal Green.—The B.C. has been recommended, in consideration of the L.C.C. undertaking reconstruction, widening and paving works in Grove Road, not to oppose any further application the C.C. may make for the construction of overhead electric tramways in that road.

L.C.C.—Replying to Mr. Kellaway in the House of Commons, Mr. Burns stated that an inspecting officer of the Board of Trade visited the scene of the accident on the L.C.C. tramways on the Embankment on May 11th, and he was now considering his report with a view to deciding whether a formal inquiry was necessary.

The L.C.C. has obtained reductions amounting to £48,600 in the assessments of its tramway undertaking, on the ground of reduced earnings. The Islington B.C., however, has been able legally to uphold the view that the reduction is not warranted, and the Highways Committee has recommended the Council to take the matter to the House of Lords for final decision. The assessments have been reduced in 45 out of the 48 parishes.

The first of the new 8,000-KW. turbine sets at the L.C.C. Greenwich generating station will be officially started up on Wednesday next.

Mansfield.—Traction Supply.—The Electricity Committee has, subject to confirmation by the T.C., arranged to supply energy to the Mansfield and District Light Railway Co. at 1¼d. per unit for the first 400,000 units per annum, and 1d. for every additional unit. The agreement is to be for five years.

Morecambe.—Year's Working.—The revenue of the tramways undertaking last year amounted to £10,082, and the gross profit to £4,005. The net surplus was £2,184, compared with £683 in the previous year. It has been decided to allocate £1,500 to the rates and to carry forward £683.

New Zealand.—The surplus on the working of the Wellington tramway system for the past year was £3,894, compared with £11,903 in the previous year, the decrease being due to alterations to cars, costing £12,529, which were carried out during the year. The surplus on the Christchurch tramways was £6,805, compared with £2,982.

Southampton.—Year's Working.—The receipts from the T.C. tramways during the year ending March 31st last amounted to £67,672, as against £64,185 in 1913. The current consumed totalled 1,971,261 units, an increase of 6,157 units.

Warrington.—Year's Working.—The income of the T.C. tramways undertaking for the year ended March 31st last amounted to £23,753, and the expenditure to £15,217. The net profit was £3,239, of which £2,500 is to be devoted to the relief of the rates, and £739 is to be carried forward. On the motor-omnibus service there is a gross profit of £405, and a balance of £336.

Worsley.—The U.D.C. has decided to write to the local M.P. drawing attention to complaints respecting the condition of the cars and the overcrowding of the South Lancashire Tramways Co.'s route, and asking him to approach the B. of T. or take other steps to secure an inquiry into the matter.

TELEGRAPH and TELEPHONE NOTES.

Wireless Telegraphy.—The Marconi Co. recently gave a demonstration of wireless telegraphy at 100 words a minute between Chelmsford and Letterfrach, Co. Galway, and the Postmaster-General proposes to adopt this method of working between a new station near Stonehaven and a Post Office station near Newcastle-on-Tyne, as a stand-by in the event of interruption of the overland wires.

Wireless Telephony.—It is reported that a successful experiment in wireless telephony has been made between the German wireless station at Nauen and the Austrian port of Pola, a distance of 850 km.

Wireless Fog Guns.—According to the *Daily Telegraph*, the Marconi wireless control apparatus installed by the Clyde Lighthouse Trust at Gourock, from which signals are operated at Fort Matilda and on a buoy in the fairway, is said to be working well. The apparatus has been combined with the Stevenson-Moyes automatic acetylene fog-gun. This has been erected on an isolated beacon in mid-sea, and has not only been left unattended for weeks on end, but has during this time been exposed to all weathers and to the "jamming" from strong wireless signals received from ships passing close at hand. The tests have been in every way satisfactory, the gun, when the wireless control is switched on in the coastguard station where the transmitting apparatus is set up, firing at intervals of about 20 seconds and giving both a loud report and a brilliant flash. There is a sufficient supply of acetylene gas in the "gun" to allow of continuous firing, at the rate of three flashes and reports per minute, for from two to three weeks. It is expected that the same apparatus with slight adaptations will be utilised for mine and railway work, and for blasting purposes.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—July 20th. Box compound, meters, maximum-demand indicators, arc lamp carbons, and straight-stem insulators, for the Council. Specifications for each section 10s. 6d., from City Electrical Engineer, Town Hall.

July 8th. N.S.W. Railways and Tramways Department. One battery booster set to Specification No. 453. Specification (2s. 6d.) from the Electrical Engineer's Office, 61, Hunter Street, Sydney.

Victorian Railway Commissioners.—August 26th. Electric cranes. Specifications at the Railway Offices, Spencer Street, Melbourne, and at the Board of Trade Commercial Intelligence Department, London.

Melbourne.—June 3rd. Sixty tubular steel tramway poles, concentric lead-covered cable. City Council. See "Official Notices" to-day.

Hobart.—July 20th. Telegraph and telephone material, for Postmaster-General. See "Official Notices" to-day.

Perth.—July 22nd. Telegraph and telephone material, for Postmaster-General. See "Official Notices" to-day.

July 1st. 360 accumulators, Tudor type, for Postmaster-General. See "Official Notices" to-day.

August 5th. Copper wire and binders, for Postmaster-General. See "Official Notices" to-day.

Austria.—Vienna.—June 15th. Supply of arc lamp carbons for the year, January 1st to December 31st, 1915, to the K.k. Nordwestbahn-Direktion. Particulars and forms from the Abteilung für Bahnerhaltung und Bau der K.k. Nordwestbahndirektion, Vienna.

Bedford.—May 28th. Steam and other pipe-work, for the Corporation Electricity Department. Mr. R. W. L. Phillips, Electrical Engineer.

May 28th. Coal (about 9,600 tons) for the Corporation Electricity Works. Mr. C. Stimson, Town Clerk.

Belfast.—June 2nd. Corporation. 15,000 tons of washed single nuts and lighterage for the Tramways and Electricity Committee. Forms of tender from Mr. T. W. Bloxam, City Electrical Engineer, East Bridge Street.

Belgium.—The municipal authorities of the little town of Olne (Province of Liege) have just invited tenders for the concession for the supply of electrical energy for private and public lighting and power purposes.

May 28th. Municipal Council. Electric lighting installation for three sheds at the Canal Dock. Deposit £40. A copy of the cahiers des charges can be seen at the Board of Trade (Com. Int. Dept.) in London.

May 30th. The Belgian Post and Telegraph authorities in Brussels (Salle de la Madeleine). Supply and laying of a quantity of telephone cables and cable leads in the Brussels district.

Birkenhead.—May 26th. Coal for power stations, for the Mersey Railway Co. Mr. J. Shaw, General Manager and Secretary, Central Station.

Cardiff.—May 28th. Corporation. Pipe-work and feed tank. See "Official Notices" May 8th.

Cleckheaton.—May 23rd. U.D.C. 2,000 yards of concentric cable and 2,000 yards of three-core pilot. See "Official Notices" May 8th.

Croydon.—June 9th. Coal for a year, for the Corporation Tramway Department. Borough Engineer, Town Hall.

Darlington.—June 4th. Corporation. One water-tube boiler and one cooling tower, for the Electricity Department Specification from the Borough Electrical Engineer, Electricity Works, Haughton Road.

Dartford.—June 15th. U.D.C. One 500-kw. high-pressure steam turbine, generator, condenser, &c. See "Official Notices" to-day.

Dublin.—May 25th. Corporation. a.c. slot meters. See "Official Notices" May 15th.

Grangemouth. — Corporation. Supply of electric lamps, stores, &c. Specifications from Mr. D. A. Donald, Burgh Engineer.

Gravesend.—May 25th. Switchboard platform extension and high-tension room, at the Corporation Electricity Works. Borough Surveyor.

Harrogate.—The Borough Electrical Engineer is preparing a scheme for increased coal storage at the Electricity Works.

Hornsey.—June 3rd. B.C. Twelve months' supply of coal for the electricity department. Forms of tender from the Town Clerk's Office, 99, Southwood Lane, Highgate, N.

H.M. Office of Works.—June 2nd. Three years' supply of lift ropes. See "Official Notices" to-day.

Keighley.—May 25th. Corporation. One 750-kw. converting plant, for a.c., three-phase, 6,600 volts to d.c. 500 volts. See "Official Notices" May 8th.

Leeds.—June 29th. Corporation. Air-cooled transformers. See "Official Notices" to-day.

Liverpool.—June 2nd. Electrical fittings and stores for 12 months, for the directors of the Liverpool Overhead Railway. Forms of tender from the Manager, 31, James Street.

London.—Fulham. May 27th. B.C. 9,000 tons of coal for the electricity works. See "Official Notices" May 8th.

June 4th. Installation, 760 wiring points, 900 lights; telephones, call and fire bells; at Furzedown Training College and Hostels, Tooting, S.W. See "Official Notices" May 15th.

Hammersmith.—May 27th. B.C. Air-cooled static transformers, and earthenware cable ducts. See "Official Notices" May 15th.

Metropolitan Police.—June 3rd. Three years' supply and maintenance of electrical cell calls at Police Stations and Courts, for the Receiver, New Scotland Yard. See "Official Notices" to-day.

St. Pancras.—June 3rd. B.C. Coal for 12 months for the electricity department. Forms of tender from the Electricity Department, 57, Pratt Street, Camden Town, N.W.

Hampstead.—June 11th. B.C. One 1,500-kw. turbo-alternator, barometric jet condenser and pipework, cooling tower and tanks. See "Official Notices" to-day.

Stepney.—June 11th. B.C. Three years' supply meters, demand indicators, time switches and carbons. See "Official Notices" to-day.

Loughrea (Co. Galway).—May 30th. Gas engine and suction plant, dynamo and motor booster, storage battery, switchboard, overhead lines and street lamps, for Loughrea Electric Power and Lighting Co. See "Official Notices" May 15th.

New Zealand.—Wellington.—July 9th. City Council. Electric chassis for a 2,000-lb. parcels delivery van, and an electric car, for the Electric Tramways Department. Specification may be seen at the Board of Trade Commercial Intelligence Department in London.

July 27th.—New Plymouth B.C. (2) Overhead wiring and permanent way (5 route miles). (3) Sub-station equipment (converting plant, battery, booster, switchboard, &c.). (4) Rolling stock (six complete cars) for electric tramways. Specifications from Mr. F. Black, Consulting Engineer, Wellington, or B. of T. Offices, London. Deposit (2) £4 4s.; (3) £2 2s.; (4) £2 2s.—*N. Z. Shipping and Commerce.*

Auckland.—August 6th. Three 750-kw. d.c. mixed-pressure turbo-generators; one 1,500-kw. three-phase turbo-generator, including auxiliary plant and sub-station equipment. See "Official Notices" to-day.

Penrhiwceiber (Glam.).—June 3rd. Twelve months' supply of electrical fittings, stores, &c., for the Penrikyber Navigation Colliery Co., Ltd. Forms of Tenders from the Secretary.

Rochdale.—The T.C. invites tenders for horizontal-type steam-driven boiler-feed pumps. Mr. C. C. Atchison, Borough Electrical Engineer.

Shanghai.—May 28th. h.t. three-phase switchgear for a sub-station, for Municipal Council. See "Official Notices" May 15th.

Spain.—June 8th. The municipal authorities of Fregenal de la Sierra (Province of Badajoz). Concession for the electric lighting of the town during a period of 10 years.

Tenders have just been invited by the municipal authorities of Motilla del Palancar (Province of Cuenca) for the concession for the electric lighting of the town during a period of eight years.

Swindon.—June 3rd. Corporation. Steam coal. See "Official Notices" to-day.

Warrington.—May 26th. Corporation tramways. (1) 100 tons tram rails (Sandberg steel). (2) Special track work. Specifications, &c., from Tramways Manager, Car Sheds, Mersey Street.

Warwick.—June 1st. B.C. Manholes, chambers, sedimentation and storm-water tanks, and other works. See "Official Notices" May 15th.

June 1st. B.C. Electric motors, centrifugal pumps, switchgear, automatic control apparatus, pipes, valves, &c. See "Official Notices" to-day.

CLOSED.

Australia.—Queensland.—P.M.G.'s Department:—

Telephone material.—Western Electric Co. (Aus.), Ltd.
Conductor cords.—B.I. and Helsby Cables, Ltd.
15 cordless magneto switchboards, 6 lines, £6 each; 40 ditto, 10 lines, £8 10s. each; 20 magneto wall-pattern switchboards, 15 lines, £10 1s. each; 85 ditto, 25 lines, £14 19s. 6d. each; 30 non-multiple magneto switchboards, 100 lines, £40 15s. each.—J. Paton & Co.

Prahran and Malvern Tramways Trust:—

Special work (points and crossings), £2,687.—Edgar Allen & Co., Ltd.
Overhead materials and cables, £3,995.—B.I. and Helsby Cables, Ltd.

Australian Mining Standard.

Bedford.—The Corporation has made a contract with the British Thomson-Houston Co., Ltd., for a year's supply of type R.H. a.c. meters.

Bolton.—The Electricity Committee has accepted the following tenders:—

Rees Roturbo Co., Ltd.—Pressure pumps.
Grimshaw & Peers.—Cast-iron frames.

Chesterfield.—The T.C. has accepted the tender of the Daimler Co. for six additional motor-'buses.

Clacton-on-Sea.—The U.D.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., for 440 yards of service cable, at £56 10s.

Edinburgh and Kirkcaldy.—Messrs. Chamberlain and Hookham, Ltd., have received the contract from Edinburgh for the supply of d.c. meters for the coming year. They have also received the Kirkcaldy contract.

Government Contracts.—The following tenders have been accepted during the past month by the Government departments named:—

Admiralty.—Contract Department.

Electrical fittings (switches, sockets, plugs, &c.).—B.I. and Helsby Cables, Ltd.; Clarke, Chapman & Co., Ltd.; Edison & Swan, &c., Co., Ltd.; Foster Engineering Co., Ltd.; Hawkers, Ltd.; McGeoch & Co., Ltd.; Player & Mitchell; Sterling Telephone, &c., Co., Ltd.
Incandescent lamps.—Stearn Electric Lamp Co., Ltd.; B.T.H. Co., Ltd.; Cryselco, Ltd.; Edison & Swan, &c., Co., Ltd.; General Electric Co., Ltd.; Rugby Lamp Co., Ltd.; Pope's Electric Lamp Co., Ltd.
Motor generators, control gear and motors.—Veritys, Ltd.

War Office.

Telephones, hand and parts.—British L.M. Ericsson Manufacturing Co., Ltd.; Midland Electric Wire Co., Ltd.; Phœnix Telephone and Electric Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Installation of electric light, Herbert Hospital, Woolwich.—Pinching and Walton.
Installation of electric light, Piershill Barracks, Edinburgh.—Grindlay, Ross & Co.

Crown Agents for the Colonies.

Staff instruments.—Railway Signal Co., Ltd.
Tablet instruments.—Tyer & Co., Ltd.
Insulators.—Siemens Bros. & Co., Ltd.
Signals.—Railway Signal Co., Ltd.
Signalling materials.—Tyer & Co., Ltd.
Struts, &c.—Siemens Bros. & Co., Ltd.
Telegraph material.—Siemens Bros. & Co., Ltd.
Telegraph line material.—Bullers, Ltd.

India Office.—Store Department.

Cells.—Siemens Bros. & Co., Ltd.
Insulators.—Taylor, Tunnicliffe & Co.
Motor alternator.—Lancashire Dynamo, &c., Co.

Post Office.

Electric conductor rails, experimental railway, Woolwich, S.E.—Dick, Kerr & Co., Ltd.
Electric lighting.—N.W.D.O., London.—G. E. Taylor & Co.
Electrical equipment, Manchester, H.P.O.—Spagnoletti, Ltd.
Electric motor wagons, experimental railway, Woolwich.—Dick, Kerr and Co., Ltd.
Laying lines of ducts (Southwark and Deptford), D. R. Paterson, Ltd.; (Greenwich), F. G. Brummell; (Lisle Street, Wardour Street), Grieg and Matthews; (Torquay), J. A. Ewart, Ltd.
Laying lines of ducts and U-shaped earthenware troughing, Runcorn.—W. H. Worthington, Ltd.
Storage battery, Manchester H.P.O.—Premier Accumulator Co., Ltd.
Telephone exchange equipment, Darwen.—Peel-Conner Telephone Works, Ltd.
Telephone exchange equipment, extension, Derby.—Western Electric Co., Ltd.
Wireless stations (electrical equipment), Stonehaven and Cullercoats.—Marconi's Wireless Telegraph Co., Ltd.
Telephonic apparatus.—B.I. and Helsby Cables, Ltd.; North British Rubber Co., Ltd.; Western Electric Co., Ltd.
Testing apparatus.—General Electric Co., Ltd.
Extension arms.—Bullers, Ltd.
Battery boxes.—British L. M. Ericsson Manufacturing Co., Ltd.
Submarine cable.—W. T. Henley's Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephonic cable.—B. I. and Helsby Cables, Ltd.; Connolly Bros., Ltd.; W. T. Henley's Co., Ltd.; Siemens Bros. & Co., Ltd.
Porous cells.—Siemens Bros. & Co., Ltd.
Compound for ducts.—Dussek Bros. & Co., Ltd.
Stoneware ducts; insulators.—Doulton & Co., Ltd.
Telegraph paper.—Waterlow & Sons, Ltd.
Copper wire.—B. I. and Helsby Cables, Ltd.
Flame-proof wire.—C. MacIntosh & Co., Ltd.

H.M. Office of Works, &c.

Lift, Board of Agriculture and Fisheries.—Medway's Safety Lift Co.; R. Waygood & Co., Ltd.
Electric bellhanger's work.—Napier-Kimber, Ltd.

Ilford.—The U.D.C. has accepted the tender of Messrs. Frederick Smith & Co., for the supply of two miles of tramway trolley wire, at 8⅝d. per lb. The tender of Messrs. G. & J. W. Fox has also been accepted, at £1,308, for the erection of an electricity sub-station and showroom, &c., at Goodmayes.

Leeds.—The Tramways and Electrical Committee has accepted the following tenders for 12 months' supplies:—

Electrical Sundries.—General Electric Co.; Barr Bros.; British Thomson-Houston Co.; Tramway Supplies, Ltd.; Ruberoid Co.; British Westinghouse Manufacturing Co.; A. Thompson; L. Andrew & Co.; Carl Quitman; Spicer Bros., Ltd.
Oils.—R. Humble & Sons; T. H. Newsome & Co.; T. Batt & Co.; Tunstall & Co., Ltd.; Vacuum Oil Co.; J. W. Miller & Son; Theo. Phillips, Son & Co.; Leeds Oil and Grease Co.; Valvaline Oil Co.
Paints and varnishes.—G. Exley & Son; Hirst, Brook & Hirst, Ltd. Yorkshire Varnish Co.; Ross & Co.; W. Moss & Sons; R. Kearsley and Sons; Docker Bros., Ltd.; Tearne & Sons; W. Wright and Sons.
Tires.—J. Brown & Sons.
Axles.—Taylor Bros. and Co.
Points.—Hadfield's Steel Foundry, Ltd.
Fish bolts.—Bayliss, Jones & Bayliss, Ltd.
Fish plates.—Bolckow, Vaughan & Co.
Reconstruction of track.—David Speight & Son.

The Committee has also accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for 100 controllers, at £25 each; that of Messrs. Elliott Bros., for one 10,000-ampere ammeter, at £32; of Messrs. Dick, Kerr & Co., Ltd., for 10 electrical equipments for cars, at £234 10s. each; and of the British Thomson-Houston Co., for 36 arc lamps, at £6 10s. each.

London.—Shoreditch.—The B.C. Electricity Committee recommends the acceptance of the following quotation of Messrs. W. Griffiths & Co., Ltd., for laying ducts for the trunk main from the Coronet Street electricity station to the Shoreditch and Stepney borough boundary:—

For laying two three-way Sykes ducts under footway, 4s. 9d. per yd. run; granite sett or wood paved carriageway, 16s. 6d. per yd. run; asphalte carriageway, 26s. per yd. run; laying ducts in tunnel, 15s. or 20s. per yd. run, according to depth; building manholes, 1s. 9d. per ft. cb. 14-in. brickwork; 1s. 5d. per ft. cb. for 9-in. brickwork, and 1s. ft. cb. for 4½-in. brickwork; supplying and spreading Portland cement concrete, 18s. 6d. per yd. cb.

The Committee reports the acceptance of the tender of Messrs. J. W. Simpson & Co., Ltd., for £240, for boring out valve chambers and supplying new valves for No. 1 Wallsend engine at Whiston Street works.

Lambeth.—The Guardians have accepted the tender of the South Metropolitan Electric Supply Co., Ltd., of Loughborough Junction, for two electric motors in connection with the laundry plant at the Brook Street infirmary for £230.

Woolwich.—The following tenders have been accepted by the Borough Council in connection with the Grove Lane generating station extensions:—

Drew-Bear, Perks & Co., Ltd.—Steelwork for windscreen, £109.
Babcock & Wilcox, Ltd.—Steam piping, £38.
Frodingham Iron and Steel Works.—16 tons of rolled steel joists, £6 16s. per ton.
R. H. Skelton & Co.—Coal bunkers in the new boiler house, £1,044.
Ferranti, Ltd.—Two sets of choking resistances for two 250-kw. motor-generators, £50.
Wm. Cory & Son, Ltd.—Steam coal, 3,000 tons, 13s. per ton; 5,000 tons, 11s. 7d. per ton.

G.P.O.—The Controller of Stores of the G.P.O. has accepted the tender of the Edison & Swan United Co. for "Royal Ediswan" drawn-wire lamps.

Marylebone.—The tender of Messrs. J. Garrett & Son has been provisionally accepted by the B.C., at £1,160, for excavating for and constructing the underground pump chamber at the generating station.

Wandsworth.—The tender of Messrs. E. W. Smithet & Co. is recommended for acceptance, at £85, for repairing the electric lifts at the St. John's Hill Infirmary. Other tenderers were :—

Hammond Bros. & Champness	£81	Penrose & Co.	£118
Medway's Safety Lift Co.	108	The Easton Lift Co.	123
Waygood & Co.	108		

Metropolitan Asylums Board.—The following tenders have been received for the installation of electric light in Blocks 4 and 6 at the Grove Hospital :—

Alpha Mfg. Co.	(accepted) £344	Arthur Newman, Ltd.	£460
Lund Bros. & Co.	359	J. and F. May	391
Ellis & Ward, Ltd.	360	A.E.G. Electric Co., Ltd.	441
G. Weston & Sons	363	Electric Installations, Ltd.	447
H. J. Godfrey	386	Toy & Winslow	470
Sherratt Bros.	393	F. M. Prockter & Co., Ltd.	497
C. H. Cathcart & Co.	445		

The following tenders have been received for re-wiring the fire alarm and telephone systems, &c., at the Southern Hospital :—

J. and F. May	(accepted) £709	Lund Bros. & Co.	£720
Arthur Newman, Ltd.	782	Electric Installations, Ltd.	790
A. V. Gifkins & Co.	969	G. Weston & Sons, Ltd.	1,020
C. H. Cathcart & Co.	1,071	Sherratt Bros.	1,300

The Board has accepted a revised offer of the Synchronome Co., Ltd., to supply and maintain a system of 59 electrically-controlled clocks at the Eastern Hospital, at an annual rental of £28 0s. 6d., on a seven years' contract.

L.C.C.—The following tenders have been received by the London Education Committee for installing electric light in the schools named :—

Wilson Street, Islington.

Lund Bros. & Co.	(accepted) £419	R. H. & J. Pearson	£488
Alpha Manufacturing Co.	429	C. H. Cathcart & Co.	510
Arthur Newman, Ltd.	429	H. J. Cash & Co., Ltd.	519
G. Weston & Sons, Ltd.	445	Defries & Goldman	825
J. & F. May	475		

Bloomfield Road, Woolwich.

Alpha Manufacturing Co.	(accepted) £141	G. Weston & Sons, Ltd.	£175
		C. H. Cathcart & Co.	184
W. Dickinson & Co.	163	Arthur Newman, Ltd.	191
Lund Bros. & Co.	170	W. E. King	275

Luton.—The Town Council is recommended by the Electricity Committee to accept the tender of Messrs. Babcock and Wilcox, Ltd., at £298, for steam piping; also that of Messrs. Oates, at £277, for cast-iron piping.

Margate.—The T.C. has accepted the tender of Mr. A. H. Markey, Margate, for an electrical clock, with illuminated dials, for the turret at the Pavilion at Westcliff, at £30 3s. 6d. Messrs. Gent & Co., Ltd., tendered at £47 16s. Mr. Markey is also to provide an automatic time switch for putting on and off the electric light, at £10 5s.

Merthyr Tydfil.—For installing the E.L. at the Training School, the B. of G. received the following tenders :—

Aberdare Electrical Co., Ltd.	(accepted) £343
South Wales Accessories Co.	303
J. A. Boster	321
R. Alger & Sons	369
A.E.G. Electric Co.	414
Saville & Walton	425
Ellis & Ward	436
J. W. Law	500
Troup, Curtis & Co.	538

The accepted tender was recommended by the Building Committee, but there was some objection made regarding the rejection of the lowest tender, on the ground that there might be a surcharge by the L.G.B. auditor.

Newcastle and Sunderland.—The General Electric Co., Ltd., have obtained an order for 40 "Angold" magazine flame arc lamps for the Newcastle Corporation tramways; and a further repeat order for 23 "Angold" magazine flame arc lamps from the Sunderland Corporation.

New Zealand.—Public Service Tender Board :—

4,500 twin conductor cords, £258.—Lawrence and Hanson Electrical Co.

5 miles 704 yards composite telegraph and telephone cable. £3,672; 3 miles air-space paper-insulated lead-covered telephone cable, £510.—P. R. Baillie & Co.—*Australian Mining Standard.*

Portsmouth.—The T.C. has accepted the tender of Messrs. C. A. Parsons & Co. for a 2,000-kw. turbo-alternator and condensing plant, at £7,179. Several lower tenders were for foreign makes, but Alderman F. G. Foster said that the combination plant suggested was considered to be the best for the requirements of the station.

Ramsbottom.—The U.D.C. has accepted the tender of the R.E.T. Construction Co., Ltd., for two new cars, complete with wheel guards and side guards, and wheels fitted to take 40-in. diameter tires. The company will also provide new wheels and springs and new bodies for the old cars, at £60 per car.

South Africa.—Cape Town.—The contract for the alterations to the electric lighting, supply of dimmers, &c., at the Opera House has been placed with Messrs. E. A. Shaw & Co

Sunderland.—The T.C. has accepted the following tenders on behalf of the Electricity Committee :—

Sloan Electrical Co.—Carbons.
General Electric Co., Ltd.—Flame arc lamps.
Phœnix Dynamo Co.—Re-winding alternator.
W. Walker.—Dearborn water treatment composition.

Messrs. J. H. Tucker & Co., of Birmingham, have received from the Corporation tramway department a contract for the supply of its lampholder requirements during the next 12 months.

Taunton.—The T.C. has accepted the tender of Messrs. Belliss & Morcom for an engine governor, at £15 plus fitter's time and expenses; and that of Henley's Telegraph Works Co., Ltd., for a year's supply of cables.

Tynemouth.—The tenders of Mr. R. R. Todd for 300 yards of ·4-in. cable and 300 yards of ·15-in. cable, and Henley's Telegraph Works Co., Ltd., for 77 yards of armoured cable, are recommended for acceptance by the Council.

West Bromwich.—The T.C. has accepted the tender of Messrs. Bruce Peebles & Co., Ltd., for a three-wire balancer.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, May 22nd. At 8 p.m. At 39, Victoria Street. Discussion on "The Neglected Steam-Car," led by Mr. R. S. Box.

Physical Society.—Friday, May 22nd. At 5 p.m. At Imperial College of Science, South Kensington. Ordinary meeting. Papers "On a Null Method of Testing Vibration Galvanometers," by Mr. S. Butterworth, "Experiments with an Incandescent Lamp," by Messrs. C. W. S. Crawley and S. W. J. Smith, and other subjects.

Association of Engineers-in-Charge.—Saturday, May 23rd. Visit to Leiston Works, Leiston, Suffolk.

Institution of Electrical Engineers (Newcastle Local Section).—Tuesday, May 26th. At 7.30 p.m. At Armstrong College. Annual General Meeting.

Concrete Institute.—Thursday, May 28th. At 8 p.m. At Connaught Rooms, Great Queen Street, W.C. Annual Dinner.

Royal Institution of Great Britain.—Thursday, May 28th. At 3 p.m. At Albemarle Street, W. Lecture (III) on "Identity of Laws in General and Biological Chemistry," by Prof. Svante Arrhenius, Hon. F.R.S.

Liverpool and District Electrical Masters' Association.—Friday, May 29th. At 7.45 p.m. At St George's Restaurant, Redcross Street, Liverpool. First smoking concert.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued :—

Friday, May 22nd.—"D" Company. Infantry drill, 7 to 8 p.m. Technical instruction, 8 to 10 p.m.

Saturday, May 23rd.—Headquarters will be opened from 10 a.m. till 12 noon.

Monday, May 25th.—"A" Company. Infantry drill, 7 to 8 p.m. Technical instruction, 8 to 10 p.m. Miniature range instruction, 8 to 9.30 p.m.

Tuesday, May 26th.—"B" Company. Infantry drill, 7 to 8 p.m. Technical instruction, 8.30 to 10 p.m. Miniature range instruction, 8 to 10 p.m.

Wednesday, May 27th.—All Companies. Annual course of musketry at Purfleet. Rating examinations, 7 to 9.30 p.m.

Thursday, May 28th.—"C" Company. Infantry drill, 7 to 8.30 p.m. Technical instruction, 8.30 to 10 p.m. Miniature range instruction, 8.30 to 10 p.m.

Friday, May 29th.—"D" Company. Infantry drill, 7 to 9 p.m. Technical instruction, 9 to 10 p.m. Miniature range instruction, 7 to 9 p.m.

Saturday, May 30th.—Headquarters will be opened from 10 a.m. till 12 noon for regimental business only.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

A Visit to Germany.—The 40 L.B. and S.C. railwaymen, during their visit to the A.E.G. works at Berlin, were entertained to a "Red, White and Blue" luncheon. According to the *Daily News* Berlin correspondent, Director Hamspohn, in his greeting, outlined his "pet idea," that "progress in education and industry should be unified and internationalised to the common benefit of all countries, as science already is to a large extent. Competition would thus take milder forms, and make for international peace instead of international discord." This, says the writer, is "one of the working principles of the A.E.G.," and in reality "the basis of this visit"!

Our Trade with Canada.—On Tuesday afternoon at the London Chamber of Commerce, Mr. C. Hamilton Wickes, H.M. Trade Commissioner for Canada and Newfoundland, delivered an interesting address on "British Trade with Canada." We shall refer to the matter in our next issue.

Appointments Vacant.—Assistant mains superintendent (£2), for Aberdeen Corporation; assistant master in electrical engineering at the Polytechnic, Regent Street, W., for day and evening work (£180); assistant electrical engineer, for Government of Nigeria, age 25 to 40 (£300); assistant electrical and mains engineer (£104), for Londonderry Corporation. Particulars are given in our advertisement pages.

NOTES.

Our Statistical Tables.—As most of our readers are aware, for many years we published annual tables of statistics relating to electricity works, tramways, &c., in the form of single sheets; but as time passed, and the number of items increased, it repeatedly became necessary to shorten the data and to restrict the space allotted to each item, to prevent the sheets from becoming too unwieldy to be useful.

There are, however, many objections to a sheet, which must necessarily be fixed on the wall to be accessible, and we have been asked to throw the matter into the form of a booklet for desk use. This we have now done, and the book was issued last week at the price of 1s., post free 1s. 1d. Its dimensions are 4¾ in. high × 9¾ in. wide, and the contents are chosen with a view to including all information that is generally useful and necessary regarding the undertakings concerned (electricity works, electric tramways, railways and power companies), without overcrowding the book with superfluous particulars; it is handy for reference, and needs neither a stepladder nor a microscope as aids to its use. We trust our readers will find it serviceable to them in their respective vocations.

The E.C.C. Works Institute.—The Institute connected with the works of the Electric Construction Co., Ltd., at Wolverhampton, can now boast a fine equipment for indoor and outdoor recreation, this state of affairs having been brought about within the last 12 months, mainly owing to the generous co-operation of the board of directors. Indoors the members of the Institute have a new and spacious main hall containing two billiard tables. Annexed are a comfortable reading room and a lending library. Outside there is provision for the ancient game of bowls and its modern rival, lawn tennis. Crown-green bowling is favoured in Staffordshire, and accordingly the club, backed by the board of directors, has provided itself with a large crowned green, scientifically laid by a leading expert from the north. This green was formally declared open last summer by the chairman of directors, Mr. P. E. Beachcroft, but in view of its great cost and extreme youth, the club decided not to bowl upon it until the following season. An examination of the green at the present time shows how fully this heroic abstinence has been rewarded. Meantime, the question was asked: "If an outdoor sports ground, why no pavilion?" Through the kind offices of Mr. William Bulloch (manager, a director of the company and president of the Institute), the board was again approached, and as a result a substantial brick pavilion, with large main hall, cooking range, buffet, stuccoed walls, wooden verandah, and asbestos-tiled roof, now overlooks the lawns. On Saturday, May 9th, Mr. Beachcroft visited the works with the object of opening this pavilion and the new tennis lawns. Lunch was partaken of at the works, and at 2.15 o'clock the proceedings began with wrestling and boxing matches, followed by a competition open to the members of the E.C.C. fire brigade. The gathering then moved to the front of the pavilion, where Mr. Bulloch, after congratulating the club upon its acquisition, and reminding the members of the debt of gratitude owing to the chairman, asked Mr. Beachcroft to open the pavilion, and begged his acceptance of a pair of gold-handled scissors, wherewith to cut down the key which was suspended from the verandah arch. Mr. Beachcroft responded with a speech which appealed strongly to the sporting proclivities of the members, and at the same time served to accentuate the feeling of fellowship which exists between the board of directors and its employés. The pavilion was then declared open. Mr. W. M. Furniss proposed a hearty vote of thanks to Mr. Beachcroft for going down specially for the occasion, and this was seconded by Mr. James May, the oldest member of the Institute, and carried with acclamation. The arrangements were in the hands of the hon. sec., Mr. Frank Guinness, and the afternoon was voted a thoroughly enjoyable one, the only cause for regret being the unavoidable absence of Mr. James Gray (managing director), to whom the Institute—the bowling section in particular—owes so much of its success.

THE E.C.C. TENNIS AND BOWLING GROUND.

A Manchester Committee.—Mr. J. Johnston has given notice of his intention to move the following resolution at a meeting of the Manchester City Council:—That a Special Committee be appointed to inquire and report on the alleged attempts of a member of this Council to exercise undue influence on the officials of the Corporation with the object of securing orders for a firm in which he was personally interested, and to make such recommendations as will in future protect the whole of the officials of the Corporation in the proper execution of their duties.

Electricity Supply Rifle League.—The following are the match results for April last:—Brimsdown (Mursell, 97), 550, Brompton (Willis, 99), 569; Brimsdown (Mursell, 97), 550, Shoreditch (Foster, 98), 574; Brompton (Beale, Furneaux, Mugford, 95), 554, Central (Cope, Rhodes, 97), 574; Brompton (Palmer, 97), 566, Hackney (Hilling, 97), 565; Central (Cope, Harvey, 100), 575, Poplar (Randall, 89), 497; City Co. (Harlow, 96), 546, Hackney (Hilling, 98), 530; City Co. (Harlow, 98), 555, Shoreditch (Harrison, Herbert, 98), 573; Ilford (R. Tufnell, 95), 553, St. James's (Beaton, Young, 96), 569; Ilford (R. Tufnell, 96), 546, Westminster (Winchcombe, 97), 547; Poplar (Randall, 94), 538, St. James's (Beaton, 97), 557; Shoreditch (Thomas, 97), 572, Westminster (Winchcombe, 95), 554. The following are the positions to date:—

	Matches.				Scores.		Average
	Shot.	Won.	Lost.	Pnts.	For.	Agnst.	per match.
Shoreditch ...	4	4	0	8	2,293	2,182	573·25
Central ...	4	4	0	8	2,290	2,166	572·5
Brompton ...	5	4	1	8	2,832	2,779	566·4
St. James's ...	4	2	2	4	2,228	2,236	557·0
Ilford ...	4	1	3	2	2,222	2,197	555·5
Westminster	3	1	2	2	1,659	1,697	553·0
City Co. ...	2	1	1	2	1,101	1,103	550·5
Hackney ...	3	1	2	2	1,621	1,645	540·3
Brimsdown ...	3	0	3	0	1,633	1,679	544·3
Poplar ...	4	0	4	0	2,079	2,274	519·75

Centurions during the month:—Messrs. Cope and Harvey (Central).

A Scottish Granary Installation.—The new Meadowside Granary of the Clyde Navigation Trustees, which was recently opened at Partick, has a capacity of over 30,000 tons of grain, including 150 silo bins to hold 20,000 tons, and floor storage on eleven floors for 11,000 tons. The building is 312 ft. long, and the conveyor gallery running along the top is 130 ft. above the ground. Two travelling ship elevators, each of 250 tons an hour capacity, are installed on the quay for unloading vessels, these feeding the band conveyor system and main elevators. All the machinery is operated by electric motors, of which there are three of 10 H.P. to drive small bands, four of 15 H.P. to drive small bands, four of 25 H.P. to drive long bands, a 25-H.P. motor to drive elevator C. 3, two of 40 H.P. for the first lift in the ship's elevator, two of 30 H.P. for the second lift in the ship's elevator, two of 30 H.P. to drive long bands, also a 15-H.P. motor to drive turnover bands. Two 65-H.P. motors drive the main elevators.

In addition to the above there are eight 30-H.P. motors for the tunnel bands, two 10-H.P. motors for hoisting and lowering the elevators out of and into the vessel's hold, four 5-H.P. motors for driving the ship elevators along the quayside, and a motor of 8 H.P. for the electric passenger hoist.

An interesting part of the installation is the Igranic electric controlling apparatus. The grain taken up by the ship elevators is passed through automatic weighing machines and dropped on to the tunnel bands for conveyance through long tunnels by means of travelling bands operated by eight different electric motors. These tunnel bands convey the grain to the main elevator, which lifts it to the top for distribution throughout the building as required by means of shutes. Special precautions have been taken to guard against the stopping of any part of the belt in the tunnels, as these belts run from 9 to 10 miles an hour, and in a very few minutes there would be an accumulation of several tons of grain, which would have to be dug out by manual labour in order to allow the belts to re-start. Should any one tunnel motor stop, all those preceding it are automatically stopped by means of the special automatic controllers provided; further, when it is desired to start any one of these motors, it is only necessary to start one by moving a small master switch, and all the succeeding motors are started automatically.

The whole of the control gear is entirely foolproof and self-protecting, and the possibility of breakdown is therefore rendered exceedingly remote. The general idea has been to provide control gear which can be operated by few unskilled men, and in view of the loss which the breakdown would entail, the whole of the apparatus supplied has been of the highest class.

The passenger hoist is, we understand, serving a larger number of floors than any other hoist in the country; the controller for this has also been designed so as to allow of easy starting and stopping in correct register with the floors, even when operated by a strange operator.

China.—The *Standard* states that a memorial has been addressed by the Association of Chambers of Commerce to Mr. Lloyd George and Sir Edward Grey asking the Government to make a grant of not less than £300,000 out of the annual payments by China of the Boxer indemnity, towards the establishment of a British university at Hankau or such other influential centre in China as may be considered most suitable.

The Board of Trade (on the recommendation of the Advisory Committee on Commercial Intelligence) has appointed Mr. T. M. Ainscough a Special Commissioner to inquire into the conditions and prospects of British trade in China. Mr. Ainscough is to leave England before the end of May, and until then letters can be addressed to him at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

Another Flying Train.—An inventor in South Africa—a Mr. Esson—is reported to claim that he has devised a car which can travel at 500 miles an hour. The idea is to use a monorail and an overhead trolley wire; when the car, driven by an air propeller, attains sufficient speed, it will leave the rail and fly. The idea (but not the car) appears to be in the air.

The Liverpool and District Electrical Masters' Association.—We are informed that, largely owing to the demands of the Electrical Trades Union, the above Association is now an accomplished fact, and in response to a circular letter issued on March 3rd over 100 representatives of electrical firms attended a meeting held at the Common Hall, Hackins Hey, Liverpool, on March 17th. The foundation stone was then laid. The success in forming the Association has been remarkable. The membership at the moment consists of upwards of 70 well-known electrical firms, comprising most of the employers in Liverpool and district, and we understand that new members are frequently being enrolled. The primary object of the Association is to deal with labour questions, and judging from the latest demands of the local branch of the Electrical Trades Union, there is no doubt that such a body is necessary if the masters are to protect their own interests, and that it is appreciated by the electrical masters is evident by the large attendances at the various meetings that have been held. Liverpool workmen have been advanced from 9d. to 9½d. in the last six months, whereas Manchester has only just signed an agreement with the Electrical Trades Union to hold good for two years, in which the rate of wages is to be 9½d. per hour for that period. Although the wages question is perhaps the chief item, several of the other demands are regarded as equally extravagant.

The members of the Masters' Association are unanimous in their resolve not to grant these demands, and at a Conference with the delegates of the E.T.U. held last week, the Union officials were informed that none of their demands could be considered. The next move will come from the Union, and it will be interesting to note what form this takes on June 1st. The masters are fully alive to the seriousness of the situation, and in the event of a strike, are stated to be fully organised to carry out with non-Union labour the most urgent work on hand. They also consider that it is quite time the great, and in their opinion, unnecessary, unrest amongst workmen lately experienced should be settled, as contracts cannot be made in advance with any confidence that the work will be continuous.

The new Association commenced its career at the first annual general meeting on April 29th, at St. George's Restaurant, Redcross Street, when the rules were finally discussed and the method of procedure for the next 12 months was arranged. The committee elected were as follows :—

Chairman.—Mr. A. B. Gregson (Northern Electric and Ventilating Co.).

Vice-Chairman.—Mr. H. T. Boothroyd (H. T. Boothroyd & Co.).

Hon. Secretary.—Mr. E. G. Pulford (Pulford Bros., Ltd.).

Hon. Treasurer.—Mr. S. MacLeish (John Hunter & Co.).

Committee.—Mr. F. W. Smith (Herd & Smith); Mr. T. W. Robson (T. W. Robson & Sons); Mr. A. E. Chesters (A. E. Chesters); Mr. J. O. Rhodes (Electric Light and Engineering Co.); Mr. J. Scott (J. Scott, Ltd.); Mr J. Boult (John Boult & Co.); Mr. H. L. Downes (Downes & Davies); Mr. F. B. Hellon (Hellon and Co.).

In addition to the above Executive Committee, an Entertainment Committee was elected to look after the interests of the members on the social side, as follows :—Mr. J. G. Wilson (J. G. Wilson and Co.); Mr. Bennett (Simplex Conduits, Ltd.); Mr. Wood (Downes and Davies); Mr. Davies (Downes & Davies); Mr. Hellon (Hellon and Co.); Mr. Myer (F. Wilkins & Bro.); Mr. Hazel (Dargue, Griffiths & Co.); Mr. Crawford (General Electric Co.).

The first smoking concert will be held on Friday, May 29th, at 7.45 p.m., at St. George's Restaurant, and all intending members are cordially invited to be present.

Strikes and Contract Prices.—Tradesmen who do contract work for municipal and other authorities will be interested in the following resolution, which has been passed by the Harrogate Chamber of Trades, as it is a step in the direction of protecting contractors from sustaining any disability through industrial re-arrangements which may be made during the progress of contracts: — "This Chamber, in full meeting assembled, respectfully petitions the Corporation to include the fair contracts clause in all municipal contracts, *i.e.*, the contractor to pay standard rate of wages, and any increased cost so thrown upon the contractor due to rise in wages or reduction in hours of work, shall be an additional allowance to him on the contract price."

Penalising the Tramway.—From answers given in the House of Commons on Monday by Mr. John Burns, it seems that the Board of Trade has power to inquire into tramway accidents, but it has no power to inquire into motor-omnibus accidents, otherwise than by criminal proceedings.

Two New Committees.—The Treasury has appointed a Committee to consider what steps can be taken to regularise the total demand for labour from year to year and in different seasons, by adjusting the distribution of public work for Government departments and local authorities with reference to the state of employment in particular trades. Mr. Percy Alden, M.P., is Chairman of the Committee, and among the members are :—Mr. G. N. Barnes, M.P., Mr. H. E. Stilgoe (city engineer of Birmingham), and Mr. Cyril Jackson, of the L.C.C.

The B. of T. has appointed a Committee to report upon the working of the Railway Employment (Prevention of Accidents) Act of 1900. Sir W. Collins is chairman, and the members include Sir Alfred Ewing, K.C.B., and Mr. G. N. Barnes, M.P.

Institution and Lecture Notes. — Association of Teachers in Technical Institutions.—The Association will hold its eighth annual Conference at Liverpool during Whitsuntide, May 30th to June 3rd, at the Central Municipal Technical School. The open meetings begin on Monday, June 1st, when the President, Mr. P. Abbott, will deliver his Presidential address. During the Conference papers will be read by Mr. W. Hewitt, Director of Technical Education for Liverpool, Prof. Haldane Gee, Mr. W. E. Harrison, Mr. Laurence Small, Mr. W. R. Bower and others. The annual dinner will be held at the Exchange Station Hotel, on the evening of June 1st. Various visits and social items have been arranged by the Conference Committee, and an exhibition of books and scientific apparatus will be held throughout the Conference at the Technical School. The hon. sec. is Mr. J. P. Yorke, 55, Filey Avenue, Upper Clapton, N.

Birmingham Wireless Association.—On May 6th, Mr. W. F. B. Bartram read a paper on the overhauling of aerials, and dealt fully with the staying of aerial masts. He strongly advocated the use of bamboos for lengthening existing masts, and gave a rough description of a very high mast made in lattice form which cost the owner only about 15s. for material. The next meeting will be on Wednesday, May 27th, at 7.30 p.m.

Institution of Electrical Engineers.—The I.E.E. conversazione will be held at the Natural History Museum, South Kensington, on June 25th.

The result of the ballot for the election of ordinary Members of Council has been announced as follows: Mr. J. Christie, Prof. B. Hopkinson,* Messrs. G. W. Partridge,* W. H. Patchell,* R. J. Wallis-Jones and W. B. Woodhouse.* (* Nominated by the Council.) It will be seen that two of the external nominees, Messrs. J. Christie and R. J. Wallis-Jones, have been elected.

The report of the Committee of the Scottish Local Section, submitted at the annual general meeting, states that the membership numbers 391, or one more than last year. The full list of office-bearers for 1914-15, partly given in our last issue, is as follows :—Chairman, Mr. James Lowson; Vice-Chairman, Mr. David A. Starr; Past Chairmen, Messrs. Frank A. Newington, Wm. M'Whirter and J. A. Robertson; Chairman of Students' Section, Mr. Archibald Page; Ordinary Members of Committee, Messrs. M. B. Field, J. H. Bunting, J. S. Nicholson, J. K. Stothert, J. F. Nielson, E. T. Goslin, George Stevenson, Wilfrid L. Spence, James E. Sayers, A. S. Hampton, and Prof. J. D. Cormack; Hon. Secretary and Treasurer, Mr. Joseph Taylor; Assistant Hon. Secretary, Mr. Wm. F. Mitchell. The Hon. Secretary of the Students' Section is Mr. John W. Mowat.

The annual summer outing has been arranged for Tuesday, June 9th. Members and their friends will take steamer from Wemyss Bay *via* Kyles of Bute to Arran, returning *via* Garroch Head, and luncheon and tea will be served on the steamer.

The annual meeting of the Yorkshire Local Section was held on Wednesday. The following officers were elected :—Chairman, Mr. T. Roles; Vice-Chairmen, Mr. H. H. Wright and Dr. R. Pohl; Committee, Messrs. J. H. Schnauber, H. Bell, and W. E. Burnand; Hon. Sec., Mr. J. D. Bailie. Dr. Pohl gave an address on "The Design of Turbo-alternators from the Users' Point of View," and a discussion followed.

Electrical Manufacturers at Golf.—By the courtesy of the captain and secretary of the West Herts Golf Club, a competition was held at Cassiobury Park, on Saturday, May 16th, between the following electrical manufacturing companies :—The British Thomson-Houston, British Westinghouse, Siemens, and Dick, Kerr. Two rounds were played. In the morning the B.T.H. played against Dick, Kerr, and the Westinghouse against Siemens, while in the afternoon Siemens played Dick, Kerr, and the B.T.H. played Westinghouse. The competition was decided by match play on handicap, and the following were the results, the figures in brackets denoting handicap :—

B.T.H.		Dick, Kerr.	
W. C. Lusk (18), 1 up	1	C. Hardie (18)	0
C. C. Levis (8)	0	D. Kerr (9), 3 & 1	1
J. C. Murray (14)	0	C. Witts (12), 7 & 6	1
F. Hall (20)	0	S. McKay (18) 2 & 1	1
Matches won	1	Matches won	3

Westinghouse.		Siemens.	
C. S. Colton (12), 2 & 1	1	E. G. Fleming (12)	0
T. G. Wilson (12)	0	J. Kirkwood (7), 4 & 3	1
A. du Pasquier (20), 8 & 6	1	P. S. Pitt (18)	0
F. M. Rojers (24)	0	G. P. Cooper (18), 6 & 5	1
Matches won	2	Matches won	2

Siemens.		Dick, Kerr.	
J. Kirkwood (7)	0	D. Kerr (9), 1 up	1
E. G. Fleming (12), 4 & 3	1	C. Witts (12)	0
P. S. Pitt (18)	0	S. McKay (18), 3 & 2	1
G. P. Cooper (18), halved	½	C. Hardie (18), halved	½
Matches won	1½	Matches won	2½

Westinghouse.		B.T.H.	
C. S. Colton (12)	0	W. C. Lusk (18), 4 & 3	1
T. G. Wilson (12), 8 & 6	1	J. C. Murray (14)	0
A. du Pasquier (20)	0	C. C. Levis (8), 3 & 1	1
F. M. Rojers (24), 5 & 4	1	F. Hall (20)	0
Matches won	2	Matches won	2

The final result, therefore, was as follows :—

1st. Dick, Kerr, with 5½ matches.
2nd. Westinghouse, with 4 matches.
3rd. Siemens, with 3½ matches.
4th. B.T.H., with 3 matches.

The weather was perfect, and the course in excellent condition, and the day was thoroughly enjoyed by everybody. We do not hear of any record score being made, but it was unanimously decided that Mr. Lusk's handicap be reduced from 18 to 10.

Rubber.—A cable received by the Malay States Information Agency from Singapore states that the April exports of plantation rubber amounted to 1,548 tons, compared with 1,285 tons in March and 762 in April, 1913. The total exports for the first four months of the current year were 5,717 tons, against 3.187 tons last year. The following table gives the details for the three years:—

	1912.	1913.	1914.	
January... ...	253	784	1,181	tons
February ...	274	743	1,703	,,
March	427	898	1,285	,,
April	387	762	1,548	,,
Total ...	1,341	3,187	5,717	

These figures include transhipments of rubber from various places in the neighbourhood of the Straits Settlements, such as Borneo, Java, Sumatra and the non-Federated Malay States, as well as rubber actually exported from the Colony, but they do not include rubber exports from the Federated Malay States.

At the auctions commenced early this week there was a record quantity listed for sale, the total aggregating 1,500 tons. The prices ruling at the opening showed a small reduction compared with those obtaining in the private market, and a moderate fall compared with those ruling at the previous sales, the demand, too, being of a rather disappointing character.

Electrical Publicity.—We have received from the Electric Supply Publicity Committee, 20A, Tudor Street, E.C., particulars of some new publications, including an electric cooking poster, size 25 in. × 40 in., and a coloured postcard reproduction of same. An illustrated folder on the electric iron, and illustrated trade leaflets dealing with "electric irons for laundries," and "electric service for hairdressers," have also been issued, together with reprints of Mr. F. S. Grogan's paper on "The cooking problem—Why electricity is winning." We have also received a folder entitled: "Some electric kitchens, and what the cooks think of electric cooking," from the Westminster Electric Supply Corporation, Ltd., Eccleston Place, S.W., containing 21 4 in. × 3 in. views of electric stoves in different kitchens, mostly of the domestic variety. The illustrations are very instructive, and should bring conviction to those who still doubt the feasibility of electric cooking.

Smoke Abatement Inquiry.—The Departmental Committee on Smoke Abatement sat in public on Wednesday and Thursday this week, and will meet again on June 10th. The secretary is Mr. E. A. Faunch, of the Local Government Board.

The "Paragon" System.—Mr. William P. Durtnall informs us of the successful granting of his American patent in connection with his well-known method of generating variable-frequency polyphase alternating current for electrical ship propulsion, railway traction, and other industrial purposes. This was the result of a recent patent case which Mr. Durtnall successfully contested in America with an engineer, who was endeavouring to get American patents for a similar system. Mr. Durtnall's patent application had two years' priority.

The German patent for the "Paragon" cycle internal-combustion engine has also been recently granted; the engine was described in our issue of January 10th, 1913.

Drawings and tenders for over £50,000 worth of the "Paragon" internal-combustion railway locomotives have recently been submitted to an important railway abroad, where selling rights have been granted to important merchant houses in each territory, and designs are now proceeding for such locomotives with 12 driving axles up to 3,000 H.P., using "Paragon" gas engines as prime-movers, the axles being each driven by a 250-H.P. "Gearless" Paragon motor.

The I.M.E.A. Convention, 1914.—The official programme of the Convention to be held at Birmingham, June 15th to 20th, has now been issued, and includes all the items mentioned in the preliminary announcement given by us on p. 584. Applications for tickets must be made not later than June 8th, to the Secretary, I.M.E.A., 28, Bedford Square, W.C.

Inquiries.—A correspondent asks for the address of the secretary of the Electric Water Polo League. Makers of Francis wall nails are asked for; also makers of Greenfield armoured flexible. Makers of the "Empire" cells are asked for: also makers of submersible lamps, complete with small electric batteries, for fishing purposes at night.

Making Rain.—The Australian Commonwealth radio-telegraph engineer (Mr. Balsillie) has been engaged for some time upon a series of experiments with the object of producing rain by means of a system based upon the principles of wireless telegraphy, and has lodged an application for provisional letters patent for a "device for producing rain." If he can devise a means to stop the rain too, we shall be glad to hear from him in this country also.

The King of Denmark.—At the Royal Command Performance before their Majesties the King and Queen, and the King and Queen of Denmark, at Buckingham Palace on the evening of May 12th, Mr. Ponting showed his series of cinematograph pictures taken during Captain Scott's last memorable journey to the South Pole. "Kinarko" carbons—the only cinematograph carbons of British manufacture—were used.

The "Point Fives."—All those attending the I.M.E.A. Convention who wish to be present at the meeting of the "Point Fives" at Birmingham on June 18th, are requested to communicate with the hon. secretary, Mr. A Hugh Seabrook, as early sa possible. The meeting will be at 10 p.m. at the Grand Hotel.

"F" Rays.—Reports from Italy once more allege that Signor Ulivi has successfully exploded floating mines from a distance with "F" rays. Demonstrations were made at Havre a year ago before the French authorities, but the latter did not purchase the invention.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The following appointments have been made by the Nelson Corporation:—MR. W. D. CHALMERS, mains superintendent; MR. H. WHITTAKER, assistant station superintendent; and MR. JOHN CRABTREE, shift engineer.

The Kilmarnock T.C. has awarded an honorarium of £100 to the manager of the electricity department in recognition of his services in connection with the promotion of the E.L. Extension Order, and has agreed to increase his salary by £100 per annum.

The Law and Establishment Committee of the Shoreditch B.C. recommends that the salary of MR. C. NEWTON RUSSELL, borough electrical engineer, be increased from £600 to £700 per annum, with a further increase in 12 months of £50, to £750 per annum.

The Birmingham Electric Supply Committee has appointed MR. E. A. MILLS, of the North Metropolitan Electric Power Supply Co., to the post of assistant constructional engineer to the electric supply department, at a commencing salary of £250 per annum, rising to a maximum of £300. There were 194 applications.

Swansea Corporation is recommended to appoint MR. W. H. GEAKE, charge engineer at Greenock, to a similar position at the electricity works at a commencing salary of £115, rising by annual increments of £7 10s. to a maximum of £130.

MR. P. G. CAMPLING, second engineer-in-charge at the Bermondsey electricity works, has resigned his appointment. The Council's Electricity Committee propose to appoint MR. C. J. OAKE, at present third charge engineer, to fill the vacancy at a salary of £130 per annum, rising in two years to a maximum of £140.

The Greenock Corporation received 63 applications, which have since been reduced to 18, for the post vacated by MR. J. A. ROBERTSON, who left last week for Salford. MR. J. H. PARKER has charge of the Greenock undertaking, pending the appointment of Mr. Robertson's successor.

On May 12th, at the electricity works, Worksop, MR. H. A. BEST, chief assistant electrical engineer, was presented with a case of cutlery, on the occasion of his leaving to take up a similar position at Worthing. The gift was subscribed for by the whole of the electricity works staff, and a number of colleagues in other departments. Mr. J. Percival Crowther, manager and engineer, made the presentation. Mr. Best had been associated with the department for over 11 years, and had at all times loyally supported him (Mr. Crowther) in all his schemes; his relations with the staff had always been cordial and pleasant, and he had carried through all his dealings with consumers in a courteous and tactful manner. Mr. Best briefly responded.

At the last meeting of the Worksop U.D.C., MR. M. H. VIPOND, of Leith, was appointed mains superintendent in the electricity department. There were 13 candidates. Mr. Vipond takes the place of Mr. H. A. Best, who, as stated above, goes to Worthing, Sussex. A number of friends belonging to the Worksop Operatic Society presented Mr. Best with a solid silver matchbox inscribed with the names of the characters he has played. Other personal friends presented him with a pipe.

Tramway Officials.—MR. WILLIAM H. TAYLOR, late deputy electrical engineer of Walthamstow, has arrived in Perth, Western Australia, and taken up his duties as electrical superintendent of tramways. He is supervising the building and equipping of the new power station of 9,000 KW., sub-stations, ring main, transmission lines and tramways. The present system of tramways is being considerably extended, and the work is being carried out under Mr Taylor's directions. The consulting engineers for the scheme are Messrs. Merz & McLellan, who have prepared all designs.

Chesterfield T.C. has appointed MR. CHAS CROSSLEY as tramways superintendent, and increased his salary from £104 to £125 per annum.

General.—DR. KIMURA SHUNKICHI, a Japanese authority on wireless telegraphy, has resigned his position in the Japanese Naval Department, and has opened an office in Tokio as a consulting engineer on the subject.

MR. THOMAS E. ROBERTSON, patent agent, has removed to 43-46, Southampton Buildings, Chancery Lane, W.C.

MR. H. PERKINS has been appointed by MESSRS. FALK, STADELMANN & Co., LTD., Farringdon Road, E.C., as their electrical representative in the Midlands and Eastern Counties.

Obituary.—The death took place on May 12th of MR. PERRY, of the staff of the Isle of Thanet Electric Light and Traction Co., Broadstairs.

NEW COMPANIES REGISTERED.

British Drawn Wire Lamp Co., Ltd. (135,607.)—This company was registered on May 5th, with a capital of £2,000 in £1 shares, to carry on the business of engineers, machinery manufacturers, wire manufacturers and drawers, metallurgists, glass makers and workers, &c. The subscribers (with one share each) are:—L. Strawson, 16, King's Road, Kingston-on-Thames, traveller; W. H. Jackson, 41, Griffiths Road, Wimbledon, engineer. Private company. The first directors are not named. Solicitor: O. B. Thomas, 59, Chancery Lane, W.C.

Collins, Electrical, Ltd. (135,610).—This company was registered on May 5th, with a capital of £500 in £1 shares, to carry on the business of electrical and general engineers, &c. The subscribers (with one share each) are:—C. F. Collins, 12, Alexandra Avenue, Southall, Middlesex, electrical engineer; Marian E. Collins, 74, Somerset Road, Newport, Mon., draper's assistant; Mabel A. Clarke, 14, North View, Brentham, Ealing, W.; Dora A. Hancock, 74, Somerset Road, Newport, Mon. Private company. The number of directors is not to be less than four or more than six; the first are C. F. Collins, Marian E. Collins, Mabel A. Clarke, and Dora A. Hancock. Registered office, 119, Clerkenwell Road, E.C.

Hale, Lowth & Co., Ltd. (135,613). — This company was registered on May 5th with a capital of £800 in £1 shares, to take over the business carried on at 45a, Market Street, Manchester, as "A. E. Hale and Co.," to carry on the business of electrical and mechanical engineers, manufacturers of and dealers in electrical goods, &c., and to adopt an agreement with A. E. Hale. The subscribers (with one share each) are:—A. E. Hale, 59, Haydn Avenue, Moss Side, Manchester, electrical engineer; W. H. Lowth, 39, Lomas Street, London Road, Manchester, electrical engineer. Private company. The number of directors is not to be less than two or more than three; the first are A. E. Hale (permanent special qualification, two-thirds of the shares allotted to him under purchase agreement) and W. H. Lowth; qualification of ordinary directors one share. Registered office, 45a, Market Street, Manchester.

Hudson, Sheed & Towell, Ltd. (135,669).—This company was registered on May 7th, with a capital of £2,000 in £1 shares (1,600 preference and 400 founders'), to carry on the business of manufacturers of, and dealers in, electric light fittings, metal workers, &c. The subscribers (with one preference share each) are:—R. W. Gostick, 27, Walbrook, E.C., chartered accountant: A. W. Hudson, Newman's Yard, rear of 9, Newman Street, W., works manager; A. J. Sheed, Newman's Yard, rear of 9, Newman Street, W., draughtsman, &c.; F. Towell, Newman's Yard, rear of 9, Newman Street, W., secretary, &c. Private company. The number of directors is not to be less than two or more than four; the first are R. W. Gostick, A. W. Hudson, A. J. Sheed and F. Towell (all permanent); remuneration of chairman, £100 per annum for first three years, and afterwards £150 per annum; none for other directors. Registered office, Newman's Yard, rear of 9, Newman Street, W.

Mies' Electric and Chemical Culture, Ltd. (135,622).—This company was registered on May 5th, with a capital of £10,000 in 16,000 7 per cent. cumulative preference and 24,000 ordinary shares of 5s. each, to take over certain patent rights relating to electrical and chemical culture, &c., and to carry on the business of agriculturists, horticulturists, nurserymen, chemical and fertiliser manufacturers, &c. The subscribers (with one share each) are:—R. Mies, 27, Pond Street, Hampstead, N.W., electro-agriculture expert; T. C. Winfield, 56, Denman Drive, Golder's Green, electrical and mechanical engineer. Private company. The first directors are R. Mies (managing director) and T. C. Winfield. Registered office, 37, Piccadilly, W.

Manchester Cable Co., Ltd. (135,621).—This company was registered on May 5th, with a capital of £1,000 in £1 shares, to carry on the business of electrical and mechanical engineers, manufacturers of electrical and general engineering appliances, &c. The subscribers (with 50 shares each) are:—H. D. Stamar, 105, Market Street, Manchester, electrical engineer; H. Lomax, 105, Market Street, Manchester, electrical engineer. Private company. The number of directors is not to be less than two or more than three; the subscribers are to appoint the first directors; qualification, £50. Secretary: H. Lomax. Solicitor: C. Barber, 23, Park Row, Leeds.

Rathkeale Electric Lighting and Power Co., Ltd. (4,142).—This company was registered in Dublin on May 8th, with a capital of £2,000 in £1 shares, to carry on the business of an electric supply company in all its branches. The subscribers (with 12 shares each) are:—J. F. Cosgreave, Rathkeale, Co. Limerick, solicitor; C. Langford, The Abbey, Rathkeale, Co. Limerick, gentleman; E. A. Whelan, Abbeyview, Rathkeale, Co. Limerick, pharmaceutical chemist; T. Costello, Rathkeale, Co. Limerick, auctioneer; J. J. O'Mahony, Rathkeale, Co. Limerick, merchant; J. Norman, Rathkeale, Co. Limerick, merchant; Dr. T. Magner, Rathkeale, Co. Limerick. The number of directors is not to be less than three or more than seven: the first are J. T. Cosgreave, E. A. Whelan, C. Langford, T. Costello, J. J. O'Mahony, J. Norman and Dr. T. Magner; qualification, £12. Registered office, Rathkeale, Co. Limerick.

Excelsior Aluminium Solder Co., Ltd. (135,722).—This company was registered on May 11th, with a capital of £1,000 in £1 shares, to take over the business of solder manufacturers and merchants carried on by the Excelsior Aluminium Co., at Brookfield Works, Gorton, Manchester, and to adopt an agreement with D. Powell, E. Greenwood, T. Gee, A. J. Orr and A. W. Robinson. The subscribers (with one share each) are:—A. J. Orr, Newholme, Albert Road, Whalley Range, manager; E. Greenwood, 227, Belle Vue Street, West Gorton, clerk. Private company. The number of directors is not to be less than two or more than five; the first are D. Powell, E. Greenwood, A. J. Orr and A. W. Robinson (all permanent); qualification, 100 shares. Registered office, Brookfield Works, Gorton, Manchester.

CITY NOTES.

Anglo-Portuguese Telephone Co., Ltd.

Mr. Herbert Allen presided on Tuesday at the London Chamber of Commerce over the annual meeting. He said that this was supposed to be a time-saving age, and telephones, except in this country under the Post Office, were perhaps the greatest time-saving thing of all. Therefore it was only right that the Telephone Co. should be selected for an innovation in order to save time, and so he proposed that his remarks with regard to the report should be taken as read. He was not aware of any precedent of this course, but he saw no objection to it.

The Chairman, in the course of his prepared statement, said the report contained one or two features of such exceptional interest that he would make only brief allusion to the operations of the past year. They once more broke all previous records in the gross income, which amounted to £67,893, an increase of £4,974 on the previous year. Expenses were proportionately rather heavier, mainly in consequence of their having to take on a large number of new employés in preparation for the opening of their new Lisbon Exchange, and to a lesser degree owing to an all-round increase of salaries and wages. They had of late been practically free from labour troubles, and a better spirit seemed now to prevail amongst the working classes in Lisbon and Oporto than for some years past. Let them hope for their sakes it would last. The general situation in Portugal at the present moment was more satisfactory than during any time last year, when they were constantly having political unrest, movements for the restoration of the monarchy and agitations of one sort and another. Their profits, at £26,535, showed an increase for the year of £1,010. The number of subscribers increased during the year by 790, after allowing for withdrawals, and was now 7,810. The total number of calls was 22,056,074, against 17,993,503 in the previous year, and the average public cost per message about ¾d., being less even than in the previous year. The Portuguese public could have no better evidence than this of the splendid service they got from this company and the splendid value they got for their money. It was now 27 years since the company started business, with a gross income of £4,934, and a profit of £1,695, derived from 1,423 subscribers. Besides this, he had prepared a little table, which would show how their operations of the past year compared with those of 10 and 20 years ago:—

	Gross income.	Net profit.	No. of subscribers.	No. of calls.	Average cost per message.
1893 ..	£15,048	£4,572	2,271	1,360,771	·90d.
1903 ..	24,232	7,075	2,566	2,471,978	·85d.
1913 ..	67,894	27,369	7,810	22,056,074	·73d.

Their business extended throughout Lisbon and Oporto—covering a radius of 30 km. in the former case, and 20 km. in the latter—and they served a population of about 750,000 people. In both cities they experienced from year to year an almost continually uninterrupted expansion of business. Their concession ran until 1937, and contained satisfactory provisions for compensating them in the event of the undertaking ever being taken over by the Portuguese nation. Their relations with the national and local authorities were quite satisfactory, and on the occasion of Mr. Kerr's frequent visits to Portugal, he found the Ministers most courteous and obliging and ever ready to give the company every possible assistance. From the profit and loss account they would see that after paying royalties to the Government amounting to £1,977, £3,834 for debenture interest and redemption, and £940 for income-tax, and bringing forward £5,609 from the previous year, they had at their disposal £27,369. It followed, therefore, that with an encroachment of only £631 on their reserve fund or other resources they could pay the dividend and bonus of 28 per cent. which they recommended in the report. This, however, was not the course they proposed to adopt. During the past year an independent valuation had been made by Messrs. Gill & Cook, their consulting engineers, of all the company's property, with the result that the reserves which they had built up were found to be considerably in excess of the depreciation which it was designed to meet. The board therefore felt that there was no need on this occasion to make the usual contribution to the reserve, but, on the contrary, that they were justified in returning a little of it to the shareholders. They, therefore, proposed to take £7,503 from the reserve, add it to the disposable profit balance of £27,369, pay a dividend and bonus of 28 per cent., amounting to £28,000—of which they had already received 4 per cent., or £4,000 by way of interim dividend—and carry forward £6,869. The reserve fund had been built up out of undivided profits during the last seven years or so. It was not, in the strictest sense of the word, a reserve fund at all, inasmuch as it was not invested outside the company's business or existent in any tangible shape. It largely represented revenue moneys spent on capital account, and to that extent was a set-off against any depreciation which might have been taking place on the capital work of earlier years. The reserve fund was primarily a reserve against depreciation; he did not say they would not be justified in dipping into it—pretty freely, if need be—for general purposes—but primarily it was a depreciation fund. The practice with many telephone companies was to utilise the surplus, after payment of dividends, in writing down capital expenditure by a sum which they considered equal to the depreciation of the year and placing a small balance to reserve for general purposes. In their case they generally left the capital expenditure untouched and built up a nominal reserve fund which at any moment might be applied, either wholly or in part, in writing down capital expenditure to its depreciated value. It was not unlikely that in future they might adopt the more general practice, and, instead of building up a so-called reserve which was merely a book entry and liable to mislead the unthinking, create a small reserve for contingencies and write off depreciation year by year. It was probably all the same in the long run, but at times the appearance of a large nominal reserve gave the balance-sheet a somewhat misleading appearance. On one occasion a few years ago they did write down the capital expenditure by a transfer of £20,000 from the reserve, and possibly they might do something of the kind again next year. At the present moment the fund was £62,500; they were now appropriating £7,500 toward the 20 per cent. bonus; and a year hence they would have the balance of £55,000 to deal with, besides the surplus profits of the year. In the meantime the valuation made during the past year by Messrs. Gill & Cook satisfied the board that the reserve fund was well in excess of the actual depreciation in the physical assets as a whole. Another interesting subject mentioned in the report was the proposed issue of 50,000 new shares. The capital expenditure in 1913 amounted to £25,498, and was higher than in any previous year. That, of course, was accounted for by the heavy expenditure in connection with their new exchange in the north of Lisbon, which it was reasonable to expect would enable them to cope with their constantly-expanding business for some years to come. Not that they were at all averse to continual capital expenditure so long as it brought them a reasonable return. In the last eight years they had spent on capital account altogether about £105,000, although in the same period they had incurred no fresh capital liability either on share or debenture account; on the contrary, they had simultaneously reduced the debenture debt by over £10,000. They might ask where they had obtained the money. Well, the greater part, of course, was represented by surplus profits which had been put back into the business; next, there was their increased indebtedness to manufacturers and others; and the balance had been met by temporary loans. None of them cared for temporary loans, which had a bad habit of falling due at inconvenient moments, and they could not go on indefinitely building up liabilities to manufacturers and others; the directors therefore felt that the time had come for making a further issue of shares, and this they proposed to do forthwith. The issue would consist of 50,000 shares, which would be made at par, and offered in the first instance to the existing members of the company. They had not thought it necessary to incur the expense of underwriting the issue, as it was tolerably certain that the majority of the shareholders would take up their quota, but such shares as might be left over would be taken up or placed by the directors under the discretionary powers with which they were invested. When this issue has been made, the subscribed capital would be £150,000, and whether measured by the magnitude of the business or by comparison with that of other similar companies, he did not fear that it could be regarded as excessive. Their plant was all well up to date and in good condition, and most of their wires were now underground. He had been asked whether they were likely to be able to maintain the present rate of dividend on the enlarged capital, and saw no reason for misgiving on this score, or why the new capital should be less remunerative than the old. It was true their new exchange in Lisbon—with its capacity for 6,000 subscribers—was not yet finished, and in that respect the business of the current year might not get much help, but in other directions their business was continually expanding. Possibly their next interim dividend might be only 3 or 3½ per cent., but it need not necessarily follow from that that for the present year as a whole they would pay less than 7½ or 8 per cent., and once the new exchange was in full swing, the 8 per cent. dividend which they had almost come to regard as a settled thing should be tolerably safe.

Mr. Charles Woolley seconded the motion, and after some complimentary remarks by Mr. Hibbert, the report was adopted.

The whole proceedings, including the formal business of re-election of the directors and auditors, and a vote of thanks to the board and staff, lasted 15 minutes.

Kidderminster and District Electric Lighting and Traction Co., Ltd.

The directors' report for 1913 states that the capital expenditure on electric supply was increased by £2,317. The gross receipts, including the dividend on the shares held by this company in the Kidderminster and Stourport Electric Tramway Co. and the receipts from motor-omnibuses, aggregated £11,605, which, with £414 brought forward, makes £12,020, compared with £11,050 for 1912. After deducting all expenses (including debenture stock and other interest) there remains an available balance of £3,409. It is proposed to put to renewals fund £1,000, dividend on cumulative preference shares for the year requires £1,500, a dividend at the rate of 1½ per cent. per annum on the ordinary shares requires £705, and £204 is to be carried forward. The company has ordered 10 motor-omnibuses to develop traffic in outlying districts. Pending delivery eight motor-omnibuses have been hired. The report is accompanied by a copy of the accounts of the Kidderminster and Stourport Electric Tramway Co. for the year 1913. The capital expenditure shows an increase of only £30. The gross receipts were £6,369, a decrease of £130, and the expenses, before providing for renewals, £3,352, an increase of £160. The profit on the year's working, after providing for renewals, is £2,016 plus £43 brought forward. There has been applied to reserve £500, to dividend at the rate of 2½ per cent. £1,430, and £129 is carried forward.

Mr. C. S. Shibreff Hilton presided on Monday over the annual meeting held at Electrical Federation Offices, Kingsway. He said that the additional capital expenditure of £2,224 had been principally expended in the purchase of additional machinery and boiler for the power house. The revenue showed a net increase from sale of current of about £380. Generation expenses increased by £150; maintenance by £270; and management expenses by about £420, due to increased salaries. The net balance showed a decrease of £113. The dividend from the Kidderminster and Stourport Electric Tramway Co. was less by 1 per cent. or £560. They had charged the cost of inaugurating motor-omnibus services, amounting to £535, to the net revenue account, and he hoped that those 'buses would prove a great success and bring them a considerable revenue in the current year. It was proposed to have a separate company for that business and combine it with the services of the Worcester Electric Traction Co. They would hold shares in that company, and the directors would be jointly elected by the Worcester Co. and the Kidderminster Co. The amount written off for inaugurating the motor-'bus services would not have been so large had it not been for the competition which they had to face at rather an unfortunate time, but all the indications were that those 'bus services would pay the company very well in the future.

Mr. J. A. Lycett seconded the motion, and the report was adopted.

Lancashire Power Construction Co., Ltd.

The directors' report for the 15 months ended March 31st, 1914, states that it has been deemed advisable (in order to bring into this company's accounts any dividends declared by the Parliamentary company, whose financial year ends on December 31st) to effect a change in the date of the company's financial year. To bring this about the present accounts cover a period of 15 months to March 31st, 1914. The output of the Parliamentary company has continued to increase so rapidly that it has been necessary to provide additional plant for that company's generating station, as well as capital for considerable extensions to mains and sub-station equipments. Of the proposed issue of £100,000 of prior lien bonds referred to in the last report, £55,000 has been subscribed and allotted, and it is intended to issue the balance of £45,000 during the present year, making the total issue of prior lien bonds £150,000.

The trading profit of the Lancashire Electric Power Co. for the year 1913 amounted to £22,785, plus interest on hire-purchase plants, &c., £741, making £23,526, compared with £15,374 for 1912. The balance brought forward from 1912 was £3,137, making the amount available for division £26,663, which has been allocated as follows:—Debenture interest, £4,500; reserve fund, £10,000; dividend of 3 per cent. on share capital issued, £11,744; carried forward, £419. It will be see from the aforesaid figures that the position of the Parliamentary company, as the result of the year's operations, has materially improved, and that, for the first time, it is in a position to pay a dividend on its share capital. The development of the business is indicated in the following figures:—

	1909.	1910.	1911.	1912.	1913.
Units generated ..	9,251,831	13,646,307	17,771,986	23,110,807	28,191.442
Max. load in KW. ..	3,820	4,690	5,530	6,730	9,720
H.P. connected ..	7,710	10,600	13,600	16,400	28,900
Receipts	£15,294	£24,952	£32,726	£42,773	£54,515
Expenditure ..	15,164	18,467	22,031	28,156	31,730
Profit on trading ..	130	6,485	10,695	14,617	22,785

The revenue from all classes of supply dealt with by the Parliamentary company has steadily increased; the Salford Corporation bulk supply contract did not, however, benefit the accounts to any considerable extent, as the supply was not commenced until October, and then only on a small scale. A much larger supply is now being taken. The outlook for the present year is distinctly encouraging; whilst it is true that there is a certain amount of depression in the textile industry, this has not yet had any adverse effect on the company's output. On the other hand, the various new contracts entered into during the past year are exercising a beneficial influence on both the output and profit for the current year, and the results of the first two months of the year 1914, compare very favourably with the corresponding months in 1913.

Turning now to the revenue account of the Lancashire Power Construction Co., Ltd., the total receipts for the 15 months amount to £24,382, and after deducting therefrom the expenditure of £17,896, there is available £6,486, which it is proposed to allocate as follows:—Write off balance at debit of revenue account at December, 1912, £2,613; reserve account, £3,873.

Stock Exchange Notices.—Applications have been made for official quotations in the following:—

Cuban Telephone Co.—Further issue of £105,000 5 per cent. first mortgage convertible bonds.

Eastern Telegraph Co., Ltd.—Further issue of £103,294 4 per cent. mortgage debenture stock.

Brisbane Electric Tramways Investment Co., Ltd.—The directors' report for 1913 states that the dividends on the shares held by the company amount to £115,922. After deducting general charges in London and expenditure in Brisbane, including insurance, there remains a net balance available of £115,848. £40,000 has been added to reserve fund, and the total dividend on the ordinary shares is 8 per cent. for the year, carrying forward £3,123. In order to provide for the cost of extensions, &c., the directors recommend the issue of 30,000 new ordinary shares of £5 each, to be offered at par to the ordinary shareholders.

Wolverhampton Electric Construction Co., Ltd.—The directors report a net profit for the past 10 months, after providing £5,666 for debenture interest, and £5,000 for depreciation, of £27,126. After paying 7 per cent. preference dividend 6 per cent. is to be paid on the ordinary shares for 10 months.

Craigpark Electric Cable Co., Ltd.—Mr. W. S. Brown, who presided at the annual meeting, held in Glasgow on May 13th, said that the balance-sheet this year was the most satisfactory they had had. That was partly due to the natural growth of business. The company had had a good share of the prosperity which had taken place in the trade of the country. In addition, they had not been harassed by severe fluctuations in the price of copper and rubber, as they had been in the past. Prof. Maclean seconded, and the report was adopted.

Castner-Kellner Alkali Co., Ltd.—An interim dividend of 5 per cent. for six months ended March 31st last is announced.

Allmäna Svenska Elektriska A.-B.

The annual report of this company has recently been published and it gives some very interesting details about the activity during 1913. The capital, which was £100,000, has been increased by the issue of a new series of shares to £666,667, but the new issue will not be entitled to any dividends before next year. The results are very satisfactory and a dividend of 8 per cent. had been distributed. In the following table are shown the gross and net profits and expenditure for the last four years: –

	1910. £	1911. £	1912. £	1913. £
Gross profits	30,889	42,167	50,667	90,556
Expenses	6,056	13,611	14,778	42,611
Net profits	24,833	28,556	35,889	47,945
Depreciation	15,889	16,444	20,722	30,000
	30,889	42,167	50,667	60,556
Actual gross profits	46,778	58,611	71,389	90,556

The reserve fund was at the end of 1912 increased from £19,444 to £23,667. When the capital was extended, there was at the same time undertaken a financial reconstruction of the company, which consisted in the withdrawal of the preference shares and the founder shares. All shares were instead placed on equal terms as regards dividends, and the reserve fund disappeared in connection with this operation. The new capital was subscribed at 20 per cent. above par, and the amount of this premium enable the company to establish a new reserve fund, amounting to £53,333, which has now been increased to £58,889. In the following table are shown the turnover and other matters for the last three years:—

	1911. £	1912. £	1913. £
Turnover	711,500	774,000	955,600
Value of goods exported	174,800	212,300	242,500
Number of orders per 31/12/1913	3,689	4,977	6,887
Electrical machines delivered:			
Number	6,011	8,001	10,816
Capacity in kilowatts	220,000	272,000	340,000
Number of workmen employed ...	2,527	2,780	3,287

The difference in the turnover between 1912 and 1913 is very high and the exports are now four times as much as in the said year. In the report it is stated that the demand for electrical goods during 1913 has been very strong, which has had a favourable effect on the prices. During 1914 the home market has shown no sign of depression, while the orders from abroad have decreased in number. The prospects for this year are on the whole satisfactory. The number of orders in hand has risen very considerably, but some of them are not to be executed before 1915. As regards the orders for large electrical plants there are now three generators with a capacity of 10,000 h.p. each, which are to be delivered to the "Alfkarleby" power stations in Sweden. The first generator to the Porjus power station of the State Railways was delivered in December, 1913. From the Norwegian Hydro-Electrical Co. has been obtained an order for six generators of 20,000 h.p. each for Rjukan II., and for two generators of 11,000 h.p. each, which are to be installed at the Svaeljfas power station. In Japan the company has secured an order for six generators with a total capacity of 16,000 h.p. for the Sagami power station, and some large orders from Portugal and Canada have also been obtained. The Domnasfoets Ironworks have placed an order with the company for electrical plant and machinery for a rolling mill of 9,200 h.p. capacity, which is going to be electrified. Further, the company has got an order for four electric motors of 1,600 h.p. each for the Holsta Paper Mill in Sweden. The electrification of the Saltsjö Railway, near Stockholm, has now been completed and the electric plant is working very satisfactorily. The transmission and conducting lines for the railway from Kiiruna to Riksgränen in North Sweden are nearly completed, and the electrical locomotives for same are also approaching completion, so that the whole line will be operated electrically in the course of this year. The A.S.E.A. has several subsidiary companies, of which the Swedish Company, the A.B. Skandinavika Elektricitetsverk is the most important. In Norway the A.S.E.A. and the Elektrisk Bureau of Kristiania have formed a new company under the name of the A.S. Norsk Motor and Dynamofabrik with a capital of £55,600. The factory buildings at Hasle, near Kristiania, are now under construction. The Danish branch has been turned into a new company with a capital of £5,555. The A.S.E.A. has also subsidiary companies in Finland, Spain and England, and has now also opened branch offices at St. Petersburg. All the foreign companies are ordinary trading concerns with the exception of the Norwegian company, which is a manufacturing concern.

Last year it was reported that the A.S.E.A. would very likely find a dangerous competitor in the German A.E.G., which had the intention of erecting a large branch factory at Malmo. The necessary sites were acquired at Malmo by the A.E.G., but so far no further steps have been taken in order to realise the project. In regard to competition, the A.S.E.A. has always pursued the policy of keeping its hands free, and has consequently made no agreements with the large foreign electrical companies in regard to the fixing of prices and the division of markets, etc. It has followed a policy of free competition everywhere. The company last year took up the manufacture of electrical cooking and heating apparatus, and its manufactures have now been put upon the market and are expected to become dangerous competitors of the German goods which previously were dominating the Swedish market.

Rangoon Electric Tramway and Supply Co., Ltd.

The directors' report for the year 1913 states that in order to meet the growing expansion of the business it has been found necessary to raise additional funds, the board have created £300,000 five per cent. second mortgage debenture stock, of which an issue of £100,000 was made in November last and fully subscribed. The balance of the new issue of debenture stock will be issued as and when required. The cars travelled 1,499,760 miles, an increase of 37,475 miles, and carried 11,427,556 passengers, an increase of 794,228; the total receipts being Rs. 9.41,935, an increase of Rs. 51,613 or 5.79 per cent.

Towards the end of the year the directors commenced a service of motor omnibuses, which in addition to acting as feeders to the tramways, will also, it is hoped, supply a want for transport of a more elastic nature than the tramway service. It would be premature to say what the financial result of motor omnibuses will be. They bid fair to supply a want, but the expenses of operation have yet to be ascertained.

In the private lighting and power department, the gross receipts for current supplied of all descriptions amounted to Rs. 5.77,035 as compared with Rs. 4.80,232 in 1912, an increase of 20.16 per cent.; the working expenses were 42.16 per cent. of the receipts, as against 45.10 per cent. for the previous year.

The gross receipts of the house wiring and supply department amounted to Rs. 1.20,828 as compared with Rs. 1.64,571 in 1912, the profit realised being Rs. 22,478 as compared with Rs. 33,161 in 1912. Although the profit is less than for the previous year, the department continues to carry out efficiently the objects for which it was originally founded.

A continuation of settled economic conditions of trade in Burma, upon which the success of this company so largely depends, has again resulted in the directors being able to present a satisfactory report to the shareholders.

The gross profits for the year were £60,710. Interest on debenture stocks absorbs £9,107, provision for redemption of 4½ per cent. debenture stock £5,875, depreciation on sundry assets in Rangoon £1,024, transfer to reserve for renewals account £12,500, transfer to special reserve for cables, etc. £2,000, income tax, balance of, £471, fees for directors, managing director, and trustees and expenses in London £2,540, expenses of 5 per cent. debenture issue, proportion written of, £1,405. The net profit is £25,924, plus £751 brought forward. Preference dividend absorbs £15,000, and a dividend on the ordinary shares of 6 per cent. for the year is recommended, leaving £1,055 to be carried forward. During the eight years of the company's existence, the total dividend paid upon the ordinary share capital has amounted to 22½ per cent., being an average return of 2.81 per cent. per annum to the holders of ordinary shares.

The annual meeting was held on May 6th at 3, Great Winchester Street, E.C., Mr. Frank Tobin presiding.

The Chairman said that the future redemption of 4½ debenture stock would probably proceed more rapidly, and it was important to bear that in mind because, as that stock was wiped out, the position of the recently issued 5 per cent. second mortgage debenture stock would steadily improve. He hoped that the issue of £100,000 made last autumn would supply their needs as regarded capital expenditure for the next two years. The profits last year were the largest they had yet made, and they had been attained with the accompaniment of increased economy. With regard to their industrial progress during the past twelve months, that had been mainly in that branch of the business which dealt with the supply of light and power. The tramways had done very well and had given them increased earnings, but they still stood at the same 25 miles of track as originally, and any increase in that part of their business could only be moderate. It had done better last year than in 1912; it had earned more, and it was very satisfactory to know that the board had succeeded in their aim of working the tramways for 50 per cent. of the gross takings. For 1913, he was glad to say, they had been able to keep just within those figures. As regarded the light and power business, the increase last year had been very considerable, and he thought they might fairly confidently hope that there would be a continuance of the demand for an increased supply of light and power. It was chiefly the development of that part of the business that had led to their issuing further capital. They were spending a considerable amount at the power house, for, although they had sufficient power for what they were supplying now, the business was growing all the time. Rangoon relied upon the company to supply the city with all the electric light and power it needed, and the board could not afford to take any risk of breakdown—they had to keep a larger margin in reserve than was necessary in the case of a company working in England. The board felt justified in recommending a dividend of 6 per cent. on the ordinary shares; this was the first year they had been able to declare such a large dividend. In conclusion, the Chairman paid a tribute to the staff in India for the zeal and ability with which they served the interests of the company.

Sir Frederick Fryer, K.C.S.I., seconded the motion, which was carried without discussion.

Lima Light, Power and Tramways Co.—The report shows a net profit of £p99,597. The total dividend for the year is 4½ per cent., and there is carried forward £p184.

Eastern Telegraph Co., Ltd.

The annual meeting was held on May 13th at Electra House, E.C., Sir J. Wolfe Barry, K.C.B., presiding.

In moving the adoption of the report (Elec. Rev., p. 793), the Chairman said that the gross revenue for the year amounted to £1,462,800, a decrease of £37,200. The falling off in the message receipts appeared to be fairly general, but the largest decline was shown in the receipts from the Indian joint purse, which were about £18,000 less than in 1912. There were smaller decreases in most of the other branches of the traffic, but he was pleased to notice a slight increase in the receipts from South Africa. When comparing the revenue for the two years they must remember that the revenue for 1912 was the largest ever received by the company. Considerable reductions had recently been made in certain of the telegraphic rates, some of which came into operation on 1st September last, and consequently affected the revenue for the year, as up to the date of the accounts the traffic had not been materially stimulated by the reduced rates. The principal reductions then made were as follows: Between Great Britain and Hong Kong, China and Philippines from 4s. 5d. per word to 3s. 6d. per word; between Great Britain and Japan from 4s. 10d. per word to 3s. 11d. per word; between Great Britain and Straits Settlements from 3s. 6d. per word to 2s. 11d. per word; between Great Britain and Dutch East Indies from 4s. per word to 3s. 7d. per word. A further reduction in the tariff between Europe and India, Burma and Ceylon had been made from 2s. per word to 1s. 8d. per word, which came into force as from the 1st instant. All these reductions might have a considerable effect on the receipts and expenditure in the current year, and it was to be hoped that the volume of additional traffic would be increased by reason of the lower tariffs. Additional facilities had also been given to the public by extending the acceptance of "week-end" telegrams to various parts of the world. By arrangement with the other administrations interested, these telegrams were delivered on Tuesday morning, but so far as they were concerned they would be glad to see the privilege still further extended by delivering these messages on Monday morning. The total expenses for the year amounted in round numbers to £685,200, an increase of £23,000. If, however, they deducted the special expenditure in respect of interest on temporary loans, amounting to £10,600, necessitated by the large expenditure on account of important renewals and for new cables between Suez, Aden and Colombo, the increase in the ordinary working expenses for the whole year was only £12,400. The expenses in London showed an increase of £1,500, while the working expenses at stations had increased to the extent of £25,400, of which £23,614 was due to salaries and wages, and was consequent upon a considerable but necessary augmentation in the number of the staff, to annual promotions, and to improved conditions in connection with Sunday duty and overtime. The expenses attending maintenance of cables were, however, £14,975 less this year than they were in 1912, this being due to the fact that the credits to this account in respect of the charter of their ships, etc., were considerably in excess of the corresponding credits in 1912. The net result of the year's working was that, while maintaining their usual dividend and bonus, together equal to 7 per cent. on the ordinary stock, they were able to make a substantial contribution of £330,000 to the general reserve fund. That fund had been charged with £439,761 in respect of the new cables between Suez, Aden and Colombo, combined with extensive renewals of cables in the Red Sea and Indian Ocean, and further expenditure in respect of the new cables had been incurred to the extent of £473,026, which would be charged to the fund, as and when they were able to clear off the liability in respect thereof, without, they hoped, realising any of their reserve fund investments for the purpose. It was considered expedient to vary some of the investments held in respect of reserve funds, and the realised loss incurred on the securities sold had been charged against the general reserve fund, leaving the fund £325,000 intact as a provision on account of investment fluctuations. The operation had resulted in a slightly improved return on the re-investment of the proceeds of the sale. On valuing their securities as at the date of the accounts, they ascertained that the approximate depreciation was still slightly in excess of the above mentioned amount of £325,000. There had been a considerable improvement in the total value of the securities since that date, but they thought it was advisable to leave the amount of this provision undisturbed. During the last 30 years they had charged against reserve fund for new cables alone no less a sum than £1,246,006, and the only addition to capital expenditure on this account during the same period had been £540,595. The total amount charged against reserve fund, including new cables, renewals of existing cables, making provision on account of investment fluctuations, and other special expenditure, was £5,837,202, and the balance remaining in the general reserve fund at 31st December last was £1,559,798, and the total reserves as shown on the balance sheet aggregated £2,258,655, apart from the special fund set aside as a provision on account of investment fluctuations. Not only were these figures interesting and instructive, but they enabled them to realise fully what an important bearing this practice must have had upon the satisfactory financial position of the company. It also showed that they were constantly endeavouring to improve their system and attain greater security against interruption not only in times of peace, but in the event of war, by establishing alternative routes and at the same time bringing fresh places into direct telegraphic communication with their main lines, such as, for instance, they had lately done with Colombo. They believed this policy, which had been so consistently followed for so many years, to be in the common interest of all concerned, and while securing not only a fair but a regular return to the stockholders on their investment, it enabled them to fulfil their obligations as public servants by offering greater facilities and reducing rates whenever it was reasonably possible to do so. Although it did not invariably follow that a reduction in the rate created more traffic, they always endeavoured to lower their tariffs if it were not considered likely to cause a very serious reduction in their revenue. It must always be borne in mind that whenever a reduction of rates did produce an increase in the volume of traffic, this invariably brought in its train an increase in working expenses.

Sir John Denison-Pender, K.C.M.G., seconded the resolution and the report was adopted without discussion.

Calleader's Cable and Construction Co., Ltd.

Sir J. F. Fortescue Flannery, M.P. (Chairman) presided on May 14th, at Hamilton House, over the annual meeting.

The Chairman, in moving the adoption of the report (see Elec. Rev., p. 793), said that in the years 1912 and 1913 there had been a history of abounding commercial prosperity throughout the whole civilised world. He did not think that history recorded a time of greater commercial and manufacturing activity. During both these years their company, by reason of its highly-organised system of management, had been able to obtain its full share (some people said more than its full share) of business more or less profitable. Not only in regard to the large number of small orders, which represented the bread and butter of a trade like theirs in quiet times, but also as regarded some big orders, although not so many as in former years relatively, the company had been successful; and at home, in the Dominions and abroad, due to the activity of their management, coupled with prosperity amongst their customers, they had done, as they considered, a very satisfactory year's trading. There were perhaps advances owing to the use of electricity greater than had been made in any other department of science, and these had not been neglected by the professional officers of the company, and they had kept themselves, they believed, in the front rank of scientific as well as commercial progress. In 1912 they had a record as regarded the profitable results of their trading. They had a balance of £97,000 to their credit, and in 1913 they had a balance of £91,000. Electricity, as he had said, had developed, and possibly the developments in mines and factories and railways, in general traction, telegraphs and telephones, had been as widespread as in any previous year. It was in regard to telephones that they might claim to have made some very special successes in the course of their work. Especially they had been successful in their relations with the General Post Office, who had taken over the telephone service—not always to the praise and kindly words of those who used it. But they believed that the deficiencies in the use were likely to disappear in the very near future, and certainly as regarded the apparatus with which they were concerned, which, indeed, would spread over a very large area of England, the company was doing its best to second the efforts of the Post Office and to deliver the very best possible material in the shortest possible time. In order to fulfil the contract with the Post Office, and for other purposes, they had laid down some special plant, both at Erith and Leigh, and as an illustration of the thrifty character of the board he might mention that the cost of the plant had been largely paid for out of revenue. They had not been content with a prosperous year, but they were making their arrangements in advance for the lean years which almost certainly must come, and they had taken the opportunity of revising and extending their agencies throughout the world. He ventured to say that there were few large towns in the United Kingdom, few in the Dominion, and practically no civilised country abroad where there was not at the present moment, or would be in the near future, a resident skilled representative of Callender's Cable Co. ready to do business on their behalf. As regarded the Anchor Cable Co., with which they were interested, he was able to report a period of very satisfactory progress. They had seen the dividend declared by the company, and he might add that there was a very considerable surplus not being distributed, but which was being laid up by way of revenue for the future safety and advantage of the shareholders. The maintenance of all their buildings and plant had been, as usual, paid for out of revenue. They might perhaps, with the sanction of the auditors, have treated some of these expenses differently, but they had thought it better to charge them against revenue. Large portions of the capital were invested in electrical undertakings who were customers of the company, and he was able to assure them that the whole of these investments were not only safe and satisfactory, but were in the judgment of the directors in a very improving condition. The Chairman proceeded to deal with the figures in the balance sheet, and pointed out that nothing was put down for goodwill or patents, although they held patents which they regarded as very valuable. Most of the items he said, did not call for any comment except that they showed the activity of the company and also that every sovereign of the available funds was being actively used in the business. The result was that with

£91,745 brought in from 1912 they had an available balance of £150,000, and after paying a dividend of 10s. per share and a bonus of 5s. per share they carried forward £124,581 to next year's account.

Mr. F. Thompson pointed out that the depreciation only worked out at 2½ per cent., which seemed very small. He asked whether the value put by the managing director on the shares held by the company was a realisable value or merely an estimated value, and also remarked that he understood the contingent liability in regard to the Uxbridge and District Electric Supply Co. was to have been taken over by the Trust Co.

Mr. Galliott suggested that these profitable years might be a suitable time to establish a fund for the redemption of the company's debentures.

Mr. Stewart Bain congratulated the directors on the success of the business and on what he considered a clean balance sheet.

Mr. T. Callender (Managing Director), in seconding the motion for the adoption of the report, said the feature of last year's trading had been the steady increase of their trade with their old customers. There had not been any wonderful development in the outlook of the electrical trade, but throughout the whole gamut of their customers they had found a steady increase in their requirements from the company, which, they would agree, was the most satisfactory kind of business any company could obtain. During the present year so far as they had gone that same quiet, steady increase had kept on and they were doing at the present time a healthy, quiet increasing business of the best possible kind—much of it with their old and valued friends. The feeling that a considerable slump was taking place in the industry throughout the country had not, fortunately, come their way. His friends in the North of England and Scotland had told him that they had experienced a falling off in their trade, but so far as their company was concerned it had not yet reached them. They had a large amount of business in hand and in prospect, and so far as they could forecast at present the year would be a satisfactory one. It had, however, been necessary in order to hold their position to spend a lot of money in ways which did not appear in the balance sheet or in the list of the reserves they made. They had put up research laboratories at their factory and they had put an immense amount of work in which did not appear outside, but it had put them in the forefront of electrical manufacturers, not only of this country but of the world. They would reap sooner or later the fruit of that expenditure, which had been considerable and had meant much worry to those at the head of affairs. The increasing requirements for electricity in mills and factories and mines should mean good business to them, and if heating by electricity, of which they had heard so much in Mr. Merz's report to the City of London, came along they would receive a very large accession to the already large business they had. Perhaps the only department which had not been altogether satisfactory was the engineering department, for in that they had been harassed a good deal by labour troubles. Fortunately their own men were fairly loyal to them, but the unrest and uncertainty which at present existed in the engineering trade was causing them, and others similarly situated to themselves, the greatest of anxiety and had upset many of the calculations they had made and stopped much of the advance in business which would otherwise take place. Only recently a new branch which promised exceedingly well, but which was mainly an engineering branch, came to them. They had to all intents and purposes decided to extend the factory and go in for extending the business in this new direction, but in view of what had occurred they reconsidered the matter and decided to shut it down. That was a trade which would have given employment to 200 or 300 men at any rate, and which for the present had entirely gone and would probably not take place in this country at all. It seemed a pity that this should be so, but with the present unrest they were bound to turn new business down and wait until sanity once more returned to their great trade unions. The importance of their telephone department could not be over-estimated because they were one of the firms who had been selected by the Government to give effect to their proposals for putting the telephone house in order. There was no doubt that a vast amount of money would be spent in the next few years by the Government in increasing the facility necessary for subscribers to the telephone, and large amounts of cable had already been ordered and were being put underground, and their company had received no insignificant part of these orders. In fact the Post Office had placed in their hands the work in the area south of the Wash to Cardigan Bay. Most of the work in the south of England had been left in their hands. It had not yet brought any large contracts, but it had brought a large amount of work and anxiety, as owing to the special nature of telephone engineering there was not a reserve of men who could be drawn upon to carry out an indefinite number of contracts. They had therefore been forced to supplement the staff already in their service by new men whom they had had to train, which meant heavy expenditure, but they had got together a staff and equipment to enable them to do work second to none in the United Kingdom. Their subsidiary companies were progressing well. Most of these companies were at present under development, and it would not be possible for them to dispose of the shares unless they made some quite exceptional arrangement. These shares were the shares they had to take to make their business. It was part of the expenditure necessary in any company of that kind which carried out large contracts in a more or less new industry. The shares cost them much more than the amount which appeared in the balance sheet. They had already provided large sums to meet any depreciation, and he was convinced that the sum put down in the balance sheet was the proper sum in view of all the circumstances of the case. With regard to the question of depreciation, it must not be forgotten that they had 50 acres of land and there was no depreciation with regard to that, but, on the contrary, there was considerable appreciation. Looking at it all round, they thought the amount they had devoted to depreciation was ample. They could make it appear more if they wished, and if they charged less to renewals account and put it to capital, writing it off afterwards. It was never intended that the Trust Co. should take over the liability which stood on that company with regard to Uxbridge, but he might say that the Uxbridge Co. was doing very well and paying its way. In conclusion he thought the outlook was quite satisfactory.

The motion for the adoption of the report was then carried and the Chairman was re-elected a director.

Potteries Electric Traction Co., Ltd.

The annual meeting of this company was held on Monday at Electrical Federation Offices, Kingsway, Mr. G. F. M. Cornwallis-West presiding.

In moving the adoption of the report (see Elec. Rev., p. 833), the Chairman said the result of the year's trading might be considered satisfactory, for while maintaining the same dividend as last year they were able to set aside to renewals account £3,000 more than in the previous year. The capital expenditure during the year was £3,774. Some of that had been spent in improvements on the tramway track, but by far the greater part had been expended on the purchase of motor omnibuses and further expenditure under that head would be necessary during the coming year; in fact they had already ordered six more 'buses. They were obliged to do it in order to cope with the traffic which was being developed in the district. The total capital expenditure amounted at the end of the year to £791,326, whilst the issued share and debenture capital amounted to £735,000 only. The excess of expenditure over issued capital had been met out of the company's internal reserve funds and other resources. Further capital expenditure would be necessary for doubling certain portions of the lines, extending loops and for the purchase of new rolling stock; but it would depend upon whether the negotiations which were now proceeding with the local authorities for the extension of their tenure were carried through satisfactorily. The estimate of further capital expenditure which they had in their minds was at least £35,000. They would have to consider ways and means to raise that. The only way in which they could raise it would be by some form of mortgage debenture, but it would not be worth while for them to raise the money unless the extension of tenure granted by the local authorities was for such a period that they could see their way clear to create a sinking fund which would pay off the necessary fresh issue of debentures and at the same time if any consent had to be got from the debenture holders, to provide a sinking fund for the existing debentures. It was hardly necessary for him to point out that should that be done it would be ultimately for the benefit of the ordinary and preference shareholders. He was quite certain that the new capital would be able to earn the interest upon it, especially as they had got the motor omnibuses, which, as far as he was able to judge, seemed to be a most healthy part of the company's property. If any sinking fund were created for the debentures they would become automatically extinguished at the end of a certain period and instead of the company's existing assets being used in the event of purchase by the local authority in years to come to pay for the existing debentures, the amount would naturally go to the benefit of the preference and ordinary shareholders. That, he thought, was an important point for the shareholders to consider, because at the present time there was no sinking fund for the debentures. The traffic receipts showed the substantial increase of £9,000, and there was a small increase from parcels and advertising. To some extent that increase must be discounted by the fact that in the early months of 1912 they had to deal with the coal strike which considerably reduced the traffic, and therefore the increase last year must be considered somewhat abnormal when compared with the traffic of the preceding year. They would, however, be pleased to hear that the receipts from the tramways for the first four months of the current year showed an increase of over £500 and they had taken over £2,000 during that period from motor 'buses. On the other side of the account there was an increase of £1,700 under the head of power and running expenses. Of that £1,000 was accounted for by increased wages to their employees, but they were not exceptional in showing an increased expenditure on that account. They had to deplore a considerable increase in the cost of fuel which amounted to over 40 per cent. of the total amount expended under that heading as compared with the previous year, and he was afraid there was very little hope of ever seeing a return to the coal prices they had been accustomed to in the past. In the administration and general expenses there was a considerable increase in the item for rates, which had risen from £4,386 in 1912, to £5,794 last year. That was an item over which they had no control. The increase was largely due to the re-valuation that took place last year within the Stoke Union. In 1904 that portion of the company's undertaking was valued at £3,923, when the gross traffic receipts were £90,000. The new valuation when the gross traffic receipts were £100,000 had been fixed at £7,225, an increase of £3,302; in other words, although their gross receipts were only up by 10 per cent. the valuers had increased the assessment by very nearly 100 per cent. They had done their best to deal with the matter by appeals but they had not been successful and the only result they had got was a reduction from the original valuation of £7,864 to £7,225. Repairs and maintenance showed an increase of £1,100 and they could not look forward to any reduction in that item. He explained to them at the previous meeting that the directors were building up a fund for the renewal of the track work. During the year £5,200 had been spent upon that account, but considerable further amounts would have to be spent during each of the next three of four years if the negotiations with the Council for an extension of the tenure were successful. In order to provide for that, £15,500 had been set aside out of the profits last year to the renewal account, which made that fund £24,168 at the commencement of the year. In addition to that the general reserve was increased by £2,000 and now stood at £23,000. Referring to the question of motor omnibuses, the Chairman said there had been an enormous increase in motor-'bus services throughout the country, and the Potteries district offered an attractive field for such a form of locomotion. Ten years ago an endeavour was made to utilise motor-'buses as feeders to the tram-lines, but, owing to the many difficulties they encountered, chiefly of a mechanical nature, the 'buses did not prove a success. They were one of the pioneers of the motor omnibus service in this country and the non-success was due to the faulty construction of the vehicles which they had to deal with at that time. Great improvements had taken place in the construction of 'buses within the last two or three years, and they had reliable vehicles which could be worked with success and at a profit. To meet the demand for such traffic in their district the directors last year ordered four 'buses of the latest type and an experimental service was started last December. The result of that experiment offered such promise that they had already increased their fleet to 12 'buses, of which six were in work and more would probably be required in the near future. They had had a certain amount of difficulty in obtaining licences from the local authorities, but he had great hopes that those difficulties would be overcome. The negotiations with the local authorities to which he referred last year were at that time entirely suspended, but at one of their meetings some weeks ago he pointed out that the company, as a business concern, could not possibly give improved services or embark upon an extensive programme of reconstruction unless the directors had the necessary money, and he further pointed out that they could not possibly expect to raise the money unless the time for which their tenure was extended was spread over a reasonable number of years. They were received very favourably by the Estates Committee, and he had hopes that the negotiations would come to a successful issue, which would of course give an increase of life to the company. The proposals were that their tenure should be extended until 1940, which was practically 25 years from now. The company on its part would undertake to carry out certain doublings and effect other improvements to the lines and rolling stock and pay a way-leave, the amount of which had not yet been settled.

Mr. J. Vincent Kitchener seconded the resolution which was adopted without discussion.

West African Telegraph Co., Ltd.

The annual meeting was held on Wednesday last week at Electra House, Finsbury Pavement, Sir J. Denison-Pender, K.C.M.G., in the chair.

In moving the adoption of the report (see Elec. Rev., p. 796) the Chairman said he had first the melancholy duty of referring to the death of Mr. Robert Kaye Gray. Mr. Gray had been associated with the company since its inception, and his practical knowledge of cable work, together with his commercial experience made him a most valuable director. He was, moreover, a man who by his courtesy and kindly manner endeared himself to all with whom he came into contact. They deeply deplored his loss. With regard to the report, the gross receipts for the year amounted to £45,915, as against £46,603 for 1912, or a small decrease of £688. The actual receipts for messages however showed a reduction of £1,146, and the receipts had been made up to £45,915 by the addition of interest and dividends on the reserve fund investments, while moneys on deposit brought them £158 more than in 1912. Those increased receipts from interest on reserves had made up to within £688 the deficiency on the traffic. As far as expenditure was concerned, exclusive of cable maintenance, the total ordinary expenditure amounted to £17,350, as against £17,091, or a small increase of £260. There was nothing to take exception to in that figure. On the contrary, they might congratulate themselves that the increase had been so small. The expenses attending the maintenance of cables however showed a considerable increase, due to the somewhat extensive repairs of their St. Thomé-Loanda cable, so that, adding the cost of cable repairs together with sundry differences in exchange and the income tax payable abroad, it had cost them £5,732 more this last year to work and maintain their cables. That only emphasised what he had so often said at those general meetings warning the shareholders not to congratulate themselves on a reduction small or large in cable maintenance, comparing one year's accounts with another. As he had said, last year they were faced with an expenditure of £12,150 against £6,818 for 1912, meaning an additional expenditure of about £5,000. Still, the result of the year's working had been satisfactory. They were making a contribution of £6,000 to the general reserve fund while maintaining the same dividend as in previous years. Although the general reserve fund had been charged with £5,600,000 in respect of the renewal of a portion of the St. Thomé-Loanda cable, the fund stood at £296,800, taking the securities at cost price. Of course there had been a considerable depreciation on those securities, but all the same it was a very fine reserve fund considering the capital of the company.

Sir Henry C. Mance seconded the motion and the report was adopted.

Shanghai Electric Construction Co., Ltd.

The annual meeting was held on May 14th at Basildon House, E.C., Sir Alfred Dent, K.C.M.G., in the chair.

The Chairman, in proposing the adoption of the report (see Elec. Rev., p. 831), said that it showed continuous progress and development in the undertaking. The operating profit was £37,976 as compared with £27,161. The balance of net profit available amounted to £36,700 against £28,000. The reserve for renewals would amount to £27,727. The power expenses were £10,794 against £13,137 last year, a decrease of £2,342, owing to the revision of the rates. They were entitled to claim that revision under clause 10 of the original power agreement after five years, and they gave notice accordingly in 1913, but the negotiations extended over the whole year before an arrangement was arrived at with the municipal council. The effective receipts showed an increase of £12,227, and it was a satisfactory feature that of that amount £10,814, or 88 per cent., had been retained as operating profit. That was partly attributable to the reduction of the cost of power and to the fact that the growth of expenses had been less in proportion to the gross earnings, notwithstanding that they had run nearly 137,000 more car miles than in the previous year. The expense ratio to effective receipts had been reduced from 65½ per cent. to 58½ per cent. That included the 5 per cent. royalty on the gross receipts which they had to pay the municipal council and also the heavy loss on exchange. Those items should be excluded when comparing their ratio with systems in other towns not similarly penalised, and in that case it would work out at 42 per cent. for 1913 against 47 per cent. for 1912. The average expense ratio to gross receipts over all the tramways in the United Kingdom for 1912-13 was said to be 62.68. The loss by depreciation on subsidiary coinage during the year was equal to 23.19 as compared with 24.55 per cent. in 1912, or 7.64 per cent. of the share capital. That showed a slight improvement per cent. in the currency itself, which, he feared, would not be continued in 1914 as the market was again being flooded with copper coin from the native mints. That loss on exchange was a new feature since the tramway concession was granted in 1905, and it had cost them since the service was established over £100,000. The ratio to their capital had increased from 3.63 per cent. in 1909 to 8.09 per cent. in 1913. In spite of that serious handicap they were able this year to recommend a dividend of 7 per cent. against 5 per cent. for the previous year. They had also set aside £10,000 to renewals account and had written £3,000 off preliminary expenses. The directors and auditors considered that the provision for those two items was prudent, if not necessary. On the general question of finance they would notice that after providing for a considerable sum on capital expenditure, the loan from the bankers stood in the balance sheet at £16,000. It had since been reduced to £12,000, against which they were expecting substantial remittances from Shanghai. There was, however, a further expenditure on capital account in contemplation for which provision would have to be made when the necessity arose. They had outgrown their present office accommodation, and unless they could extend their present lease and the premises themselves on reasonable terms it was doubtful whether they would not be compelled to buy land and build on their own account at no distant date. They also could not estimate the capital requirements for the development, if thought desirable, of rail-less traction as, owing to the deplorable delay in delivery of the cars they had not yet had an opportunity of testing how far that new mode of traction could be made applicable to Shanghai. He was glad to say that that morning they had received a telegram from Liverpool stating that the first two cars would be despatched on the 21st inst. The traffics showed continued expansion as they carried nearly seven million more passengers last year than in 1912, and the published traffics receipts for the current year had so far shown a satisfactory increase every week without exception. They had added 15 new motor cars during the year, the bodies of them having been built in their own workshops at Shanghai; the trucks or chassis being of a new type supplied by American manufacturers. They had also recently authorised the purchase of a further 10 motor cars and 15 trailers, which would bring their rolling stock up to 90 motor cars and 55 trailers as compared with the original stock of 65 motor cars only. There would be full use for their additional rolling stock, as they anticipated that their passengers for the current year would be considerably in excess of 50 millions. Their arrangements for through-running with the French company continued to work to the advantage of the two companies. Separate tickets were still issued on each company's lines, a system to which the French company wished to adhere. The French company was about to introduce through-running between the French 'Bus Co. and the Chinese company's lines to the terminal station of the Shanghai Hanghono Railway, and that might lead later on to an arrangement for through-running between all three companies, thus establishing a through-train service from that terminal to the Shanghai and Hanking Railway Station, which adjoined their system. The success of the tramway companies in Shanghai and elsewhere had led to enquiries by the Chinese authorities as to the possibility of starting tramways in some of their large townships, and their general manager had been in communication with some of them on the subject. It might be to their advantage to interest the company in business of that sort if obtainable on reasonable terms with adequate guarantees.

Mr. J. S. Haskell seconded and the report was adopted.

Submarine Cables Trust, Ltd.

The annual meeting was held on May 13th at Electra House, E.C., Sir J. Denison-Pender, K.C.M.G., presiding.

The Chairman, in moving the adoption of the report, said he had to refer with regret to the death of one of their trustees, Mr. Kenneth Anderson, who was appointed a trustee in 1892. He was the son of the late Sir James Anderson, who was so closely associated with and who did so much for submarine telegraphy, and his death caused the name of Anderson to fall out of the list of directors of the associated companies. Turning to the report, the Chairman said that the total receipts for the year amounted to £25,526, and after deducting the very small amount necessary for the working expenses of the Trust, £1,517, and adding £56 brought forward, they had an available balance of £24,065. Of that amount they had distributed £16,470 to the certificate-holders, being at the rate of 6 per cent. net in the form of the usual half-yearly coupon paid on the 15th October, 1913, and on the 15th April of this year. That left them with a surplus of £7,565 which, in accordance with the terms of the Trust deed, they had utilised in the acquisition of certificates. Those they had been able to buy on the market at prices somewhat under the stipulated figure of £120, exclusive of the coupon reversion, and accordingly in that way they had been able to purchase no fewer than 68 certificates during the year. That was the largest number ever acquired in any single year out of the surplus funds. Their receipts were slightly more than they were during the preceding year, whilst their expenses were about £200 less. It was impossible to make an exact comparison of the receipts with those of the previous year owing to the fact that certain changes had taken place in the capital investments. During the past year the trustees had again adopted the policy of making a redistribution of some of the investments of the Trust. They had sold a further £9,700 Anglo-American preferred stock and had re-invested part of the proceeds in shares of the Great Northern Telegraph Co. and the Mackay Companies, and the balance would be invested in due time in suitable securities as opportunity occurred. He might say that should the income of the Trust remain about the same as it was at the present time they would absorb either by purchase or drawing the last certificate in about 22 years' time, bringing the Trust automatically to an end in the year 1936, when the property would be sold and the proceeds distributed amongst the happy possessors of coupons of reversion which, at the present calculation, would represent about £170 per coupon. The number of certificates purchased in the market or drawn amounted now to 1,494 out of the original 4,200, leaving 2,706 still outstanding.

Sir Leppoc Cappel seconded the resolution, which was unanimously agreed to.

Lisbon Electric Tramways, Ltd.

The annual meeting was held on May 13th at the offices, 1, London Wall Buildings, E.C., Mr. Ludwig Breitmeyer presiding.

In moving the adoption of the report (see Elec. Rev., page 833) the Chairman said that no untoward incidents had occurred in connection with the tramways during the year; the company had continued its efficient services without interruption, and the revenue showed an increase of about £40,000 over that of the previous twelve months. That surplus, however, had been absorbed by heavier expenditure, mainly brought about by higher wages and a rise in the cost of coal and other commodities, so that the net financial result was practically the same as in the previous year. The fall in the rate of exchange had reduced the profits by approximately £5,700. That was, of course, entirely beyond the control of the board and was due to the economic conditions which had prevailed during the year in Portugal. That fall in exchange hit them both ways—by increasing the cost of coal and other material which had to be bought in sterling value, imported from abroad into Portugal, whilst on the other hand it diminished the purchasing power of local currency for their remittances to London. The exchange had veered round about 45d. for some considerable time now, and they hoped it had found its level, but as a further precaution they had built up an exchange reserve account of £50,000 to safeguard them against any violent breaks. The depreciation on their investments had necessitated their writing down by £15,554 to bring them to the market value on December 31st last. That, however, need not necessarily be considered a permanent loss. The traffic figures were again a record and showed the continuous progress of the undertaking from year to year. The number of passengers carried was 58,840,923, against 50,411,963 in 1912, showing an increase of 8,428,960. The construction of the Ascensores line was now nearing completion. One of the lines had been actually in service for a few months, and when the remainder was finished it would consolidate the whole system and tend to increase its earning powers. The work of installing the additional unit in the power house was also nearly completed. For some time past they had been trying to get a satisfactory agreement with the Municipality of Lisbon in regard to the interpretation of some of the clauses of the concessions under which they were working the tramway business. Towards the end of the year they succeeded in bringing about a settlement equitable to both sides, and one which provided for the building of many new lines and which conceded considerable advantages to the municipality as well as to the public of Lisbon. Before its final ratification the agreement had to be submitted to the new municipality elected for the current year, and he regretted to say that that body could not see its way to endorse the action of its predecessors. The directors would continue their endeavours in this direction, as their only desire was to work in complete harmony with the municipality as they were doing with the Government of Portugal.

Mr. J. B. Taylor seconded the motion.

Replying to a shareholder, the Chairman said that the company's concession ran for 99 years from 1888, at which date the undertaking would revert to the municipality without payment.

The report was adopted.

Calcutta Electric Supply Corporation, Ltd.

The directors' report for 1913 states that during the year 14,070,927 units were sold, compared with 12,043,398 units in 1912. The number of consumers connected is 7,597, an increase of 567.

Year.	Consumers.	Units sold.	Gross revenue.	Net revenue.
1910	5,695	8,940,005	£137,998	£85,597
1911	6,383	10,566,038	£151,905	£95,597
1912	7,030	12,043,398	£173,907	£110,168
1913	7,597	14,070,927	£188,767	£127,092

Exchange is calculated at 1s. 4d. per Rupee.

The profits for 1913 amount to £127,029, which, with the balance brought forward and interest received on money at deposit, makes a total of £130,321. After deducting the interim dividend of 3½ per cent., actual, paid on the ordinary shares in November, 1913; the dividends paid and accrued on the preference shares, and the other items set out in the net revenue account, there remains an available balance of £84,115. The directors recommend that £42,000 be placed to the credit of the depreciation and renewals account; that £5,000 be added to the reserve fund; and that a final dividend be paid on the ordinary shares for the second half year, at the rate of 5½ per cent., actual, making 9 per cent. for the year, which will leave £7,448 to be carried forward, after providing for the directors' extra remuneration of £2,500, and a bonus of £1,271 payable to the staff in India. The reserve for depreciation and renewals will thus be increased to £154,386, and the reserve fund, with the addition of £1,874 from dividends on investments, will stand at £97,963. The business has increased to such an extent that additional office accommodation has become necessary, both in Calcutta and in London. New offices have accordingly been taken, and are already occupied at Calcutta, and the company's head offices in London will be removed next month to 1, Broad Street Place, Finsbury Circus, E.C. The expenditure on capital account last year amounted to £70,148, the total outlay to December 31st last being £1,229,145. The demand for electrical energy in Calcutta continues to increase, a demand which must be met—and it is probable therefore that additional capital may have to be issued later. The board recommend that authority be given to the directors in accordance with a notice issued to the shareholders.

STATEMENT OF ELECTRICITY GENERATED, SOLD, &c.

Units generated		19,670,350
Units sold	Public lamps .	47,078
	By special contract	978,629
	To consumers by meter for lighting	3,865,512
	To consumers by meter for power	9,179,708
	Total sold	14,070,927
Used on works		3,425,019
Not accounted for		2,174,406
Accounted for		17,495,946
KW connected for public lamps . . .		105
Maximum supply demanded in KW.		5,593

Continental.—Belgium.—As is fairly well known, Belgian companies have manifested considerable enterprise in the direction of creating and investing in electric tramways and supply works in different countries. Three of the principal trusts are the Société Générale de Chemins de Fer Economiques, the Société Générale Belge d'Enterprises Electriques and the Société Financière de Transports et d'Enterprises. These have a combined share capital of £2,260,000, which has a quotation value of over twice this amount, and bonds have also been issued to the extent of £1,200,000. Including the premiums realised on new issues of capital, it is calculated that about £4,000,000 is now invested by the three companies in tramways and supply works. The new Belgian company law has rendered it necessary for companies in general to prepare a list of the securities held in portfolio, and the three in question indicate, apart from various financial operations, a total combined investment of £2,600,000, which is distributed among 46 companies having an aggregate share capital of £28,000,000, and loan capital of £20,000,000. The countries covered by these undertakings include Belgium, France, Italy, Spain, Germany, Russia, Austria, China, Siam and South America, and the three trusts have been engaged in the business for a period of years dating onwards from 1886 for the first mentioned, 1895 for the second, and 1898 for the third.

The balance-sheet of the Bell Telephone Manufacturing Co., of Antwerp, for the last financial year shows a loss of £15,948.

North France Supply Co.—The report for 1913 of the Société l'Energie Electrique du Nord de la France states that the total production amounted to 54,656,300 kw.-hours, as compared with 40,506,800 kw.-hours in 1912. At the end of December the total plant at the Wasquehal station, which is situated in the vicinity of Roubaix, comprised 43,000 h.p., but since then a further unit of 9,000 h.p. has been brought into operation. During the year further contracts were concluded with many manufacturers in the district, and it had been necessary to order an additional turbo-generator set which will be ready at the end of 1914. The balance of gross profits amounts to £46,000, or £8,000 in excess of 1912. After making provision for renewal and redemption funds and making other allocations, the net profits are returned at £24,800, which sum has enabled the payment of a dividend of 6 per cent. on the ordinary share capital of £400,000, this rate comparing with 5½ per cent. in 1912.

The Russian A.E.G.—The report for 1913 of the Russian A E.G. states that although political complications and the dearness of money caused disquietude, the economic development of the country continued also throughout the year. The electrical industry is deriving advantage from this state of affairs. The company's works were employed to the full extent of their capacity, and the orders now on hand exceed the value of the total turnover in 1913. As gross profits the accounts show the sum of £175,148, as compared with £129,561 in 1912. After providing for depreciation and reserve funds, the balance of net profits permits of the payment of a dividend of 9·4 per cent. on share capital of £1,200,000, as contrasted with 9 per cent. on £800,000 in the preceding year.

France.—Among the new companies recently formed in France are the Société Miniere et Electrometallurgie du Sud-Ouest, Paris (21, Rue du Treilhard), capital, £20,000, and the Société Electrometallurgique de Montricher, Chambery, capital, £120,000. The object of the last-named concerns is to acquire and carry on the Rochette works at Argentine and Montricher (Savoy).

Doulton & Co., Ltd.—A dividend of 10 per cent. on the preference shares is announced, bringing the dividend up to December, 1911. £26,826 is carried forward.

West India and Panama Telegraph Co., Ltd.—The directors recommend the payment of dividends of 6s. per share on the first preference shares for six months to December 31st, and 6s. per share on the second preference shares for six months to December 31st; also 1s. per share on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange markets have taken on a better complexion for the time being. For this the chief reason must be sought in the idea that peace is coming in Mexico, as well as in Ulster. Mediatorial efforts in regard to the former are said to be meeting with a fair amount of success, and the strong recoveries which have occurred in Mexican Railway stocks led to revival in some of the utility issues. The pressing difficulties surrounding Ulster are, it is hoped, gradually yielding to commonsense, and only in the railway world is there marked unrest for the moment.

The charming suggestion that all railwaymen, whatever their grade, should be put upon a 48-hours' week and receive an immediate increase in their wages of 5s. per week, may attract the wistful envy of the average member of the Stock Exchange, but fails to inspire confidence in the stocks on the part of his client. Until Monday, the market had been making quiet progress towards recovery; but in the face of the five-shillings-a-week-rise suggestion, there came a general relapse, and fairly heavy falls took place in the prices of the steam stocks.

Undergrounds participated to a mild extent. On the week, Metropolitans are ⅜ lower; Districts lost ¼; Underground Electric Railways shares of both classes and the 6 per cent. Income bonds have given way. The last-named trio weakened on the reasonable hint thrown out by the Road Board that the omnibuses should contribute to the upkeep of the roads. This, if brought into operation, would certainly make a considerable difference to the profits of the Underground Electric group, unless fares were advanced. Besides this, there are, of course, the negotiations which have been in progress between the men and the company with reference to wages and hours, and these contributed to slight reductions in depressing quotations. The rest of the securities in this department are steady. District 4½ per cent. Preference eased off to 84½, but except for this there are no alterations worth mentioning.

London Electricity Supply descriptions are steady, but stagnant. St. James' rose to 9½, and County of London Preference followed up its improvement last week of half-a-crown with a similar gain; in fact, there have been buyers in the market of County Preference at $12\frac{1}{16}$. Holders of both classes of shares might notice that while the old can be sold about 12, they could be replaced by the new Preference at 11½ or less, and, allowing for the difference in the dividend payments, there is a decided turn in making the exchange. Chelseas are better at 4⅞; Charing Cross, City Preference and Edmundson's Preference gained ⅛ apiece, and for several shares, the official quotations for which have not been advanced, there are better buyers than sellers. Nothing further has transpired in the market as to new developments in connection with the recent holding scheme.

Reduction in the dividend on Reuters has come without much surprise to anybody. It was felt that the Company would have been better advised to have paid in 1912 the same rate which it has just declared for 1913—namely, 7 per cent.—instead of distributing 10 per cent. in respect of the former year. The reduction in the dividend brings down the yield with a run, but it is generally agreed that sound finance can have no quarrel with Reuters for paying the smaller amount. The report said that Reuters Bank, Ltd., is making satisfactory progress; incidentally, it may be noticed that the Bank brought out at the beginning of the week an issue of 6 per cent. Trust Certificates on behalf of the Federal Government of Mexico. Callenders, on the strength of a favourable meeting, rose to 12⅝, and Henleys have continued their rise, another 10s. improvement taking the price to 15 middle, which makes a gain of about 30s. since the beginning of the month.

Other Manufacturing things are good. British Westinghouse Preference have risen to 31s., so that apparently the statement quoted here last week, to the effect that the company is doing exceedingly well, has been sufficiently appreciated to bring in buyers. Electric Construction Ordinary and Preference shares have both improved by reason of the rise in the dividend on the former. Willans & Robinson Preference stock, quoted *ex* £4 dividend last Thursday, is nominally only 1 point lower. British Aluminium Ordinary have regained their slight loss of last week, and the Debenture stock is 2 points higher at 92½. Castner-Kellners are $\frac{1}{32}$ better on the declaration of an interim dividend of 5 per cent. on old and new shares. Last year it was 9 per cent., on old shares only, so the present distribution is equal to an advance of 1 per cent.

The principal gain in the Mexican division is one of 6 in Mexico Tramways Common shares, while the Light and Power shares are 5 higher; the bonds of both companies are better. Advices by mail and cable continue to report the absence of damage to property owned by private undertakings, and, having regard to the immunity from harm which the prominent oil concerns—even at Tampico itself—have enjoyed, there is sound justification for the hope that the light and power companies will come off equally scatheless. It will be noticed, however, that prices go up and down to the extent of several points per week, from which it might be supposed that business is active, whereas, as a matter of fact, the opposite is the case—to such an extent that buying or selling of a mere handful of shares is sufficient to bring about fluctuations of several points. Brazil Tractions are 2 better, the market for these shares recovering much of its previous elasticity and buoyancy.

Rio Tramway Firsts are harder, but the Seconds went back a little. Para Electrics are steady, pending the announcement of what is expected to be a reduced dividend, and the rest of the issues in this market are firm. Calcutta Electric Preference have regained their slight loss of last week, but the Ordinary remain dull, notwithstanding the improvement in the dividend.

The resolutions for increasing the capital of the Brisbane Electric Tramways Investment Company were to be submitted at the meeting on Thursday in this week, the proposal being to create 30,000 new Ordinary shares of £5 each, to be offered at par to ordinary shareholders, and to rank in all respects *pari passu* with those at present existing. The Barcelona Traction, Light and Power Company is said to have a new issue of Preferred capital in contemplation, but it is expected that this will be offered in Brussels.

Apart from Cable shares, the list of Telegraph and Telephone descriptions shows comparatively few changes. West Coast of America fell another ⅛ in consequence of the passing of the dividend, and Marconis, after being 3¼, reacted to 3⅛, the Preference shares also being easier at $2\frac{9}{16}$. Direct Spanish Telegraph Preference fell ¼. New York Telephone bonds have rallied to all but par. Chili Telephones fell $\frac{3}{16}$ to $7\frac{6}{16}$.

The Rubber share market, after making a brief demonstration of strength, subsided on somewhat poor results being obtained at the opening of the auction sales this week in Mincing Lane. Business is very quiet, and with the price of the raw produce tending to dwindle, there is little encouragement to offer prospective purchasers.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 19th.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 18 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	14½ — 16½	..	..
Do. Do. Deferred	100	..	..	5⅝ — 7⅝	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89½ — 91½	+ ½	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	3	..	55 — 58	..	5 8 8
Do. 5 % Perp. Deb.	100	5	5	92½ — 94½	+ ½	5 6 0
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80 xd	..	5 12 9
Central London Railway, Ord.	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	83 — 85	..	4 14 3
Dc. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1903	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88 xd	..	4 11 0
Hastings Trams, 6 % Pref.	1	6	6†	21/32 — 23/32	+ 1/32	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord.	1	..	..	3/16 — 9/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	17/32 — 21/32	..	7 12 8
Do. Do. 4½ % 1st Deb.	100	4½	4½	78 — 83	..	5 8 5

NAME.	Stock or Share.	Dividends for		Closing Quotations May 19th.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 6
London United Trams, 4 % Deb.	100	4	4	56 — 60	..	6 13 4
Metropolitan Railway Consol.	100	1⅜	1⅜	39½ — 40	—	3 15 0
Do. Surplus Lands	100	2¾	2¾	62 — 64	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	..	4 6 4
Metropolitan District Ord.	100	Nil	..	26 — 26½	— ½	Nil
Do. 6 % Deb.	100	6	6	138 — 141	..	4 5 3
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 86	—1	5 4 8
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 13 0
Potteries, Ord.	1	3½	3½	5/16 — 7/16	..	8 0 0
Do. 5 % Pref.	1	5	5	17/32 — 21/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81¼ — 84¼ xd	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	7⅞ — 8⅛	— ⅛	Nil
Do. "A"	1/-	..	..	11/32 — 13/32	— 1/16	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	116 — 117	+1	5 2 7
Do. 4½ % Bonds	100	4½	4½	99½ — 101½	..	4 8 8
Do. 6 % Income	100	6	6	88½ — 89½	— ½	6 14 1
Yorkshire (West Riding), Ord.	5	Nil	..	5/16 — 9/16	..	Nil
Do. 6 % Pref.	5	3	4	4¾ — 4⅞	..	4 2 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅝ — 4⅞	..	5 12 10
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 7/16	..	6 4 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4½ % Deb.	100	4½	4½	98½ — 101½	..	4 8 6
Do. 5 % Deb.	100	5	5	96½ — 98½	..	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	103 — 106	..	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11¼	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	99 — 101	..	4 19 0
Brazilian Traction, Light and Power	$100	6	6†	79½ — 81½	+2	7 7 3
Brisbane Trams Invt., Ord.	5	8	8	7½ — 8	..	5 0 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 — 101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	111 — 115	..	6 19 4
Do. Pref. Ord.	100	6	6	104 — 108	..	5 11 1
Do. 5 % Pref.	100	5	5	102 — 105	..	4 15 2
Do. 4½ % 1st Mort. Deb.	40	4½	4½	96 — 99	..	4 11 1
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	93½ — 95½	..	4 9 1
Calcutta Trams, Ord.	5	7½	9½	6½ — 7	..	6 15 9
Do. 5 % Pref.	5	5	5	5 1/16 — 5 5/16	+ 1/16	4 14 3
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 18 4
City Buenos Aires Trams (1904)	5	5	5	5 3/16 — 5 7/16 xd	..	4 11 11
Do. 4 % Deb.	100	4	4	92 — 97	+1	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie El. Trams 5% A Deb.	100	5	5	84 — 89	..	5 12 4
Do. 6% B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord.	1	..	..	¼ — ½	..	..
Do. Pref.	1	4⅜d.	6	23/32 — 31/32 xd	..	6 5 0
Lisbon Elec. Trams, Ord.	1	6	6	1 3/32 — 1 11/32 xd	..	4 9 3
Do. 6 % Pref.	1	6	6	15/16 — 1 1/16	..	5 1 0
Do. 5 % Deb.	100	5	5	95 — 100	..	5 0 0
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
„ Elec. Tr. (1904), Deb.	100	5	5	101 — 103	..	4 17 0
Manaos Trams & Lt., 1st Deb.	100	5	5	78 — 81	..	6 3 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ — 100½	..	4 19 6
Mexico Trams Com	$100	7	7	67 — 71	+6	..
Do. Gen. Con. 5 % Bonds	..	5	5	77 — 81	+1	6 3 5
Do. 6 % Bonds	100	6	6	74 — 79	+2	7 11 10
Para Elec. Rlys. & Lt., Ord.	5	10	10	3⅞ — 4⅜	..	11 8 6
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	86½ — 89½ xd	..	5 11 8
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	95½ — 97½	+1	5 2 8
Do. 5 % Mort. Bonds	100	5	5	87½ — 89½	— ½	5 11 9
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	96 — 100	..	5 0 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	92½ — 95½	..	5 4 9
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10⅜ — 10⅞	..	5 10 4
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 9
Brompton & Kensington, Ord.	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91½ — 94½	..	4 4 8
Charing Cross, West End & City	5	5	6	4⅞ — 5⅜	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅝	+ ⅛	4 17 4
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4⅝ — 5⅛	+ ⅛	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10	16 — 17	..	5 17 8
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	..	4 9 0
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 7 4
Do. 4½ % Second Deb.	100	4½	4½	100 — 103	..	4 8 1
County of London, Ord.	10	6	7	11¾ — 12¼	..	5 14 3
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜	+ ⅛	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	103 — 106	..	4 5 3
Do. 4½ % Second Deb.	Stock	4½	4½	98 — 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	5/16 — 9/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3½ — 4	— ⅛	7 10 0
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9

Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½ — 8	..	5 12 0
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅜ — 1¾	..	5 2 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	92½ — 94½	+ ½	4 3 9
Metropolitan	5	4½	4½	3¼ — 3¾	..	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 — 100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 — 101	..	4 19 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10¾	..	5 14 3
Oxford	5	7	7	5 13/16 — 6 3/16	..	5 11 0
St. James' and Pall Mall, Ord.	5	10	12	9¼ — 9¾	+ ⅛	6 3 1
Do. 7 % Pref	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2¾ — 3⅛	..	6 10 4
Do. 5 % First Mort. Deb.	100	5	5	99 — 102	..	4 18 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	Nil	..	5/16 — 9/16	..	..
Do. 5 % Cum Pref.	5	3‡	4	2½ — 3	..	6 13 4
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 13 6
Westminster, Ord.	5	10	10	8¼ — 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4 15/16 — 5 3/16	..	4 6 9

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* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 19th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 11 7
Calcutta, Ord.	5	8½	9	7⅛ — 7⅜	..	5 14 3
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	+ 1/16	4 16 7
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	5 8 0
Canadian Gen. El. Com.	$100	7	8	105 —110	..	7 5 6
Do. 7 % Pref.	$100	7	7	117 —122	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 — ⅝	..	7 12 0
Do. 5 % Deb.	100	5	5	87 — 90	..	5 11 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	83 — 88	—1	6 16 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½—95½	..	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	4	¼ — ½	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 —105	..	4 15 2
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	104 —107	..	4 13 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	58 — 63	..	7 18 10
Mexican Lt. & Power, Common	$100	4	4†	37 — 42	+5	..
Do. 7 % Cum. Pref.	$100	7	7	68 — 73	+1	9 11 5
Do. 5 % 1st Mort. Gold Bds.	..	5	5	68 — 73	—1	6 17 0
Do. 5 % 2nd Mort. Bonds	100	5	5	59 — 64	—1	7 18 3

NAME.	Stock or Share.	Dividends for		Closing Quotations May 19th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	50 — 54	..	..
Montreal, Lt., H. and Power	$100	9	10†	220 —225 xd	..	4 9 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 —245 xd	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 —103 xd	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5½	6	134 —138	+1	4 7 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	99½ - 101½ xd	..	4 8 8
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	98 —100 xd	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	86 — 88	—1	5 13 8
Victoria Falls Power, Pref.	1	6	6	23/32 — 25/32	..	7 18 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	+1	5 14 3

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 19th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	23/32 — 27/32	..	8 5 0
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	6 17 2
Babcock & Wilcox	1	16	16	2 15/16 — 3 1/16	..	5 4 7
Do. Pref.	1	6	6	1¼ — 1⅜	..	4 7 6
British Aluminium, Ord.	1	..	5	15/16 — 1 1/16	+ 1/32	4 14 1
Do. 6 % Cum. Pref.	1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	97 —100	..	5 0 0
Do. Deb. Stk.	100	5	5	90 — 95	+2	5 5 3
B.I. & Helsby Cables	5	10	13	9¼ — 9¾	..	6 18 4
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	101 —104	..	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	2	Nil	5	1 7/16 — 1⅝	+ ⅛	6 3 0
Do. Deb.	100	4	4	73 — 75	..	5 6 8
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	49 — 53	..	8 10 0
Do. 4½ % Second Deb.	100	4½	4½	29 — 33	..	13 12 8
Callender's Cable	5	15	15	11⅞ — 12⅜	+ ⅛	5 13 7
Do. Pref.	5	6	6	5 — 5½	..	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	22½	2 9/16 — 2 13/16	+ 1/32	8 0 0
Do. Deb.	100	4½	4½	104 —107	..	4 4 1

NAME.	Stock or Share.	Dividends for		Closing Quotations May 19th.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17
Dick, Kerr	1	Nil	..	⅜ — ⅝	..	..
Do. Pref.	1	6	6	21/32 — 25/32	..	7 18
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	1	5	6	⅝ — ¾	+ 3/32	8 0 0
Do. Pref.	1	7	7	1 — 1⅛	+ 1/16	6 4 5
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 18 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10¼ — 10½	..	5 14 8
Do. Deb.	100	4	4	87 — 91	..	4 8 0
Henley's, Ord.	5	15	20	14½ — 15½	+ ½	6 9 0
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	101½—105½	..	4 7 0
India-Rubber, G. & T.	10	7½	7½	10 — 11	..	6 16 5
Do. Pref.	10	5	5	8¾ — 9¼	..	5 5 8
Telegraph Construction	12	20	20	86½ — 88½	..	6 4 7
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	64 — 68	..	5 17 8
Do. B 4 % Cum. Pref.	100	..	£4	42 — 46 xd	—1	8 14 0

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 19th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾ — 6¼	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 —127	+1	6 6 0
Do. Collat. Trust	$1000	4	4	90 — 93	..	4 6 0
Anglo-American Telegraph	Stock	3	3	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	108¼—109¼	+ ½	5 10 1
Do. Def.	Do.	30/-	30/-	23⅛ — 23⅜	..	6 7 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	6†	7 3/16 — 7 7/16	— 3/16	5 7 5
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	78 — 80	—1	5 0 0
Cuba Telegraph	10	6	6†	8½ — 9½ xd	..	6 6 4
Do. 10 % Pref.	10	10	10	16 — 17 xd	+ ½	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7¼ — 7¾	— ¼	6 9 0
Direct United States Cable	10	4	4	6½ — 7	..	5 14 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	+1	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	130 —133 xd	..	5 5 3
Do. 3½ % Pref. Stock	Do.	3½	3½	77 — 79 xd	..	4 8 9
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 3 4
Eastern Extension	10	7	7	12½ — 13 xd	..	5 7 9
Do. 4 % Deb.	Stock	4	4	94½ — 96½	..	4 8 0
Globe Telegraph and Trust	10	6	6†	10⅞ — 11⅜	..	5 5 4
Do. 6 % Pref.	10	6	6	12½ — 13	..	4 12 4
Great Northern Telegraph	10	20	20	81 — 83	..	6 1 1
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	5	5	81 — 84	..	5 19 1
Do. 4 % Cum. Pref.	$100	4	4	68 — 71	..	5 12 7

NAME.	Stock or Share.	Dividends for		Closing Quotations May 19th.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph	1	20	20	3 1/16 — 3 3/16	— 1/16	6 6 6
Do. 7 % Cum. Partic. Pref.	1	17	..	2 7/16 — 2 11/16	— 1/16	6 6 6
Monte Video Telephone, Ord.	1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Pref.	1	5	5	23/32 — 27/32	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99 —100	+ ½	4 10 0
Oriental Telep. and Elec.	1	10	10	2 3/16 — 2 5/16	..	4 6 7
Do. 6 % Cum. Pref.	1	6	6	1 7/32 — 1 9/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	87½ - 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	7	8½ — 9½	..	7 7 4
Submarine Cables Trust	Cert.	6	6	126 —129	+ 1	4 18 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 — 100	..	4 10 0
United River Plate Telephone	5	8	6†	6¼ — 6¾ xd	+ ⅛	5 18 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅝	..	4 9 0
West Coast of America	2½	2½	Nil	⅞ — 1⅛	— ⅛	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	1¼	2⅛ — 2⅜	..	5 5 3
Do. 6 % Cum. 1st Pref.	10	6	6	9⅞ — 10⅜	..	5 18 5
Do. 6 % Cum. 2nd Pref	10	6	6	8⅞ — 9⅜	..	6 11 6
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	10	7	7	13⅝ - 13⅞	..	5 1 11
Do. 4 % Debs.	Stock	4	4	95½ - 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	93 — 96	..	4 18 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Lightning Damage at Cape Town.—Our Cape correspondent states:—"A severe thunderstorm broke over the Cape Peninsula recently, and did a considerable amount of damage to electric lighting installations. Unlike the districts further north, the thunderstorms in the Cape Peninsula are usually of such a feeble character that no special precautions have been taken against lightning discharges damaging house installations by means of the overhead wires. During the storm in question, however, in many instances the lightning entered the houses and blew the distributing fuseboards to atoms; the house of the Mayor of Greater Cape Town was damaged in this way."

Fire on the Rand.—Our Cape correspondent writes to state that "a fire broke out on May 1st in the Victoria Falls power station near the Robinson Mine. In some manner unexplained the transformers caught alight, and being filled with oil, there was a dangerous flame within a few minutes, jeopardising the main buildings, which are three storeys high. The manager of the adjoining mine assisted the brigade in the water supply, and after strenuous efforts the firemen were successful in overcoming the fire. The damage is estimated at £3,000."

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING APRIL, 1914.

The April returns of electrical export and import business, which we publish herewith, are only satisfactory in that they do not reflect to any great extent the general reports of declining trade.

These returns show some falling off all round as compared with the March figures, but are at a higher level than in February, and include the Easter period.

The exports reached a total value of £485,534, as compared with £498,145 recorded for March, and deducting the value of the telegraphic business, some £77,000 for the month, the value of the remaining general business was appreciably below the monthly average obtaining last year.

The imports, on the other hand, with a total of £273,205, which compares badly with the previous month's £292,579, were still considerably ahead of the monthly average (£245,000) in 1913.

The re-exports total of £22,190 is the lowest so far recorded this year, and compares with £21,810 in March.

The only satisfactory sections of the export returns were cables, batteries and telegraphic material, and the falling off in electrical machinery exports accounts largely for the poor month's returns.

Machinery imports, however, were somewhat higher than in the previous month, the greatest drop in the imports occurring in telegraphic and telephonic business.

The Indian market still remains an excellent one for British products, while it is noticeable that United States importers increased their electrical business with us by some £24,000 on the month.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephone cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,714	425	...	130	1,599	347	7,754	116	80	67	131	2,195	14,558
Germany	4,403	1,580	41	...	296	8	2,035	...	15	96	60	590	9,124
Netherlands, Java and Dutch Indies ...	834	788	324	...	21	126	2,330	135	47	51	4	253	4,913
Belgium	726	211	194	31	52	25	3,222	437	18	...	1,410	...	6,326
France	548	31	2,364	42	...	7	9,976	66	95	80	125	1,167	14,501
Portugal	50	10	12	28	...	...	107	2,430	...	...	478	462	3,577
Spain, Canary Isles and Spanish N. Africa...	1,104	63	68	10	...	245	3,884	...	...	232	275	241	6.122
Switzerland, Italy and Austria-Hungary ...	1,678	93	141	...	13	22	3,616	...	129	611	166	487	6,956
Greece, Roumania Turkey and Bulgaria ...	358	451	96	...	...	...	187	...	9	12	...	1.851	2,964
Channel Isles, Gibraltar, Malta and Cyprus...	84	220	136	112	39	127	445	...	...	...	99	108	1,370
U.S.A., Philippines and Cuba	302	9,447	...	15	...	138	648	5	96	...	134	939	11,724
Canada and Newfoundland	971	343	1,700	644	49	417	6,088	...	258	31	555	1,009	12,065
British West Indies and British Guiana ...	315	...	30	25	...	200	137	...	...	...	2	119	828
Mexico and Central America	34	...	...	18	...	...	47	...	9	...	84	9	201
Peru and Uruguay	214	...	71	76	...	...	1,025	...	20	6	2	147	1,561
Chile	870	277	53	215	18	...	2,926	...	13	...	31	...	4,403
Brazil	1,740	313	531	40	...	1,218	9,210	5,191	223	29	21	2,230	20,746
Argentina	5,967	7,273	649	1,214	1,328	704	13,647	13	1,057	51	516	1.612	34,031
Colombia, Venezuela, Ecuador and Bolivia...	1,042	345	284	...	...	...	1,019	...	...	...	5	328	3,023
Egypt, Tunis and Morocco	476	36	87	106	...	18	2,064	10	825	...	275	1,426	5,323
British West Africa	180	217	14	66	...	932	194	...	164	...	21	8.769	10.557
Rhodesia, O.R.C. and Transvaal	1,679	2,757	78	654	44	69	2,069	2,015	313	46	51	53	9,828
Cape of Good Hope	1,187	1,944	447	462	35	479	5,755	...	165	...	1,867	1,210	13,551
Natal	1,199	5,813	147	174	212	...	9,437	397	565	17	1.397	1,150	20,508
Zanzibar, Brit. E. Africa, Mauritius & Aden	949	246	233	63	...	26	361	5	2	...	865	437	3,187
Azores, Madeira and Portuguese Africa ...	241	774	111	251	...	45	300	...	...	...	42	357	2,121
French African Colonies and Madagascar...	...	...	...	18	...	...	122	...	...	...	...	4,634	4,774
China and Siam	1,002	13,060	125	...	...	312	3,659	63	154	149	61	485	19,070
Japan and Korea	266	178	29	68	...	270	11,176	...	2,614	45	18	31,844	46,508
India	4,841	17,822	3,522	1,970	461	1,486	28.541	2,713	7,035	525	569	6,330	75.915
Ceylon	445	172	235	...	...	...	396	12	76	...	205	...	1,541
Straits Settlements, Fed. Malay States and Sarawak	1,463	996	592	87	78	164	4,468	461	359	98	215	866	9,847
Hong Kong	415	96	234	...	11	299	27	822	1,225	38	14	376	3,557
West Australia	1,345	1,249	4	244	...	20	1,293	1,545	211	16	12	...	5,939
South Australia	176	514	91	533	...	526	2,139	...	130	...	54	212	4,375
Victoria	356	4,575	661	965	311	1,229	6,077	233	345	...	19	774	15.545
New South Wales	1,921	2,532	483	915	773	1,606	21,409	734	...	147	3,402	3,026	36,948
Queensland	209	1,512	66	292	68	264	1,766	...	105	...	1,484	1,877	7,643
Tasmania	31	196	...	...	...	...	186	...	...	...	154	...	567
New Zealand and Fiji Islands	1,262	2,701	1,244	1,166	52	141	16,539	1,250	985	10	3,887	...	29,237
Total, £	42,597	79,260	15,097	10,634	5,460	11,470	186,281	18,653	17,342	2,357	18,710	77,573	485,534

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephone cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	581	...	...	135	...	...	4,123	...	1,099	60	6,611		12,609
Germany	4,678	22,942	2,705	9,239	6,023	2,483	91,835	2,117	3,205	8,052	6,542		159,821
Holland	...	104	...	209	617	...	7	...	13	220	...		1,170
Belgium	898	2,314	...	131	7	...	4,245	...	180	873	3,354		12,002
France	...	680	1,493	1,837	212	26	1,246	...	1,436	3,361	905		11,196
Switzerland	211	383	...	26	44	612	947	8	...	82	81		2,394
Italy	55	6,514	...	...	45	...	207	...	...	218	323		7,362
Austria-Hungary	24	770	...	339	20	...	16	...	215	53	...		1,437
United States	10,194	34	2,124	34	672	80	17,407	26,460	984	305	6,227		64,521
Total, £	16,641	33,741	6,322	11,950	7,640	3,201	120,033	28,585	7,132	13,224	24,043		272,512

Additional imports : Spain, carbons, £410. Canada, electrical goods, £113 ; machinery, £170.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephone cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above... ...	12,864	886	...	829	451	...	5,215	...	604	1.277	64		22,190

Total Exports : £485,534 Total Re-Exports : £22,190 Total Imports : £273,205

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

FINLAND AND ITS WATER POWER.

FINLAND has an area of 373,604 sq. km., and a population of 3 millions. About 41,659 km.^{2}, or 11 per cent. of the total area, is occupied by lakes, and the number of these is so immense that the country in poetry is called "the land of the 1,000 lakes." In the central and southern parts the number of lakes is greatest, and through the south-western part the River Kumo flows into the Gulf of Bothnia. During the dry season the flow of water in this river is about 160 cb. m. per second, which goes up to 570 m.^{3} per second at the high-water mark. In the north there is the large lake Näsijaroi, which has a length of 100 km. At the place where the rivers from this and another lake come together, they form the Tammerfors waterfalls, which have a height of 18 m., and a flow at low-water mark of 63, and at high-water mark of 164 m.^{3} of water per second. Here is situated the town of Tammerfors, which has a population of 43,700, and is one of the industrial centres of Finland.

In the southern part of the country is the Paijänne Lake, which has a length of 250 km., and from which runs the River Kymmene with a flow of 180—300 and 400 m.^{3} per sec. at low, middle, and high-water mark. This river forms along its course a number of waterfalls and rapids, of which the most important are :—

	Height of the fall.	*Available E.H.P.*
Voikka	6·60 m.	9,240
Kuusaukoski	9·50 ,,	13,300
Myllikoski	7·80 ,,	10,900
Keltis	5·10 ,,	7,140

In the south-eastern corner is the Saimaisjö, a lake with a number of branches. From this flows the Vuoxen river, which is about 148 km. long and runs with considerable speed into the sea of Ladoga, in Russia. The flow of water is 480, 570 and 660 m.^{3} per sec. In its upper course there are 13 waterfalls on the short distance of 25 km., viz. :—

	Width. Metres.	Height of the fall. Metres.	Capacity, E.H.P.	
			Greatest.	Smallest.
Niskaskoski ...	190	1·60	17,000	8,500
Tainionkoski ...	70	5·9	44,000	31,000
Linnakoski ...	170	5	37,000	26,000
Imatra	20	18·3	138,000	98,000
Kyyronkoski Myllikoski Vallinkoski	115	10·4	78,000	55,000
Räikköläukoski ...	45	8·8	66,000	46,500
Rouhialoukoski ...	60	7·5	56,000	39,500

The remaining four have not been measured as yet.

Most of the rivers in the central part of the country are running into the Saimasjö, and by regulation it should be possible to obtain between 300,000 and 400,000 E.H.P. from the Vuoxen River.

In the northern part there are not so many or so large waterfalls as in the south; amongst them may be mentioned the Kajana Falls and those formed by the Ulea River.

Up to the present time only comparatively few of the many waterfalls have been harnessed, and then chiefly by private people in the pulp, paper and chemical industries. Experts have, however, long been pointing out what an immense economic loss to the country it is to employ foreign coal or wood as fuel for locomotives, when the country has such an abundance of energy available in the form of water power.

Several foreign, Finnish and Russian Banks and financiers have, however, had their attention directed towards this important question, and have made a start with the harnessing of waterfalls for the production of energy for railways, lighting, and industry, and the State is also engaged on the same matter.

A German financial syndicate, consisting of the Deutsche Bank, Bank für Handel und Industrie, and Elektrische Licht und Kraftanlagen A.G., has thus bought the Vallinkoski and part of the Rouhialoukoski Waterfall for a total sum of nearly £250,000.

The railway authorities are now considering a project for the electrification of three different railway lines, the total length of which is 678 km. Among these is the line between Wiborg-Helsingfors and St. Petersburg, for the running of which there will be required 33,000 H.P., which will be derived from the Vallinkoski waterfall.

Another syndicate has been formed in Brussels for the acquisition of those waterfalls in the Vuoxen River which are in private hands, and some Russian groups are also making preparations to get their share of the Finnish waterfalls.

The Finnish Senate has had plans worked out for the harnessing of the Imatra Waterfalls and a couple of others in the Vuoxen River, and in the preparation of these plans special precautions have been taken with the view of avoiding injury to the beauty of the surrounding scenery. Part of the energy to be produced by these falls will be employed for the electrical towing of ships in the Saima Canal. This canal, which connects the southern part of the Saima Lake with the Gulf of Bothnia, was opened for traffic in 1856, and has a length of 59·3 km. The width at the bottom is 11·9 m., which, however, is reduced to 7·4 m. at those places where the canal has to pass rocks. The depth is 2·7 metres. The difference in height between the sea and the level of the Saima Lake is 75·9 m., and there are in all 28 locks, through which the vessels have to pass. In 1910 the number of boats passing through this canal was 7,000. It has been designed for vessels with a maximum length of 31·2 m., a width of 7·1 m. and a draught of 2·5 m.

ELECTRIC BATTERY VEHICLES.

THIS subject was discussed by the SCOTTISH LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS on March 24th. For an abstract of Mr. F. Ayton's introductory statement see ELECTRICAL REVIEW, page 557.

MR. HALLEY CRAIG (Glasgow) said he thought the results spoken of by Mr. Ayton justified them in saying that there was no doubt a field for the electric vehicle. But the petrol vehicle held the field at present, and before they could expect a share of the business a great deal of uphill work had to be done. He, personally, was much interested in the Edison battery as against the lead batteries. He spoke with 20 years' experience of lead batteries, and he suggested that if the Corporation of Glasgow and other power producing concerns would provide charging facilities on more extensive lines than at present, the popularity of the electrically-driven vehicle would be sure to improve.

MR. WATSON (London) thought that the Corporation of Glasgow, with its good charging facilities, should indicate where such vehicles could be charged. Enthusiasm for the electric vehicle was rapidly developing. There was no doubt that the bulk of municipal work in the next few years would be taken up by electrically-propelled vehicles. The Edison accumulator business, established here two years ago, while not actually trading in batteries, could take the credit of opening up and causing an interest in active work in this direction. Some time ago they had orders at the rate of one a week; now they had increased to two a week, and from the number of inquiries which were being received they anticipated that it would soon be three a week. He was confident that the increase would be very rapid, for in America he was informed that the numbers of electrically-propelled vehicles had risen from 23,000 to 30,000 since Christmas. Good charging facilities were, however, most essential. The manufacturers were doing their utmost to get assistance from central-station engineers, and some of the latter had acquired electrical vehicles, which was a sign that they believed in what they were preaching. When electric vehicles were sold they were supplied with an ampere-hour meter, which showed at a glance the position in which the van stood with regard to current, and if the van was let down it was to a certain extent the driver's fault. He was present at a test which was made recently for a firm of brewers. The van was a 2-ton vehicle, and the load, besides that of four men, was 2 tons 17 cwt. The van was capable of doing 40 miles in very dry weather, though 45 could be got out of it. The van was driven right across London to the top of Highgate Hill. With special instruments for taking the readings he found that they were taking 80 amperes on the flat, at the foot of the hill 140 amperes, and at the highest point 240 amperes. They returned at 35 miles per hour to the garage three or four miles away, and he discovered on calculating that the total consumption was 48 units, equal to a cost of four shillings. When they got figures like that they would agree that there must be a future before the electrically-propelled vehicle.

PROF. BAILEY (Edinburgh) said they must put down practically the whole of the success attained to the Edison battery. If they had a battery running, say, four years, with running costs one-third the cost of petrol, the case for the electric vehicle was made out. The only trouble was the expense of the accumulators at the present moment, and the price of the car would have to be brought down to compete with the petrol vehicle. It was difficult to make a saving in the running cost in the case of the private pleasure car, and the extra cost in the case of the electric battery in the first instance would militate against it. Then there was the difficulty of charging, and in his opinion a special machine would have to be brought out if a man was to own his own charging plant at a reasonable price.

MR. W. W. LACKIE (Glasgow) stated that the electricity department of the Glasgow Corporation had had an electric vehicle in use for a year, and, from the returns which he had had prepared, he was satisfied that the vehicle was doing the work of two horse vans. A horse and van could be hired in Glasgow for £12 to £14 a month, and the electric vehicle cost them about £24 a month, but whereas the horse and van were only available for 10 hours a day from Monday to Friday, for four hours on Saturday, and not at all on Sunday, the electric vehicle was available for seven days a week and 24 hours a day. It was agreed that the petrol car had a sphere for which the electric car at its present stage was not suited, but for town work there was no doubt at all that the electric vehicle had many advantages over the petrol car. In Chicago, last year, he saw (without exaggeration) hundreds of electric pleasure vehicles, and many of these were driven by ladies. It was a common thing there for a lady and gentleman to drive to the theatre, leave the car at the theatre door, and drive home again when the performance was over. Mr. Dalrymple (the tramways manager) mentioned in his report of his recent tour in the States that he saw hundreds of people going to business daily in Detroit with their own cars, which they simply left in the street until the time came for returning home in the evening. These, however, were Ford cars driven with petrol. He was told that in Chicago there were 700 electric commercial vehicles and 3,000 pleasure electric vehicles, as against about 1,800 petrol cars. In Glasgow there were about 3,000 motor-cars, 1,600 motor cycles, and 200 heavy motor vehicles, a total of 4,800, all of them petrol driven, of course, with the exception of the electric vehicle belonging to the electricity department. If the electric vehicle could be brought down to the price of the petrol car, there was no doubt that it would stand comparison in other respects. He would certainly be satisfied with 10 per cent. depreciation on an electric vehicle, whereas it was customary to write off 20 to 25 per cent. in the case of a petrol car. With electricity at 1d. per unit the cost of fuel was one-third what it was for petrol. There was one point about which he was not satisfied at present, viz., the adoption of 110 volts as the standard pressure for charging batteries. This pressure had been adopted from American practice where they had never gone in for 200 and 250 volts for lighting purposes. He thought it would simplify matters very much if the battery makers would supply in this country a battery suitable for plugging on to a 250-volt circuit with a small resistance. He learned in New York that one company was prepared to supply either an Edison battery or a lead battery, but the price for the Edison battery was much higher than the price for the lead battery, the Edison battery costing about three times as much as the lead one. The lead battery was guaranteed to do 9,000 miles, and after that it could be renewed for £40. It would appear that if the Edison battery lasted for four years, which it was guaranteed to do, it was to be preferred to the lead battery. The cost of a lead battery was £72, and of the Edison battery £201 for a half-ton truck.

Mr. W. L. Spence (Glasgow) thought that if the electric-battery vehicles were to be adopted, they would have to be more moderate in capital cost than at present. Few people could afford to have electric-battery vehicles at the present high prices, and as electrical engineers they were wise in not boasting too much of the Edison battery from the commercial point of view. The capital cost was high, and there was no immediate prospect of its reduction. The commercial point of view was first cost, and he thought it would pay to use lead batteries, because of the very reduced cost and the possibility of a further reduction at an early date. The motors most used seemed to be series-wound, and he thought it an extraordinary mistake with a storage battery, which was essentially a constant-voltage affair; there ought to be a motor to suit it. With series motors all control was necessarily rheostatic. They might have commutation and combination of battery cells, but that in battery practice was not a good scheme. It was much better to keep their battery as a single block, and for that purpose they were better with a shunt-wound motor. He suggested that a motor with a speed range of 20 miles should be used. After all, the petrol motor was hardly comparable with the electric motor. It was a continuous-torque machine, and could be driven upon top speed. Mr. Spence showed a diagram of an electric vehicle, the principal feature of which was the shunt winding, variable-speed gear and double traction gear driving upon a live axle. With an apparatus of this sort the battery would not run to any excessive cost, and the chassis without the body should not cost more than £75 or £80.

Mr. Robertson (Glasgow) was of opinion that doctors and other professional men would favour the electric vehicle if they had some method of charging at their own homes. The electric vehicle was far and away the best for the professional man because of the ease of control, absence of vibration, cleanliness, and the fact that it could be started from the seat. He thought some way might be arrived at so that batteries could be standardised. If that were done and some kind of exchange set up, this form of traction would become very much more popular. He suggested the establishment of roadside depôts for recharging or supplying batteries, but standardisation of voltage was necessary.

Mr. Seddon (Edinburgh) hoped it would only be a question of a short time before the electric vehicle took a large share of the traffic. He agreed with the previous speaker that the shunt motor appeared to be of higher efficiency upon a general line of running with the motor connected across the terminals of the battery. With regard to the cost of Edison batteries, he believed that if the price went down it would tempt people to take a bigger interest in the batteries, and judging from the number of lead cells in use, one could readily appreciate the fact that the Edison battery was too high in cost.

The Chairman (Mr. J. A. Robertson, Greenock) also spoke on standardisation. He thought this was one of those cases where standardisation did not mean stagnation as in other branches of industry, and they could put a much better design on the market here than in America, where the industry had developed very rapidly. It might be asked why they were so very far behind in this country, with little or no development in the electric vehicle industry, while in the United States there were 37,000 in use, and on the Continent large numbers were to be seen. He thought one of the reasons was the want of co-ordination between the manufacturing industry and the generating industry. In America the supply was in the hands of the manufacturers, and in this country it was in the hands of the municipality, and that might be a disadvantage. He thought, however, that the largest development was to be looked for in this country from the commercial vehicle for some years to come, and the municipalities were in a position to take the lead over any private company. They required a large number of vehicles for different purposes, for refuse collecting, street sweeping and street watering, and for other purposes, and for these the electric vehicle was suitable. Mr. Page showed slides of the Paris garage and the motor-vehicles there. He was in Paris in May on the occasion of the Institution meeting, and went to see one of the new destructors put up there, and at the same time saw one of these machines which had been in use for a year and a-half, and seven which had been in use for shorter periods. As a result of these experiments the Paris municipality had at that time just decided to change from the horse-drawn service to the electric vehicle. After making trials with petrol and electric vehicles, and comparing them with horse service, they had come to that decision. He was not at liberty to give figures, but these showed a decided saving over horse traction, and a decided saving over petrol, the ratio being approximately 60 per cent. for electric vehicles against 100 for petrol. His experience in Greenock was that a petrol-driven motor worked out at 2·1d. per ton-mile. He was speaking of a commercial motor, 4 tons, operating in a fairly hilly district, and 2d. per ton-mile was not an expensive figure, particularly for their district. The lead cell had hardly been done justice to, but he thought for these heavy commercial vehicles there was a great future still for the lead cell, and those wagons he saw in Paris were fitted up with lead cells. Mr. Edison had given them a cell with distinct advantages over the lead cell, and one which for the light pleasure vehicle was more suitable than the lead type could be.

Mr. Page, who read the paper in the author's absence, in the course of his reply said the suggestion that the electric vehicle manufacturers should get out batteries with a voltage of something like 200 volts was about the likeliest way out of the difficulty if space could be found for the batteries. In cases where charging facilities were required, the Glasgow Corporation would not be found wanting. It was good news to hear from Mr. Watson that orders were going up in number, but they would certainly be more if Mr. Watson's firm would cut down the first charge. The Glasgow Corporation electric van cost £560 without the body, which came to about £45, so that the overall price was in the neighbourhood of £600, and they got a petrol van to do the same work for about £400. The field of the electric car was definite and clear to them at present. They were not out to try to compete with petrol cars and he did not think they would. The lead battery as compared with the Edison battery had at least double the weight, and that that would militate considerably against the extensive use of lead batteries. He did not agree with the shunt-wound motor, and if they were going into the gearing question they would lose one of the soundest arguments for pushing electric vehicles, and that was simplicity of control.

THE FIRST ELECTRIC RAILWAY IN SPAIN.

The Southern Railway Co. of Spain serves the important territory between Linares and Almeria, and, in particular, the mining districts in the province of Santa Fé. Practically the whole of the 14 miles of single track between Gergal and Santa Fé comprises gradients of 1 : 35, and by the year 1906 mineral traffic had become so heavy that steam working was very difficult on this route. The average weight of empty trains ascending to Gergal is 150 tons, and of laden trains descending to Santa Fé is 450 tons. It was decided to adopt three-phase electric traction for goods and mineral service retaining, at least temporarily, steam traction for the comparatively unimportant passenger service. The speed of ascent has since been raised from 7½ to 15½ m.p.h., the traffic capacity of the line being correspondingly increased. It is arranged that up and down trains run in pairs, and pass each other at the intermediate station of Fuente-Sante. The three-phase system was chosen in order to make possible simple regenerative working, to which the contour and general circumstances of the system are very favourable. The heavy descending trains are kept easily and efficiently under control, and light ascending trains are propelled by the energy recuperated.

A steam-driven central station has been erected at Santa Fé, which will be near the centre of the line when the latter is extended to Almeria. A 750-kw. (cos ϕ = 0·8), 6,000-volt, 25-cycle alternator, capable of supplying 20 per cent. overload for half an hour, is driven at 107 r.p.m. by a direct-coupled cross-compound jet condensing Lenz steam engine. The generating set is provided with a 30-ton 16-ft. fly-wheel securing a coefficient of cyclic irregularity of 1 : 250. From this fly-wheel a 25-kw. exciter is belt-driven. Two De Naeyer boilers with 3,050 sq. ft. of heating surface provide 7,700 lb. of steam per hour (11,000 lb. on overload) at 170 lb. per sq. in., and superheated to 300° C. A liquid resistance is installed to absorb automatically any excess of regenerated energy over that required by the ascending train. At present the station lies at one end of the line, and 5,500 volts mean line pressure is maintained by a Tirrill regulator connected through 3·14 sq. mm. pilot leads to a pressure transformer at Fuente-Sante.

Two 8-mm. copper wires are suspended over each track, the rails serving as the third conductor. Over bridges, the wires are carried by tubular iron structures of simple but substantial construction. In tunnels (which vary in length from 312 to 1,050 ft.) the conductors are carried by cross wires anchored to the roofing; the points of suspension of the conductors lie from 15 ft. 9 in. to 16 ft. 6 in. above rail flanges, and the lowest point in the conductors lies 9 in. or 10 in. above the loading gauge. Posts are spaced 1,150 ft. apart on straight, and 720 to 920 ft. on curved track. Arrangements are made for the accommodation of a h.t. three-phase feeder when the line is extended 11 miles to Dona Maria. In the open, the conductors are suspended at a height of 18 ft. 6 in. from span wires attached through Ambroin insulators (porcelain in stations and tunnels), and a strainer to galvanised iron rings which are nailed to the posts after adjusting the height of the conductor. The contact lines are attached to the span wires by special carriers with ebonite and porcelain insulation tested to 10,000 volts. Wurtz lightning arresters are installed at the terminal and intermediate stations. A paste bond was tried, without success, between the rail joints: Carpentier-Riviere flexible bonds are now riveted beneath the rails, and cross connections are made every 100 yd. or so.

The existing rails being retained, it was necessary, in selecting electric tractors, to limit the load per axle to 13 tons. Allowing for the steep gradient and the weight of trains to be hauled, it was decided provisionally to use 4-axle, 52-ton locomotives. Instead of using single 640-H.P. 4-axle locomotives, it was decided to use two 320-H.P. 2-axle locomotives for each train, thus securing reserve equipment at minimum cost and providing economical and flexible units for shunting work and the like. When using two locomotives, control is from either cab. The electrical equipment is by Brown-Boveri, the mechanical by the Ateliers Suisse Construction des Wagons. Five tractors are at present in use, the general arrangement and dimensions being as in fig. 1*: four windows and six doors are provided. Each carries a 300-K.V.A., 5,200/450-volt transformer as shown. The motors are 6/12 pole machines of the three-phase squirrel-cage type, rated at 220/160 H.P., 450 volts, 500/250 R.P.M., 25 cycles, and geared 1 : 4·5 to the axles. The weight of each motor, including gears and gear case, is 3 tons, and of the mechanical and electrical equipment on each locomotive, 13 tons each. The normal speed is 15½ M.P.H., but in case of need, and to facilitate starting, the number of stator poles in the motor may be doubled; the maximum speed is thus halved and the tractive effort increased 45 per cent. To improved the starting torque, and to increase the short-circuit current, suitable resistances with large cooling surfaces are mounted between the rotor bars and short-circuiting ring. Five tappings on the low-tension side of each transformer provide for the application of reduced pressure to the motor stator on starting; the necessary switching operations are performed by servo-motors, on each locomotive and a single master controller; complete wiring diagrams are to be found *loc. cit.* The motor characteristics with 6 and 12 poles respectively are :—Full load H.P., 220, 160; R.P.M., 450, 225; cos ϕ, 0·96, 0·87; efficiency, 89 per cent., 85 per cent.; temperature rise on sustained full load output (6 poles, 220 H.P.)—stator windings, 70° C.; stator plates, 52° C.

Each locomotive is provided with a bipolar collector bow; a 6-H.P. transformer ventilating fan; and a compressor capable of compressing 17½ cb. ft. of air per minute to 100 lb. per sq. in. Pressure in the air reservoir is maintained automatically between 80 and 100 lb.; should it fall below 80 lb., for any reason, the overhead contact bows fall, hence the train cannot run when the air pressure required for braking is not available. If the line pressure is low, due to simultaneous heavy demands, it may be necessary to place the motor controller on the 550-volt contact to obtain full rated output; normally the latter is obtainable on the last notch but one (450 volts). To secure maximum efficiency whether of driving or regenerative braking, the motors are operated whenever possible on one of the last two controller notches.

Electrification was effected without derangement of service, and perfectly satisfactory operation has been obtained since electric working was commenced in June, 1911. So long as the time table is observed, the central station has to supply appreciable energy only during starting periods. At other times, energy generated by the descending train suffices to drive the ascending train. Although the motors are exposed continuously to an impalpable dust of iron ore, they have given no trouble.

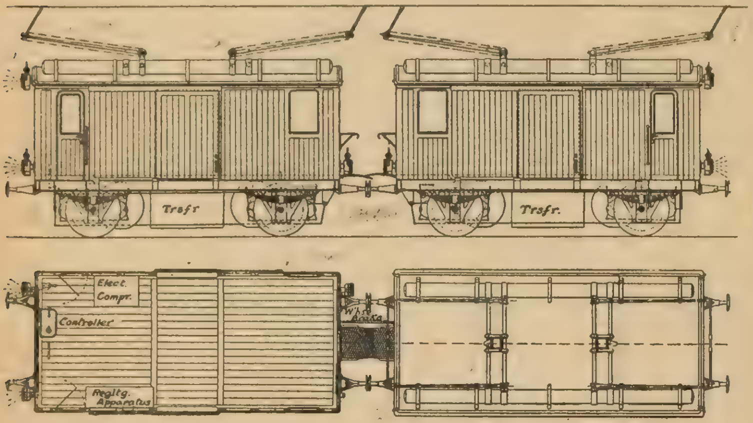

Fig. 1.—Electric Locomotive, Southern Railway of Spain.

Electric Steel Works.—It is announced that the important electric steel works belonging to the Société Electro-metallurgique P. Girod, of Ugine, Savoy, which has a share capital of £480,000, have passed into the possession of Schneider & Co., of Creusot. The headquarters of the former are at Ugine, and the company also has four French branches at St. Gervais, Bionnay, Venthon and Queige, and a further one at Gourtepin, Switzerland. The works, which find employment for 600 men, produce ferro-manganese, ferro-silicon, ferro-tungsten, and all sorts of electro-steel.

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* See also "La Technique Moderne," pp. 170-175, 1914.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Small Power Dynamos, &c.

We have received from the Small Power Dynamo and Motor Co., of Openshaw, copies of their latest list dealing with D.C. dynamos and motors, motor-generators and rotary converters, in sizes from $\frac{1}{16}$ to 3 H.P. squirrel-cage motors, and A.C.—D.C. motor-generators.

The direct-current machines are fitted with slotted drum type armatures running in phosphor bronze bearings provided with ring lubrication. The field coils are former wound; carbon commutator brushes are used. The machines are carefully tested and will carry an overload of 25 per cent. for 30 minutes and 50 per cent. for a few minutes without injurious heating or sparking.

The machines are built of either open, semi or totally-enclosed types; shunt, series or compound wound; and are fitted with ball bearings if required. From the numerous machines illustrated, we have selected the firm's small direct-current rotary converter and totally-enclosed ball-bearing grinding motor for illustration.

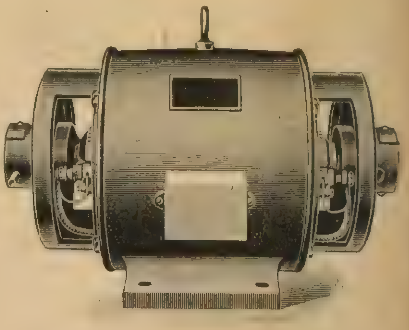

Fig. 1.—Small D.C. Rotary Converter.

The converter, fig. 1, built for outputs between 40 and 700 watts, has a double-wound armature with a commutator at each end, and is designed to run on primary voltages ranging from 100 to 250

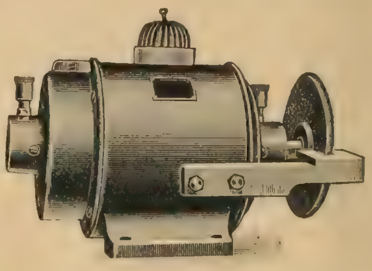

Fig. 2.—Grinding Motor, Small Power D. & M. Co.

The grinding motor, fig. 2, is built in sizes of from ½ to 3 H.P., speed 2,000 to 1,700 R.P.M., and an adjustable tool rest is fitted. Similar machines, but with projecting screwed shafts, are supplied for polishing.

It will be gathered that the company have laid themselves out to cater for the small motor business, and their list contains detailed information as to output, price, &c.

Small Portable Electric Pumps.

The portability of electric power for small pumping operations has, perhaps, not been realised to the very fullest extent, and it is probable that quite a considerable amount of progress can be made in this direction. As an example of one method by means of which this problem has been attacked, we may mention an interesting portable equipment for small work which has been put on the market by the Edwards Manufacturing Co., of Cincinnati. This is shown in fig. 3, and illustrates a very neat form of self-contained vertical drive in which the return water pipes are utilised to act as a bracing for the connecting shaft between the motor and the pump itself. In order to compensate for any slight lack of alignment, should this occur, a form of universal joint is used in the connection between the motor and pump. The working parts of the pump are made of brass, and the rotor is run in ball-bearings and is self-lubricating. As the motor is mounted on the exhaust pipework it sustains its own weight, and as there are no intermediate bearings on the shaft, there is obviously no wear on the parts. It is claimed that for the smaller outputs which are required for pumping out barges, boats, &c., say about 60 gallons per minute, the motor can be put into operation by connecting it to an incandescent lamp socket, and the motor is built either for direct or alternating current. It is furnished with means for swinging if necessary, and as the pump itself is of the valveless type, there is no danger from muddy water, while as the apparatus is self-draining, the occurrence of cold weather does not entail risk of freezing internally contained water.

In larger sizes the pump is specially built for heavy work, and its operation under such circumstances is shown in fig. 4, this plant pumping 350 gallons per minute at the installation of the Marmet Coal Co., Cincinnati. As the motor is hung in a bracket at the top of the pump, the drive shaft is relieved of unnecessary weight. The motor can also be lifted from the bracket and carried separately from the pump if necessary. The motor is waterproof and can thus be operated in rain, and is also air-cooled, preventing the motor from running hot on steady runs. The usual length of standard is 10 ft. For an output of 60 gallons per minute a ½-H.P. motor is installed, while for 250 gallons per minute the motor is of 7-H.P. capacity. For bilge pumping, small drainage services, &c., the pumps appear to offer a very good means of dealing with difficulties.

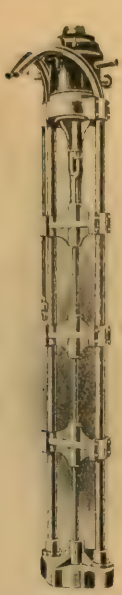

Fig. 3.—Self-contained Portable Pump.

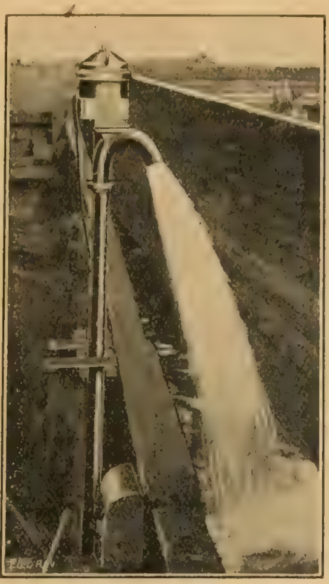

Fig. 4.—Pump in Operation.

Central Lamp Suspension.

Referring to the growing tendency on the part of municipal authorities to suspend lamps centrally over the streets instead of using lamp standards on the kerb, where they impede traffic, the London Electric Firm, of Croydon, point out that the difficulties met with in adopting this plan in streets of irregular frontages can easily be surmounted.

For a considerable period the lighting of the main street of Bromley (Kent) has been carried out largely by means of centrally suspended arc lamps, the traders in this street having insisted on the provision of improved illumination. Where a low building is met with, the suspending cable is either attached to a short pole or to a chimney stack, as shown in the accompanying illustration. There is no difficulty in doing this. The cables are, of course, exaggerated in the view to make them visible.

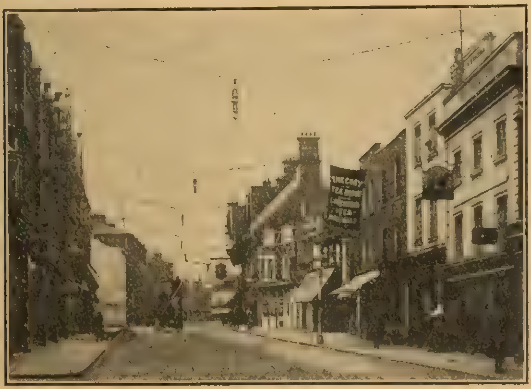

Fig. 5.—Bromley High Street ; Suspended Lighting.

A Simplex Sign.

Electrical contractors should remember that some of the positions which might be profitably employed for placing an electric sign are not appreciated by advertisers. The more unusual the design or application of an electric sign the better chance there is of the subsequent effect being remunerative to the advertisers, and hence there is more likelihood of the contractor making a sale. Firms specialising in this class of work, such as Simplex Conduits, Ltd., Garrison Lane, Birmingham, are always willing and in a position to assist the contractor by suggestions and suitable designs.

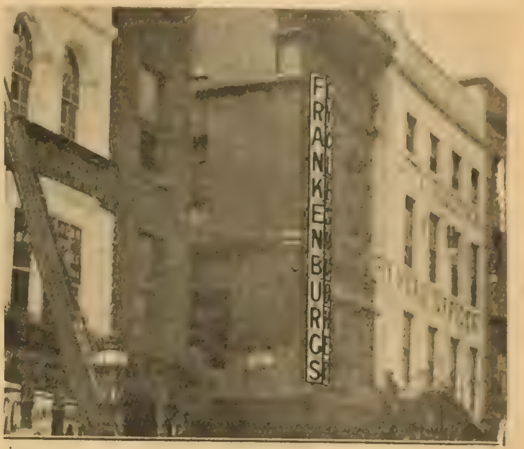

Fig. 6.—Simplex Sign at Birmingham.

The accompanying view, fig. 6, shows a Simplex sign erected in Birmingham. It is three-sided, over 25 ft. high, each letter measuring 24 in., alternate spaces being arranged as a door for changing lamps or inspection purposes. Twenty-four 50-c.p. lamps are used for lighting, and the sign is legible at a great distance.

The Econo Vacuum Cleaner.

Messrs. Duncan Watson & Co., of 62, Berners Street, W., have recently introduced a neat little vacuum cleaner of somewhat similar shape to, but cheaper construction than, their well-known Santo machine. The new machine—the Econo—stands 18 in. high, and is 11 in. in diameter, weighing only 23 lb. It contains a double fan driven by a universal motor, which is easily adapted for use on either A.C. or D.C. circuits. Each machine has a small resistance in the base, which is cut out for alternating-current working by a screw plug. An internal oil reservoir is fitted, which can be filled from outside, and provides the necessary lubrication for many months' use. The parts are standardised ; a metallic suction hose is provided, and the machine taking less than ⅓ unit per hour can be attached to an ordinary lampholder.

Vitreous Tiles.

Messrs. Chance Brothers & Co., Ltd., of 28, Victoria Street, Westminster, have recently brought out a new line of vitreous tiles and mosaics which possess exceptional qualities. These tiles are of granular structure, and are made in moulds which provide them with serrations on the back, so that they take a firm hold of the cement. They are of the same material throughout so that they do not flake or craze, and they can be had in a great variety of colours. The tiles are suitable for facing the walls and floors of engine rooms, &c., and would make an excellent substitute for glass in the flooring of switchboard galleries, being, in fact, closely akin to glass, and capable of being cut with a diamond ; they never become slippery, and, if worn right through, would keep their colour to the last. They can be cut to any shape, and make excellent mosaics, while their cost is quite moderate.

Small Steam Turbines.

Messrs. R. S. Price, Ltd., of 12, Norfolk Street, London, W.C., are introducing small turbines of powers from ½ H.P. upwards, for direct coupling to fans, blowers and turbine pumps, &c. The turbines are of the single-disk axial-flow impulse type, the velocity of the steam being utilised in stages by causing it to pass and repass through the same set of blades. The great simplicity of this type enables it to be constructed in compact form and at low cost, and it gives the desired output without excessive speed of revolution.

"Nightingall" Automatic Cookers.

From the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., we have received particulars of the "Nightingall" electric cookers, which we illustrate in figs. 7 and 8, on p. 888.

This cooker is built up of sheet metal on an angle iron frame, and is double cased and lagged. The heating element, rated at 1,800 watts, is situated in the bottom, protected by a wire frame, and is automatically controlled by a mercury thermometer fitted at the back of the cooker, which gives heat steps of 200°, 300°, 400° and 500° F. The column of mercury actuates a solenoid switch, which cuts off current as soon as the heat of the oven has arrived at the predetermined temperature.

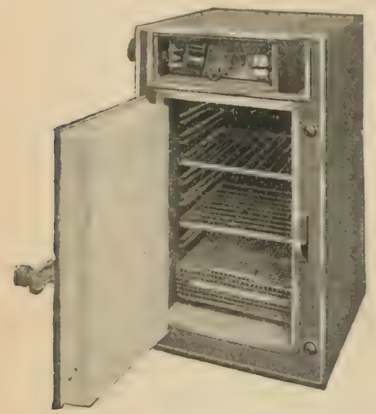

Fig. 7.—Nightingall Automatic Cooker.

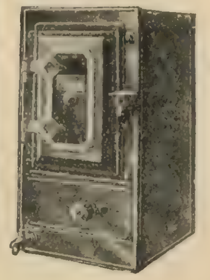

Fig. 8.—Automatic Steamer.

Both current and temperature being controlled at one point, no special knowledge is required for the operator, and the oven is practically "foolproof."

The "Nightingall" steamer is constructed on similar lines, but is smaller. Automatic control is given with two temperatures—high, which equals a steam pressure of about 2 lb.; and low, which is just above boiling point. The heater is of 800 watts rating, of the immersion type, placed in a water space at the bottom.

Steel Works Electrification.

That the efficiency of blast furnaces is greatly increased by the removal of moisture from the blast is undisputed. Very many ways in which the moisture can be removed are in existence, the majority involving the use of some chemical substance, such as chloride of calcium, to absorb the moisture. These processes, however, leave much to be desired in the efficacy with which they remove the moisture, and a method which has found far greater approval consists in converting the atmospheric moisture into snow which can then be readily removed.

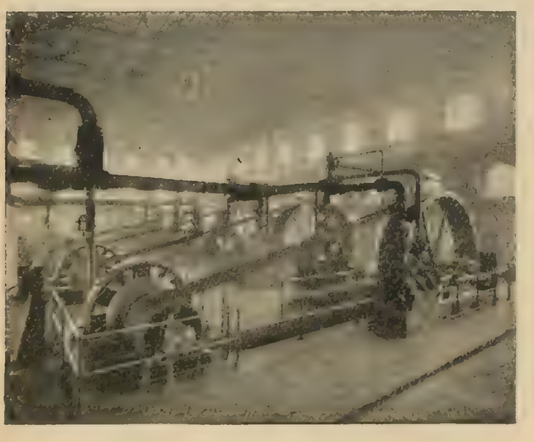

Fig. 9.—Witton Motors Driving Ammonia Compressors.

A large plant, working on this principle, has recently been installed in the Midlands. It consists of six 400-h.p. d.c. "Witton" motors, with cast-steel shells, driving "Haslam" ammonia compressors; the accompanying view, fig. 9, gives an excellent idea of this plant. The motors have interpoles and are controlled by switchgear standing by each set. The ammonia compressors work in conjunction with a refrigerating plant, producing cold brine which cools a series of pipes. The blast on its way to the blowing engine is passed through these pipes, which are in duplicate, and the snow is removed from the interior surface of one set at frequent intervals, the other set meanwhile being in commission for the refrigerating process. The electric motor equipment for this installation was supplied by the General Electric Co., Ltd.

LEGAL.

Attorney-General *v.* Long Eaton Urban District Council.

Mr. Justice Sargant, on May 12th, delivered his reserved judgment in the action brought by the Attorney-General, at the relation of the Long Eaton Gas Co., to prevent an alleged undue preference being given to consumers of the defendant Council's electric supply.

The case was heard on April 3rd, 6th and 7th last, and fully reported in the Electrical Review at pp. 616 and 649.

Mr. Justice Sargant, in giving judgment, said that in this action the Attorney-General, on the relation of the Long Eaton Gas Co., was seeking to restrain an alleged breach by the Long Eaton Urban District Council of the provisions of Secs. 19 and 20 of the Electric Lighting Act, 1882. The most important rates of charges are, for the purpose of this action:—(1) For lighting houses, shops and other premises, except factories, a flat rate of 3½d. per unit, less 10 per cent. discount; (2) for lighting factories, 3d. per unit for the first 2,000 units per quarter, afterwards 2d. per unit less, in each case certain discounts, increasing with the amount of the account; and (3) for power or heating, for a consumption not exceeding 250 units per quarter, 2d. per unit, and for larger consumptions per quarter a gradually decreasing charge per unit, until for a consumption between 4,000 and 6,000 units per quarter the rate is 1d. per unit, and for a consumption exceeding 6,000 units per quarter the rate is ¾d. per unit. The difference in the rates of charge for lighting and power respectively involves this, namely, that if a consumer desires a supply for power as well as a supply for light, he must have a separate circuit on his premises for the supply for each purpose, each circuit being separately connected with the mains, and having a separate meter at its terminals. Each such circuit is as separate, electrically speaking, from the other as if it furnished a separate supply to a different consumer; and the consumer who has the two circuits can use the maximum supply of electricity through each circuit simultaneously. What has given rise to the present proceedings is a circular which was issued by the Council on or about September 25th, 1911, and which is couched in the following terms, namely:—"Dear Sir,—I am directed by my Council to inform you that the following resolution has been adopted with reference to the price charged for electricity to power consumers, which will take effect as stated therein:—Revision of electricity charges. The Committee having fully considered this matter recommend that the present scale of charges remain in force where power and lighting are both taken exclusively from the Council's electricity mains, but in cases where electricity supply is taken for power only or for power and partial lighting, the lowest scale of charges, where the number of units consumed during any quarter exceeds 4,000, shall be 1d. per unit, and otherwise according to the existing scale. Such amended charge to commence on January 1st, 1912." It is alleged that the differentiation expressed in this circular between those large consumers of power who take power and lighting exclusively from the Council's mains and those large consumers of power who take for power only, or for power and only partial lighting, is a breach of Secs. 19 and 20 of the Electric Lighting Act, 1882; and it is sought to restrain this differentiation by the injunction of this Court. Secs. 19 and 20 of the Electric Lighting Act are in the following terms: "(19) Where a supply of electricity is provided in any part of an area for private purposes, then except in so far as is otherwise provided by the terms of the licence, order or special Act authorising such supply, every company or person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply." (20) "The undertakers shall not, in making any agreements for a supply of electricity, show any undue preference to any local authority, company or person, but, save as aforesaid, they may make such charges for the supply of electricity as may be agreed upon, not exceeding the limits of price imposed by or in pursuance of the licence, order or special Act authorising them to supply electricity. It is said by the plaintiff that both sections of the Act are infringed: Sec. 19, because the supply of electricity to B for power purposes is a supply corresponding with the supply to A for power purposes, and is applied for and given under similar circumstances; Sec. 20, because the lower charge to A is undue preference. It is said by the defendants as regards Sec. 19, first, that the supply to A for power and exclusive light is not a supply corresponding with a supply to B for power only and partial lighting; and secondly, that even if the supply to A for power has to be considered separately, and so "corresponds" with that to B, still, the circumstances are not similar in the two cases. As regards Sec. 20, the defendants say that there is sufficient dissimilarity in the conditions of supply between the two cases to prevent the difference of charge, though perhaps preferential, from amounting to an undue preference. The first defence as regards Sec. 19 seems to me a question of construction, and I will deal with that defence first. As already pointed out, any supply of electricity for power is in the ordinary course taken quite separately from any supply for lighting, namely, by a separate circuit connected with the mains by separate terminals and with a separate meter. And this being so, I think that according to any ordinary use of words, the Council must be said to be offering not a single supply of electricity but an alternative supply, and that any consumer taking power and light in the ordinary way on separate circuits, would be said to be taking not a single supply but two supplies, namely, a supply for power and a supply for light. And I can see no sufficient reason for cutting down the beneficial operation of Sec. 19 so as to prevent its application to each such separate supply. In my judgment, the hypothetical consumer B, though taking a supply for power only, is taking a supply corresponding with the like supply of energy to A for power purposes, although A may also be taking an additional separate supply for light. And if any differentiation is allowed between them *qua* their respective supplies for power, it must be on the ground that the circumstances are not similar in the two cases. The second defence as regards Sec. 19 and the defence as regards Sec. 20 seem to me to be very much the same, and to differ, if at all, only in degree. Under each section I think that the whole circumstances may be considered from the broadest possible point of view, and that the question is whether the circumstances affecting consumer A or consumer B in relation to their supply of power are substantially dissimilar or sufficiently dissimilar broadly to justify the differentiation proposed by the circular. The general language of the two sections, and their relation to each other, are curiously similar to those of Sec. 90 of the Railway Clauses Act, 1845, and Sec. 2 of the Railway and Canal Traffic Act, 1865. And some of the decisions under those Acts as well as the one or two decisions under the Act now in question, or equivalent legislation in the Colony of Melbourne are in point here. The most important and apposite of the railway cases that have been cited to us are the London and North-Western Railway *v.* Evershed, 3 Appeal Cases, p. 1029; Denaby Main Collieries Co. *v.* Manchester, Sheffield and Lincolnshire Railway, 11 Appeal Cases, p. 97; Baxendale *v.* Great Western Railway, 28 Law Journal, Common Pleas, p. 69; and Phipps *v.* London and North-Western Railway, 1892, 2 King's Bench, p. 229. From these cases and those of Metropolitan Electric Supply Co. *v.* Ginder, 1902, I Chancery, p. 411, and Attorney-General of Victoria *v.* Corporation of Melbourne, 1907, Appeal Cases, p. 469, I think a fairly clear distinction may be drawn for the present purpose between those reasons for making a lower or preferential charge which under legislation of this kind are legitimate and those which are illegitimate. It would seem that A must not be charged less than B, merely to overcome a greater reluctance on the part of A to become a customer, or to induce A to become a customer in respect of another supply, although either of these reasons might be a good commercial reason for charging less to A were the public undertakers merely carrying on any ordinary commercial business. On the other hand, any circumstances which render it less costly, or otherwise more profitable to supply A than B, constitute a legitimate reason for making a lower charge to A for the same supply. And if the Court came to the conclusion that some such circumstances existed, then proof would not be required that the diminution in the charge was precisely equivalent to the diminution in the cost of the supply. To apply these principles to the present case, if, as alleged by the relators, the object and result of the circular were to coax or induce those who took power only, or power and partial lighting, to take the whole of their lighting from the Council, and the extra custom thus obtained would not *per se* make the rendering of the existing service less costly or more profitable to the Council, then the policy of the circular would be wrong, and the differentiation between A and B would be illegal. But if, on the other hand, the combination of lighting or exclusive lighting would make the supply of power, or of power and partial lighting, to the customer in question less costly or more profitable, then there would be a justification for reducing the charge to A as compared with B, or (to follow the precise lines of the circular) for increasing the charge to B as compared with the charge to A. As I understand the argument, this view of the law was accepted on both sides, and the contest between the parties really resolved itself into one of fact, namely, whether as between customer A, who takes power exclusively and light exclusively from the Council, and customer B, who takes power exclusively but either no light or only part of his light, the taking by A of an exclusive supply of light renders it cheaper or more profitable to the Council to give a supply of power to him than to B. The onus of establishing this would appear to rest on the Council. Speaking generally, the technical and other evidence by which they sought to prove their case seemed to me extremely thin. On the other hand, no technical evidence at all was called by the plaintiff. In this state of things I must do the best I can on the materials before me. But should the same sort of question ever be brought out again with reference to a larger undertaking, there would be room for very much fuller and more complete technical evidence on both sides. One thing seems fairly clear from the evidence of Mr. William Jenkins—namely, that before making the change, the Council did not seek technical advice, and that in making it they were not acting on any reasoned or effective comparison with the cost of supplying the typical consumer A with power as compared with the cost of supplying B with power. Nor would it, I think, be doing the Council an injustice to say that the charge was made merely on a rough general view of commercial inducement to the consumer and commercial advantage to the Council in which no distinction was made between, on the one hand, coaxing or inducing customers to increase their custom by taking a second supply, and, on the other hand, lowering a charge to a customer for an existing supply by taking a supply of a different kind. They obviously had little if any idea as to what was or was not prohibited in this respect by their statutory obligations. Mr. Snell, the Council's expert, of course was better informed. But even he, as will be seen, fell into some mistake on this point. And he was apparently only called in long after the change and for the purpose of giving evidence in this action, and justifying the change *ex post facto*. If, therefore, the Council have a good and sustainable reason for giving lower terms for power to A than to B, this would seem to be due rather to good fortune than to good judgment. The only evidence in justification of the preference to customer A that has to be seriously considered is that of Mr. Snell, and a good deal of that evidence may be dealt with very briefly. At the end of his examination-in-chief he relied on the extra business thus secured in supplying energy for lighting, but this is an inadmissible reason. In another part of his evidence he pointed to the progressive improvement in the load factor of the undertaking down to the present time, but this had been taking place quite as much prior to the change as subsequently to it. And he also referred to the figures in relation to supply of various particular consumers, as to which I will say a few words a little later, but which when examined certainly do not seem to help his case. All this seems to me to be of very little if any value. The only part of Mr. Snell's evidence which struck me as really relevant or important was that in which he attempted to show that under the special conditions of Long Eaton the supply of energy for lighting factories is in a sense supplementary to the supply of energy for power and improves the load factor of the undertaking by providing a demand for the machinery at the defendants' power station at a time when it would otherwise be idle. Mr. Snell, of course, had to acknowledge that as the load factor for light is much worse than that for power a customer for both power and light has in general a worse load factor than a customer for power only. For inasmuch as he takes his maximum load for power, his total load factor is a mean between the worse load factor for light and the better load factor for power, though the lower load factor for light may be, and should if the relative price for light and power are fair, be compensated for by the higher price per unit charged for light. But he said that inasmuch as at Long Eaton some 20 per cent. of the power load, viz., that attributable to the winding machinery, is not working before 7 a.m. or after 7 p.m., the factory owner who takes light as well as power gives during the summer (by which I mean the lighter) months of the year an opportunity to that portion of the machinery at the central station which may be regarded as installed against the winding machine load of being used for the production of light during the whole or some of the hours between 7 p.m. and midnight, and the whole or some of the hours between 4 a.m. and daylight, or, in times of great activity, between midnight and daylight. And the result, said Mr. Snell, was that the load factor of such a consumer, consumer A, was improved, and that he was in truth a better customer—a customer who could be supplied more cheaply—than customer B. This would no doubt be quite true if no more machinery had to be installed to supply customer A than customer B, or if, what is much the same thing, load factor could properly be calculated with reference to the maximum demand or load during the summer months of the year, and not with reference to the maximum load throughout the whole of the year. But in fact the contrary is the case. The demand for electric lighting is, of course, a demand that varies seasonally, and the demand or load that really matters, and against which plant had to be installed, is that during the winter or dark months, as, indeed, is indicated in the calculation of load factor in the Council's accounts on the usual annual basis. Further, there is nothing whatever to prevent the period of maximum demand for lighting coinciding with the maximum or peak load for power; and, indeed, so far as the factories alone are concerned, there is a good deal to make the two synchronise. And accordingly it is quite clear that the typical consumer A, when compared with the typical consumer B, must be considered as necessitating the installation in the central station not merely of machinery sufficient to satisfy his demand for power, but also of extra machinery to satisfy his demand for light, and so as increasing to that extent the denomination of the fraction representing his load factor before its conversion into a percentage. If this be so it is difficult to see on what principle the machinery used to supply power to the winding machinery run by female labour can be considered as being profitably employed in supplying light to those parts of the factory which are run by male labour. For, *ex hypothesi*, other machinery has had already to be installed for the purpose of supplying light not merely to the principal part of the factory where the male labour goes on working, but also to that portion of the factory where female labour is employed, and where the supply of light is not required for any longer hours than the supply of power. When this difficulty was put to Mr. Snell, the only answer that he could give to it was that during the summer months the plant was overhauled, and that one by one the units at the central station were dismantled. But I cannot think that this explanation was at all adequate or satisfactory, having regard to the capacity of the station, viz., 950 KW., and having regard also to the marked difference (as shown by the summer and winter curves put in) of a maximum daily winter load of some 658 KW. and a maximum summer load of some 308 KW. This seasonal difference alone must obviously give ample opportunity for overhauling and for dismantling more than one unit at a time, unless the units are of size altogether disproportionate to the output of the station, and, indeed, are only two in number. And in the absence of anything like definite information on this point either from Mr. Snell or from the engineer of the Council, I cannot look on this supposed advantage with regard to overhaul as any real justification for the differentiation between consumer A and consumer B. It seems to me that large user being already allowed for in the condition that 6,000 units are to be consumed per quarter, and there being no *constat* that consumer A does, in fact, consume more altogether than consumer B, whose bill for power alone may largely exceed that for the power and light consumed by A, no real reason has been shown for regarding A as a more profitable customer than B. A's load factor, calculating it in the ordinary and proper way over the year, and not over a portion of it, is worse than B's, and worse substantially in proportion to the amount of light he takes, as, indeed, it should be having regard to the fact that he pays more per unit for light. And the taking of two supplies by A does not involve any diversity factor in A's demand, if I rightly apprehend the sense in which Mr. Snell used that term. For A's peak time for power and peak time for light, may be, and often are, concurrent, the whole factory, of course, requiring to be lighted, for instance, at 6 p.m. during the winter months when the demand for power is in full force. Though I have defined B as a customer who either takes for power only or takes for power and partial lighting, I have hitherto considered him in the light of the first alternative, namely, as taking for power only. But if he is now considered as taking for power and for partial lighting, any differentiation between him and A is even less, and the preference shown to A is even less defensible. He may well be taking more for power than A, and more for light than A, and may be taking them in the same relative proportions as A. And yet if he takes any light at all from any other source, he is to be denied the allowance of 25 per cent. made to A. This is not in my judgment a mere isolated or exceptional case of hardship such as might be found under any sale increasing by definite steps, but an example of a class of cases likely to occur and specially aimed at by the circular. It seems to me impossible to justify such a differentiation as this. And the express making of the differentiation is a very strong indication that the reason for making it was not the relative cheapness of supplying A, but the desire to oust competition in supplying light. The only other matter I need refer to is a table called Appendix A, which was put in by the Council for the purpose of showing the average price paid by the 17 consumers who fall within the same class as the hypothetical consumer A. So far as it goes, that table seems to me to tell strongly against the Council. On the two scales adopted by the Council, each of no less than 7 of these 16 consumers pays less to the Council for power and lighting together than he would do if he took the same amount of power alone. And the whole number of these consumers who, together take very much more than half the total units supplied by the Council, only pay £34 5s. 2d. extra for the 81,098 units supplied to them for lighting purposes. Now, not only are those units nearly one-tenth of the units taken for power, for which £2,799 18s. 4d. is paid, but having regard to the difference in load factor between light and power, they must require an installation of probably about one-third of the machinery which is required for the power units taken by these consumers. And as stated at the foot of the table that the Council reduce accordingly, if 1d. per unit is a proper sum for a supply of power, and 3d. per unit is a proper sum for a supply of light, it is obvious that the supply of light to these customers causes the Council an extraordinary loss. The foot-note in the table in the following terms, viz.: "Thus to acquire 9·16 per cent. more business, the company reduce the price 6½ per cent.," may throw some light on the object with which the reduction is proposed to be made as between A and B. But the comparison made by it is obviously wrong. For it assumes that, but for the reduction, the 81,098 units of light, as well as the 884,938 units of power, would have been taken, and would have been charged for at 1d. Further, the reduction is, of course, not 6½ per cent. at all, but 25 per cent., viz., from 1d. to ¾d. And the commercial effect is that 81,098 units of light which ordinarily would, at 3d., cost £1,013 14s., are, in fact, supplied for £34 5s. 2d. In the result I come to the conclusion that there is a breach both of Sec. 19 and of Sec. 20—of Sec. 19 because B is asking for a supply of power corresponding with that demanded by A, and under similar circumstances; of Sec. 20 because an undue preference is by the circular to be given to A as compared with B. The plaintiff is, in my judgment, entitled to a declaration that the differentiation proposed by the circular of September 25th, 1911, between those consumers of over 6,000 units per quarter for power who do and those who do not take their lighting exclusively from the Council, is in contravention of Secs. 19 and 20 of the Electric Lighting Act, 1882. Then there will be liberty to apply for an injunction if necessary. If the defendants determine to appeal, no such application will be made while the appeal is pending. The defendants must pay the costs of the action.

GODFREY *v.* COX.

MR. MUIR MACKENZIE, one of the Official Referees of the High Courts, on May 13th, heard this action, in which Mr. Herbert James Godfrey, electrical engineer, of High Road, Balham, claimed from Mr. Cox, a retired dentist, £89 8s., the balance of account for "goods sold and delivered and work done to the order of the defendant" in respect of electric lighting and heating at his house "Belmont," at Streatham.

Mr. E. G. Palmer, with him Mr. Godfrey C. Hutchinson, instructed by Mr. R. C. Monty Hether, appeared for the plaintiff, and Mr. Le Riche, instructed by Mr. David C. Cragie, for the defence.

The defence set up was an admission of the employment of the plaintiff with an allegation that the work was done negligently and improperly, there was also a general denial of liability, but the sum of £38 8s. was paid into Court.

From the statement of counsel, it appeared that the plaintiff was called upon to do the work upon existing fittings and at cut prices. The materials supplied and the workmanship were not, said the plaintiff, inferior, being of a kind consistent with the kind of work contracted for. "Belmont" was an old suburban house, and was at the date of the contract partly wired. As far as could be gathered the wiring and electric light fittings had been in the building for some years and were in bad condition. Mr. Cox was having his house redecorated and there were certain structural alterations being made. It was under these circumstances that Mr. Godfrey approached Mr. Cox, with the result that a contract was entered into. It was found at starting that the whole of the work was in one circuit, and Mr. Godfrey gave instructions to his workmen to split it up into four. Certain work was done which was not included in the contract particularly in relation to the sinking, according to orders given to the plaintiff's foreman, into the walls previously exposed wires and laying them in tubing sunk into the walls. The work proceeded steadily, but the plaintiff experienced great difficulty in doing it by reason of the decoration work being carried on simultaneously. As the work progressed Mr. Godfrey received a cheque on account for £15, but he was not successful in his applications for further payments, and finally on the completion of the contract he asked that the work should be inspected suggesting a day. The plaintiff's foreman, a Mr. Lovegrove, attended accordingly for the purpose of carrying out a test, but no-one appeared on behalf of the defendant, and the surveyor on the premises refused to have anything to do with it, saying that he was not concerned. The County of London Electric Supply Co., however, came and made a test, but found the walls being washed with a hose pipe, which was not a proper thing to do. They, however, only found fault with the switches in the basement, which leaked, and required renewing, but that work did not come within the plaintiff's contract. The writ was issued, and then the plaintiff succeeded in getting an inspection, but he was not allowed to be present, although his foreman and one of his experts were present. An insulation test was made, which was satisfactory. Referring to the allegation of the defendant, counsel said that one of the grounds of complaint was that there was no electrical continuity, and others were that there were certain gaps where the old wires had been extended, that there were gaps where the wires were bare, that the wiring to the garage was bad, and that there were certain loose joints. There was also an allegation as to a joint-box under the gravel path having been filled up with clay, and that certain wires had not been enclosed in tubing. It was admitted that there was justification for complaint as to certain defects, which were of a very slight character. Liability was also admitted for certain gaps in the joints, in regard to the short lengths of casing, and the plaintiff would be willing to supply solid drawn tubing instead of close jointed tubing. There were two other matters of complaint, for which there was justification. One was the joint-box under ground in the garden, and plaintiff was prepared to see that it was made watertight. The same remark would apply to a joint-box in the wall in the garden. The whole of the defective work could be done for a sum of from £8 to £10. The plaintiff's solicitor had written to the defendant's solicitor, stating that he, plaintiff, was prepared to satisfy, not only the Electric Supply Co., but the Insurance Co. also, but no notice was taken of that communication, and the defendant had the work done with a considerable amount of extra work at a cost of £61, for which he counterclaimed. The defendant also counterclaimed for rent, owing to his having been kept out of the premises, but the plaintiff said that the builders were in the house, engaged upon their work altogether unconnected with the electric fitting, for some time after the plaintiff's work had been completed.

MR. HERBERT JAMES GODFREY, the plaintiff, gave evidence bearing out counsel's opening statement that he had contracted for electrical work with the Metropolitan Asylums Board, with the Wandsworth Board of Guardians, with the London, Brighton and South Coast Railway, and with H.R.H. the Princess Louise. He also added that he had done work frequently for Mr. Cox during the past 10 years.

MR. LOVEGROVE, the plaintiff's foreman, gave evidence as to the work done under plaintiff's direction at "Belmont," and in cross-examination said that although he regarded the job as a good one, he could not say that the work was perfect in every respect.

MR. GEORGE HENRY KILSBY, electrical engineer, and manager to Messrs. Gifkins & Co., of Victoria Street, Westminster, said that on November 17th last he inspected the electrical work at "Belmont," and noticed that there was old electric lighting in the house, chiefly on the top floor and basement. Where gaps occurred it was possible to use continuity grips, but when the casing was partly wood and partly tube that was not done. There were between 20 and 25 gaps, some small, and some 4 or 5 in. long. For the smaller gaps a split sleeve might be used. The cost of supplying additional pieces of tubing and split sleeves would be about £2 5s.

On May 14th, MR. KILSBY further said that he had agreed that the close-jointed tubing should be removed, and that there should be substituted for it screw joints. He also undertook to cure what defects there were outside. The cost of remedying the whole of the defects, both interior and exterior, would not exceed £10 or £11. The Supply Co. had connected when he went there, and had indicated that they were satisfied with the tests.

In cross-examination, the witness was asked whether gaps were not dangerous, and he replied that sometimes they might be, but he had never known of an accident in consequence. He agreed that the gaps should not be there, as they might be dangerous. For the locality, he thought the work was not unsatisfactory. Some of the outside work was bad, it was true, especially that portion which was enclosed in the close-joint tubing.

MR. RICHARD LUND, electrical engineer, carrying on business as Lund Bros. & Co., at 78, Queen Victoria Street, who stated that he had carried out large contracts for the War Office and the Admiralty during the past 25 years, gave confirmatory evidence.

Several witnesses called for the defence gave evidence in support of the allegation that the work was defective and unsatisfactory.

On Friday the hearing was resumed and concluded, when the Referee reserved judgment.

Mygatt *v.* Glynn.

In the Court of Appeal on Wednesday, the Lord Chief Justice, Lord Justice Phillimore and Mr. Justice Lush dealt with the appeal of Mr. Anglo Otis Mygatt, of Clifford Street, Bond Street, W., the managing director of Holophane, Ltd., a company formed for the purpose of manufacturing and distributing a new prismatic shade for electric and other lights, from a judgment for £2,000 in favour of Major Geoffrey Carr Glyn, of Eaton Place, who was a director of the company. In the Court below Mr. Mygatt claimed £4,660 on a bill of exchange which he said the defendant dishonoured. In a counterclaim Major Glyn claimed 10 per cent. of the profits made by the plaintiff out of the Holophane Co., in return for which the defendant relieved the plaintiff from all the worries and anxieties connected with the business. It was on this counterclaim that the defendant succeeded and obtained judgment, against which the plaintiff now appealed.

The Court ordered a retrial of the counterclaim on which the defendant succeeded, holding that the Judge assessed the damages due to Major Glyn on insufficient evidence.

PARLIAMENTARY.

Bristol Corporation Tramways Bill.

As already stated in the Electrical Review, Lord Lytton's Committee of the House of Lords has passed the preamble of the above Bill. When the Committee came to consider the clauses a great deal of discussion arose regarding the proposed working to carry out the views of the Committee. The parties subsequently conferred and agreed upon the following new clause :—(1) Notwithstanding anything contained in the Bristol Tramways Acts, 1872 to 1911 (including in that expression, where used in this section, the St. George and Hanham Light Railway Order, 1898), the Corporation shall, within six months after May 1st, 1915, proceed to purchase, and the company shall sell to the Corporation, the whole of the undertaking of the company upon the terms, and in manner following, that is to say, as to so much of the undertaking (other than the light railway portion thereof) as is within the city as the same existed on January 1st, 1904, upon the terms of Sec. 43 of the Tramways Act, 1870. As to the remainder of the undertaking (including the light railway portion thereof), upon such terms, as failing agreement, shall be determined by an arbitrator to be fair, having regard to all the circumstances of the case. (2) The payments to be made by the Corporation to the company for the undertaking shall, failing agreement, be determined by an engineer or other fit person nominated as arbitrator by the President of the Institution of Civil Engineers, on the application of either party. (3) The purchase of the undertaking of the company shall be carried into effect with all due diligence, and shall be completed by a deed of conveyance duly stamped, and upon the completion of the said conveyance the undertaking of the company shall be transferred to the Corporation, and as from such transfer all the rights, powers and authorities of the company in respect of the undertaking of the company shall be transferred to, and vested in, and may be exercised by the Corporation. (4) For the purposes of this section the expression, "the undertaking of the company," means the undertaking of the company authorised by the Bristol Tramways Acts, 1872 to 1911, as existing at the date of such purchase.

Walsall Corporation Bill.

A Select Committee of the House of Commons, presided over by Mr. Gardner, has had under consideration this Bill, which deals, among other matters, with proposals for extending the borough tramways to outlying districts.

The Hon. J. D. Fitzgerald, K.C., explaining this part of the Bill, said that four new trackless trolley routes were proposed (1) commencing from the existing tramway at Rushall, through Pelsall to Brownhills, and from there back to the present terminus at Walsall Wood ; (2) a continuation of the Bloxwich line through Great Wyrley to Cannock ; (3) from the existing terminus at the Great Barr boundary on the Birmingham Road to Scott Arms, Great Barr ; and (4) along Corporation Street and West Bromwich Road to the Wednesbury boundary at Tame Bridge. The last named route was intended to be connected up with West Bromwich, which town last year obtained power to run trolley trams and motors up to their borough boundary. The intention was when they had constructed their trolley route, to connect up with it and make a complete trolley route from Walsall to the centre of West Bromwich. The opponents of the Bill were the Staffordshire County Council and the Urban District Councils of Brownhills and Cannock, who asked for contributions for the maintenance of the roads. Counsel asked the Committee not to impose any such condition upon the promoters, and pointed out that if a private company ran a service of motor-'buses in Walsall, the County Council could not ask them for a single penny.

Alderman Cope, chairman of the Tramways Committee, giving evidence in support of the Bill, said that the Corporation had successfully operated tramways in the town for the last 14 years. He was strongly of opinion that the new trolley routes were greatly needed to increase the travelling facilities of the various districts through which they would run.

Mr. Hamilton, general manager of the Leeds Corporation Tramways also gave evidence supporting the Bill as did Mr. Spencer general manager of the Corporation Tramways in Bradford.

Questioned on the point of the Corporation being compelled to make a contribution for road maintenance, Mr. Spencer said he thought it would be very unfair to put such a clause into the Bill. He could not see why trams and trackless trolley vehicles, which were the poor man's conveyance, should be compelled to contribute towards the maintenance of roads, when motor-'buses did not contribute anything at all.

Mr. Forbes Lankester, addressing the Committee on behalf of the County Council, submitted that it was only fair that they should be paid half the cost of such road reconstruction as would be rendered necessary by the introduction of new traffic.

After hearing considerable evidence, the Chairman said the Committee had come to the decision that the Walsall Corporation should pay £4,000 to the Staffordshire County Council, apart from street widening, if required. That was to apply over the whole road system. Walsall would pay three-eighths of a penny per car-mile on the trolley traffic undertaking.

On May 12th considerable discussion took place relative to clauses, and Mr. Fitzgerald, for the promoters, agreed to a subclause under which, if there should be a dispute as to whether a road should be reconstructed, the question should be submitted to an arbitrator. An amended clause was also agreed to under which, in the event of it being necessary to reconstruct two or three miles of roadway at a cost of £5,000 or £6,000, the amount payable to the Walsall Corporation should be limited to £4,000, the balance going to the local authorities which had to reconstruct.

Electric Lighting Provisional Order Bills.

The following Electric Lighting Provisional Order Bills, promoted by the Board of Trade to confirm Orders, have been before the Examiners, and ordered to go for second reading :—

No. 1 Bill.—Confirms orders to Hawarden R.D.C. ; to Midland Electric Light and Power Co., in respect of Kenilworth ; to Ledbury Electric Supply Co., in respect of Ledbury ; to Llanfairfechan U.D.C. ; to Merthyr Electric Traction and Lighting Co. (Amendment) ; Newton-in-Makerfield U.D.C. ; to Oulton Broad Electricity Co., Ltd., in respect of Oulton Board ; to James Herbert Edwards, in respect of Ruthen ; to Slaithwaite U.D.C. ; to Thornton U.D.C. ; to Messrs. Petters, Ltd., in respect of Yeovil.

No. 2 Bill.—To South Wales Electrical Power Distribution Co., in respect of Abercarn ; to Lancashire Electric Power Co., in respect of Chorley ; to Farnham Gas and Electricity Co. (extension of area) ; to Harwich Corporation ; to Corporation of Hull (extension) ; to Knottingley U.D.C. ; to Leeds Corporation (extension) ; to James Herbert Edwards, in respect of Warminster.

No. 3 Bill.—To James Duncan, in respect of Aboyne and District ; to James Duncan, in respect of Ballater ; to James Duncan, in respect of Ellon.

No. 4 Bill.—To Gilbert Allom in respect of Banstead, Walton-on-the-Hill and Kingswood ; to the Derbyshire and Nottinghamshire Electric Power Co. in respect of Beeston and district ; to James Herbert Edwards in respect of Bradford-on-Avon ; to Frederick Harold Edwards in respect of Feltham and district ; to the U.D.C. of Gelligaer ; to the Derbyshire and Nottinghamshire Electric Power Co. in respect of Heanor Eastwood and district ; to Mr. Bernard Edward Granville Bailey, the Hon. Weetman Harold Miller Pearson, M.P., and Mr. Thomas Stallibrass in respect of Midhurst and district ; to the Colne Valley Electric Supply Co., Ltd., in respect of Rickmansworth and Chorleywood.

Midland Railway Co.'s Bill.—Lord Barnard's Select Committee of the House of Lords has passed the preamble of the Bill promoted by the Midland Railway Co. for the construction, at an estimated cost of £629,276, of a double line of railway, a mile and a half in length between a point of junction with the London and Blackwall Railway in Stepney and a junction with the Midland Railway in Bromley-by-Bow ; and the widening and equipment of the existing railway, 7½ miles long between Barking and Upminster, at a cost of £252,836.—Mr. Talbot, K.C., for the promoters, explained that the proposals were brought forward to carry out the obligation placed on the Midland Co. when they were before Parliament in connection with the acquisition of the London, Tilbury and Southend Railway. The first proposal would take some years to carry out.—Mr. Tatlow, chief assistant to the general manager of the Midland Co., stated that the company had under consideration the question of the electrical equipment of the whole of their system in the neighbourhood of London, as well as the line to Southend.—The opposition to the Bill came from the London County Council, as owners of certain schools and a number of private petitioners, the ground of opposition being that the proposed works would seriously prejudice property.—The Committee held that this matter must be left to the general law.

London Electric Railways Bill.—This Bill, which has already passed the House of Commons, came on Friday before Lord Lamington's Committee of the House of Lords. The principal object sought is the compulsory acquisition of land in Westminster Broadway for the erection of offices, and powers are also sought for the construction of subways and escalators at Piccadilly Circus, Trafalgar Square and Tottenham Court Road. The only opposition came from the Cannon Brewery Co., in regard to the acquisition of St. James' Restaurant, and on the suggestion of the Chairman the parties conferred and came to an agreement. The preamble was passed and the Bill reported for third reading.

Tramway Provisional Orders.—The Examiners have passed the Tramway Provisional Order Bill which authorises the Corporation of Rotherham to construct several short lengths of tramway in the borough. Standing Orders have also been found to have been complied with in regard to the Western Valleys (Monmouthshire) Railless Electric Traction (Extension). Altogether about 17 furlongs of route are proposed to be run over, and power is given to raise £20,000 additional capital.

Stone Gas and Electricity Bill.—The Unopposed Bill Committee of the House of Commons has passed the Stone Gas and Electricity Bill, the chief objects of which are to extend the existing limits of supply. The Bill has already passed the House of Lords.

Newcastle Corporation Bill.—The Standing Orders Committee of the House of Commons has decided to allow the Newcastle-on-Tyne Corporation to include a new clause in its Bill to enable it to run motor-'buses in the urban district of Weetslade.

Second Readings.—In the House of Lords the London United Tramways Bill, the Deal and Walmer Gas and Electricity Bill, and the North Metropolitan Electric Power Supply Bill, were read a second time.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

AUSTRALIA.—The Customs Authorities have issued the following decisions as to the duties to be levied on certain electrical and similar goods imported into the Commonwealth; the duties quoted in each case are those under the preferential tariff in British goods:—

Ears and Trailing Frogs for overhead wires of electric tramways; and Trolley Poles for cars	10 p.c. ad. val.
Electro-magnetic Chuck, rectangular ...	20 p.c. ad. val.
Steel Rails for suspension railway	10 p.c. ad. val.

NEW ZEALAND.—The Customs Authorities have decided that in the case of imports of Blackman electric forge blowers the parts are to be dutiable as follows: Blower, 20 per cent. ad. val.; motor, 10 per cent. ad. val. The duty quoted in each case is that levied under the preferential tariff on British goods.

FINLAND.—The Customs Authorities have issued a decision to the effect that electric pocket lamps, gilt or silver plated, are to be dutiable at the rate of 47.10 marks per 100 kg. on importation. —[Note. 25 Finnish marks = £1.]

ITALY.—The Customs Authorities have decided that glass insulators with internal bush of iron are to be dutiable as wares of glass with ornaments or accessories of other materials at the rate of 18 lire per 100 kg. Apparatus for giving electric shocks set in action by the insertion of a coin in a slot are dutiable at the rate of 150 lire per 100 kg. if the metallic wires along which the current is transmitted are covered with silk.

UNITED STATES.—The American Treasury Department have decided that "flashlight cases" composed of metal for manufacture into electric pocket lamps to be carried on or about the person are to be dutiable at the rate of 60 per cent. ad. val.

MEXICO.—The surtax of 50 per cent. of the amount of duty payable at the rates quoted in the Mexican tariff, plus the 10 per cent. surtax on those rates formerly levied, has been cancelled.

BAHAMAS.—A new tariff came into force on March 23rd last in accordance with which the duty on goods not specifically mentioned (no electrical goods are mentioned) as being separately dutiable and not free of duty are liable to a rate of 20 per cent. ad. valorem in place of the rate of 25 per cent. formerly leviable. The following goods are free of duty: Electrical apparatus and appliances; steam, oil, gas or electric engines; tramway rails; machinery; tramway rolling stock; telephones.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

10,902. "Means for and method of reducing the frequency of electric currents by means of static transformers." A. M. Taylor. May 4th.

10,904. "Telephone switches." T. Green. May 4th.

10,930. "Instantaneous electrical liquid heater." A. Howard. May 4th.

10,945. "Brush holders for multipolar electric-motors." R. Bosch (Firm of). May 4th. (Convention date, March 5th, 1914, Germany.) (Complete.)

10,948. "Electric railways." C. M. White. May 4th. (Manley Edwin Sturges United States.) (Complete.)

10,980. "Electrolytic manufacture of alkali metals and alkali metal compounds." E. A. Ashcroft. May 4th. (Complete.)

11,018. "Instruments or apparatus for registering telephone calls." J. S. Foley, W. Hill, and H. Hackett. May 5th.

11,048. "Toy telephone." F. E. Foster and F. S. Werner. May 5th.

11,052. "Telephone instruments." Siemens Bros. & Co., Ltd., and F. Baker. May 5th. (Complete.)

11,076. "Incandescent filament electric lamps." A. Godefroy. May 5th.

11,089. "Electrical dynamo machines." Soc. Anon. des Automobiles et Cycles Peugeot. May 5th. (Addition to 7,840/13. Convention date, May 16th, 1913, France.) (Complete.)

11,097. "Electric burglar alarm systems." J. P. Williams. May 5th. (Complete.)

11,102. "Methods of producing electric oscillations." E. von Lepel. May 5th. (Complete.)

11,112. "Manufacture of stratified fibrous materials, especially for chemical and electric-insulating purposes." Meirowsky & Co., Akt. Ges., and M. Meirowsky. May 5th. (Complete.)

11,116. "Electrical re-actors." P. Torchio. May 5th. (Complete.)

11,120. "Antenna for wireless telegraphy and telephony." N. J. Jeffries. May 5th. (Complete.)

1,156. "Connecting-arrangements for electric circuits." J. H. Woolliscroft and H. T. Boothroyd, Ltd. May 6th.

11,159. "Dynamo-electric machines." T. Fiorani. May 6th. (Convention date, May 29th, 1913, Italy.) (Complete.)

11,165. "Electrical energy supply installations." A. P. Lundberg, G. C. Lundberg, P. A. Lundberg, and G. Pegg. May 6th.

11,185. "Electrical transformers." Siemens Bros. Dynamo Works, Ltd. May 6th. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

11,211. "Register circuits for telephone installations with separate setting and speaking paths." Siemens & Halske Akt. Ges. May 6th. (Addition to 16,538/13. Convention date, May 6th, 1913, Germany.) (Complete.)

11,212. "Circuit arrangements for telephone exchanges." Siemens Bros. & Co., Ltd. May 6th. (Siemens and Halske Akt. Ges., Germany.) (Addition to 18,356/12.) (Complete.)

11,216. "Magneto ignition apparatus suitable for use with internal combustion engines." A. Soames. May 6th.

11,222. "Telegraphy." A. P. Ogilvie & Creed, Bille & Co., Ltd. May 6th.

11,229. "Construction of telephone-index or directory holder." H. R. Hazard. May 6th.

11,244. "Electric machines for use in motor cars." P. J. M. Gasnier. May 6th. (Divided application on No. 26,838/13.) November 21st. Convention date, May 7th, 1913, France.) (Complete.)

11,249. "Magnetos intended more especially for lighting bicycle lamps and the like." J. A. Hardy. May 7th. (Complete.)

11,252. "Combination contact for electrical or other purposes." J. Dugdill. May 7th.

11,263. "Reflectors, diffusers and the like for electric and other lights." T. Ballinger. May 7th.

11,265. "Method of placing the trolley poles of tramcars on the overhead wire and the removal of same." G. E. Watmough and W. J. Smith. May 7th.

11,301. "Electrical time-switches." H. Leitner. May 7th.

11,309. "Supports for overhead conductors for electric railways. British Westinghouse Electric and Manufacturing Co., Ltd. May 7th. (Westinghouse Electric and Manufacturing Co., United States.) (Complete.)

11,312. "Electric brakes for railways and the like." C. W. Paget and J. Dalziel. May 7th.

11,325. "Accumulators." G. Beaupere. May 7th. (Convention date, May 8th, 1913, Belgium.) (Complete.)

11,340. "Means for preventing too rapid changes of speed of machinery." Siemens-Schuckertwerke G.m.b.H. May 7th. (Convention date, May 7th, 1913, Germany.) (Complete.)

11,343. "Means of supporting and insulating conductor-rails of electric railways." E. P. B. Estler. May 8th.

11,369. "Safety magnetic clutch locking-apparatus for railway carriage doors." W. T. B. Masters. May 8th.

11,372. "Means for actuating signals on locomotives by electro-magnetic induction." G. Kapp. May 8th.

11,399. "Dynamo-electric machines. Crompton & Co., Ltd., and N. Pensabene. May 8th.

11,404. "Electrical condensers and the manufacture thereof." G. Giles. May 8th. (Addition to 10,895/14. Convention date, July 3rd, 1913, Switzerland.) (Complete.)

11,408. "Appliance for electrical jacquard machines." Osterreichische Siemens-Schuckertwerke and Regal Patente G.m.b.H. May 8th. (Convention date, May 10th, 1913, Austria.) (Complete.)

11,410. "Electrical contact device." Osterreichische Siemens-Schuckertwerke and Regal Patente G.m.b.H. May 8th. (Convention date May 10th, 1913, Austria.) (Complete.)

11,436. "Protective devices for alternating electric current machines." British Thomson-Houston Co., Ltd., and F. H. Clough. May 8th.

11,474. "Arrangements for regulating the speed of machinery." Siemens-Schuckertwerke G.m.b.H. May 9th. (Convention date, May 10th, 1913, Germany.) (Complete.)

11,492. "Housing for electro-magnets." E. Gengenbach. May 9th. (Complete.)

11,496. "Electric lighting equipment of motor-cars and like vehicles." G. A. Jelly. May 9th.

11,516. "Electric control apparatus for signalling systems." A. D. Cardwell. May 9th. (Divided application on 17,439/13, July 29th. (Complete.)

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24,243. Arc Lamps. H. Weiss. October 23rd.

4,071. Telephony. D. S. Hulfish. February 17th.

6,911. Process for Manufacturing Articles or Objects of Tungsten. O. Voigtlander. March 20th. (March 23rd, 1912.)

9,140. Thermostats for Controlling Electric Circuits. A. W. Prim and F. W. Roper. April 18th.

9,205. Automatic Telephones. J. M. Furnival. April 19th.

9,384. Electric Switches. British Thomson-Houston Co. (General Electric Co.). April 21st.

9,484. Capels or Couplings for Cables, Ropes, and for like purposes. J. S. Sparkes. April 22nd.

9,593. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). April 23rd.

9,768. Telegraphy. W. Judd, B. Davies, and Eastern Telegraph Co. April 25th.

9,996. Control of Electro-mechanical Transmission Gear. H. F. Haworth. April 29th.

10,892. Means for Improving the Illuminating Effect of Incandescent Electric Lamps. W. J. Beville. May 8th. (November 10th, 1913.)

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THE UNIVERSAL ELECTRICAL DIRECTORY

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1914 EDITION

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

THE NEED FOR A SCIENTIFIC EDITOR.

WE have had occasion in recent numbers to comment upon the extraordinary enthusiasm with which certain of the daily papers heralded the advent of a new invention. Upon the merits of the invention, both practical and scientific, we have already had our say, and do not propose to repeat ourselves. But it may be appropriate to make a few observations of a general character directed to the need for reform in certain newspaper offices.

Now that some of the great morning papers have begun to publish statistics of daily sales, it appears that we are on the eve of a new kind of newspaper war. The first desideratum would seem to be—increased circulation. It matters not that the standard of the paper is lowered, so long as the circulation is increased; and one method of adding to the number of subscribers is to comment upon some scientific discovery—a miraculous invention, a new cure for a new disease, or a method of extracting gold from sea water. A public trained in the elementary schools has certain smatterings of scientific knowledge, sufficient, at any rate, to make its members read the scientific news. "They must," says the editor, "be catered for; and, by the by, it may increase our circulation. So here goes!" The "pithy par" relating to the latest scientific toy is then inserted, uncensored by any technical mind, and impliedly approved by the editorial "we."

There is grave reason to suspect that some of this zeal for the new-fangled idea is stimulated by the gentle art of the publicity department.

> He who would in business rise
> Must either bust, or advertise.

Your newspaper proprietor must have his columns filled with advertisements. It pays. Your advertiser must needs have his flaming announcement published on some page of the journal whereon there is some pretence of reading matter. That reading matter need not necessarily be true; but it *must* be spicy and it must be *readable*. If it can be linked up with the wares advertised, so much the better for both parties. The advertiser gets more publicity; the advertisee can charge more for his columns. Look at the "Motor Notes" which appear in so many papers. Is it a mere coincidence that "motor" accessories of all kinds are advertised on the same page? Is it by accident that the writer of the "Notes" illustrates his points by referring to the goods sold by firms whose names are set forth, in leaded type, hard by the emanations from his pen?

The up-to-date advertising agent can apply this system with considerable success to a new invention which is going to revolutionise industry. The discoverer of perpetual motion enters the office of a daily paper, carrying his machine in a carpet bag. He interviews the news Editor. Straightway a note is sent round to the advertisement manager. Further colloquy takes place, and on the morrow there appears an account of a strange and epoch-making device. The announcement occupies a column and a half; while the second half of the second column is filled with an advertisement of a new kind of lubricating oil, which, as it never coagulates, is eminently adapted for greasing wheels which are in perpetual motion.

Is it worth while to throw out a suggestion which may serve to remedy a crying evil? The salary of a new sub-editor would make no substantial difference to the annual balance-sheet of a great newspaper. The services of a man who had sound practical training could be procured at a reasonable figure. He would not even have to devote his whole time to the job, as his services would only have to be called into requisition on rare occasions. No article purporting to describe a new invention should be published except under his supervision. No account of any discovery should be allowed to appear unless passed and approved by him. His editorial approbation would enhance the value of the invention to the inventor and the public; his censure would cause it to be assigned to its proper pigeon-hole in the great library of Truth. If the lay Press is to maintain its great traditions in this country, there seems to be grave need for such new form of censorship. Technical matters should be treated of by a technical man, or else left severely alone. To compare small things with great, what would be thought of the proprietors of a technical journal if they were to interview a political crank, and publish with the seal of their approbation his scheme for the reconstruction of the United Kingdom? They would inevitably lose caste with their technical readers. In the office of a great daily paper which advocates political views of a certain kind, or which supports a certain political party, there are experts who can deal with, and, if necessary, expose the political charlatan; but the proprietors of a technical journal, who own to no political opinions, must needs exclude and ignore him altogether.

Were the *Daily* ——— to advertise for a technical journalist who could keep it straight in matters of scientific interest, there would be hundreds of applicants for the post. Incidentally, too, the appointment of such a man would have this effect. It would become attractive and valuable to the inventor to have his work "reviewed" in the columns of a paper known to have an expert on the staff. If a journal is famous for its literary criticism, your author is glad to submit his work for criticism. The reading public, seeing a favourable review, will respect the criticism, continue to subscribe to the journal in question, and last, but not least, buy the book reviewed, or order it from the library.

SIR RONALD ROSS.

An appeal to the Government by Sir Ronald Ross for a grant of money to compensate him for personal outlay and losses involved in his investigation of malaria, opens the question of the State endowment of Science in an unusual form. The point is raised on an exceptionally advantageous case, as the merit and success of the work are exceptional and unquestioned.

Ross's work on malaria, Jenner's on vaccination, Simpson's introduction of chloroform, Lister's antiseptic treatment, and Pasteur's work on rabies, stand, we suppose, in a class by themselves. These men have saved human life on a scale on which no soldier has been able to destroy it. And the case is not one in which the discoverer has received no recompense. Honour and fame he has, with years and energy to enjoy them. The Nobel prize is substantial, and the salary of his Professorship is probably adequate.

The claim advanced is simply this. That a State ought to pay for scientific work by which it profits, without regard to its having initiated or countenanced it. Two grounds are alleged: (1) The ground of honour; (2) the ground of expediency; and the English Government are said to have admitted their liability when they remunerated Jenner, Manby, and others. Whatever force there may be in the argument of expediency, there seems to be none whatever in the argument of honour. The introduction of the word is a complete misuse of terms. No one would dream of applying the word "dishonourable" to an individual, still less to a trustee, who refused to make money payments for work he had not contemplated; and our Government is a trustee. Even if there were an ethical obligation for payment, on whom would it rest in this case? The benefit which the British Islands have received from Sir Ronald Ross's work is infinitesimal compared with that which the United States have received in Panama, or the Governments of India, Egypt, and the Tropical Colonies in their several domains. Our Treasury is not responsible for debts of honour of other Governments to our subjects. The word "dishonourable" can hardly have been used seriously. The honour of a nation is something different from that.

Let us turn to the argument of expediency. Sir Ronald Ross argues that a nation is unwise if it does not compensate losses incurred in successful research, since the refusal discourages searchers and inventors, and proposes that a sum of £20,000 a year should be set aside to provide useful pensions for all the higher forms of intellectual effort. What is a useful pension? For a judge £3,500 a year is considered useful; and for a politician who reaches the Cabinet £1,200 is the accepted figure. We can find as many judges as we want, and could fill a cabinet of the largest size twice a year. How many doctors can we produce of Sir Ronald Ross's rank? By our reckoning, four in a century.

The great achievements of science, letters, and religion have no calculable relation to money, and the men who can do these things will do them in spite of all difficulty, and do them because they must. Fame is the spur, and money can do little to encourage or discourage them. Nor can we look to any official body to reach the man of genius when he wants help. The argument from expediency seems to fail with that of honour. Again, the payments voted by Parliament to discoverers in previous cases have been clearly as of grace, and established no rule for the future. A claim as of right is ill-founded. Though, however, the immense value of the return from Sir Ronald Ross's work does not seem to establish a claim for payment, we are sure no one would be displeased to hear that a substantial grant was to be made.

But we hope the appeal may effect more than this. It is another brilliant illustration of the mere money value of scientific work, and another argument for spending money on scientific education, the case for which seems almost too clear to be arguable, but may be stated once again. Our public secondary schools, from Eton and Winchester down to small endowed schools in provincial towns and villages, have a curriculum based in the main on the literary scheme laid down by ancient grammarians, and established in England by the revival of letters. Polytechnics and similar schools in great towns are mainly occupied in teaching special arts, not in the general education of the boys, and do not substantially affect the last statement. Nor does the fact that some science forms part of nearly every curriculum. The normal schools of the boys who are to be the leaders, directors, managers, of our technical affairs are, in the main, literary schools, in which science is a mere accessory.

Now it seems undeniable that the majority of boys—perhaps of girls also—would acquire a broader and sounder education from biology, physics, and chemistry, with music, letters, and art as accessories, than they now receive from dead languages. Can we not look forward to the establishment through the whole country of secondary schools working on a scientific curriculum? Our ancient endowed schools are much more than the equivalent of the Gymnasia of Germany, but we want the other schools as well, and we may read into Sir Ronald Ross's appeal a new and emphatic statement of the economic value of the science schools, the Realschulen, which are prominent among the causes of Germany's development. Even with the greatest activity 30 years will be none too long to develop the system and produce the staff of trained teachers, and we have lost far too much time already.

Australian Labour Questions.

It will be remembered that about three years ago the relations between the tramway employees and employés in Australia became acute. The points in dispute were taken before the Arbitration Court, and after a hearing occupying 93 days, judgment was given by Mr. Justice Higgins on December 21st, 1912. This judgment defined the wages to be paid in a number of cases and gave legal sanction and force to a number of agreements which had been arrived at between the men and several of the companies. In one case, that of Brisbane, it was decreed that other things being equal, preference was to be given by the company to members of the men's Union. This was strongly resented by the company, who, in company with the Adelaide Tramways Trust, from first to last refused to admit the jurisdiction of the Federal Arbitration Court and took the case to the High Court of Australia on a number of points, including several constitutional questions.

The decision of the High Court has recently been given to the effect that the Arbitration Court is subject to its authority, and that it has power to revise or modify its decisions. This decision, which is held in many quarters to be contrary to the intentions of the framers of the Arbitration Act, places the findings of the Court at the mercy of any flaw in the legal conduct of the case, and postpones for long periods the operation of the award. The feeling in Adelaide amongst the workers is very bitter, and an early strike is feared. It is nearly 18 months since the award granting them higher wages was given, they have not received them, and now the prospect of their ever getting them is decidedly remote. Stronger measures are urged, and the hands of those who are striving for the solution of industrial disputes by peaceable means are weakened. We await news of the later developments.

Copper.

The position of the copper market is not improving, even if it is not actively deteriorating. The last statistics made an indifferent showing, but they were received with complete equanimity by the market, in which interest has been dwindling steadily for some time. During the month ended May 15th, the stocks in England and France increased from 12,732 tons to 15,465 tons, and the total visible supply from 27,203 tons to 30,284 tons. Compared with the last few years, the present figures, however, are very small, for at the end of April last year the total visible supply in Europe was 43,828 tons, in 1912 59,892 tons, and in 1911 94,768 tons. There are clear signs, however, that in North America production is greatly on the increase, the April output having been a record at 67,634 tons, compared with 65,023 tons in March, 54,714 tons in February, and 58,826 tons in January. The stocks in the United States have also undergone some growth, showing an addition in April of about 2,600 tons to 31,400 tons, but this was the only increase this year. The world's visible supply during last month was added to by 5,700 tons, the total standing at 61,233 tons, compared with 55,572 tons on March 31st, and 62,640 tons at the end of February. On the whole, the outlook does not point to any material improvement in market conditions yet awhile, for there is not the smallest doubt that trade generally is still in a reactionary frame of mind, and no substantial alteration for the better can be looked for in the immediate future. Output is feeling the stimulus of the high prices of recent years, which enormously spurred on efforts at the development of properties. Hence enlarged yield, the effects of which are being felt, though with much less acuteness than might reasonably have been expected. There are what appear to be pretty sound reasons for thinking that the production in the United States is now about reaching its maximum for a period. Last year considerable discussion was caused by the apparent discrepancy between the copper production of the country as returned by the smelters, and that issued by the refiners. This, however, was capable of a very simple explanation, which was that the smelter capacity had been greatly increased, so that the refiners could not keep step with the output of rough material. Since then, however, the position has changed with the putting into commission of new refining plants, and to-day the refineries are capable of handling more raw material than that produced from day to day by the smelters. Whereas formerly, therefore, there was a stock of rough material in the hands of the smelters awaiting refining, this has been largely eaten into, and to-day the refineries are in a position to handle more stuff than the smeltery output affords them. For this reason it would appear that the American production of refined copper is not likely to undergo much expansion in the next few months. Meantime while the leading producers of metal profess comparative indifference to the current of demand reaching them, there is equally not much desire on the part of the trade to anticipate requirements, and new business remains reserved. Things, on the whole, are rather poor, and the speculative market can hardly be expected to form the centre of interest again until there is some fresh development. This may possibly be forthcoming from the long expected railway rate decision in the United States, for which people are getting tired of looking, however. Consumption generally is quite fair, but falls short of the top figures of last year.

Oil Fuel.

The City is always resounding with the cry of an oil boom which does not come. That is to say, it comes not in the shape of the public purchasing all the watered share capital offered by promoters. Possibly the public have discovered that, like rubber, oil is being used as a basis for much financial jugglery. Considering that some years ago oil could be bought on the Thames for 30s. per ton, it seems reasonable to suppose that at double and treble that figure, the bulk of the increased price above the old profit rate of 30s. must represent increased profit to-day of a very extravagant order. Somebody must be making money. A dozen years ago it was pointed out by the author of a work on liquid fuel that the use of oil was never likely to be universal until the production had increased to a much greater extent relative to the production of coal than the ratio of 5 per cent. to which it had then attained. This ratio has not yet been much exceeded. Oil production has increased, but so also has the output of the world's coal, and there is nothing yet in sight to warrant any belief in the rapid change of the above ratio or even in some future change. It was held that liquid fuel was the fuel of the emergency. The popularity of the petrol-driven car has forced up the production of oil, and the high prices have induced every effort to augment it.

The increasing use of oil in the Navy warrants the endeavour being made to find oil in these Islands. Little is being done, but oil can be extracted from coal by systems of low-temperature distillation. The use of oil in the Navy should certainly make for efficiency, and systems of low-temperature distillation ought to be encouraged, so that irrespective of large stores there may be no shortage of fuel at a critical moment. It is perhaps fortunate that oil is so dear, for it will thereby be kept out of use by the steam-users, who may not recognise the significance of facts. Liquid fuel cannot become a steam-user's fuel ashore except to a very limited extent ; it can help the ordinary boilers to cap the load peak with full-pressure steam.

But let nobody listen to the promoters' glib talk of oil fuel as though it were unlimited in amount. Doubtless many steam-users regret the day they put in oil-burning furnaces, for the price to-day is quite beyond the purse of the steam-user. Liquid fuel has its special uses—they must, we fear, remain special until such time as the liquid portions of bituminous coal are extracted by some method of low-temperature distillation, whereby the more valuable constituents of coal are preserved for other industrial purposes than combustion. Great Britain holds a great potentiality of liquid fuel and ought very soon to be able to assure herself an ample and cheap supply for the Navy, so rendering herself free of the exorbitant prices for oil now charged by the foreigner. This matter is of vital importance, and affords a great and profitable field for scientific research and paying industry. It has an immediate bearing upon the price of electrical energy, for when the possibilities of coal are utilised to the utmost the cost of fuel for the generation of electricity will be greatly reduced.

SHOULD THE COUNCIL BE BLAMED?

By C. H. WORDINGHAM, M.Inst.C.E.

Though an ex-member of Council, and elected to serve in another capacity on the next Council, the writer is at present in the position of an ordinary member of the Institution, and he trusts, therefore, that he may, without impropriety, comment upon the article in the current issue of the Review.

The article deplores the failure of the so-called "forward" policy of the Institution, and blames the Council for not persevering in it, warning it that the Institution is liable to degenerate into a technical debating society.

After all, is a technical debating society, such as, for example, the Institution of Civil Engineers, such a very contemptible body? It is true that the commercial element is of vital importance to the industry—he would be a senseless visionary who could doubt it—but let the pure science be cut off for 10 years, and where would the engineer be? Let engineering talent be withdrawn for a similar period, and where would the commercial man be? He would have to find a new outlet for his capital and his energies. Let us not be blinded by the importance of the financial man, the organiser and the salesman; they are absolutely necessary and worthy of all respect, but their sphere of usefulness is absolutely dependent on the discoverer, the inventor and the engineer.

No one with the ordinary equipment of intelligence can fail to desire the protection and furtherance of the industry by which he gains his livelihood, but it is at least open to argument as to what are the best means of securing the desired end. Why must the Institution do everything; and why is the multiplication of associations necessarily to be deplored?

The starting of new organisations to cover the same ground as old ones can rarely, if ever, be justified, and is nearly always an unmixed evil, but the formation of an association to do specific work that cannot otherwise be done efficiently, is quite another matter, and may produce most beneficial results. People, especially if enthusiastic, are fond of labelling their own policy as a "forward" one, but it is well to make sure that the title is merited.

The writer has always entirely disagreed with the policy inaugurated a few years ago in connection with the affairs of the Institution, and felt sure that it was doomed to failure. The collapse has come far sooner than he anticipated, but that it would come was inevitable. It is absolutely impossible for a heterogeneous body like the Institution to represent adequately the commercial interests of any one section of its members. The interests of one section may be, and often are, directly antagonistic to those of another; how, then, can the Council represent with any fairness the interests of either to the outside world? If their whole weight is thrown in favour of one, it is grossly unfair to the members constituting the other; if they halt between two opinions, their aid is useless to either party. It may be said that they should reconcile the opposing interests; in nine cases out of ten, this is impossible and the only real solution, as in the affairs of nations, is an appeal to arms, and each must fight the other to a finish, both using their full strength. It is unfair, and it is foolish, to blame the Council for failing to accomplish the impossible, though they may justly be blamed for attempting it.

The Institution has a wide legitimate field of great usefulness to the industry in promoting scientific and engineering research; in organising discussions on purely scientific and on engineering matters both in their technical and commercial aspects; in providing facilities for the acquirement of information by its members, whether by means of its reference library, its lending library, the demonstration of new discoveries or technical processes, the exhibition of new inventions or the preservation of articles of interest, either historically or on account of their illustrating some peculiar occurrence or phenomenon; in organising visits to foreign countries or to places of exceptional interest in this country.

Surely here is a field that can well occupy the attention of the Council and provide an adequate return to the members for their subscriptions. Let the Institution leave the non-engineering aspects of every section alone, not because it is undignified for it to deal with them, but because it is quite incompetent by its constitution to deal with them.

The writer believes it to be a fundamental truth that the material interests of the members engaged in any particular section of the industry can only be adequately looked after by those members themselves, for the interests of all must be identical if effectual action is to be taken. A conspicuous example of the value of an association for a particular interest is the I.M.E.A. This Association has won for itself a unique position; it represents the municipal electrical industry adequately, and can speak with authority and weight on behalf of the municipal stations of this country; if it wants to fight, it can fight whole-heartedly, and if it chooses to compromise, it can do so. This is only possible because it is purely municipal and has no other interest to serve.

Let every other section follow this example; there are signs that the wisdom of doing so is being recognised. The consulting engineers have formed an Association, to which many of them belong, having for its object the promotion of the well-being of that important branch of the profession. The manufacturers have formed the B.E.A.M.A., and the advantages of the existence of such an organisation are already manifest, not the least being the fact that it is now possible to obtain the collective and authoritative opinion of any section of manufacturers on any question affecting them, for example, in connection with standardisation of manufactured articles.

For many years the writer has urged that the method indicated is the only adequate and practical way of protecting and fostering the electrical industry, and this seems a fitting opportunity of emphasising it. Let every branch of electrical activity be represented by its own association for the protection of its individual interests—municipal engineers, company engineers, tramway engineers, consultants, manufacturers, teachers, telegraph engineers, telephone engineers, wiring contractors, vehicle builders, and so on. Let them fight one another as often and as furiously as is necessary, and let the best side win. Let each properly constituted association be recognised by the Institution, and be represented on the Council, and we need hear no more of abortive Industrial Committees, nor witness periodical attacks on the Council because they do nothing for the industry.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Comparative Economics of Tramways and Railless Electric Traction.

In the communication appearing in your issue of the 15th inst. criticising my paper read before the Institution of Civil Engineers, points are raised which were brought forward during the subsequent discussions.

I should be sorry, however, for the views expressed by your correspondent to remain unchallenged until the publication of the Minutes of *Proceedings*, and I should therefore be obliged by your insertion of the following reply.

With regard to the question of earning capacity, which I have assumed in my diagrams as the same as that of the tramcar, your correspondent, in common with other critics, falls into the error of assuming that the capacity of the cars at present running is the limit of the capacity possible with the railless car.

As a matter of fact, these cars are designed of a capacity to suit the requirements, but this by no means represents the maximum capacity. The railless car, with top seats, carries 40 passengers. A new type, lately shipped to the East, single-decked, and with two compartments, carries 56 passengers. Another type is designed, also for Oriental conditions, having a trailer attached, and carrying together 70 passengers.

There is, however, no reason why the power car should not haul two trailers. In Amsterdam, where the streets are narrow and the traffic very dense, the tramcar, single-decked and of the same capacity as a railless car, hauls either one or two trailers, according to requirements. This operation is referred to in my paper, and shown to be quite economical. It bears favourable comparison with the method adopted in this country of running cars of maximum capacity at the same time interval all through the day.

Without, however, going further into the carrying capacity of railless cars not yet running in this country, I will confine myself to an analysis of figures given in the Board of Trade returns of the actual earning capacity of railless cars.

In my paper I made a comparison of the capital expenditure and route length of the York tramways with what would have been the result if the installation had been by railless electric traction. I will now further compare the results of earning capacity on the York tramways with those of the railless electric line at Rotherham.

According to your correspondent, the earning capacity of the railless line should be assumed to be in proportion to that of the tramway as 1 : 1·6; in other words, the railless car to take 62½ per cent. of what is taken by the tramcar.

The Board of Trade returns up to March, 1913, of the York tramways, which had a route length of 6·225 miles, showed a car-mileage for 365 days of 602,623, thus 265 car-miles per day per mile of route. The returns for the railless line at Rotherham, 4·7 miles in length, showed a car-mileage during 178 days, since the line was opened, of 56,887, thus 68 car-miles per day per mile of route.

The much greater traffic density at York is certainly no ground for expecting the receipts per car-mile to be lower than those at Rotherham, other things being equal. The gross receipts at York were 9·012d. per car-mile. According to your correspondent, therefore, if there had been a railless line at York instead of tramways the receipts would have been not more than 62½ per cent. of the tramway receipts, thus 5·622d. per car-mile.

At Rotherham, however, the receipts were 10·35d. per car-mile. The cars in service there are only single-decked, and seated for 28 passengers. There has been considerable overcrowding on them. They would not be suitable for the complete transportation of the population of York.

I will put it, however, to your correspondent whether in the face of the above figures, he holds that if the railless system had been installed in York, using either top-seat cars carrying 40 passengers or running trailers when required with an aggregate capacity of 70 passengers, the railless car would still only take 5·622d. per car-mile? It seems to me a *reductio ad absurdum.*

Your correspondent goes on to take exception to my assumption of equal expenditure on the overhead equipment. This objection is trivial. My analysis of capital expenditure and maintenance of tramways is taken from the averages of the returns which are practically such as one must estimate for railless lines. The extra trolley line does duty in the transmission of the energy. For instance, for a line of the traffic density of the one at Rotherham I assume in my diagrams £1,200 per mile as the capital cost of overhead equipment. The actual cost at Rotherham was £1,100 per mile. The cost of maintenance is in my tables assumed at 0·155d. per car-mile. At Rotherham it was 0·120d.

Your correspondent then takes up the question of road maintenance, and instances the case of Dundee, where the road has been found too weak to stand the traffic of the railless car, and will require to be rebottomed.

He considers that a tramway would have been preferable. I think it is somewhat out of date now to begin disputing the question of rails with a limited width of paved road *versus* a completely paved road suitable for all traffic.

The advent of the mechanically-propelled vehicle is for all time, and has come upon us with a rush. It claims the creation of a highway system, *intact*, *substantial*, *smooth*, *dust free*, suitable for transport both of passengers and goods by heavy vehicles moving at a rapid rate.

Your correspondent charges me with ignoring the subject of road surface improvement. I have not ignored it; I stated in my paper the fact that the recent Acts of Parliament have included a charge of [illegible]d. per car-mile for this purpose. I have not, however, adopted this or any other figure as an ascertained fair charge, because no one is in a position to do so.

The present burden on the householder-ratepayer for the upkeep of the roads is out of proportion to that of the proprietor of vehicles, whose use of the roads is a more direct one. Some redistribution of this burden is probable. But the whole community uses the road, and all should pay their proportion.

There should, however, be some discrimination in favour of public carriers. If they are squeezed between the upper millstone of unremunerative fares for the working classes and the lower millstone of high charges for road maintenance, they will be squeezed out of existence.

The public carrier should not be classed as regards taxation with the millionaire who keeps a dozen or so of motor-cars purely for his own convenience and pleasure.

The Government appears to take the view that the problem of road reconstruction is an Imperial one, and has taken the first step towards its solution by the appropriation of Imperial revenue for that purpose; whether, or to what extent, it will also increase the carriage licence duty, who can tell? If so, there would be no sense in attempting a charge per car-mile on public carriers, which is only capable of determination in the case of regular services. The tax should be levied on each vehicle according to its class and capabilities of use. If it is unused, that is the owner's affair. If he does not want to pay the licence any longer, he can sell it or scrap it.

I cannot see what useful purpose is gained by trying to reduce the road damage down to a figure per car-mile. The subject must be threshed out comprehensively, and as far as public carriers are concerned the fare adjusted to the cost of operation. If the passenger pays the parliamentary fare of 1d. per mile, probably the motor-omnibus or railless car could afford to pay from 1d. to 2d. per car-mile towards road maintenance. If the fare is only ½d. per mile, it is doubtful whether the motor-omnibus can afford to pay ⅜d. per car-mile.

Moreover, where a road has a weak bottom, mechanical traction will destroy it; where it is of the character of London streets, it will make scarcely any impression on it. If you send a 100-ton locomotive over a piece of portable track, you will need a new portable track next day, and probably a new locomotive. If you send it over rails of 100 lb. per yard, the wear is infinitesimal. It is the same thing with roads.

In the good work done by the Road Board in the registration of traffic density on main roads, the figures range from 35 tons up to 5,000 tons per day, as great a variation as between a portable track and a main-line railway.

T. Graham Gribble.

London, E.C., *May* 19*th*, 1914.

"Schoeller" Miners' Lamp Gas Detector.

I note a letter from Mr. W. Schmahl in the current issue of your journal referring to my letter of last week. His letter has the merit of being crisp and business-like, and, like Mr. Schmahl, I have no time to spare for lengthy discussion.

I think, however, it only just to say that, contrary to his statement, my letter proves neither that I have failed nor that he has succeeded, and I think it would be reasonable and of general interest to very many engineers if Mr. Schmahl would state whether he would guarantee the Schoeller detector to give, say, five reliable consecutive measurements of methane if the firemen remained in, say, 2 per cent. mixture for 15 minutes, without access for fresh air—a very ordinary condition of working in the pit.

Favourable statistics and guarantees on this point would assist Mr. Schmahl in popularising his instrument.

Fred J. Turquand.

London, W.C., *May* 25*th*, 1914.

Review of "Electrical Meters."

In your issue of May 15th, Mr. A. P. Young deals with a question raised by us in a letter published in your issue of April 24th. In this we advocated the statement of the error of an instrument as a percentage of the reading rather than of the true value, on the ground that it was certainly more convenient, and probably more logical also.

Mr. Young, on the other hand, is in favour of the alternative proposal which he regards as more logical, no less convenient, and, in fact, as having "everything in its favour."

As regards convenience in use, we are strongly of the opposite opinion for the following reason :—As an example, let it be supposed that a certain meter indicates a consumption of 150 units and is known to be running 3 per cent. slow. It is undoubtedly a simpler matter to add 3 per cent. of 150 units (4·5 units) to the reading (making 154·5 units consumption) rather than to have to divide the reading by 100 — 3/100, which is necessary under Mr. Young's convention.

As regards the logical sequence of thought involved in the two conceptions, the example afforded by a clock dial may perhaps be cited. Suppose it is known that a certain clock is five minutes slow, and the time indicated is 10.47. The straightforward process would seem to be to add five minutes to 10.47, giving the correct time as 10.52. Mr. Young, on the other hand, would have us try to work out what time would, when five minutes had been deducted from it, give the time shown on the clock dial, namely, 10.47.

These two processes appear to us to represent very fairly the respective trains of thought entailed by the two methods.

At the same time, whatever may be their respective merits, we certainly agree with Mr. Young in his suggestion that the matter should be definitely settled in the meter specification now under revision, and, we would add, in the ammeter and voltmeter specification when this comes up for reconsideration, as it is hoped may shortly be the case.

Everett, Edgcumbe & Co., Ltd.,
KENELM EDGCUMBE, *Director.*

London, N.W., *May* 25*th*, 1914.

The Institution and the Electrical Industry.

It is to be regretted that so little of the affairs of the Industrial Committee is known to the 5,000 Members and Associate Members. The member who is not on the Council, but who has extracted from the opportunities allowed to him a sufficient basis to form an opinion of the desirability of the "unanimous opinion" of the Committee carrying conviction to the Council, has insight and capacity which the Institution should utilise in other directions, when he is discovered.

Will the statement of Mr. Hirst be printed ? Because a ridiculously small number of members heard very indistinctly his remarks at the annual meeting on Thursday, at 5 p.m.

Was that hour selected to suit some individual members of Council ? It certainly does not suit the majority of those who could attend an annual meeting. I have not counted how many of the Members and Associates live near enough to attend, nor did I count the few who did attend. I note, in passing, that the Council was not present as a whole.

My object in writing to the ELECTRICAL REVIEW is to endeavour to learn whether it is the wish of a majority of Members and Associate Members that the work initiated by Dr. Ferranti shall come to an untimely end. For one, I have endeavoured to follow, from outside, the progress of that Committee, and I feel extremely dissatisfied with the incapacity displayed by dissolving a Committee that is admittedly "unanimous" in its decision that it needs more scope.

By reasonable, concerted action we can demand and secure sufficient details to form an opinion as to the actions both of Council and of the Industrial Committee. I am criticising neither, for the best of reasons.

Is there in our non-political Ireland an Ulster ?

The opinion of Dr. Ferranti and other members on the dissolution of the Committee would interest me.

I do not want the Institution to become anything less than "the widest representation of the industry."

I believe the formation of the Industrial Committee had the sanction and goodwill of more than a three-quarters majority of Members and Associate Members.

Will you, Sirs, publish a form for those of your readers who are included in the voting classes of the I.E.E. to return to you, to learn whether there is a desire for more information and for renewed life to the Industrial Committee ? I suggest the following, so that it can be cut out and signed and returned :—

"The Institution and the Electrical Industry."
c/o ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C.

1. I $\left\{\begin{matrix}\text{will}\\ \text{will not}\end{matrix}\right\}$ support a request to the Council of I.E.E. and to the former members of the dissolved Industrial Committee for a full joint statement to Members and Associate Members of the I.E.E. of the reasons for the dissolution and reasons for and against complying with the unanimous opinions of that Committee, as reported to the Council.
2. I $\left\{\begin{matrix}\text{will}\\ \text{will not}\end{matrix}\right\}$ support a continuation of an Industrial Committee.

Signature and class in I.E.E. ....
Postal address ....

Not a Member of Council.

London, *May* 23*rd*, 1914.

[Mr. Hirst's statement is printed elsewhere in this issue. As regards the proposed referendum, it is not for us to enter the lists ; if the members themselves are sufficiently interested to commit their views to writing, our "Correspondence" columns are open to them.—EDS. ELEC. REV.]

The Weekly Rest.

With the rejection of the Weekly Rest Day Bill in the House of Commons on Friday last, all hopes of legislation for a weekly rest day for all workers are at an end for some time to come ; the result was not unexpected, owing to some absurd clauses *re* Sunday trading.

The A.E.S.E. having concentrated its efforts recently on obtaining support for the Bill, will now use all its powers to obtain a weekly rest day for station and mains engineers, and also in the case of mains engineers and assistants, to do away with the liability to be called out at any hour of the 24, and compulsory residence in the district concerned for 168 hours every week, by means of some system of relief.

The majority of Councils, Corporations, and chief electrical engineers are entirely in favour of the principle of a weekly rest day, though there seems to be some reluctance in putting the principle into practice ; maybe, they are somewhat perturbed as to the effect on the third decimal place in the total costs per unit.

To those who recently read the magnificent report of the Coventry Corporation electricity department (with the lowest cost per unit in the country), it would, perhaps, not have appeared so magnificent if they had known that the employés of the generating department were working seven days per week, and the charge engineers receiving the lowest average salaries for municipal stations of similar capacity (10,000 KW.) in the country. As far as I know, there is only one station of similar or greater capacity where the charge engineers are paid smaller salaries than at Coventry, it being one of 12,000 KW. owned by one of the Newcastle-on-Tyne companies with the ridiculous maximum of 45s. for a seven-day week. It is rumoured in the case of Coventry that the Local Government Board Auditor or Inspector has hinted several times that the salaries be increased, and a six-day week be instituted ; though this was not carried out, all employés in the electricity department were granted two weeks' wages as a bonus. I think they would have preferred a weekly rest day.

Recently the employés of the Greenwich power station of the London County Council applied for a weekly rest day : the matter was referred, as is the custom, to the Conciliation Board, and as no agreement could be reached it was referred to an arbitration committee, which decided for some reason unknown that a six-day working week of 48 hours was inadmissible, but agreed to reduce the working hours from 56 to 52. I give this instance to show the extreme reluctance that exists to carry out the principle of the weekly rest day, though I am sure that in this case all the councillors and heads of departments are in agreement with the principle.

In no other industry where the employés have the same degree of specialised training is there the scandal of the seven-day working week. Especially is a weekly rest day necessary to those who work shift work for reasons of health, irregular hours, night shifts, and the difficulty of obtaining the necessary sleep during the day-time, contributing to the unhealthiness of the occupation.

It was hoped by some station and mains engineers that the Institution of Electrical Engineers might use their influence on behalf of the seven-day week men, a fair number of whom are either Students or Associate Members, but it is the old story of conflicting interests which no doubt prevented them, the same perhaps that dissolved the I.E.E. Industrial Committee recently.

The only hope now for station and mains engineers is the A.E.S.E., which is slowly but surely being built up into an irresistible organisation. The A.E.S.E. does not propose to make extravagant demands, but insists on the principle and practice of a weekly rest-day, and that engineers in all cases must be paid a salary in accordance with their duties and responsibilities, and certainly more than those whom they have under their supervision.

Those who criticise the A.E.S.E. are referred to the advertisement pages of the ELECTRICAL REVIEW of recent date. If they compare them with those of 18 months ago before the A.E.S.E. came into existence, it will be noted that in the great majority of junior appointments advertised the salaries offered have increased more than 100 per cent. Working conditions have been bettered and salaries increased in a number of individual stations, and it is well known that station and mains engineers are now treated with much more respect than in the days before the advent of the A.E.S.E.

There are not any paid officials in the A.E.S.E., and the offices and positions on the executive are held by mains and station engineers; the subscription is nominal, and there is no valid excuse why any station or mains engineer should not be a member.

W. J. Ebben, *Hon. Sec. A.E.S.E.*

Leyton, *May* 26*th*, 1914.

Frequency Changer.

Your correspondent, "F. W. T.," in to-day's ELECTRICAL REVIEW is surely mis-stating the facts. The unidirectional pulsating current is of the *same* frequency as the alternating current. If he wants a transformer to *double* the frequency, I have no doubt that I can design him one which shall have a fairly high efficiency, but not quite so high as for a three-fold step-up. (See also my recent paper to the I.E.E. in this connection.)

I have not yet completely worked out how satisfactorily to halve the frequency; but I have succeeded in reducing it to one-third, and this meets most cases, besides requiring no continuous current. I have shown publicly the frequency being reduced from 75 to 25 periods.

A. M. Taylor.

King's Heath, *May* 22*nd*, 1914.

Street Lighting.

We send you to-day a copy of the *Preston Guardian* of Saturday, May 23rd, containing a report of the Streets and Buildings Committee's decision on the question of street lighting.

A specification was issued by the Corporation engineer to which the Gas. Co. and ourselves were asked to tender for the supply, lighting and maintenance of 90 1,000-C.P. lamps in the central portion of the town. Our prices, £7 10s. per annum for lamps burning 3,500 hours, and £6 for lamps burning 2,000 hours, were £2 and £1 10s. respectively lower than the Gas Co.'s tender.

The gas company, however, offered to reduce the price of street lighting to the whole of the gas lamps now supplied by them by about £400 a year, and to contribute to the Corporation the sum of £500 per annum for three years towards the cost of converting flat-flame burners to incandescent burners.

The Corporation must agree to forgo or limit their powers under the Preston Gas Act (Sec. 45), which entitles them to be supplied with gas for illuminating purposes at the lowest rate offered to other consumers for any purpose.

These concessions and conditions are quite outside the specification, and, in any case, we have no contract for street lighting outside the central area. It is, therefore, impossible for us to compete on equal terms.

The National Electric Supply Co., Ltd.

THOMAS CROSS, *Secretary.*

Preston, *May* 25*th*, 1914.

The Wiring of Public Buildings.

This subject raised by your correspondent, Mr. Sykes, is one that is of great importance to the electrical industry. As an ex-employé of the Office of Works, and having a first-hand knowledge of the condition of the wiring in a large number of public offices, I can assure Mr. Sykes that the wiring of some buildings is "rotten." This knowledge is common property amongst the electricians employed by His Majesty's Office of Works Department. I have seen the wiring also of a comparatively recent job, and have no hesitation in saying that it is one of the worst electrical jobs I have ever seen. If the same experts who gave evidence in the Osgood *v.* Sunderland case could see the wiring of these and other buildings they (the experts) would have a fit. I, too, with Mr. Sykes think that a public inquiry should be held, and may say, in conclusion, that to make these various buildings "safe" would require the expenditure of thousands of pounds.

W. J. Webb.

London, S.W.

THE PRINTING TRADES' EXHIBITION.

As we mentioned in our note last week, most of the printing machines exhibited are driven electrically, the greater portion being individually driven. This applies not only to the printing machines, but also to the Linotype and Monotype machines. The latter are driven through belting from small motors placed on the floor alongside the machines, the starting-switch panel being fixed on the side of the machine in a position handy for the operator. Machines like Babcock's, which have no trip motion on the cylinders, are driven by means of fast and loose pulleys. This is a somewhat old-fashioned method of driving machines, but if the loose-pulley drive is not adopted, it is necessary to use a reversible motor for backing up, and this introduces expense and a certain amount of complication, although, on the whole, it would be, no doubt, more economical, from the current-consuming point of view. Most of the Wharfedale machines are driven by spur gearing, as this is the most convenient method, the main driving shaft being fairly low down and at the back of the machine.

The Miehle machines, on the Linotype and Machinery Co.'s stand, are for the most part driven by short belts from motors placed in the side frame of the machine, jockey pulleys being used to take up the slack of the belt and keep it taut. This, whilst a very convenient method from the point of view of the printer, as the motor occupies no space outside the machine, is not so convenient from the point of view of the engineer, and particularly the supervising engineer, as it is necessary to get inside the machine to attend to the brush gear. A more convenient arrangement is that shown at the Miehle Co.'s stand, in the Gilbey Hall, where the pulley is placed on the commutator end of the motor, permitting the brushes to be got at from outside the machine. This method of driving Miehle machines was, we understand, introduced a few years ago by Mr. Broadbent, and we have no doubt that it will in time become the general method of driving these machines. A motor of somewhat small dimensions is required, and at present there are only a few makers who can supply them of the requisite power and dimensions. Among these makers we might specifically refer to Messrs. Electromotors, Ltd., who are the actual makers of the motors on the Miehle Co.'s stand, and also the whole of the motors on Messrs. Mann's stand and others. In point of numbers there are probably more motors made by this company than by any other firm, due, no doubt, to the fact that they have specialised largely in printing press equipment.

On several of the stands examples of the latest printing methods are shown—that is to say, the Intaglio method, which, it is considered, will create something of a revolution in the printing industry. Whilst there is nothing electrical shown at these stands, the development of this method will mean more work for electrical engineers, as the copper printing rollers are produced electrically, and arc lamps are necessary for preparing the pictures.

In this connection, reference may be made to Messrs. Canning & Co.'s exhibit in the Gilbey Hall. At this stand is a good display of electro-plating plant, including motor-driven plating dynamos and plating vats for copper depositing, nickel facing of stereos, and nickel-steel facing. Some electrically produced copper rollers are also to be seen upon which ½-in. deposit has been produced in 10 hours. The copper is deposited direct on iron, the cyanide process being used for the first coating, and this is followed by the sulphate process, the solution being agitated by air and the deposit burnished in the solution.

At the stand of Messrs. Penrose & Co. a large exhibit of photo-engraving machinery is to be seen, including what is claimed to be the largest camera in the world, and also arc lamps which are necessary for this class of work.

Among the smaller applications which may be mentioned are the self-contained electric grinding and polishing machines for litho stones and zinc plates. These consist of a vertical motor, to the spindle of which the grinding stone or brushes are fixed, handles being provided so that the whole equipment can be easily moved about over the stone or zinc plate. These are to be seen at the stands of Frederick Wesselhoeft, and also in the Haddon Hall.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

On Thursday last week the annual general meeting of the Institution was held; the report of the Council was received and adopted, and the statement of accounts was approved. These were given in abstract in our last issue.

With regard to the dissolution of the Industrial Committee, of which he had been chairman, Mr. H. Hirst said he would like to make a short statement. Although as a Member of Council, he agreed with the wording of the report, absence abroad had prevented him from taking any part in the framing of it, and he was afraid that it might be misunderstood by some of the members who were interested in this question. He had no fault to find with the powers that were conferred on the Industrial Committee so far as the Council could confer powers, but it did not seem to be generally known that the Council considered it essential that the Industrial Committee should not deal with matters which might be construed to have a political bearing. All the Members of Council who were members of the Committee were anxious to respect this wish, but when it was considered that in this country concessions had been granted by Parliament to some 400 municipalities in regard to electricity supply stations, it was very difficult to find subjects connected with municipal electricity supply that did not touch politics. This was also proved by the condition of affairs which arose at the time when Dr. Klingenberg read his paper, when the Council had some fears that the paper might lead to a political discussion. The Council had other wishes which did not appear in the constitution of the Committee, but which had been respected by the Committee. The Council considered that questions which were to the detriment of a certain section of its members should not be dealt with, and some members of the Industrial Committee were anxious to respect that wish. Other members of the Committee felt that if a proposition that was for the benefit of the whole industry was brought forward, some section might have to give way or to suffer slightly. The Council having made this ruling, however, it was difficult for the Industrial Committee to choose suitable subjects which were likely to meet with the approval of the Council. Well-known members of the Council who were respected by everybody thought that the high standard of the Institution might suffer if it lent its name to discussions dealing with money matters, such as finance or trade discounts, that were likely to enter into the discussion of industrial questions. They were very anxious that no publicity should be given to any of those deliberations. Whilst within those limitations the Industrial Committee had full powers, he thought it was due to himself, as chairman, and to some of the members who differed from those views, to say that the above were some of the limitations of the constitution which were not referred to in the report, and which acted against the possibility of the Industrial Committee doing such work as it was hoped could have been done. He did not say this as a complaint or as a reproach, but thought it should be understood by those who took an interest in the question.

At a later stage Mr. A. H. Seabrook, in proposing a vote of thanks to the honorary auditors, took the opportunity to say, as vice-chairman of the defunct Industrial Committee, that he regretted that the Council could not see its way to make itself the centre of the electrical industry, not only from the point of view of technical and scientific matters, but also with regard to industrial and commercial questions. After all, whether they were professional or business men, they were all dependent on £ s. d., and whether their interests were technical and scientific, or industrial and commercial, the financial factor was an essential factor in their existence, not only as an Institution, but as individual members of the electrical industry. In his opinion it was regrettable that the articles of association did not seem to allow the Council to take a full share in these industrial and commercial matters. It was evident from the attendance that day, and the complacent attitude of the audience, that members were perfectly satisfied, unlike himself, that the Institution should confine itself entirely to the aims for which it was originally constituted. He did not wish to make any protest or complaint, but merely gave expression to his own regret in regard to the matter.

Mr. Kenelm Edgcumbe associated himself with the remarks of Mr. Seabrook.

Mr. W. M. Mordey, before proposing a vote of thanks to the honorary solicitors, also digressed to say that he was one of those people who thought that the influence, dignity, and usefulness of the Institution would be best maintained and increased by following the example that they had always had before them, of giving their attention to the scientific and engineering foundations of the electrical engineering industry, rather than by attempting in any way to make it a trade association. This principle, from which the growth and strength of the Institution had sprung, was, he thought, in the long run, actually the best and most helpful to the electrical profession.

PARLIAMENTARY.

Leeds Corporation Bill.

Last week the Select Committee of the House of Lords, presided over by the Earl of Plymouth, concluded its consideration of this Bill which, amongst other matters, seeks to empower the Corporation to extend the tramways. The Bill was opposed by the Yorkshire Electric Power Co., and the Great Northern and Midland Railway Companies, and the West Riding County Council.

Mr. Forbes Lankester, K.C., who with Mr. H. Lloyd, K.C., and Mr. Jeeves, were for the promoters, explained that the tramway undertaking of the Corporation was a very prosperous concern. In 1910 they obtained powers to install a system of railless traction, and this had been a great success. The Corporation now proposed to extend the railless system into the districts of Otley and Burley, which were greatly in need of direct communication to the centre of the city. The Yorkshire Electric Power Co. wished to provide the electricity for these extensions, but he submitted that the Corporation could supply their own electricity at a cheaper rate and in a better way. The opposition of the County Council was directed to the cost of the upkeep of roads, and the contention of the promoters was that the trolley cars did not do so much harm as motor vehicles, and they should be treated like ordinary traffic.

Mr. J. B. Hamilton, general manager of the Leeds Corporation tramways, gave evidence in support of the Bill. He explained that the proposals were to carry the existing tramways at Guiseley to the White Cross, and to extend the line at York Road to Walton. The proposal with regard to railless traction was to run trolleys from that proposed tramway extension at the White Cross, Guiseley, to Otley and Burley in Wharfedale. At present the Corporation had 113 miles of tramways, and last year the receipts were £411,531, which allowed of a surplus of £70,000 being paid into the city fund. The Corporation did not agree that they would interfere with the statutory rights of the Yorkshire Electric Power Co.

In cross-examination, Witness said he estimated that the gross receipts from the Otley and Burley route would be £7,218, the estimate being based on the running of 190,780 car-miles at 9d. per mile. He estimated the working expenses at £5,167, and the capital charges, &c., at £1,334. He had put down a further £298 for road maintenance at ⅜d. per car-mile, but he did this not because he admitted the principle, but in view of the recent decisions of Parliamentary Committees, he wanted to be on the safe side.

A number of local witnesses were called as to the benefit which would accrue to the districts from the proposed further travelling facilities, and Mr. Smithson (chairman of the Leeds Tramways Committee), and Mr. C. J. Spencer (general manager of the Bradford Corporation tramways), also gave evidence in support of the Bill.

Mr. Talbot, K.C., on behalf of the Midland and Great Northern Railway Companies, urged that it was not the province of local authorities to provide transit facilities outside their districts, and argued that the proposed trolley vehicle system was not a real extension of the Leeds tramway system. The position of the railway companies would be that they would have the competition, and, as large ratepayers, have to bear a portion of any loss incurred.

Mr. Ram, K.C., for the West Riding County Council, asked the Committee to say that if the trolley vehicles were allowed, the Corporation should contribute to the maintenance of the roads.

Mr. Woodhouse, general manager of the Yorkshire Electric Power Co., urged that his company were the only statutory company able to supply electric energy in the district under consideration, and they were prepared to supply the Corporation at the rate of 1⅛d. per unit for 200,000 units, and at a reduced rate when the quantity was increased.

The Committee decided that the Bill should be allowed to proceed on condition that the Corporation should contribute to the maintenance of the roads over which the trolley vehicles ran at the rate of ·375d. per car-mile. An arbitration clause was to be inserted in the Bill as to the fixing of the rate at the end of three years, which could be put in operation by either of the parties. The Corporation was not to be required to make any contribution towards the capital expenditure of widening or reconstructing roads. The Corporation was to be permitted to supply electrical energy for the sole purpose of the trackless trolley system on the proposed route.

Birkenhead Corporation Bill.

A Select Committee of the House of Lords, presided over by Lord Barnard, on May 19th, passed the Bill promoted by the Birkenhead Corporation, which, among other matters, sought to enable the Corporation to run motor-'buses in connection with the tramways undertakings.

Mr. Clode, K.C., explained that the Corporation were asking for powers to run motor-'buses so as to provide facilities in districts where development had proceeded beyond the tramway area, and to couple up certain outlying districts with the tramways by means of the motor-'buses. At present all the tramway routes started from the ferry, and the idea was to link up these routes by omnibuses so that people could get across from one route to another without having to come back to the common starting point. It was proposed to spend £17,000 on omnibuses and £3,000 on depôts.

Mr. Vesey Knox, K.C., on behalf of the Cheshire County Council, asked that the Corporation should be subjected to the same conditions as that imposed upon Manchester, whereby the Manchester Corporation agreed to give the County Council and the local authorities a veto over the running of any of the omnibus services so that the whole matter could be discussed between the different authorities.

After consultation, Mr. Solly, the Chairman of the Birkenhead Corporation Parliamentary Committee, said the Corporation would be prepared to make a contribution of ⅜d. per car-mile for road maintenance.

The Committee consulted in private, and the Chairman announced that they were not prepared to grant the Manchester clause, but would be prepared to sanction some payment to the outside authorities whose roads were used, for maintenance.

Eventually the Committee passed the Bill subject to the insertion of a clause to the effect that the consent of the County Council should be necessary before the motor-'buses could be run in the outside districts, that the consent should not be unreservedly withheld, and that, failing agreement, an arbitrator should decide the question of the amount of contribution to be paid by the Corporation towards the cost of the maintenance of the roads used by the motor-'buses.

Ashington U.D.C.'s Bill.

After three days' hearing, the Select Committee of the House of Lords, presided over by Lord Lamington, on May 21st, passed the preamble of the Bill promoted by the Ashington Urban District Council to empower them to supply gas within their district, and the parishes of North Seaton, Woodhorn, Cresswell, Ellington, Bothal Demesne, Pegswood and Sheepwash, and to acquire the gas mains, meters, &c., of the Ashington Coal Co.

Mr. H. Lloyd, K.C., for the promoters, explained that there was at present no statutory supply of gas, but the Ashington Coal Co. had a small gasworks in connection with their colliery, and also supplied a number of private consumers. The Northern Counties Electricity Supply Co. came into the district in 1902, and took electric current from the generating station of the Coal Co. By an agreement come to lately, the Newcastle Electric Supply Co. were operating the Northern Counties Co., and there had been some improvement in the supply. There was great complaint in the district with regard to lighting. He objected to any clause being inserted to the effect that no loss from the gas undertaking should be allowed to fall on the rates, as the Electricity Co. might give away electricity for a few years and crush the Gas Co. out of existence.

A great deal of evidence was called as to the need for improved lighting facilities.

Mr. Vesey Knox, K.C., on behalf of the Ashington Coal Co., contended that the proposal was an unjustifiable scheme of municipal trading. The Northern Counties Electricity Supply Co. had spent £40,000 on distributing plant in the district, and since the Newcastle Electricity Co. had operated there had been an enormous improvement in the supply. If there was a loss on the gas undertaking, it meant that the Coal Co., who paid half the rates, would suffer considerable loss.

The preamble of the Bill was passed, subject to the approval of the Local Government Board to the borrowing powers.

Second and Third Readings.—In the House of Lords, on May 19th, the Hightown Gas and Electricity Bill passed its third reading. On May 20th the Norwich Electric Tramways Bill was read a second time.

In the House of Lords on Monday the Shropshire, Worcestershire and Staffordshire Electric Power Bill passed its third reading; also the Yorkshire Electric Power Bill.

In the House of Commons on Monday the North Metropolitan Electric Power Supply Bill passed second reading.

Newcastle Corporation Bill.—The Standing Orders Committee of the House of Lords has decided not to dispense with standing orders in regard to the application of the Corporation to insert a new clause in their Bill to allow them to run motor-'buses in the districts of Long Benton and Weetslade.

LEGAL.

Franco-British Electrical Co. *v.* Clifford Bros.

At the Bow County Court recently, plaintiffs were awarded £4 9s. 3d. in a claim for damages for breach of warranty against defendants, an East Ham firm. Plaintiffs ordered in 1912 certain electric time switches to automatically switch on and off current for electrical advertising signs, and they said that one of these, instead of turning off the light after six or seven hours, left the current on wasting during the hours of a sunny day. One witness said that the lights outside the Pavilion Theatre were on several occasions found burning in the morning. Eventually the apparatus was removed, and the fireman was paid to switch the light on and off. Mr. P. Clifford said that the plaintiffs were the only firm who had complained. He had supplied such switches to a number of electrical firms. It was some months after they had been fixed that the plaintiffs complained.

His Honour Judge Smyly said that it would take a certain time to find out whether the switch did what was required. He found for the plaintiffs for the amount named. Plaintiffs claimed £7 17s. 6d.

Godfrey *v.* Cox.

Mr. Muir Mackenzie one of the Official Referees of the High Courts, on Monday, May 25th, delivered judgment in this case, which was an action to recover £89 8s., balance of an account for electrical work done at the defendant's house, "Belmont," Streatham, by the plaintiff, Mr. Herbert James Godfrey, electrical engineer, of 188, High Road, Balham, and which was fully reported in our last issue. Mr. Godfrey, who had previously done electrical work for Mr. Cox, was approached by the defendant to do electrical work of various kinds in the house, including wiring, fitting and heating, the account for which originally amounted to £104 8s. The defendant, however, alleged that the work had been done negligently and improperly, and paid £38 8s. into Court. On behalf of the plaintiff it was contended that the work was done at "cut prices," but that it was nevertheless well done in accordance with the contract. On the other hand, the defendant alleged that the work was done negligently and improperly, and that he had had to get the defects remedied by another contractor.

Mr. Muir Mackenzie, in giving judgment, said that the contention of the defendant was that the contract was for certain work to be done for an agreed sum of money, and that as the work had not been done in accordance with the contract, nothing was recoverable. He (the Referee) found against this contention. The plaintiff, according to his case, completed his work, and was entitled to be paid, but the defendant denied that the work was of the best character. On this issue he found in favour of the defendant. The outside work was bad, and the inside work was also faulty, and it was the duty of the defendant, under the circumstances, to take such steps as were necessary to put himself in the position in which he would have been if the plaintiff had properly fulfilled his contract. He employed another firm to make good the installation. In this he (the Referee) found that the defendant had acted reasonably, and that the firm was not employed to do more work than was necessary. For this the defendant claimed £63, but he (the Referee) found that he was only entitled to recover £53 6s. The defendant had paid £38 8s. into Court, which was more than sufficient to cover the balance due from him. There would, therefore, be judgment for the defendant on the action, and for payment out of the balance. The costs would be for the defendant on the claim and the counterclaim.

Judgment was entered accordingly.

Marconi *v.* Helsby Wireless Telegraph Co.

The hearing of this action, which is to come before Mr. Justice Eve in the Chancery Division, has been fixed by his Lordship for Tuesday, June 23rd.

Venner's Signs v. Stellar Signs.

In the Chancery Division on Friday, before Mr. Justice Astbury, Mr. F. Russell, K.C., mentioned this case, which, he said, related to the infringement of a patent. It was not an ordinary case of infringement, but it was a rather serious case, in which an old employé of the plaintiffs was concerned.

Mr. Kerly, for the defendants, asked for an adjournment with a view to answering the evidence of the plaintiffs. He suggested that the motion should stand over till the second motion day of next sittings.

His Lordship said the motion would stand till Thursday (yesterday), and he would then consider whether it should stand over further.

Mr. Kerly said there was a good deal of evidence to consider.

The motion accordingly stood over till yesterday.

Osram Lamp Works, Ltd., v. Pope's Electric Lamp Co., Ltd.

In the Chancery Division on Tuesday, Mr. Justice Joyce heard a summons by the Osram Lamp Works, Ltd., for leave to deliver interrogatories to Pope's Electric Lamp Co., Ltd., with regard to the process of manufacture of certain filament lamps which were alleged to be an infringement of the plaintiffs' patent. The interrogatory which the defendants' objected to answer in its present form was as follows:—Whether the filaments of the said lamps are constructed by mixing tungsten of the same and what compounds thereof with some organic, and what organic binding medium, and whether or not it is then prepared in the form of filaments carbonised and by some and what method is the carbon removed.

Mr. J. Hunter Gray, for the Osram Lamp Co., said he wanted the information asked for in order that the defendants' process might be gone through and shown to be an infringement.

Mr. Clarke (for defendants): I can't be forced to tell what my process is.

Mr. Gray stated that what his clients did was to take tungsten and make it into a powder and mix it with some organic powder such as sugar to stick it temporarily together. Then it was squirted through a small hole to make the filament. Afterwards it was subjected to heat to reduce the sugar to carbon, and the carbon was removed chemically by steam and hydrogen at an even higher temperature. This produced a coherent wire of tungsten. Plaintiffs' patent covered the use of any organic binding medium, which was afterwards carbonised and had the carbon chemically removed.

Mr. Clarke said he would admit that the defendants used tungsten for their filaments, and that this was bound together with an organic medium, but afterwards the defendants' process was quite different to that of the plaintiffs.

In the end, his Lordship held that the plaintiffs were not entitled to all the information they asked for. It was really a general question: What is the mode you use? That would be inadmissible, and would be disallowed.

Leave to appeal was granted.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Manager" writes:—"I should like to know the legal position of an electricity supply undertaking in the following instances:—

1. Due to a street improvement scheme a number of houses are being pulled down, necessitating the removal of the service cables. Can the electricity supply undertaking make a charge to the Corporation responsible for the carrying-out of the street improvement?

2. If a service is run into a building at the request of the tenant and with the permission of the landlord—the tenant afterwards removing and the property changing hands—the new landlord requires the service to be removed from his premises. Can the electricity supply undertaking legally make a charge for removing the service cable?

⁂ As to (1) provision is made by the 1899 Electric Lighting (Clauses) Act for the rights of undertakers whose property is affected by a street improvement. By Clause 17 of the Schedule to that Act, one month before any alterations are made in a street which would affect wires and lines notice of the proposed alterations must be served. Within three weeks after the service of any such notice and plan upon any owners those owners may, if they think fit, serve a requisition upon the operators requiring that any question in relation to the works or to compensation in respect thereof or any other question arising upon such notice or plan shall be settled by arbitration, and thereupon the question, unless settled by agreement, must be determined by arbitration. In settling any question under this section an arbitrator must have regard to any duties or obligations which the owners may be under in respect of the pipes, wires, electric lines, or works, and may, if he thinks fit, require the operators to execute any temporary or other works, so as to avoid interference with any purpose for which the pipes, wires, electric lines, or works are used, as far as possible.

As to (2) the remedy of undertakers who are called upon to remove service lines which are no longer in use must be pursued against those with whom they contracted. In the case referred to in the query, it is presumed that the away-going tenant will have complied with the terms of his contract to pay for a supply for a certain period. Having done that, unless there is a special clause to the contrary, the fittings, &c., become so vested in the owner of the premises, and attached thereto, that he can be compelled to pay the reasonable cost of their being removed. By Sec. 24 of the Electric Lighting Act, 1882, a power of entry is conferred, but it really depends upon the conditions under which they were first put in whether a charge for removing them can be made or not.

BUSINESS NOTES.

The Holidays.—The Great Eastern Railway Co. has issued an attractively illustrated quarto album of "East Coast Pictures" in connection with the earlier holiday movement. Copies can be obtained free from the Superintendent of the Line, Liverpool Street Station, London, E.C.

Catalogues and Lists.—Messrs. Carson & Evans, 3, Fenchurch Buildings, London, E.C.—New folder giving information, testimonials, &c., respecting Carvanite, the sales of which for the four months ended April, 1914, are reported as being eight times greater than for the corresponding period of 1913.

The Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, London, W.—Price leaflet particularising their new electric bell indicator for ships, lifts, hotels, &c.

Messrs. Feld Bros. & Co., Ltd., 25, Budge Row, London, E.C.—72-page catalogue, with information, illustrations and prices relating to special electrical apparatus and material for the construction and working of overhead travellers, cranes and other transport appliances. A separate album contains dimensional sketches corresponding to the articles described in the catalogue. The material has been standardised as far as possible by the firm, and the drawings are so arranged that they can be used as original tracings. This publication should be of interest to those engaged in connection with electric crane or conveying plant equipments; its usefulness will not be detracted from by such spelling as "swith-boxes," "pols" (for poles), "aplyable," "watertigth," and so on.

Messrs. J. H. Holmes & Co., Portland Road, Newcastle-on-Tyne.—Fourth edition of the mining section of their catalogue. It consists of 48 pages of half-tone pictures of power station plant, motors, pumps, haulage gear, oil switches, mining switch pillars, switchboards, controllers, &c.

The A.E.G. Electric Co., Ltd., 133-135, Oxford Street, London, W.—Book (222 pages) entitled "Electricity in the Home and Workshop" containing a great deal of information, together with prices and a number of interesting illustrations regarding the following matters:—Electric lighting with incandescent, arc and quartz lamps respectively, electric heating and cooking apparatus, electric fans, electric motors for household and industrial service, illumination and advertisement lighting, Christmas tree lighting, and electric clocks.

The company have also issued a large collection of illustrated and priced lists regarding a wide range of electrical goods, including fans, kettles, small motors, drills, grinders, lamps, wires, transmission fittings, electric refrigerators, and so forth.

The Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, London, W.C.—Three new lists for the trade. No. 255 describes the Sun switch-ceiling rose and pendants fitted with same; No. 256 illustrates and particularises the Lavigne electric unpickable lock, adapted for every possible requirement in door fastenings; and No. 257 deals similarly with a range of fittings for ½-watt lamps for interior and exterior use.

Mr. E. C. Amos, 22, Martin's Lane, Cannon Street, London, E.C.—New 44-page catalogue containing fully illustrated particulars, with tabulated information concerning capacities, dimensions, weights, &c., of low-pressure centrifugal pumps made by Mr. A. Borsig, of Berlin, for whom he is British representative.

The National Cash Register Co., Ltd., 225, Tottenham Court Boad, London, W.—A very interesting copy of the "N.C.R.," the firm's trade organ. It illustrates the development of the firm's cash registers, and also effectively shows what a great benefit has been conferred upon the human race by patented inventions.

Messrs. G. W. Goodchild & Macnab, 56 58, Eagle Street, Southampton Row, London, W.C.—Hanging wall chart setting out dimensions, weights, prices and code-words of their "Dekef" ball bearings—thrust, journal, and transmission shafting. Copies will be forwarded on application.

Messrs. Adnil Electric Co., Ltd., Artillery Lane, London, E.C.—Illustrated price-list (No. 127AE) giving full particulars of their standard type "G. F." direct-current interpole motors from 1 to 125 h.p., and dynamos from 3½ to 90 kw.

The Power Plant Co., Ltd., West Drayton, Middlesex.—List No. 9 contains illustrations and description of their double-helical gearing for machine tool drives; No. 10 deals with double-helical spur gears for automobiles, &c.

Messrs. Crompton & Co., Ltd., Chelmsford.—New leaflet No. 537, describing their cell-testing voltmeter, and giving prices of same.

Rhadoonit.—The makers of "Rhadoonit" inform us that as a result of their advertisement in the Electrical Review, they have received inquiries from nearly every country of any importance in the world, including the British Colonies and Dominions, but excepting, of course, certain European States where requirements are catered for direct from the works of the makers in Germany. Mr. C. A. Muller, of 10, Arcade, Westgate, Bradford, the sole agent for the United Kingdom, states that the works have now eliminated the inability of Rhadoonit to withstand immersion in oil and its tendency to soften under sustained high temperature.

A G.E.C. Advertising Campaign.—The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have made arrangements whereby electricians, ironmongers, &c., can supply "Magnet" domestic irons for 15 days' free trial—this with a view to popularising "other uses" of electricity where electric lighting is in vogue. In this connection a small 32-page booklet has been issued by the company, which not only deals with the price and cost of using electric irons, but also with a complete range of domestic electric accessories.

Book Notices.—*Ornamental Lathe-Work for Amateurs.* By C. H. C. London: Percival Marshall & Co. Price 3s. 6d. net.—Many engineers are fond of the workshop, not only for commercial reasons, but also for the sake of the recreation it affords in leisure hours. To such this book should prove a valuable guide, as it opens the way to the practice of an art that offers possibilities of infinite diversity. Not only does the author embody in its pages the fruits of his own experience as a craftsman, he also gives particulars of prices and sources of materials, information which is often difficult to secure. The author, who reproduces views of many beautiful things that he has made, states that they were all produced within about nine months, and that he made all his own apparatus. The book is full of useful hints, with illustrations far above the average, and we have no hesitation in recommending it.

The Engineering Index Annual, 1913. New York: Engineering Magazine Co.—This is the twelfth volume of the Index, and, like its predecessors, is heartily welcome; we have so often expressed our appreciation of its contents and of the skill with which they are compiled and classified, that we are somewhat at a loss for new encomiums wherewith to sound its praises. The Index covers some 250 publications, of which, it is interesting to note, three-fourths are printed in English—such is the dominance of our tongue. As an aid to rapid search for references to published articles on any subject of engineering interest, it remains unrivalled.

The Municipal Year Book for 1914. London: Municipal Journal, Ltd. Price 15s. net. This volume has grown in size and increased in usefulness as the years have passed, and the edition now before us impresses one with the extent and importance of the undertakings and operations conducted to-day by municipal departments. In the upkeep and extension of their various undertakings, municipalities are large customers for all kinds of manufactures, and that fact alone makes such a work as this practically indispensable to those concerned with industry and trade; but there are many others also who in public and professional life are frequently requiring information such as a book of this nature is able to give in its numerous sections. The members of the different councils in England, Wales, Scotland and Ireland and their chief officers, and information regarding the cities, boroughs, &c., for which they act, form by no means the least useful section, and in later parts there are given tabulated statistics of electricity supply and tramway undertakings with detailed analyses of accounts; water and gas undertakings are also covered, and in the present edition there is a new section, which is likely to grow, relating to motors in municipal service. Other important sections deal with education, town-planning, and the housing of the working classes refuse disposal, baths and wash-houses, protection from fire, old-age pensions, a digest of legal cases, a summary of legislation of 1913, municipal debt and assets, local taxation returns, tramwaymen's wages and hours of labour. Mr. Robert Donald is director of the *Year Book*, and Mr. Albert E. Cave is its editor.

British Trade with Canada.—A few months ago (Electrical Review, December 12th, 1913) we gave particulars of the scheme for sending a British train across Canada for advertising and pushing the sale of British manufactures. The Canadian Chamber of Commerce (Oxford Court, Cannon Street, E.C.), which is organising the scheme is at present conducting a Canadian trade campaign, in order to secure collective action at the earliest possible date on the part of British firms anxious to secure an increased proportion of Canadian import trade. It is trying to strengthen the British Manufacturers' Section of the Chamber by the addition of further representative firms and the subscription of a Canadian Trade Fund. The fund will be devoted to a year's campaign sending special commercial commissioners to Canada to report upon the problems of the market considered from the British standpoint. These commissioners, it is suggested, will act under the advice of, and in consultation with, Mr. C. Hamilton Wickes, H.M. Trade Commissioner in Canada. In the preliminary list of members in the British Section we observe the names of several well-known electrical manufacturers. The Secretary of the Chamber will be glad to give the fullest information available to any British firm.

At the London Chamber of Commerce last week Mr. Hamilton Wickes, who in his capacity as our Trade Commissioner in Canada, has already had abundant opportunities for studying the Canadian market from the British point of view, gave an instructive address to a fairly good gathering of City men. He began by giving figures to show that £76,000,000 of the gross imports into Canada were open to the British manufacturer or trader. In the Board of Trade report shortly to be issued that £66,000,000 was analysed showing the extent of the possibilities for particular trades. We were dealing with a market all along the border of which we had a powerful competitor, and we lacked an Anglo-Canadian merchant organisation. A number of criticisms were offered of British methods. Ordinary English yards and inches were used, and it was a land of dollars and cents, and English firms should remember these points in sending catalogues. The United States had the advantage that its currency was the same as the Canadian. In respect to delivery, the States possessed little or no advantage over the Britisher. Time was, of course, lost if there was correspondence Home and back. Canadian firms objected when, after giving an order for goods, they got an invoice by return and had to wait two or three months for their goods. This was particularly noticeable in hardware. It was a mistake to think that a method of business which had succeeded in Australia could necessarily be applied with equal success in all the rest of the world. One Continental organisation that he had met both in Australia and in Canada did not invoice the buyer until the goods were landed in Canada. The Canadians swore that this was the way things should be done. It was bringing things into line with the practice of the U.S. manufacturers on the South side. British firms said that they could not find suitable agents in Canada, but Mr. Wickes said that they did not realise the expense and the currency, and did not give favourable terms. It was said that the range of British goods was not wide enough to bear the expense of the travelling—they could not pay enough to have the territory properly covered, but Mr. Wickes advocated the formation of groups of manufacturers of similar articles—not identical lines—who would have one agent. That was the only way in which the cost could be sufficiently reduced to pay the different concerns interested. The main difficulty that our firms had to get over was to learn the habit of distributing. Mr. Wickes wondered why the trading community here as a whole took so little interest in the Trade Commissioners and the Board of Trade Commercial Department. "We have to carry the information to you, and in many cases force it down your throats." Why, when firms sent representatives to Canada, did those representatives not call and secure the invaluable information that the Trade Commissioner could put at their disposal? "Why does the Press boycott the Trade Commissioner and the Commercial Intelligence Department of the Board of Trade and their attempts to help the commercial community?"

In the course of a brief but interesting discussion which followed, several speakers spoke very highly of the assistance that they had received from the lecturer of the afternoon in trying to extend their trade relations both in Australia and in Canada.

"Metroflam" Lamps.—The Newcastle-on-Tyne Corporation has just placed a further repeat order with Messrs. Johnson and Phillips, Ltd., with 40 long-burning "Metroflam" lamps, bringing the total number installed up to 130. Repeat orders for these lamps have also recently been received from the Glasgow, Blackpool, Southend, South Shields and Willesden lighting authorities.

Bankruptcy Proceedings.—W. R. Wedge, electrical engineer, The Arcade, Northampton. — The adjourned public examination of this debtor was to have been held at the County Hall, Northampton, on May 19th, but when the case was called, the Official Receiver, Mr. A. Ewen, stated that he had received a letter from the debtor, stating that whilst at work he had met with an accident. Debtor did not think it was a serious matter, but the doctor had said it was. The letter was accompanied by a doctor's certificate. The Official Receiver applied for a further adjournment, and the case was, therefore, again adjourned.

L. J. Aron, engineer, 7, Harpur Street, Bloomsbury, W.C.—Receiving order made May 18th, on creditors' petition. First meeting June 3rd. Public examination July 1st, both at Carey Street, W.C.

Jas. Brockie, mechanical engineer, 41, London Road, Forest Hill, S.E.—Last day for proofs for dividend June 7th; trustee, Mr. M. W. W. Mackie, 47½, Old Street, E.C.

William Henry Pease, electrical engineer, 19, Princess Royal Terrace, Scarborough, York, late Royal Hotel Shops, Scarborough, and 19 and 20, Baxter Gate, Doncaster, York. The following are creditors herein:—

General Electric Co.	£145	Postmaster-General	£14
Pease, Mrs. W.	152	Barlow & Co.	21
Pease, Miss E.	70	Joyner & Co.	22
Gent & Sons, Ltd.	37	Steel Conduits & Fittings	14
Johnson & Phillips	22	Tonks, J., & Sons	26
Brimsdown Lamp Co.	28	Eldridge & Morris	85
Adnil Electric Co.	15	"Bankers"	21
London Electric Warehouse	18	Appleyard, Arthur	18
Hallamshire Electric Co.	14		

William Walker, lately carrying on business at 2-3, Red Lion Court, Fleet Street, E.C., as "David Smith & Co.," dealers in electric lamps.—At a sitting of the London Bankruptcy Court, held on Tuesday, before Mr. Registrar Linklater, this public examination was held. The statement of affairs showed liabilities £968 10s. and assets "nil." Replying to Mr. Egerton S. Grey, Official Receiver, the debtor stated that he was born in New Zealand and came to this country in 1908. Until July, 1911, he was in employment, but then commenced business on his own account as above, with a capital of £28, his own money. He subsequently borrowed £762 from his wife, and the whole of that money was lost in the business, which was to exploit lamps manufactured in Dresden, Vienna and Paris. It was carried on until 1912; the petitioning creditors, who were the Osram Lamp Works, Ltd., then obtained an interlocutory injunction restraining him from selling any lamp manufactured with a squirted filament. They wanted him to enter into an agreement not to sell any lamp manufactured by people other than themselves and two other firms. That he refused to do, and the Osram Co. proceeded with their injunction, and obtained judgment for the costs of the action. Witness was unable to pay the bill, and these bankruptcy proceedings ensued. The business was closed in December, 1912, and witness had since been employed as managing director of a company. He attributed his failure and insolvency to the costs of litigation. The books were destroyed when the business was closed. The examination was concluded.

Trade Announcements.—The Brush Electrical Engineering Co., Ltd., has issued a notice to the effect that the business of the electrical supplies department of the company, trading under the name of the London Electric Warehouse Co., Manners Street, York Road, London, S.E., has been taken over as and from April 1st last by the Anglo-Colonial Engineering Co., Ltd., 13, City Road, London, E.C. The Anglo-Colonial Co. will assume responsibility for all receipts and payments. The managing director of the company will be Mr. P. J. White (late general manager of the London Electric Warehouse Co.), and it is its intention to specialise in everything electrical.

Messrs. Pearson & Co., dealers in E.L. fittings, of 31, Cornmarket, Oxford, are removing to new premises at 19-23, George Street.

Liquidations.—The National Telephone Co., Ltd.—A meeting will be held at Hamilton House, Temple Avenue, E.C., on June 25th, to hear an account of the winding up from the liquidator, Mr. G. Franklin.

The Grindell-Matthews Wireless Telephone Syndicate, Ltd.—Mr. H. W. Kirby, of Basieshaw House, Basinghall Street, E.C., has been appointed liquidator (with a committee of inspection) in the compulsory winding up of this company.

The De Forest Wireless Telegraph Syndicate, Ltd.—A meeting will be held at the offices of Messrs. Allen Attfield & Co., 147, Leadenhall Street, E.C., on June 29th, to hear an account of the winding up from the liquidator, Mr. S. J. Ashby.

Canada.—The Imperial Trade Correspondent at Toronto (Mr. F. W. Field) reports that an electrical and mechanical engineer, with a good connection throughout Canada, wishes to get into touch with United Kingdom electrical and mechanical engineering firms desirous of transacting business in Canada. Information may be obtained at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Meter Approved.—The B. of T. has approved of the Ferranti polyphase watt-hour meter, type C.T., deposited by Messrs. Ferranti, Ltd., in February, 1913.

LIGHTING and POWER NOTES.

Aberystwyth.—Street Lighting.—The T.C. has decided to consult an expert on the question of lighting portions of the town by electricity. Part of the district is already lighted by electricity by the Chiswick E.S. Corporation, which has been asked to suggest a scheme by which a better light could be obtained from current at present used.

Accrington.—Annual Accounts.—The revenue of the Corporation electricity undertaking for the past year amounted to £27,678, the working expenses to £17,979; and after meeting capital charges a net surplus of £677 remained, as compared with £2,323 in the previous year. The units sold amounted to 5,856,030, as against 4,836,024 in 1912-13, and included 435,000 sold in bulk to Haslingden. The total cost per unit amounted to 1·107d., and there were 1,136 consumers. The bulk of the energy is generated by gas engines operating in conjunction with a by-product plant, and it is somewhat noticeable that the revenue received from by-products (sulphate of ammonia and tar), was over £500 in excess of the revenue received from the Haslingden supply mentioned above.

Argentina.—The Minister of Public Works of the Province of Mendoza has been requested by the representative of the Argentine Power and Railless Traction Co. to ask the Government to declare as lapsed the concession for electric light, power and tramways in the city and suburbs of Mendoza, granted to the Compania Luz y Fuerza. The company, which has been working the concession for two years, has a capital of $1,000,000 gold in bonds, which, together with $850,000 in shares, is held by the Compania Alemana Transatlantica de Electricidad, and about $4,500,000 paper, has been advanced by the parent company, the Deutsche Ueberseeische Elektrizitäts Ges., so that the capital invested in the Mendoza undertaking is about $7,000,000. A new hydro-electric station, with a capacity of 12,000 H.P., is at present being constructed for the company by the Compania General de Obras Publicas.

The Isla Syndicate, which holds a concession for the use of the waters of the San Juan River, has deposited $100,000 in guarantee of fulfilment of its concession. This has been transferred to the Central Argentine Electric Light, Power and Tramways Co., which has been registered with a capital of £450,000. The engineers entrusted with the works are Messrs. Dick, Kerr & Co.—*Review of the River Plate.*

Aughton (near Ormskirk).—Proposed E.L.—The Parochial Committee has agreed to receive a deputation on the question of an electricity supply for the district.

Bacup.—At a conference between representatives of the Bacup and Rawtenstall T.C.'s it was decided that the present agreement is to be terminated, and that the whole question of the management of the electricity undertaking shall be reconsidered.

Bailieborough (Co. Cavan).—E.L. Scheme.—Mr. John W. M'Keever, of Ardee, has submitted an E.L. scheme for the towns of Bailieborough, Shercock, Mullagh and Kingscourt to the Bailieborough B. of G., and a special meeting of the board has been arranged to discuss the matter.

Barnes.—Vehicle Battery Charging.—The U.D.C. has resolved to charge 1d. per unit for charging electric battery vehicles during times other than peak-load hours, 1½d. per unit during peak-load hours, and ¾d. per unit between 11 p.m. and 6 a.m., with a minimum charge of 2s. for one charging operation. In future all large consumers of current for heating and power are to be supplied at 1½d. per unit, less 33⅓ per cent. discount.

Barrow-in-Furness.—Year's Working.—During the last year the revenue of the Corporation electricity department increased from £17,524 to £20,149, and working expenses from £9,250 to £11,460. The net profits decreased from £702 to £513. The units sold totalled 2,081,317, an increase of 21 per cent.

The Electricity Committee has decided to charge 1d. per unit for current for charging electric battery vehicles at other than peak-load hours.

Basingstoke.—Loan Requirements.—The B.C. has resolved to borrow £14,000 for electricity purposes; also to purchase the necessary columns, brackets and fittings for electrical street lighting.

It has been decided to charge 5d. and 4½d. per unit for lighting, 3½d. per unit for outside shop lighting, and from 2d. to 1½d. per unit for power purposes.

Bexhill.—Year's Working.—The gross profit of the electricity department for the year ended March 31st last was £6,524, compared with £6,173 in 1913. The net profit was £1,817, against £1,276, and has been carried forward.

Bootle.—L.G.B. Inquiry.—Mr. T. C. Ekin held an unopposed inquiry last week into the application of the T.C. for sanction to borrow £19,312 for the extension of the electricity undertaking, including a new generating station, a sub-station, mains and services.

Bury.—Rate Relief.—The Electricity Committee has decided that out of its profit of £2,185, £1,000 shall be paid to the relief of the rates, and the balance to the reserve fund.

Cleethorpes.—Proposed Loan.—The U.D.C. is applying to the L.G.B. for sanction to a loan of £10,000 for the extension of the electricity undertaking.

Colwyn Bay.—Year's Working.—There was a gross profit of £3,836, and a net profit of £1,168, on the past year's working of the electricity undertaking.

Connah's Quay.—L.G.B. Inquiry.—An inquiry was held on May 22nd into the application of the U.D.C. for a loan for carrying out an electric light scheme.

Continental Notes.—Sicily.—La Société d'Electricité de la Sicile Orientale, which is now supplying current to 15,619 clients, has decided to establish a steam-operated generating station at Catania, to act as a reserve to the water-power plants.

Germany.—The Bergische Licht, Kraft und Wasserwerk Ges. is the name of a new concern formed to acquire the municipal gas and electric lighting undertakings in the town of Bergisch-Gladbach, and the concession for the electric lighting of Bensberg.

Cowbridge and Penybont.—The B. of T. has issued an order empowering the South Wales E.P.D. Co. to supply electricity in the borough of Cowbridge, six parishes in the area of the Penybont R.D.C., 27 parishes in the area of the Cowbridge R.D.C., and a portion of the parish of Llantrisant.

Croydon.—Year's Working.—The net surplus on the electricity undertaking for the past year amounted to £1,877, which with other amounts left £2,284 to be carried forward. The reserve fund from which £6,559 was taken during the year for new turbine plant and the sinking of an artesian well, had a balance of £26,494, and it has been agreed to transfer the surplus, £2,284, to this fund.

The engineer (Mr. A. C. Cramb) reports a considerable increase in electrical cooking and heating, and urges that steps be taken to obtain powers for hiring out the necessary apparatus or installing it on the hire-purchase terms. The units sold show an increase of 733,355 on the year, during which reductions in price were made equivalent to £1,000 to the tramways department and to £800 for public lighting services.

Loan Sanction.—The L.G.B. has sanctioned a loan by the T.C. of £9,500 for new electricity mains, and £500 for sub-stations.

Cranbrook.—E.L. Scheme.—The Joint Committee of the P.C. and the R.D.C. on May 20th discussed the E.L. scheme proposed by Messrs. Saunders & Co., of Westminster. A parish meeting recently voted in favour of the scheme, but objections have now been received to the use of overhead wires. By the casting vote of the chairman, a resolution was passed to the effect that, whilst not averse to the scheme, the Joint Committee strongly deprecated the use of overhead wires.

Dinas Powis.—Proposed E.L.—The St. Andrew's P.C. has decided to consider the question of E.L. in the parish, on account of its treatment by the Barry Gas Committee.

Enniscorthy.—Proposed E.L. Scheme.—The U.D.C. has decided to take steps to start an electricity undertaking in the town; a report by Mr. Harris, of Dublin, estimated the cost of a scheme at £1,632, the annual revenue at £1,507, and the working costs at £752. Information is to be obtained from similar towns which have adopted electric lighting.

Falkirk.—Plant Extensions.—The T.C. has decided to install another battery at the electricity works, at an estimated cost of £4,750, and to extend the switchboard, at an estimated cost of £1,000.

Frinton-on-Sea.—Proposed Promenade Lighting.—The E.L. Co. has submitted to the U.D.C. proposals for lighting the sea-wall promenade, and for the supply of current to the occupiers of huts for heating purposes. The Council has requested full particulars of the scheme.

Greenock.—Proposed Loan.—The T.C. has decided to apply to the Secretary for Scotland for power to borrow an additional £30 000, to meet the cost of extensions at the electricity works. The output of the department for power and light during April showed a decrease of 47,000 units compared with April of last year.

Hessle.—Proposed E.L.—The Hull T.C. has decided to issue the necessary notices for supplying electricity to Hessle. The heads of agreement with the U.D.C. have been settled, and the question of Hull paying Hessle £462, expended in obtaining the prov. order, has been waived.

Huddersfield.—Loan Sanction.—The Electricity Committee has received the sanction of the L.G.B. to borrow £21,500; sanction has now been obtained to the borrowing of £52,000 out of £62,000 applied for.

India.—Street Lighting.—In order to compare the respective merits of electric and gas lighting, the Municipal Commissioner has arranged with the Bombay E.S. and Tramways Co. and the Bombay Gas Co. to carry out experiments in several streets of the city.

The Simla Municipality has applied for a loan of Rs. 2,75,000, for the first extension of its hydro-electric scheme.—*Indian Textile Journal.*

Keighley.—Prov. Order.—The R.D.C. has agreed to support an application by the Keighley Corporation for a prov. order to supply electricity to Steeton and Morton Banks, the former relating to the lighting of the main road. The Corporation has also been permitted to canvass the residents of Morton Banks, to ascertain the probable demand.

Leeds.—L.G.B. Inquiry.—Mr. T. C. Ekin last week held inquiries into the application of the T.C. for sanction to borrow £212,000 for extension of the electricity undertaking, and £17,600 for the purchase of the undertaking of the Roundhay and District Electric Lighting Co. The price to be paid for the latter was the amount of the preference and ordinary share capital in the company, £12,390, with interest on the ordinary share capital at the rate of £3 2s. 4d. per cent.

Limerick.—Year's Working.—The net profit on the Council's electricity undertaking for the past year amounted to £181.

Lisnaskea.—Proposed E.L.—The R.D.C. has been informed by the L.G.B. that as objections have been made to the E.L. scheme for the town, an inquiry will be held at an early date.

Llanfair Caereinion (Montgomeryshire). — E.L. Scheme.—An E.L. scheme for the town has been put in hand, and is to be completed by the end of October. Power is to be obtained from the River Banwy.

London.—The L.C.C. has been recommended by its Finance Committee to grant the following loans for electricity purposes:—Fulham B.C., £5,000, including £4,590 for mains, and £410 for plant; Shoreditch B.C., £11,073, including £5,745 for land, £2,142 for mains, £1,916 for services, and £1,270 for meters; Southwark B.C., £10,087, including £7,055 for mains, £1,867 for machinery, £1,040 for services, and £125 for meters; all these loans have been sanctioned.

The Finance Committee has also recommended the Council to sanction the following loans for electricity purposes:—Poplar B.C., £5,000 for a site for coal storage; Shoreditch B.C., £11,481, including £5,000 for mains, and £6,481 for plant.

Hackney.—The B.C. has decided to take up a loan of £16,350 for electricity purposes, which has been sanctioned by the L.C.C.

Westminster.—The City Council is recommended to continue, for a further 12 months, its contracts with the Charing Cross, West End and City E.S. Co., the Metropolitan E.S. Co., and the St. James' and Pall Mall E.L. Co., for the supply of electricity to the Council's buildings.

Hayle.—Street Lighting.—The U.D.C. has decided to ascertain the cost of a public lighting installation by electricity, and the annual charge, based on the existing 61 lamps, for maintenance.

Middlesbrough.—Year's Working.—The net profit of the Corporation electricity department during the past year was over £4,000, an increase of £2,278 on the previous year.

Middleton.—Year's Working.—There was a deficit of £640 on the past year's working of the electricity undertaking.

Morecambe.—The T.C. has received the draft consent of the B. of T. to supply electricity to premises in Heysham.

New Zealand.—The new 9,000-h.p. hydro-electric station of the Waihi Gold Mining Co., which is the largest in Australasia, has recently been put into operation. The power-house is at Hora Hora Falls, on the Waikato River, and the plant consists of six turbines of the Francis type, built by Jens Orten-Boving & Co., each of 1,500 b.h.p. capacity at 187 r.p.m., direct-coupled to a 1,050-kw. Siemens three-phase, 5,000 volt, 50-cycle alternator. The pressure is stepped up to 50,000 volts for transmission to Waikino, 44 miles distant, the transmission line with steel towers and three copper wires, passing over the Te Aroha ranges, rising to a height of 2,500 ft. Normal spans are 480 ft., and the maximum about 1,300 ft. At Waikino, the pressure is stepped down to 11,000 volts for transmission 5½ miles to Waihi, and a portion is used locally at 500 volts in the company's 200 stamp battery. At the mine the motors are supplied at 2,000 volts. Some 30 motors have been installed for all classes of work, and the company has the right to supply local authorities on the route in bulk, for distribution purposes.

Nottingham.—Year's Working.—The revenue for the past year of the Corporation electricity department amounted to £96,818, and the expenditure to £56,713; of the balance, after meeting capital charges, £8,000 was allocated to the relief of the rates, and £4,471 to the reserve fund.

Oldham.—Year's Working.—The net profit on the Council's electricity undertaking for the year ended March 25th last, was £1,994, compared with £1,044 in the previous year. The power load increased by 42 per cent. during the year, and lighting load by 17 per cent.

Paisley.—Street Lighting.—It is understood that a Sub-Committee of the T.C. is considering an important scheme for the extension of the electric lighting system. The scheme generally is to light the main thoroughfares from the present terminals to the burgh boundaries, and, as the existing cables are inadequate, the scheme would necessitate new cables throughout the town, which may possibly be laid in duplicate, so that every alternate lamp could be switched off at midnight.

Peru.—The Cerro de Pasco Mining Co., which owns large copper and coal mines in the State of Junin, has just completed a large hydro-electric plant. The power is obtained from the river Yauli, near Pachachaca, and conveyed by a canal, about 10½ miles long, to the power station at Oroya. It is stated that from 12,000 to 14,000 h.p. is available.

Portsmouth.—Year's Working.—The past year's working of the Corporation electricity department resulted in a net profit of £4,364, of which it is proposed to allocate £3,000 to the relief of the rates, and £1,000 to reserve.

Reading.—Bulk Supply.—The B. of T. has granted the Reading E.S. Co. permission to supply electricity in bulk to the York Town and Blackwater Gas Co.

Richmond (Surrey).—Street Lighting.—The T.C. has granted permission for the Richmond E.L. and P. Co. to install electric lighting in the Crescent, Kew Road, Sheen Road and Bridge Street, as an experiment.

Salford.—Probable Extensions.—It is anticipated that the Electricity Committee will need to take steps in the near future to cope with the increasing demand for current. Several firms have intimated that they will require additional supplies before long.

Sedgefield.—Street Lighting.—The R.D.C. has given the Trimdon P.C. permission to erect overhead wires for electrical street lighting at Trimdon Grange and Trimdon Colliery. The work is being carried out by Messrs. Reed, Ferens and Co., and current is to be supplied by Messrs. Walter Scott, Ltd.

Southport.—New Charges.—The T.C. has recently adopted the following method of charging for electricity:—To business premises, according to the maximum load demanded, plus ¾d. per unit; private houses, at a fixed charge based on the gross rental, plus ¾d. per unit.

Stirling.—Loan Sanction.—The T.C. has received sanction to the borrowing of £3,000 for electricity purposes. In granting the application, the Secretary for Scotland pointed out that attention should be given to the building up of an adequate reserve fund.

Swindon.—Subject to a seven years' contract, the T.C. has decided to supply electricity, on arranged terms, for lighting and power to the new factory of the Imperial Tobacco Co.

Tilbury Docks.—The Port of London Authority has authorised the installation of electric accumulators at the Docks, at an outlay of £5,500, for the working of a series of electric cranes.

U.S.A.—Half-watt Lamps.—The electrical department of the Sanitary District of Chicago has decided to use 2,000 half-watt lamps, in 300 and 500-watt sizes, for street lighting. They will be operated on straight-series arc A.C. circuits from compensators giving 20 amperes in the secondary. The makers guarantee 1,350 hours' life; and as the result of tests it has been found practicable to operate mixed circuits with flame arcs.

The electors of Los Angeles have voted in favour of the issue of bonds of 6½ million dollars for the completion of the hydro-electric generating plant, and the construction or acquisition of an electric distributing system. The three electric companies in the city have energetically opposed the municipal scheme, and have offered to purchase the energy for resale in the city at a price fixed by the city authorities.—*Elec. World.*

TRAMWAY and RAILWAY NOTES.

Ardsley.—Railless Traction.—The B. of T. has sanctioned the borrowing by the Council of £4,000 for the railless traction system.

Baildon.—Proposed Loan.—The U.D.C. has decided to apply to the L.G.B. for sanction to borrow £21,800, for the construction of tramways.

Birmingham.—First-Class Tramcars Abandoned.—The service of first-class cars in Hagley Road has proved a failure, and has been withdrawn. The inside fares were doubled, while outside they were as usual, but it was found that only a small percentage of passengers paid the increased fares.

Bristol.—Proposed Tramways Purchase.—Reports have been prepared by Mr. J. B. Hamilton, manager of the Leeds city tramways, and Mr. J. F. C. Snell, jointly, and by Mr. J. M. McElroy, manager of the Manchester city tramways, concerning the proposed purchase by the T.C. of 25 miles of tramways belonging to the Bristol Tramways and Carriage Co., upon which the Council has an option of purchase on May 1st, 1915. Messrs. Hamilton and Snell state that the company refused "at present" to supply information or to allow an inspection of the undertaking, and their estimates have, therefore, been compiled from descriptions in the technical Press, civic data, the examination of the workings of the undertaking which were available to all, and from experience elsewhere. The 25 miles of tramway, including the power station and all depôts, are valued at £600,000, and the net surplus available on a year's working by the Council is estimated at £37,073, which could be easily increased. Longer penny stages divided into halfpenny stages are recommended. The reporters do not agree that tramways are becoming an obsolete type of conveyance, and state that the substitution of a motor-'bus service in Bristol would cost £78,872 per annum more than the tramways. Railless electric traction is not favoured for general use, and the report is in favour of the purchase of the undertaking by the Council.

Mr. McElroy's report is also strongly in favour of municipal purchase, and states that tramways on the overhead system have not been threatened by other systems of traction. He also thinks that the fares are too high. Messrs. Hamilton and Snell state that there is scope for several new routes in Bristol, and also for railless traction services.

On Tuesday last the City Council considered the purchase not only of the option lines, but also of the outlying sections. which, under a clause inserted in the Bill, has been made compulsory. Mr. J. Littleton, an accountant, criticised the experts' figures, and contended that the basis of 6·04d. as the working costs per car-mile was wrong, and that it should be at least 8·36d. He stated that the purchase would involve the Council in a loss. The Council, without a division, approved a resolution which virtually pledges it to purchase if the decision is confirmed by a poll of the electors.

Continental Notes.—France.—From the report of the Paris Metropolitan Railway Co. for 1913, which has just been issued, we learn that a new power supply sub-station, known as the Auteuil, was put in operation in September last. At the Republique and Motte-Picquet sub-stations two new 1,500 KW. transformers were added to each, while one of similar capacity was installed at the Denfert-Rochereau sub-station. At the Bercy power station a new 1,500-KW. alternator—making the eighth—has been put down to replace an old continuous-current set. Seventy new motor coaches and 64 trailers were added to the rolling stock during the year, and 108 of the first category and 21 of the second have been ordered for the new lines approaching completion.

The Société des Chemins de Fer Economiques du Nord, which owns three steam railways in the Upper Savoy Department, has secured Government authority to convert them to electric traction. It has also secured a concession for the construction of two local electric railways, one from Samoens to Sixt, and one from Pont de Fillinges to Habere-Poche.

A concession has been granted for the construction of electric tramways between St. Germain-en-Laye and Argenteuil, and between St. Germain-en-Laye and Maisons-Laffitte.

Russia.—The Council of Ministers has approved the raising by the town of Vilna of a loan of about £427,000 for the installation of an electric tramway in the city. The loan has not yet received Imperial sanction.

Switzerland.—An 80-year concession has been awarded to a syndicate represented by M. le Dr. E. Mory, of Adelboden, and M. R. Zehnder-Spörry, for the construction of a narrow-gauge electric railway from Frutigen to La Lenk, *viâ* Adelboden. The line has to be ready for working within 30 months from the date of commencement. The cost of construction is estimated at £200,000.

Italy.—The Municipal Tramway Board of Turin has been authorised to construct an electric tramway from that city to Monte Rosa.

Croydon. — Estimates, 1914-15. — The estimated receipts of the tramways undertaking for next year are £90,171, and working expenses are expected to amount to £71,589, leaving a gross balance of £18,582, reduced to £2,017 after meeting capital charges, &c. It was pointed out that the figures were speculative, but the receipts had lately been improving.

Dundee.—Year's Working.—The total revenue of the T.C. tramways department for the past year amounted to approximately £69,475, an increase of £4,431 on the previous year.

Exeter.—Year's Working.—The revenue of the T.C. tramways department for the past year amounted to £17,489. The net surplus was £1,724, and has been carried to the reserve and renewals fund, which now stands at £7,833.

Huddersfield.—Year's Working.—The total income of the T.C. tramways department for the past year was £116,320, an increase over the previous year of £6,611, and an average of 11·54d. per car-mile. The total working expenditure was £70,971, or 6·92d. per car-mile. The net profit was £8,800, of which £6,662 has been applied to the relief of the rates.

The B. of T. has consented to the doubling of the tramway track in Leeds Road North.

Japan.—The Imperial Railway Board has granted concessions for the construction of the following electric railways:—Ikegami Electric Railway Co. (6·32 miles); Tamba Electric Railway Co. (5·5 miles); Nagoya Electric Railway Co. (2·7 miles); and the Ama Electric Railway Co. (4 miles).

Leeds.—Proposed New Cars.—The Tramways Committee has recommended the T.C. to ask the B. of T. to sanction the borrowing of £22,500 for the provision of 25 new tramway cars. It is estimated that between 50 and 70 will be required in the near future. About half the cars will be built by the Corporation, and the remainder will be bought from private contractors.

Leicester.—Proposed Tramway Extensions.—The Tramways and Electricity Committee has recommended the T.C. to construct a tramway from Aylestone Road *viâ* Welford Road to Clarendon Park Road, at an estimated cost of £19,954.

London.—Hackney.—The Electricity Committee has recommended a charge of 1d. per unit for energy for charging electric vehicle batteries during unrestricted hours, and 3½d. per unit during restricted hours.

Manchester.—Annual Report.—The annual report of the Corporation tramways department states that during 1913 four new routes were opened, bringing the aggregate length of single track open for traffic on March 31st last, including lines over which the T.C. had running powers, to 194½ miles. The revenue amounted to £925,310, and working expenses to £585,224. Including bank interest, £13,594, the gross profit for the year was £353,610. The net profit was £200,309, of which £97,219 has been placed to the reserve, renewals and depreciation account, and £100,000 to the relief of the rates. The revenue per car-mile was 11·410d., against 11·351d. in the previous year. Working expenses were 7·216d. per car-mile, against 7·132d. There were 1,303,353 parcels carried, against 1,189,143. The total profit in this department was £3,642. There are now 662 tramcars in stock. The passengers carried exceeded 205,000,000, an increase of 17,933,558.

Nottingham.—Year's Working.—The total revenue of the Corporation tramways undertaking for the year ended March 31st last amounted to £175,329, an increase of £8,218 over the previous year. Working expenses amounted to £108,422, and of the surplus £7,013 has been placed to the reserve and renewals fund, £34,340 to capital charges, and £24,000 in aid of the rates. The energy consumed amounted to 5,359,804 units, a decrease of 401,292 units. The car-mileage was 3,524,621, an increase of 38,831, and the Notts. and Derby Co.'s cars also ran 19,000 miles in the city. Passengers carried numbered 40,410,404, an increase of 1,926,322, while the company's cars also carried 125,000 passengers.

Stirling.—Proposed Tramways Purchase.—The Stirling and Bridge of Allan Tramways Co. has intimated its willingness to sell its undertaking to the T.C., but it prefers that the T.C. should first come to terms with the Bridge of Allan T.C. and the County Council, and afterwards come to a definite agreement. The company asked that the negotiations might be carried out speedily, as it intended, if no agreement were arrived at, to apply for a prov. order to introduce a system of petrol tramcars over the whole of the present route. The T.C. decided to submit its proposals in writing.

Stoke-on-Trent.—In the face of strong opposition, the Federated Council last week passed a resolution to extend the lease of the tramways to the Potteries Electric Traction Co.

York.—Tramway Extensions Sanctioned.—The application of the T.C. for powers to extend the tramway system has been granted by the Light Railway Commissioners.

TELEGRAPH and TELEPHONE NOTES.

British Automatic Telephones.—The automatic telephone exchange recently opened by the Indian Government at Simla is reported to have proved immediately successful, and the question of adopting the system at other Indian stations is under consideration. The apparatus was made and erected by the Automatic Telephone Manufacturing Co., Ltd., within 10 months of receiving the order. The company has also installed an automatic exchange at Cordoba for the United River Plate Telephone Co., Ltd., and is now erecting a similar one at Rosario. Each exchange has an ultimate capacity of 10,000 lines; the Cordoba Exchange is at present fitted for 2,000, and that at Rosario for 5,000 lines. At the annual general meeting of the River Plate Co., the chairman said that the service at Cordoba was giving general satisfaction.

Germany.—The *Times* states that a working arrangement has been concluded between the two rival German wireless telegraph companies—the Telefunkengesellschaft, of which Count Arco is the head, and the Hochfrequenzmaschinengesellschaft, which uses the Goldschmidt machines. The extent of the agreement is uncertain, but it is stated that the two companies will share stations—the latter company's station at Neustadt, in Hanover, and the former company's American station at Tuckerton, for communication between America and Germany.

Guernsey.—The statement of accounts of the Guernsey States Telephone Department for the year 1913 shows a total income of £7,139, and expenditure, including interest and sinking fund, £6,375, leaving a net profit of £764, an increase of £156 on the previous year. The loan account stands at £32,000, of which £2,882 has been paid off; the reserve fund for depreciation amounted to £15,542, and the reserve fund for contingencies to £4,223. The total outlay on construction was £45,283, of which £13,283 was paid out of the reserve funds. The number of subscribers' lines was 1,725, an increase of 72; the mileage of metallic circuit wire was 1,446 overhead and 824 underground. The total number of messages during the year was 1,366,433.

International Congress.—At the Congress of Telegraph and Telephone Engineers, which is to be held at Berne on September 1st, the following subjects will be submitted for discussion:—Protection of telegraph and telephone lines from the influence of electric tramway and railway currents; telephoning to great distances through underground and submarine cables; introduction of mechanical working of telephones—its advantage from the standpoints of working and economy, and to what extent its introduction is desirable; comparison of automatic telephony as regards erection and working costs and erection of local stations, with introduction of reduced tariffs, and the study of the best working system for large networks.

Japan.—The expenditure for the extension of the Japanese telephone service during the coming fiscal year is estimated at £300,000, the same as that of last year; the number of telephones to be newly installed will be about 12,000.

Oceania.—Owing to the favourable position of the French Colonies in Oceania on the new shipping routes opened by the Panama Canal, it has been decided to establish a coaling station at Papeete (Tahiti). The future importance of this port demands sufficient facilities for telegraphic communication, and, the nearest cable being 2,125 miles away, wireless telegraphy is to be employed. At present France alone, among the Powers having interests in the Pacific, is inadequately connected with her possessions there. With a view to remedying this state of affairs, large stations are to be erected at Noumea and Papeete. The necessary powers were obtained from the Chamber of Deputies on April 3rd last, credit for £75,500 being voted to the Colonial Minister, and the Colonies agreeing to contribute a total of £20,000 towards the cost of the scheme. It is estimated that the cost of maintaining 8 or 10 hours service per diem will average about £6,000 per station per annum. The two new stations in conjunction with the French submarine cable from Australia to New Caledonia will connect French possessions in Oceania with sources of coal and other supplies in Australia, and the powerful radio station now under construction at Saigon will be able to communicate (at least during favourable night hours) with New Caledonia, distant 4,700 miles oversea. The Saigon station will be completed in the spring of 1915, and will be one of the most powerful stations in the world. A 425-H.P. generating set will supply a musical transmission set with current of 1,000 cycles frequency. The aerial will be carried by eight 410-ft. masts, and its length will exceed 2,630 ft.—*La Lumière Electrique.*

Pacific Cable.—The Pacific Cable Board has introduced, as from yesterday, a week-end cable service between Canada and Australasia, the charges being $3 for 20 words and 15 cents for each additional word.

Sweden.—A proposal is to be brought before the Swedish Parliament to contribute 900,000 kronen towards the cost of construction of a direct telephone communication between Sweden and Germany.

Trunk Telephone Service.—The Postmaster-General states that from June 1st the reduced charges at present made for abortive trunk calls will be abolished, and that a system of following up trunk calls, which have failed at the first attempt, will be introduced, without extra charge.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—July 20th. Box compound, meters, maximum-demand indicators, arc lamp carbons, and straight-stem insulators, for the Council. Specifications for each section 10s. 6d., from City Electrical Engineer, Town Hall.

July 8th. N.S.W. Railways and Tramways Department. One battery booster set to Specification No. 453. Specification (2s. 6d.) from the Electrical Engineer's Office, 61, Hunter Street, Sydney.

Melbourne.—June 3rd. Sixty tubular steel tramway poles, and concentric lead-covered cable. City Council. See "Official Notices" May 22nd.

Hobart.—July 20th. Telegraph and telephone material, for Postmaster-General. See "Official Notices" May 22nd.

Perth.—July 22nd. Telegraph and telephone material, for Postmaster-General. See "Official Notices" May 22nd.

July 1st. 360 accumulators, Tudor type, for Postmaster-General. See "Official Notices" May 22nd.

August 5th. Copper wire and binders, for Postmaster-General. See "Official Notices" May 22nd.

August 12th. Cable, lead-covered and various, for Postmaster-General. See "Official Notices" to-day.

Belgium.—June 2nd. The municipal authorities of Rocour (Province of Liége) are inviting tenders for the concession for the supply of electrical energy for public and private lighting and power purposes in the town.

Brighton.—June 9th. Corporation. 20,000 to 24,000 tons of single washed nuts for the electricity department. Forms of tender from Mr. H. Talbot, Town Clerk.

Canada.—May 30th. Saskatoon City Council.—Two 750-H.P. water-tube boilers, two chain-grate stokers, two sets economisers, and two sets superheaters. Specifications from Mr. E. Hanson, City Electrical Engineer.—*Canadian Engineer.*

Cleckheaton.—June 10th. 3,000 tons of slack coal for the Electricity Department. Mr. J. H. Linfield, Clerk to U.D.C., Town Hall.

Darlington.—June 4th. Corporation. One water-tube boiler and one cooling tower, for the Electricity Department. Borough Electrical Engineer, Electricity Works, Haughton Road.

Dartford.—June 15th. U.D.C. One 500-KW. high-pressure steam turbine, generator, condenser, &c. See "Official Notices" May 22nd.

In our "Official Notices" last week the advertisement of the Dartford Urban District Council, inviting tenders for plant for the electricity works, was inadvertently headed "Urban District Council of *Deptford*." We regret the mistake.

Dover.—June 2nd. Coal for the T.C. Mr. R. E. Knocker, Town Clerk, 69, Castle Street.

Dundee.—Corporation Electricity Department. Tenders for the execution of steel work for the erection of sub-station in Bellfield district. Mr. H. Richardson, General Manager and Engineer.

France.—Paris.—Machine tools for the State Railways electric material repair-shops at Garenne. Particulars, 72, Rue de Rome, Paris.

June 3rd. Supply of bronze and copper wire, in 33 lots, to Ministry of Posts and Telegraphs. Particulars, 103, Rue Grenelle, Paris.

Brest.—Tenders are required (1) for the construction of an ironwork building at the naval dockyard at Brest; (2) for the equipment of the same, including six 5-ton electric cranes, two 30-ton travelling bridges, a lift, and sundry accessory lifting appliances. Intending tenderers must apply at once for the bases of competition and leave to compete, to M. le Directeur des Constructions Navales, at Brest.

Glasgow.—June 4th. Corporation. 145,000 tons of coal (singles and pearls) for the Electricity Department. Specification from Mr. W. W. Lackie, Engineer, 75 Waterloo Street.

Grays.—June 15th. U.D.C. 12 months' supply of Griff or Babbington hard steam coal for the Grays Thurrock U.D.C. Forms of tender from the Electrical Engineer.

Great Torrington.—Firms willing to undertake installation and working of the electric lighting should communicate with Mr. G. M. Doe, Solicitor, Great Torrington. See "Official Notices" to-day.

Harrogate.—June 22nd. Corporation. Economiser, 288 pipes, for Electricity Department. See "Official Notices" to-day.

Hornsey.—June 3rd. B.C. Twelve months' supply of coal for the Electricity Department. Forms of tender from the Town Clerk's Office, 99, Southwood Lane, Highgate, N.

H.M. Office of Works.—June 2nd. Three years' supply of lift ropes. See "Official Notices" May 22nd.

Keighley.—June 11th. Small slack (about 6,000 tons) for the Electricity Department. Mr. H. Webber, Borough Electrical Engineer and Tramways Manager, Power Station, Coney Lane.

Leeds.—June 29th. Corporation. Air-cooled transformers. See "Official Notices" May 22nd.

Liverpool.—June 2nd. Electrical fittings and stores for 12 months, for the directors of the Liverpool Overhead Railway. Forms of tender from the Manager, 31, James Street.

London.—L.C.C.—June 4th. Installation. 760 wiring points, 900 lights; telephones, call and fire bells; at Furzedown Training College and Hostels, Tooting, S.W. See "Official Notices" May 15th.

Tenders are to be invited by the Highways Committee for the supply of rotary converters, static transformers, and an overhead crane required in connection with the re-arrangement of tramways sub-stations and sub-station plant, and also for the supply of certain plant, tools, and equipment for the Cressy Road, Hampstead, and the Camberwell car-shed extensions.

June 23rd. 50, 100 or 150 complete trailer-cars and equipment of 200 existing electric motor-cars with couplers and traction gear for drawing trailer-cars. See "Official Notices" to-day.

Battersea.—June 24th. B.C. Coal telpherage plant. See "Official Notices" to-day.

Metropolitan Police.—June 3rd. Three years' supply and maintenance of electrical cell-calls at Police Stations and Courts, for the Receiver, New Scotland Yard. See "Official Notices" May 22nd.

St. Pancras.—June 3rd. B.C. Coal for 12 months for the Electricity Department. Forms of tender from the Electricity Department, 57, Pratt Street, Camden Town, N.W.

Hampstead.—June 11th. B.C. One 1,500-kw. turbo-alternator, barometric jet condenser and pipework, cooling tower and tanks. See "Official Notices" May 22nd.

Stepney.—June 11th. B.C. Three years' supply of meters, demand indicators, time switches and carbons. See "Official Notices" May 22nd.

Loughrea (Co. Galway).—May 30th. Gas engine and suction plant, dynamo and motor booster, storage battery, switchboard, overhead lines and street lamps, for Loughrea Electric Power and Lighting Co. See "Official Notices" May 15th.

Manchester.—June 10th. The Education Committee is inviting tenders for a complete electric lighting installation at Soss Moss Special School. Specifications, &c, £1 1s. (returnable) from the Education Offices, Deansgate.

June 12th. Corporation. Twelve months' supply of washed and dry coal for the Electricity Committee. Forms of tender from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Morecambe.—June 25th. Corporation. 2,500 tons of coal or slack, for Electric Supply Department. See "Official Notices" to-day.

New Zealand.—Wellington.—July 9th. City Council. Electric chassis for a 2,000-lb. parcels delivery van, and an electric car, for the Electric Tramways Department. Specification may be seen at the Board of Trade Commercial Intelligence Department in London.

July 27th.—New Plymouth B.C. (2) Overhead wiring and permanent way (5 route miles). (3) Sub-station equipment (converting plant, battery, booster, switchboard, &c.). (4) Rolling stock (six complete cars) for electric tramways. Specifications from Mr. F. Black, Consulting Engineer, Wellington, or B. of T. Offices, London. Deposit (2) £4 4s.; (3) £2 2s.; (4) £2 2s.—*N. Z. Shipping and Commerce.*

Auckland.—August 6th. Three 750-kw. d.c. mixed-pressure turbo-generators; one 1,500-kw. three-phase turbo-generator, including auxiliary plant and sub-station equipment. See "Official Notices" May 22nd.

Penrhiwceiber (Glam.).—June 3rd. Twelve months' supply of electrical fittings, stores, &c., for the Penrikyber Navigation Colliery Co., Ltd. Forms of tenders from the Secretary.

Rochdale.—June 3rd. Electric automatic book lift for the Treasurer's Department. Mr. P. W. Hathaway, A.R.I.B.A., Town Hall.

Spain.—June 5th. Tenders are being invited by the municipal authorities of Cabra (Province of Cordoba) for the concession for the electric lighting of the town during a period of four years.

Swindon.—June 3rd. Corporation. Steam coal. See "Official Notices" May 22nd.

Salford.—June 15th. 24 car bodies, also trucks, motors, controllers, &c., for same. General Manager, Corporation Tramways, 32, Blackfriars Street.

Wallasey.—June 6th. Steel framed buildings for the generating station in Dock Road, Poulton. Drawings, &c, £2 2s., obtainable from Mr. J. A. Crowther, Borough Electrical Engineer, Seaview Road.

Warwick.—June 1st. B.C. Manholes, chambers, sedimentation and storm-water tanks, and other works. See "Official Notices" May 15th.

June 1st. B.C. Electric motors, centrifugal pumps, switchgear, automatic control apparatus, pipes, valves, &c. See "Official Notices" May 22nd.

CLOSED.

Australia.—P.M.G.'s Department:—

Victoria.—90,000 pattern "A" insulators, £2,250.—Warburton, Franki (Melbourne), Ltd.

Queensland.—500 c. b. table pattern telephones, £737: 100 ditto, £390: 700 ditto, wall pattern, £1330.—J. Paton & Co.

N S W. Railways and Tramways Department.—Eight d.c. motors to specification 445.—Standard Waygood Hercules, Ltd.—*Tenders.*

Barnes.—The U.D.C. has decided during the year to order 100 meters from the Electrical Apparatus Co., Ltd.

Barrow.—The T.C. has placed an order for a feed pump with the Pulsometer Co., the price, exclusive of erection and connections, being £88; and one for a transformer, £109, with Messrs. Ferranti. Arrangements have been made with the B.I. and Helsby Cables, Ltd., for the purchase of 6 tons of copper, at £66 10s. per ton, to be made into cable as and when required.

Belgium.—Eleven firms—two French, one Italian, five German and three Belgian—last week submitted tenders to the Belgian Post and Telegraph authorities, in Brussels, for the supply of 195 tons of copper wire. La Compagnie Française des Métaux, of Paris, submitted the lowest tender for 100 tons, while the lowest offer for the other 95 tons came from the Westfalische Kupfer und Messingwerke Gesellschaft, of Ludenscheid, Westphalia.

La Société Electricité de l'Est de la Belgique, of Verviers, has secured the concession for the electric lighting of the little town of Thimister (Province of Liége).

Buckhurst Hill.—The U.D.C. has accepted the tender of Messrs. Stuart & Moore, Ltd., of Ealing, W., for the installation of electric call-bells for the fire brigade, at £88 11s., with £8 a year for maintenance.

Burton-on-Trent.—The T.C. has accepted the tender of Messrs. Manlove, Alliott & Co., Ltd., for extensions to the refuse destructor plant, at £1,765.

Colwyn Bay.—Messrs. Chamberlain & Hookham, Ltd., have received the contract for meters.

Falkirk.—The T.C. has accepted the following tenders for annual stores:—

Heavy cables.—Callender's Cable Co.
Small cables.—W. Geipel & Co.
Polyphase meters.—The Electrical Co.
Single-phase meters.—Bat Meter Co.
D.C. meters.—Chamberlain & Hookham and Reason Manufacturing Co.
House service fittings.—Henley & Co.
Transformers.—Ferranti, Ltd.
Metal-filament lamps.—Millar & Stewart.

Glasgow.—The Tramways Committee (Works and Stores) recommends the acceptance of the following tenders :—

Clevis bolts.—J. Hally Craig.
Rubber-insulated cable.—W. T. Henley's Telegraph Works Co., Ltd.
Three core lead covered cable ; single core lead-covered cable.—J. Hally Craig.
Double lead sheathed telephone and test cables ; E.H.T. rubber-insulated cables.—B.I. and Helsby Cables, Ltd.
Rails and fishplates for Govan depôt.—Barrow Hæmatite Steel Co., Ltd.

The offer of Messrs. Johnston Park & Co. (£125) to rewire the electric light installation at the sewage disposal departments, works and stables, at Haghill, has been accepted.

Edinburgh.—The Corporation has placed the contract for continuous-current meters (Bastian patents) with the Electrical Co., Ltd.

Ilford.—The District Council proposes to enter into a fresh contract with the New System Private Telephone Co., Ltd., in respect of the whole installation of 22 instruments for a period of eight years.

London.—L.C.C. The Education Committee recommends that the chairman, vice-chairman, and deputy-chairman of the Council, and the chairman and vice-chairman of the Education Committee and of the Buildings Sub-Committee of the Education Committee be each authorised during the Whitsuntide recess to open the tenders received for the installation of electric light at Furzedown Training College and Hostels, Wandsworth, and to accept the lowest satisfactory tender.

The Highways Committee reports the receipt of the following tenders for the supply of wood-working machinery and equipment required for the third section of the central car repair depôt.

W. B. Haigh, Gruban & Co., Ltd.		£1,372
" " "	(alternative)	1,335
Buck & Hickman, Ltd.	(not to specification)	1,486
" " " (alternative)	"	1,541
J. Pickles & Son	"	1,531
T. Robinson & Son, Ltd ; Wadkin & Co. ; A. Ransome & Co., Ltd.	(incomplete tenders)	

The Committee recommends the acceptance of the tender of Messrs. W. B. Haigh, Gruban & Co., Ltd., for £1,372 (including a provision of £30 for pulleys and £25 for extra works if required).

The Committee has accepted the tender of Messrs. Newton Bros., for the reconstruction of two 50-KW. motor-generators.

The Committee recommends that none of the tenders received for the supply of polyphase electricity meters be accepted. Only two tenders were received, and the prices were much in excess of the estimate.

The Committee also recommends that a pneumatic hoist, portable compressed-air cleaning apparatus, two magnetic-brake testing instruments, and one insulation-resistance testing instrument be obtained from Messrs. S. H. Heywood & Co., the Globe Pneumatic Engineering Co., Messrs. Elliott Bros., and Messrs. Evershed and Vignoles, Ltd., at the estimated costs of £180, £150, £30, and £14 respectively.

The Committee reports the acceptance of the tender of the B.I. and Helsby Cables, Ltd., for the supply of copper bonds for 12 months—Class T, 8 items, 1 (A) and 1 (B) ; and also the acceptance of the undermentioned tenders for the supply of materials in connection with the equipment of the boiler-house workshop at the Greenwich generating station :—

High-speed shaping machine, emery grinder and universal disk grinder.—Selson Engineering Co., Ltd., £104 10s., £29 10s., and £55 10s. respectively.
High-speed sensitive drill, and grindstone and trough.—Buck & Hickman, Ltd., £12 16s. 6d. and £8 respectively.
Portable air-compressor and tools.—Alley & MacLellan, Ltd., £233 10s.
Rope-testing gear.—W. and T. Avery, Ltd., £21 5s.

HAMMERSMITH.—The B.C. Electricity Committee reports the receipt of the undermentioned tenders for switch fuses and apparatus for sub-stations :—

Universal Electric Manufacturing Co., Ltd.	(recommended)	£ 6
Seage & Co.		41
Spagnoletti, Ltd.		41
" " (alternative)		40
British Calibrated Fuse Co.		65
G.E. Co.		70
Turners & Manville		87

For relagging the boilers and sundry steam pipes at the generating station, the tender of Messrs. Matthew Keenan & Co., Ltd., at 10½d. per ft. super., is recommended.

The following tenders for insulated wires for the year ending March, 1915, have been received :—

Armorduct Manufacturing Co., Ltd. (Foreign)	(recommended)	£93
Ward & Goldstone, Ltd.		108
Pirelli, Ltd. (Foreign)		109
Drake & Gorham, Ltd. (Foreign)		111
Electrical Co., Ltd.		123
Liverpool Electric Cable Co.		127
G.E. Co., Ltd.*		129
C. Mackintosh & Co., Ltd.*		141
Gillespie & Beales		146
Geipel & Co.*		155
Electrical Trades Supply, Ltd.		165
Callenders, Ltd.		169
Johnson & Phillips, Ltd.		169
London Electric Wire Co.		169
W. T. Henley's Telegraph Co.		169
British Insulated and Helsby Cables		170
Siemens Bros., Ltd.		171
India-Rubber and Gutta-Percha Co.		172
Western Electric Co., Ltd.		172
W. T. Glover & Co., Ltd.		173
Edison and Swan U.E.L. Co., Ltd.*		170

* Net. All the other tenders are subject to a 2½ per cent. discount.

MARYLEBONE.—The Guardians have accepted the tender of Messrs. Lund Bros. & Co., at £1,783, for installing electric light at the North Kensington Infirmary. In all, 14 tenders were received, the prices ranging from that accepted to £3,075.

Huddersfield.—The Corporation Electricity Committee has accepted the following tenders :—

Switchboard for tramway supply.—Ferguson, Pailin & Co.
Steam pipes.—John Spencer, Ltd.
Cable.—Geipel & Co., and B.I. and Helsby Cables, Ltd.
Switchgear for controlling the motor converters at the tramway power station.—Bruce Peebles & Co., Ltd.

Llanfair Caereinion.—Mr. R. Edwards, of Llanuwchllyn, has received the contract for the electric lighting scheme. The work is to be completed by October 1st.

New Zealand.—DUNEDIN.—The Electric Power and Lighting Committee has accepted none of the tenders received for constant-current transformers and street-lighting material, but has recommended that tenders for these supplies be obtained as required.—*N.Z. Shipping and Commerce.*

Rochdale.—For the Corporation electricity station there has been placed with Messrs. E. Bennis & Co., Ltd., through Messrs. Clarke, Chapman & Co., Ltd., a contract for eight chain grate stokers, each 11 ft. 5 in. long × 5 ft. 1½ in. wide, for Woodeson water-tube boilers.

South Africa.—HEIDELBERG, TRANSVAAL.—The Council has placed the order for the erection of a complete power station with the A.E.G. Electrical Co., of South Africa, Ltd., Johannesburg.

The Public Works Department of the Union of South Africa has placed an order with the same company for its total requirements throughout the Union of drawn-wire lamps during the next 12 months.

Southend-on-Sea.—The T.C. has accepted the tender of Messrs. Grenshaw & Peers, of Bolton, for three electrically-driven coal wagons for the electricity works, at £303.

Stirling.—The T.C. has accepted the tender of Messrs. Callender's Cable and Construction Co., Ltd., for a feeder cable, at £816.

Walthamstow.—The U.D.C. is recommended to accept the tenders of Messrs. Babcock & Wilcox, at £2,585, for the supply of an additional boiler, overhead bunkers and conveying plant at the electricity works, and at £385 for the supply and fixing of pipe work ; and that of the New Conveyor Co., Ltd., at £3,825, for installing conveyors and ash bunkers.

West Ham.—The tender of Messrs. John Baker & Co. (Rotherham), Ltd., is recommended to the T.C. for acceptance for a supply of 32-in. and 22-in. tramway tires, at £1 6s. 8d. and 19s. 3d. each respectively.

Weymouth.—The T.C. has accepted the tender of Mr. G. Bryer Ash for a year's supply of Newbury best steam coal for the electricity works, at 13s. per ton delivered at the works.

FORTHCOMING EVENTS.

Liverpool and District Electrical Masters' Association.—Friday, May 29th. At 7.45 p.m. At St George's Restaurant, Redcross Street, Liverpool. First smoking concert.

Institution of Mining Engineers.—Thursday, June 4th. At 11 a.m. At Burlington House, Piccadilly, W. General meeting. At 7 p.m., at Hotel Cecil, anniversary dinner.
Friday, June 5th. River trip.

Salford Technical and Engineering Association.—Thursday, June 4th. Whit week tour : Scarborough and district.

Royal Institution of Great Britain.—Thursday, June 4th. At 3 p.m. At Albemarle Street, W. Lecture on "Faraday and the Foundation of Electrical Engineering," by Prof. Silvanus P. Thompson, F.R.S.
Friday, June 5th. At 9 p.m. Paper on "X-rays and Crystalline Structure," by Prof. W. H. Bragg, F.R.S.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued :—

Friday, May 29th.—"D" Company. Infantry drill, 7 to 9 p.m. Technical instruction, 9 to 10 p.m. Miniature range instruction, 7 to 9 p.m.

Saturday, May 30th.—Headquarters will be opened from 10 a.m. till 12 noon for regimental business only.

Monday, June 1st. Tuesday, June 2nd. Headquarters will be closed for the Whitsun holidays.

Wednesday, June 3rd.—All Companies. Rating examination will be held from 7 to 10 p.m.

Thursday, June 4th.—"C" Company. Infantry drill, 7 to 9 p.m. Technical instruction, 9 to 10 p.m. Miniature range instruction, 9 to 10 p.m.

Friday, June 5th.—"D" Company. Infantry drill, 7 to 8.30 p.m. Technical instruction, 8.45 to 10 p.m. Miniature range instruction, 8.45 to 10 p.m.

Saturday June 6th.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

NOTES.

Electric Lamps for Miners.—Mr. McKenna stated in the House of Commons last week that researches made in recent years appeared to point strongly to the conclusion that working in insufficient light was the main cause of miners' nystagmus, and this point was kept in view when it was decided to impose photometric tests for all types of safety lamps approved under the Coal Mines Act, 1911. He was advised that as a result of these tests, and of the increasing use of electric lamps, the illumination below ground was improving, and he trusted that as this improvement continued it would have a substantial effect in reducing the number of cases of nystagmus.

"Laugh, and the World Laughs with You."—A Scottish correspondent writes:—"There was a bit of a shindy at a meeting of the Falkirk Town Council over a proposal to send delegates to the Incorporated Municipal Electrical Association's Congress. A section of the Council objected on the ground of expense, and, turning to them, Bailie Dillon remarked:—'Try economies and you are nowhere. It is the old saying brought back—Snore, and you sleep alone. Economise, and you fight alone.' Lively talk followed, but in the end it was agreed that representatives be sent."

Notes from Canada.—Our Canadian correspondent writes:—Part of a resolution recently passed by the Ontario Parliament reads as follows:—

"In the opinion of this House, cheap and convenient electric railway transportation facilities are one of the most urgent needs in many rural sections and towns of the Province, and this House would respectfully urge upon the Dominion Government the importance of the question and the wisdom of encouraging the construction of municipal hydro-electric radial railways, and that this House further respectfully urge upon the Dominion Government the great importance of co-operating with the Province in the development of the water powers created by existing and projected canals now under construction, and capable of development by the utilisation of the water powers necessarily supplied thereto, and not required for navigation purposes."

The Canadian Pacific Railway is considering the question of the electrification of its terminals at Montreal, and it is also reported that at Roger's Pass Tunnel in the Selkirk Mountains, B.C., a length of 20 miles will be operated electrically, instead of only 5 miles as previously intended.

It has been announced officially in Vancouver, B.C., that the Public Service Corporation may shortly construct a plant in which the waste material from sawmills will be used for generating heat and light for general distribution in the business parts of the city.

A municipal electric store in Saskatoon, Saskatchewan, is declared to be a failure, and a private company has offered to take it over.

In the Ontario Legislature, after considerable discussion on the subject of public ownership of telephones, it was decided that the proposal was not feasible at present.

Extensions to the tramway system in Edmonton, Alberta, to cost about £33,600, are to be undertaken, and the ratepayers have just voted approval of a by-law for that amount.

Owen Sound, on the shores of Georgian Bay, is considering the question of having a tramway system; a private company is asking for a 25 years' franchise.

From Richelieu to Sherbrooke (a distance of about 70 miles as the crow flies) in Quebec, a 50,000-volt transmission line is to be built, although a portion only of the line will be constructed at present.

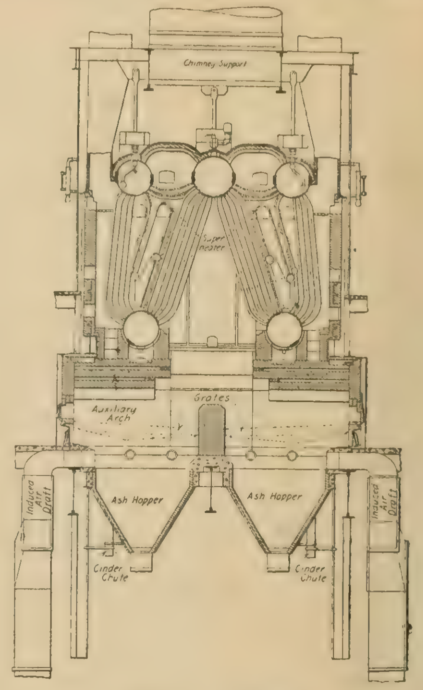
For extensions to the Ontario Hydro-Electric Power Commission's system about £1,000,000 has been provided in the Provincial estimates for this year. The money is divided up somewhat as follows:—

Niagara system extensions	£680,436
Severn system	110,000
Wasdell's Falls development	38,350
St. Lawrence system	4,536
Port Arthur system	4,102
Eugenia Falls system	50,000
Office building	30,000
Provincial work	33,000

Electric Lighting in Tokio.—The last Japanese mail brings the news that the problem of the unification of the electric lighting interests in Tokio by the amalgamation of the three existing concerns is expected to be the next topic to engross public attention after the election of members of the Tokio municipal council, which is to take place next month. The three concerns, which have been in keen competition, are stated to have at last become impressed with the risks attending the continuance of the competition. It is reported that the Municipal Electric Bureau is actually suffering loss, and that it is only by the profits realised from the tramways that the deficit on the electric lighting undertaking is being covered. The greatest difficulty to be surmounted in bringing about the amalgamation of the three concerns is the conflict of interests between the Tokio Electric Light Co. and the Kinugawa Hydro-Electric Co. with respect to the supply of power, this having become a cause of competition between the two concerns since the Tokio Co. purchased the interests of the Katsuragawa Hydro-Electric Co. However, the conflict of their interests is not apprehended to be entirely beyond a compromise.

Unsaleable Fuel for Generating Electricity.—The *Electrical World* of May 9th and 16th gives a full description of a power station which has been built by the Lehigh Coal and Navigation Co. to utilise refuse coal for which there is no market. The company turns out annually enough anthracite coal refuse to maintain in continuous operation generating plant of 100,000 KW.; the present installation is of 30,000 KW., but ultimately it will be extended to the former figure. Philadelphia and New York are distant only 73 and 98 miles respectively; the working pressure is 110,000 volts, except for local consumers.

The boilers are arranged in a single row beneath the railway track, on which 50-ton standard-gauge cars run, dumping their contents into bunkers holding two days' supply of coal. Ashes are removed by running railway trucks into the basement under the ash hoppers. The low grade of fuel employed necessitated the use of special grates and combustion chambers. Eight double-ended Babcock & Wilcox boilers are installed, each having four grates; the boilers are of the five-drum bent-tube type, with superheaters, as shown in the accompanying figure. Six of the boilers are fitted with hand-fired grates, 12 ft. × 8 ft., making a total grate area of 384 sq. ft. each boiler. The other boilers have mechanical stokers. Details of the grates are given in the article, as well as other novel features, such as sliding furnace doors, double fire arches with air spaces between, &c. Steel smoke-stacks are used, and to economise in building construction the flues are connected with them *above* the roof of the boiler-house, where economisers can be installed later if desired. Forced draught is provided (not induced draught, as indicated in the figure) by electrically-driven Sirocco blowers.



SECTION OF BOILER.

There are three 12,500-KW. 11,000-volt 25-cycle turbo-generators, the turbines being bladed on the A.E.G.-Rateau system, while the rest of the design is of Curtis type; the steam consumption is 12·3 lb. per KW.-hour at full load, with a vacuum of 28 in. Cooling water for the Leblanc jet condensers is obtained from an artificial pond of 269 acres, which serves as a cooling pond, the intake and discharge pipes being about 4,000 ft. apart.

Copper.—The mid-monthly figures for supplies, as tabulated by Messrs. H. R. Merton & Co., show that the reserve is maintained, in spite of the large consumption of last month. English supplies have increased 355 tons, French 1,281, and European 906 tons, as compared with the end of May, 1914. Arrivals from North America for the fortnight are on the low side, Spain and Portugal send the average amount to this country; Chile shipments are just on the average, and Australian a little above. Total deliveries for the fortnight are lower at 22,175 tons, but this may, of course, be altered so far as the monthly output is concerned. The stocks in American producers' hands, according to the American Producers' Association's figures, were, at the end of April, 31,401 tons. At the same date the world's visible supplies were 60,679 tons, a considerable increase over the total at the end of March.

A Manchester Committee.—When the resolution mentioned in our last issue concerning a councillor having exercised influence over Corporation officials in the letting of contracts, came before the City Council on May 20th there was no seconder.

(*Continued on page* 915.)

The Semi-Automatic Telephone Exchange of the City of Dresden.

[BY OUR BERLIN CORRESPONDENT.]

THE equipment of the Telephone Exchange of the city of Dresden has, during the last two years, undergone a complete transformation, hand operation being replaced by a semi-automatic service. The last subscriber connected to the hand-operated Exchange was, on January 29th last, switched over to the new Exchange, thus completing a conversion which, on account of adverse local conditions, had to contend with enormous difficulties.

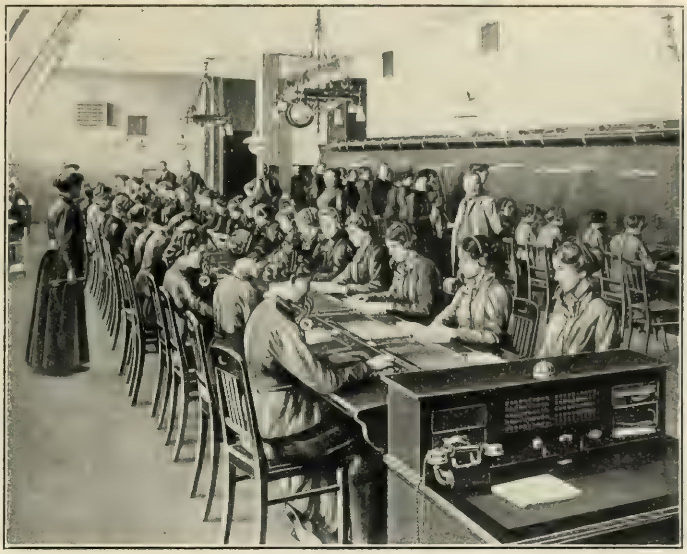


FIG. 1.—INQUIRY STATION AND ADDITIONAL SWITCHBOARDS.

Though the installation of the new Exchange was commenced a short time after the inauguration of the Posen semi-automatic Exchange (in July, 1912), the first subscribers could not be connected up to the new apparatus before the month of April of the following year, and another nine months of strenuous work was required to bring the work to a successful conclusion. In fact, local conditions entailed a gradual conversion from the old to the new mode of operation, which, in its turn, required the installation of a special intercommunication service between the old and new Exchanges. The difficulties thus occasioned were intensified by a temporary rather troublesome lack of space, so that the equipment of the operators' positions could not be installed before providing for space by the conversion of some of the subscribers' circuits.

The new semi-automatic telephone exchange is housed in a building owned by the Imperial Post Office, on Post Square, the selectors being installed on the third and fourth floors, in four halls. Hall 1 (figs. 2 and 3), situated on the fourth floor, on Marienstrasse, comprises all the selectors for the first 10,000 subscribers' circuits, with the exception of the second group selectors, installed in Hall 2, on the third floor (fig. 4, p. 912). The selectors for the subscribers' circuits

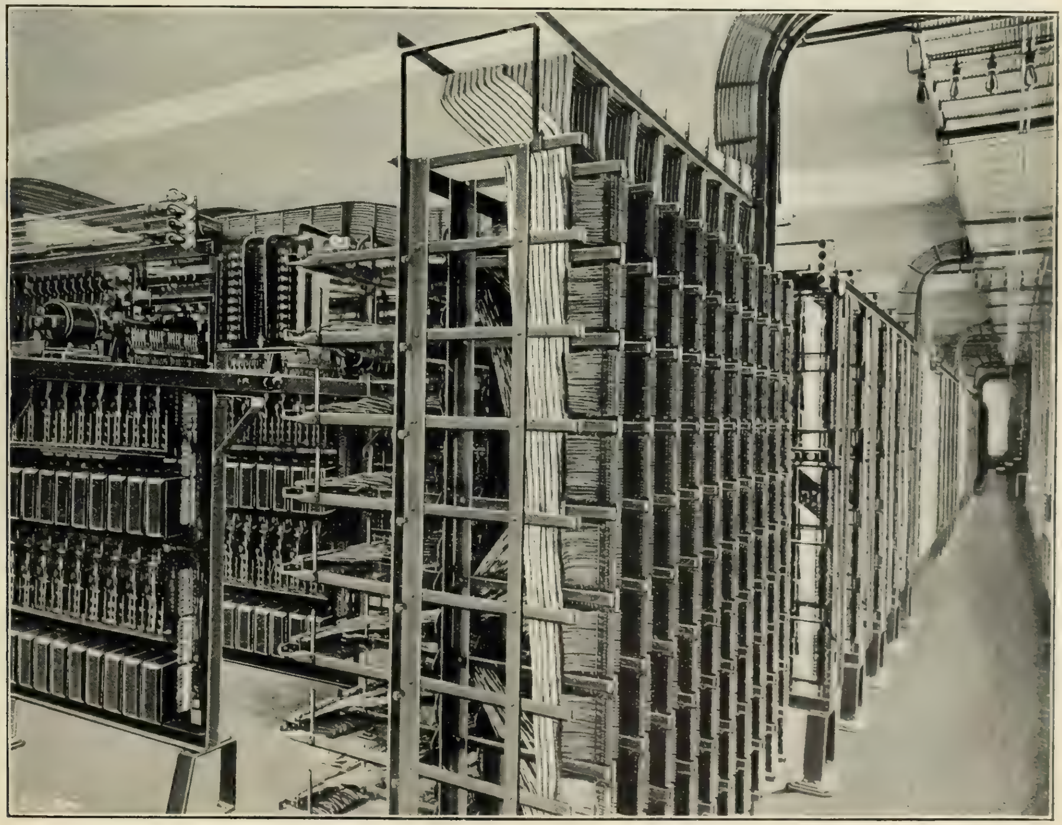


FIG. 2.—PRE-SELECTORS, GROUP AND CIRCUIT SELECTORS FOR SUBSCRIBERS 1—10,000 (HALL 1).

10,000-20,000 are installed in Hall 3, on the fourth floor —on Wallstrasse—and the corresponding second group selectors and special selectors for subscribers having several circuits in Hall 4 (fig. 5, p. 913), situated below the former. In Hall 2 there are installed, in addition to the second selectors for the first 10,000 subscribers' circuits, the motor-driven number transmitters for the operators' keyboards, as well as the calling current and buzzer machines.

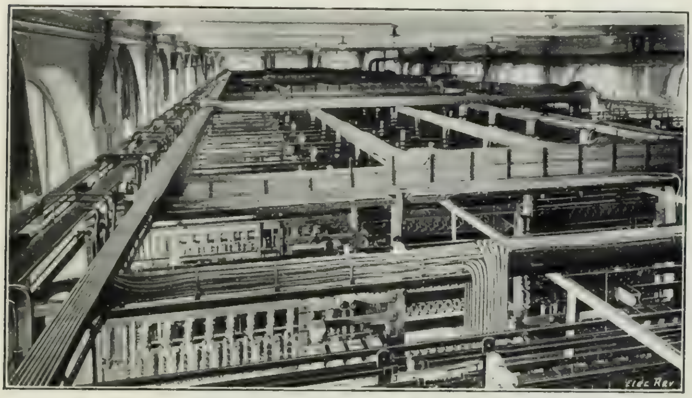


Fig. 3.—Selector Frames, seen from above (Hall 1).

In one of the halls on the third floor there is installed what is called the Inquiry Station, which comprises the whole of the hand-operated switchgear (fig. 1, p. 911), viz., 30 tables each with two operators' positions opposite one another, two additional switchboards with a total of six operators' positions, for the trunk service, and three additional switchboards, with a total of nine positions, for the incoming and outgoing suburban service. The 60 inquiry positions have each been equipped with two sets of keys for effecting any connection desired by subscribers. The mode of operation may be briefly described as follows :—

As the subscriber, in the usual manner, calls up the exchange by taking his receiver off the hook, he is, by his pre-selector, connected with a disengaged first group selector. At the same time there is actuated an exchange selector, which connects the telephone of an operator who happens to be disengaged to the calling subscriber's circuit. The operator hears the call with her head telephone without performing any manipulation for this purpose. She inquires, and while repeating the number stated by the subscriber, presses down in succession the keys corresponding to the figures named, thus actuating the number transmitters, and by means of these the selectors. As soon as the operator has pressed down the last key (units), she is switched off automatically, and thus becomes available for another call, to be dealt with by means of the second key-board, while the selectors are still busy with the former connection. The whole of the work of these operators is thus limited to inquiring the number desired and adjusting for it on the key-board, all the rest being done by the selectors.

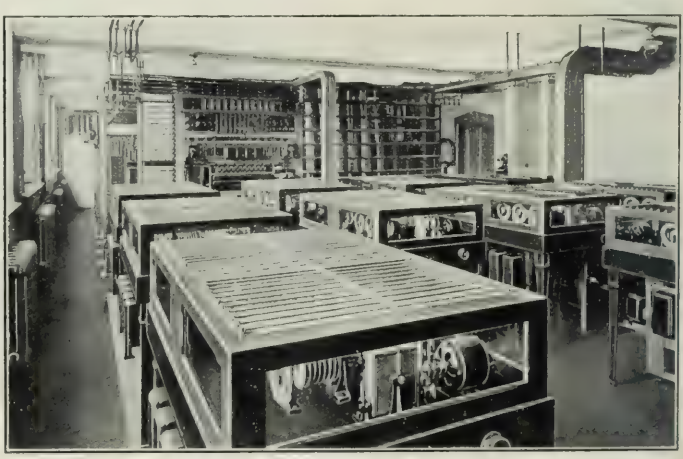


Fig. 4.—Second Group Selectors for Subscribers 1—10,000, and Figure Transmitters (Hall 2).

Whenever the subscriber desires a connection with a suburban circuit, the operator switches his circuit up to the additional switchboard, by pressing down key 6 of the ten-thousand row. Connections with the trunk-line record table are effected in a similar manner, by pressing down key 0.

Between the operators' positions of the two front tables of the inquiry station, a considerable number of call lamps are seen in the table centre, one lamp being provided for each Exchange selector, which is lighted in case the selector does not immediately find a vacant operator's post. when a call is received. The calling circuit is then switched on to a waiting contact and assigned automatically to the next working position that becomes vacant.

In front of these operators' positions there is placed transversely to the row of tables a superintendents' table, which, apart from some further checking devices, is fitted with a signal lamp and jack for each operator's position. Each time a call arrives at the Exchange the checking lamp assigned to the busy operator's position is lighted, to be extinguished again as soon as the call has been dealt with. By plugging into the jacks the superintendent, without the operator's knowledge, is able to switch herself on to each operator's position, thus accurately checking the service.

Moreover, there has been provided, for continually superintending the whole of the service, a special working room, where all the signals of the various groups of apparatus are repeated. There are further installed there recording instruments, which automatically record the current consumption, as well as instruments allowing the number of connections effected and simultaneously existing in the various groups to be gauged, so that the load on the exchange may be checked at any time. Any trouble is signalled and recorded automatically at this central post, while checking apparatus enable the whole of the *personnel* to be permanently supervised.

Two accumulator batteries, charged from the Post Office power house, are provided for supplying current to the selectors, and for the central feeding of the exchange and subscribers' microphones. The single-phase current required for calling subscribers is supplied by four converters connected up to the lighting mains, the buzzer currents for the "no-reply" and "busy" signals being generated by four collector buzzers (fig. 6, p. 914).

In fig. 7 (p. 914) is illustrated the main distributor installed in a special room, by which the external circuits are connected up to the exchange circuits. In the centre there are installed the relay frames for the additional switchboards, the back of which is accessible from the distributor room, as seen on the right-hand side of the figure. The same picture, like fig. 3, illustrates in a striking manner what an enormous number of cables and individual conductors have to be dealt with and arranged in a straightforward way in erecting a large telephone exchange.

The semi-automatic telephone exchange of the city of Dresden is at the present moment the largest installation of this kind in existence, 16,000 subscribers' circuits being so far in operation. Another exchange is shortly to be installed in the suburb of Striesen.

Messrs. Siemens & Halske, to whose courtesy we are indebted for the particulars embodied in this article, have installed not only the Dresden exchange, but also a number of other exchanges of a similar kind, among which those of Posen and Amsterdam are the most important. Semi-automatic exchanges are being installed also at Liegnitz and Leipzig.

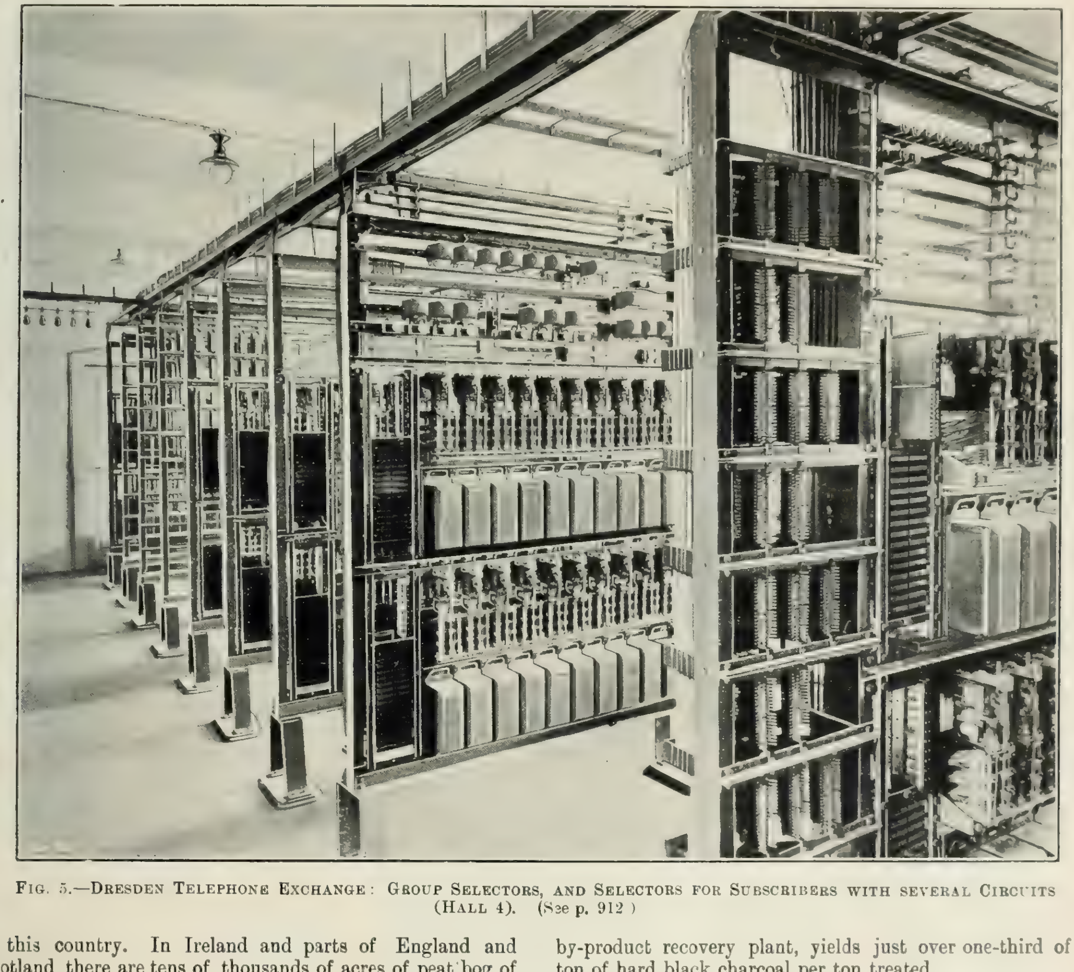


Fig. 5.—Dresden Telephone Exchange: Group Selectors, and Selectors for Subscribers with several Circuits (Hall 4). (See p. 912.)

ELECTRICITY FROM PEAT.

By GEORGE CLIFTON.

The possibilities of producing electrical energy from peat through the medium of a producer plant are rapidly becoming recognised by engineers on the Continent, although for some reason the idea has not met with so much favour in this country. In Ireland and parts of England and Scotland there are tens of thousands of acres of peat bog of which no use is made.

Various projects have been mooted from time to time, but little has actually been done in this country in connection with the utilisation of peat.

In Sweden, on the other hand, a large number of peat-fuel plants are in successful operation. The power is obtained by driving generators with gas engines fed from suction producer plants.

Practically all the peat fuel obtained at present is air-dried, as this process, in spite of the element of uncertainty, appears to be the cheapest and most practical. It has been said that when peat is properly treated, the removal of the water is a very easy matter, and the more water there is in the peat the easier it is to deal with the substance, and to produce a hard and dense fuel which, when dried, will not contain more than 15 per cent. of moisture. This moisture, moreover, is in a state of combination with the peat, and is given off, during the manufacture of charcoal, in the form of mixed gases in which hydrogen largely predominates. The process mentioned consists of desiccating or pulping the peat in order that all the fibres may be thoroughly crushed and broken. It is evident that otherwise these fibres, which are actually tubes, would hold a high percentage of moisture, which would either delay the air-drying process or lead to a false appearance of dryness, which might cause an attempt to be made to convert the peat into fuel prematurely. These fibres, or tubes, if not destroyed, hold the water, which turns to steam in the drying, and causes the blocks of fuel to crack and disintegrate.

Further, unless peat is air-dried—that is to say, if any compressing process is adopted with a view of eliminating the moisture—a number of valuable by-products are also removed. These comprise sulphate of ammonia, methyl alcohol, acetic acid, pyridine and paraffin wax. In addition to these by-products, the peat, when treated in a by-product recovery plant, yields just over one-third of a ton of hard black charcoal per ton treated.

With producers working with peat one of the principal difficulties lies in getting rid of the tar. Experiments have been tried in the direction of working such producers intermittently, there being periods of blowing during which the fuel in the producer was raised to incandescence, and periods of gas-making during which the tarry by-products were passed through the glowing mass and split up into gas. The resultant combustible mixture has too high a calorific value, some 330 B.TH.U., for use in ordinary gas engines. It would, however, appear evident that the proper course to pursue would be to extract the tar and other by-products from the gas by passing it through suitable scrubbers and cleaning chambers fitted with baffle plates before allowing it to pass to the engine.

Recently a special plant was erected by a leading firm of engineers to work with peat fuel. The results obtained have been perfectly satisfactory, and during a six hours' test run with a load of 250 B.H.P., the peat consumption per B.H.P.-hour averaged 2·55 lb. It must be noted in this connection that the water content of the peat used was approximately 19 per cent. It was found, however, that the plant worked as well with sodden as with dry peat, the only difference being in the amount of fuel used. Peat was successfully used which had a water content as high as 70 per cent.

Coke scrubbers are not particularly efficient as a means of removing peat tar from the gas. A water spray of ample size is much more reliable, as it acts as a cooler as well as a washing agent. The plant mentioned above required cleaning at first at least once a week. It can now be run for treble that time or longer if necessary, this being due to an increase in the quantity of water used for washing. As some guide to the amount required for the purpose it may be said that the best results are obtained when between 6 and 8 gallons per B.H.P.-hour are used. The tar recovered amounts to 5 per cent. by weight of the peat consumed, and has a certain market value which varies according to its quality and its contents of pyroligneous acid.

With such results as those outlined above, and with the examples of successful working given abroad, it would appear that the manufacture of air-dried peat fuel, to be used for the generation of electrical energy, is a sound business proposition, and one which should commend itself to engineers, especially in view of the necessity for cutting down production costs to the lowest possible point. It is really a matter for wonder that so few English engineers, comparatively speaking, have as yet given any serious attention to the subject.

COMPETITION IN GERMANY.

It is tolerably well known that the largest firms in Germany co-operate with each other occasionally in the case of huge contracts involving an expenditure of, perhaps, hundreds of thousands of pounds, but in contracts of comparatively small amounts they enter into keen competition with one another and also with the firms of lesser importance, which have been given the title of the "special electrical works." A representative of one of the latter has just taken the opportunity of attacking the policy of local authorities, especially the city of Berlin, and the installation contractors, although the latter have hitherto been regarded as being in the same position as the special firms. The special works not unnaturally claim to be efficient in the production of dynamos, motors and apparatus, but it is urged on their behalf that the State authorities and the local authorities scarcely do anything substantial to provide work for them. In the case of the city of Berlin, which now owns a few miles of tramways, it is said that special works, the names of which have been on the city's list of contractors for 10 years, have only received orders for a few hundred shillings during that period, although the contracts allocated by the city must have amounted to many millions of shillings, and many firms have not even received an inquiry from the municipal authorities in the same term of years. What is the explanation? The representative of the special works concerned states that the reason lies in the education of the officials employed by the authorities. These officials, it is declared, have frequently been obtained from the offices of the largest firms; they are familiar with the latter's plant and materials, and their former relations with the firms are maintained and cultivated. If, however, the higher municipal officials were to occupy themselves closely with the question and inquire into the methods according to which orders are placed, it is considered that a change might take place. But as long as the State and the municipal authorities do not follow the principle of awarding a definite percentage of orders to the special works, the subordinate officials will continue the more convenient policy of ordering everything possible from the largest firms. It is scarcely necessary to say that the Association of Special Electrical Works has never proceeded so far as to suggest for its constituents as a body the allocation of orders in the way proposed by one of its members in his individual capacity, and it is doubtful whether the Association would consider it advisable to put forward what would appear to be a demand impossible of fulfilment.

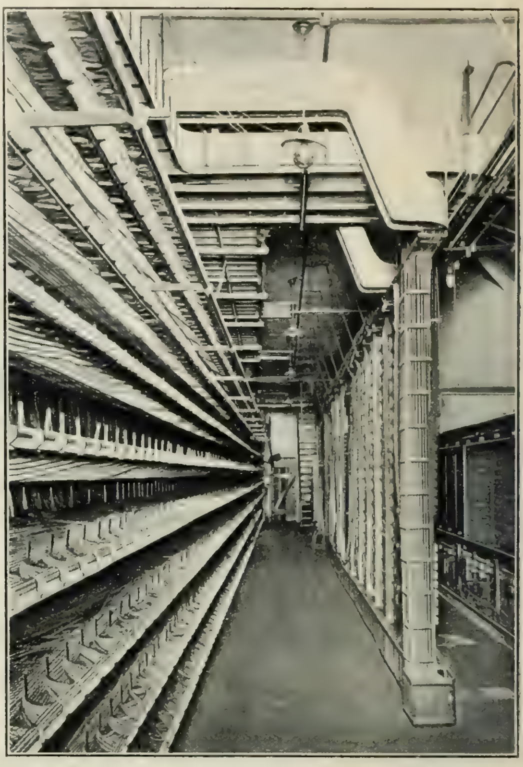


Fig. 7.—Dresden: Main Distributor, and Relay Frame for Additional Switchboards. (See p. 912.)

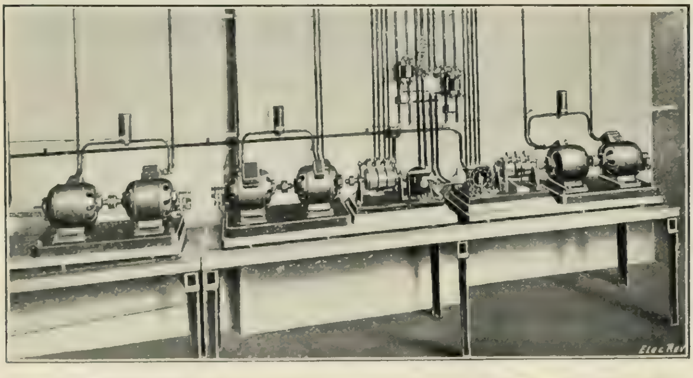


Fig. 6.—Dresden Telephone Exchange: Signalling Machines. (See p. 912.)

The installation contractors, who have hitherto been considered to be affected by the competition of the largest firms in installation work to the same extent as the special works in the manufacturing branches, are stated by the representative of the special works in question to be also partly responsible for the special works being pushed into the background. Why? The answer given is that the contractors preferably purchase motors and apparatus in the warehouses of the largest firms, because they are granted long-term credits, whilst at the same time the prejudice occasionally shown by the public against manufactures other than those of the largest firms has created the idea among contractors that they will obtain more favourable prices and more easily conclude business if they are called upon to procure machines and apparatus from the largest firms. In this way it is considered that many installation contractors are merely agents of the largest firms; yet the latter attach great value to the promotion of their own installation departments, and thus compete with the ordinary contractors, whereas the special works, it is said, do not engage in the installation business. It is therefore contended that unless the contractors do more to support the special works, they will discover the lasting mistake they have made when the special works have ceased to exist. The latter, however, possess a large amount of vitality, and are very remote from the stage of being supplanted by the big firms. Not only so, but their position should become stronger with a continuance of the work of organisation and enlightenment which was commenced some time ago under the auspices of their own particular Association.

NOTES.

(*Continued from page* 910.)

Is Aluminium Diamagnetic?—A correspondent recently asked if we could tell him whether aluminium was diamagnetic or not; much to our surprise, after a prolonged search, we have not been able to find any reference to the matter in any of the standard works that we have consulted. The magnetic properties of alloys containing aluminium have been investigated, and we have no doubt that those of the pure metal have also been examined—perhaps one of our readers will favour us with a reference covering the point.

Electricity Supply Rifle League.—An interesting shooting match took place on the range of the Central Electric Rifle Club at St. John's Wood, on Saturday last, between teams representing the above League and the North-West Middlesex League. A match last year, on the Alperon range, resulted in a win for the Middlesex men by 25 points, and the Electricians hoped to reverse this result, but failed, being defeated by 16 points. The scores were as follows:—

N.W. Middlesex League.		*Electricians.*	
Wheatland	100	Mathews (Hackney)	99
Iggulden	99	Harlow (City Co.)	98
Watts	99	Cope (Central)	97
Busby	98	Foster (Shoreditch)	97
Gobby	97	Beaton (St. James's)	96
Knight	97	H. Pearman (Westminster)	96
Calcott	96	Horley (do.)	95
Chinn	96	Hocking (St. James's)	95
Cowan	96	Harrison (Shoreditch)	95
Churms	94	Hilling (Hackney)	94
Ingram	94	Mugford (Brompton)	93
Sussex	94	Beale (do.)	89
	1,160		1,144

New School and Institute at Woking: Apparatus Needed.—A further development in the provision of secondary and technical education has been made in Surrey by the erection of a Secondary School for Boys and Technical Institute at Woking. This school has been provided by the Surrey County Council and the Woking Urban District Council at a cost of approximately £30,000, including the site and equipment. The secondary school provides accommodation for 200 boys, and in the arrangement of the curriculum special regard will be paid to the industrial requirements of the district, while provision will also be made for the preparation of boys for the Universities and for professional and business life. The buildings comprise an assembly hall, separate groups of class rooms for the Secondary School and Technical Institute respectively, together with physical and chemical laboratories, art rooms, workshops for electrical work, wood and metal work, plumbing, &c. Evening classes will be organised at the Technical Institute at which advanced instruction in technical, commercial, art and domestic subjects will be given. The building will be ready for occupation in the autumn term, 1914, and from a personal inspection, under the guidance of Mr. Patrick White, C.C., chairman of the Woking Education Committee, and Mr. Ivor Moore, chairman of the Higher Education Committee, we can state that it seems in all ways well adapted for the purpose.

The opening ceremony will be performed on Wednesday, June 15th, by Lord Moulton, a Judge of great distinction upon the Bench whose interest in numerous cases, when he was practising at the Bar, brought him intimately into touch with those connected with electrical affairs.

We commend this new Institute to the attention of British manufacturers. The need for electrical and engineering equipment affords our firms an opportunity not only for rendering valuable assistance to a very deserving object, but for familiarising the younger generation with their names and manufactures. Every up-to-date firm knows the advantage of having a permanent advertisement in a public institution where it will be brought under the notice of a continuous stream of young and impressionable minds. We are glad to remember the great readiness with which British firms responded to the invitation published in these pages to assist the Hong-Kong University, and as we shall show in our next issue, the past year has been occupied in unpacking hundreds of cases of British goods which will permanently advertise those firms and their wares in the Far East.

The appeal from Woking is somewhat different in character, and its requirements are comparatively small. Its total needs could be very readily met by a few well-disposed firms each doing a little. We understand that the equipment required is as under, and offers and other communications relating to the matter should be addressed to the Editors, ELECTRICAL REVIEW, 4, Ludgate Hill, E.C.:—

Wireless apparatus—A.C. and D.C.

Apparatus for electricity and magnetism (frictional and voltaic electricity and magnetism) for the Physics Laboratory.

One 4-B.H.P. electric motor (single-phase, 100 periods, 200 volts).

One each 6-in. and 4½-in. centre sliding, surfacing and screw-cutting lathes.

One pillar type drilling machine (up to ¾-in. hole).

One 8-in. stroke pillar shaping machine.

One Miller's Falls type power hack saw.

One emery grinder.

One 30-in. × 30-in. marking-off table.

Institution and Lecture Notes.—ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTIONS.—To-morrow the annual conference of the Association is to be opened at Liverpool, and it will continue in session until next Wednesday. The meetings will be held at the Central Municipal Technical School, under the ægis of the Education Committee of the Corporation. The programme, which is obtainable from Mr. T. J. Roberts, Technical School, Byrom Street, Liverpool, gives much interesting information regarding the Association and its work, as well as about the commercial position and the progress of technical education in West Lancashire and Cheshire.

INSTITUTION OF ELECTRICAL ENGINEERS.—At the annual general meeting of the YORKSHIRE LOCAL SECTION, on May 20th, in addition to the Members of Committee whose election was announced in our last issue, Mr. E. A. Barker was elected.

ILLUMINATING ENGINEERING SOCIETY.—On Thursday last week Mr. A. P. Trotter read a paper on the nomenclature and definition of photometric magnitudes and units, in which he discussed certain definitions submitted to the Illuminating Engineering Society of New York by a sub-committee in 1912. Whilst admitting the scientific accuracy of the report in question, Mr. Trotter criticised the terminology and the choice of units, which he considered by no means simple or comprehensible to the inexpert. For the fundamental unit he preferred the "candle," without any reference to flux density or solid angles. For the unit of illumination he favoured the foot-candle, and he pointed out the importance of "surface brightness" as a definite quantity, whereas the definitions recognised only the brightness of a source of light. In the author's opinion mean horizontal candle-power was the natural term to be used by manufacturers in testing and marking lamps, but he made an exception in the case of arc lamps, where the choice lay between spherical and hemispherical measurement.

Regarding symbols, Mr. Trotter remarked that general rules in symbology always failed as soon as they were propounded, and compared current practice with the proposals of the I.E.C. and other authorities.

MANCHESTER STEAM USERS' ASSOCIATION.—The annual report of the Committee of Management for the past year states that the membership was 2,138, and that 10,079 boilers were under inspection in 1913; the revenue was £20,994, the net balance to credit being £1,461. The reserve fund now stands at £46,527. No boiler under the Association's care burst during the year, and, after 59 years, no life has yet been lost from the explosion of any boiler which the Association has inspected and guaranteed as safe.

ROYAL SOCIETY.—On Thursday last week the Hon. R. J. Strutt read a paper on "Luminous Vapours Distilled from the Arc." Dr. G. W. C. Kaye and Mr. W. F. Higgins read a paper on "The Emission of Electricity from various Substances at High Temperatures."

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—A joint excursion was made on Saturday last to Grassmoor Collieries by members of the Notts. and Derbyshire Branch of the Association of Mining Electrical Engineers and the Midland Branch of the National Association of Colliery Managers. The visit had been arranged principally to make an inspection of a large electric generating plant driven by gas engines operated from the by-product coke ovens, and also an electric safety lamp charging and cleaning station.

Fatality.—A correspondent states that Percy Llewelyn, aged eight years, was playing in the timber yard at Bridgend on the 23rd inst., and playfully took hold of a wire on which to hang and swing. The wire was a live one from an electric station, and the boy exclaimed "Oh!" and died immediately.

Tramway Congress.—The annual congress of the Tramways and Light Railways Association is to be held at Newcastle-on-Tyne on July 16th and 17th. Headquarters, Central Station Hotel.

Inspection of Electrical Installations.—Proposals await the final sanction of the Montreal City Council for the appointment of an electrical inspector with wide power over the existing and future electrical installations in the city. In the regulations concerning his duties, as drawn up by the City Solicitor, it is stated that all installations and alterations to installations are to be inspected and approved by him before being put into use. The inspector is to be the final authority as to the way in which the work has been carried out, and his instructions are in every case to be obeyed. An elaborate system of fees to be charged is given, the minimum being 50 cents (2s. 1d.) for an installation of five lights, and for any motor $1 (4s. 2d.), an electric sign $1 (4s. 2d.), with increases for extra points. The penalty for non-compliance with the rules and regulations is a fine of $50 (£10), or imprisonment for one month. We often think that matters, as regards inspection formalities, are bad here; after reading these rules, we can only be thankful that we do not live in Montreal.

Appointments Vacant.—Lecturer in the Department of Mechanical and Electrical Engineering in the Municipal Technical Institute, Belfast (£180); lineman (overhead), for Oldham Corporation Tramways. Particulars are given in our advertisement pages to-day.

The *Melbourne Age* for April 16th stated that owing to the expansion of business in the electrical branch of the Postal Department, it had been determined to appoint an assistant to the chief electrical engineer for Victoria. Applications were invited from persons competent to fill the position. The salary was to range from £528 to £600 per annum. Persons outside, as well as inside the service, were eligible.

German Enterprise.—It is reported that an information bureau has been organised in Hamburg, for the purpose of providing expert information on technical subjects of all kinds, free of cost, with a view to the advancement of the German manufacturing industry. At the "German Expert Office" a number of technical experts, who are also accomplished linguists, are employed, and catalogues, records of works carried out, particulars of new inventions, &c., are stored there. The scope of the bureau appears to be very wide, and it will no doubt be of great assistance to German industry. A similar office in this country, which might be attached to the Commercial Intelligence Department of the Board of Trade, would be no less effective in promoting the welfare of British industry.

Educational Notes.—London University.—Prof. E. G. Coker, M.Inst.C.E., has been appointed as from September 1st to the University Chair of Civil and Mechanical Engineering, tenable at University College. He is President of the Engineering Section of the British Association this year.

Royal Institution of Great Britain.—Prof. Silvanus P. Thompson, F.R.S., will, at 3 o'clock on Thursday, June 4th, begin a course of two lectures on "Faraday and the Foundations of Electrical Engineering." Particulars are given in our advertisement pages.

On Friday last Sir J. J. Thomson formally opened the new Science Laboratories of King's College School, Wimbledon.

Smoke Abatement.—At the first meeting of the Smoke Abatement Committee, Mr. J. Hurst stated that the Coal Smoke Abatement Society had established a scheme for training stokers. The Society reported on the average about 1,350 smoke nuisances each year, as the result of one inspector's observations. He thought that the L.G.B. should deal with smoke abatement, and should be given power to enter premises. West Ham was described as very bad, whilst Hampstead and Lewisham were free from black smoke.

Trans-Atlantic Wireless Telegraphy.—On Wednesday last week the completion of the wireless station at Cefndu, near Carnarvon, was celebrated by a banquet to Mr. Marconi. The station will be opened in a few weeks for direct wireless communication with the station at New Jersey, near New York, U.S.A.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—At the Hove electricity works, on May 23rd, Mr. C. Bottomley Smith, M.I.E.E., the chief engineer, was presented with an illuminated address, together with a gold chronograph and sovereign-case, by the staff of the Hove Electric Lighting Co., Ltd., on the occasion of the transfer of the electricity undertaking from the company to the Hove Corporation, as a token of the respect and esteem in which they have held him during the whole period of 21 years of the company's tenure.

Prior to his leaving to take up the duties of assistant mains superintendent at Yoker Station under the Clyde Valley Electric Power Co., Mr. A. D. Cook, who acted in a similar capacity for the Aberdeen Corporation, was entertained to dinner in the Station Hotel, Aberdeen, and presented with a gold albert from the staff. In the absence of Mr. Bell, city electrical engineer, Mr. McKay, mains superintendent, presided, and, in presenting the gift expressed the sentiments of those present when he indicated their regret at Mr. Cook's leaving, and wished him every success in his new post. Mr. Cook suitably replied.

Mr. Bernard Muntz has been appointed assistant to Mr. H. L. Elward, the engineer-in-charge of consumers' connections under the Dublin Corporation electricity department.

Mr. R. W. Rowland Hill, who has been appointed engineer and manager for the Colne Valley Electric Supply Co., Ltd., will be pleased to receive manufacturers' catalogues, &c.

Tramway Officials.—The Glasgow T.C., it is proposed, are to be represented at the eighteenth Annual Conference of the International Union of Tramways and Light Railways, to be held at Buda-Pesth in August, by Mr. James Dalrymple, the tramways manager; Mr. John Lindsay, town clerk; and two members of the Tramways Committee to be afterwards chosen.

Mr. Harold Pugh, on vacating the position of chief inspector under the Kidderminster Tramways Co. to take up the post of traffic inspector at Sheerness, was presented with a Gladstone bag and walking stick.

General.—The Tramways and Electricity Committee of Leicester T.C. has recommended the payment of an honorarium of £500 to the borough surveyor in respect of special services rendered in connection with the tramways.

Owing to ill-health, Alderman C. F. Bennett has resigned the position of chairman of the Sheffield Corporation Electric Supply Committee. Councillor T. G. Evans has been appointed to succeed him.

Obituary.—Sir Joseph Wilson Swan.—We deeply regret to learn that Sir J. W. Swan, F.R.S., died on Wednesday at his residence, Warlingham, Surrey, in his 86th year. An account of the celebrated inventor's life and work appeared in the Electrical Review of November 24th, 1904, and the most recent photograph obtainable of him was published in the Review for November 7th last year, on the occasion of his 85th birthday.

"One Who Knew Him" writes:—On October 31st, 1828, at Sunderland, was born Joseph Wilson Swan, son of John Swan and Isabella Cameron. On May 27th, at Warlingham, Surrey, in the eighty-sixth year of his age, he passed away. Few men have done so much in so, comparatively speaking, brief a period. Few have died leaving the world so much in their debt; few have had their greatness recognised so appreciatively during their lifetime. His discoveries added greatly to the wealth and comfort of Humanity, and it is pleasant to feel that whilst he lived the world was not grudging of praise and thanks for the labours he wrought.

To most he will be familiar as a tall and somewhat austere-looking old gentleman, with a kindly voice and a gentle manner. His appearance led one at first sight to expect brusqueness, even severity. But a moment's conversation and one knew one was in the presence of one who tempered the mildest of justice with the utmost of mercy. He would overlook a fault in anyone but himself; he would never give another a task could he help it, but would always carry out the work himself if circumstances permitted. In his case, at any rate, it is not "De mortuis nil nisi bonum," but it is that there lives no one, has lived no one, who could say an unkind word, or think an unkind thought against the white-haired old man who, in spite of his knighthood, was always known in their hearts, by those who loved him best, as "Old Dr. Swan."

He was not the product of an educational system. He had but little of what is termed "schooling," but what he had he learned thoroughly, and he added to the things that were taught him at school, all that he could read in books. An elementary work on chemistry which fell by chance into his hands was largely instrumental in shaping his career. He studied book after book on the subject, which fascinated him, and at length he succeeded in getting apprenticed to a firm of manufacturing chemists. Shortly after he made the acquaintance of John Mawson, a chemist, and he entered into partnership, and before long made John Mawson his brother-in-law. The two built up a successful business at Newcastle, and as soon as his hard work left him leisure to do so, young Swan studied photography, which was then truly in its infancy, went closely into the work of Daguerre and Fox-Talbot, and eventually invented the autotype or carbon process of photography, and finally gave to the world the modern dry plate, which enabled the science to progress at a hitherto unimagined rate.

But it is in connection with the incandescent electric lamp that the dead scientist was best known. There is but little record of the early experiments he carried out, but it is known that the germ of the idea which was to grow into so great a reality was placed in his mind at a lecture given by Mr. E. Staite on electricity, at which the lecturer, amongst other demonstrations, heated to whiteness a wire of an alloy of iridium and platinum by means of an electric current. "If this could be done in the open air, why could not it be done in a glass bulb so as not to damage anything which came in contact with it?" And so the years of experiment began, first with wire, then with paper slips—with which, by the way, some fairly serviceable lamps were made—and then with parchmentised cotton threads. The question of obtaining a sufficient vacuum in the containing bulb delayed the introduction of the lamp on a commercial scale for some time, but at length the difficulties in this connection were fairly well overcome, and the first lamps, with cotton thread filaments, were put on the market. Almost directly after Mr. Swan devised and patented the making of filaments by a process of squirting nitro-cellulose through glass jets into a bowl of some coagulating liquid.

In the earlier lamps some trouble was experienced, as in the early days of the metal-filament lamp, by the vacuum becoming impaired by occluded gases, and this trouble was got over by an ingenious method of heating both the filament and the containing bulb during the process of exhausting. Difficulties were also experienced in connection with the mounting of the filaments, and particularly in attaching them to the leading-in wires.

Amongst other inventions of Sir Joseph Swan may be mentioned that of the cellular lead plate for storage batteries and a useful miner's safety lamp, in which an incandescent Swan lamp was used in conjunction with a small accumulator. He also did much to improve the half-tone process of photography.

In 1894 he was elected a Fellow of the Royal Society, and he was President of the Institution of Electrical Engineers for 1898-9. He was also an Honorary Member of that body. In 1900 and 1901 he was President of the Society of Chemical Industry, and for his services to science he was knighted in 1904. He received the honorary degrees of M.A. and D.Sc. of Durham University, and held the Hughes Medal for Scientific Discoveries. He also received the Medal of the Society of Chemical Industry, and was a Chevalier of the Legion of Honour.

The world, it is true, is greatly the poorer by his death, but it is nevertheless true that it is greatly the richer by his life, and that is as fine an epitaph as can be written.

Mr. Alfred R. Sillar.—We learn with deep regret that news has been received by cable of the death on May 20th, at Peking, of Mr. Alfred R. Sillar, brother of Mr. A. M. Sillar, the well-known consulting engineer of Westminster. Mr. Alfred R. Sillar was, in his early days, with the Electrical Engineering Corporation and Messrs. J. G. Statter & Co., and afterwards with Messrs. Siemens Bros., for whom he had charge of the town lighting system at Colchester. He was appointed borough electrical engineer for Colchester in 1900, and he held that position, supervising the construction and equipment of the tramways until 1911. In that year he was appointed chief engineer to the Chinese Chartered Electric Co., at Peking, and he has been in charge of the lighting there during the very troublous times of the Revolution, and of the subsequent rapid extensions due to the opening of the forbidden city. The deceased gentleman was expected in England this summer to arrange for extensions of the plant, but recent news showed that the present Government was cancelling the concession of the company (a purely Chinese one), and arranging to give it to a French company. This action of the Government led to indignation meetings of shareholders, but what has happened between then and May 20th, the date of Mr. Sillar's death, is unknown in this country. Our readers will remember several interesting articles which have appeared in the Electrical Review during the last few years from the pen of Mr. Sillar on the subject of British electrical trade in China.

NEW COMPANIES REGISTERED.

London Association for the Protection of Trade, Ltd. (135,754).—The London Association for the Protection of Trade, which was established in 1842, resolved at its seventy-first annual meeting that it was advisable to incorporate the Association as a company limited by guarantee, each member of the company being made liable for 1s. in the event of winding up. The Association was duly incorporated, pursuant to such resolution, on May 12th. The preamble to the "Rules" states that, in order to counteract "the numerous frauds, deceptions and thefts to which the traders of the Metropolis had long been exposed, and the very great increase of those malpractices," the Association was formed in 1842, its objects being (*inter alia*) to aid in preventing such fraud and deception, to furnish status information, to legally assist members who had been swindled, to collect debts, &c. "To aid in these objects, it is required that every member will, immediately after the attempt or perpetration upon him of any fraud, theft or deception, report to the Secretary the particulars of the offence, with the known or supposed name and address of the offender, and a description of his or her person." The present managers are 40 in number, comprising representatives of 12 firms in London and 28 in the West of England (mostly Exeter and Plymouth). Among the managers are:—H. Faraday (Faraday & Son), 146-150, Wardour Street, W., electrical fittings merchant; A. Moore (F. Braby & Co., Ltd.), 352-363, Euston Road, N.W., engineer; J. T. Osler (F. & C. Osler, Ltd.), 100, Oxford Street, W., electric light fittings and china merchant, &c.; T. L. Harding (T. L. Harding & Sons), Torquay, wholesale ironmonger; T. Bradley Rowe (Rowe, Bros. & Co., Ltd.), Exeter, lead, glass and oil merchant; J. Row (Wippell Bros. & Row), Exeter, furnishing ironmonger; J. F. Winnicott, J.P., C.C. (Winnicott Bros.), Plymouth, hardware dealer. The registered office is at 66, Berners Street, W.

Electric Floor Machine Co., Ltd. (135,862).—This company was registered on May 18th, with a capital of £3,000 in £1 shares (1,000 preference), to carry on business as manufacturers and producers of rotary or other floor surfacing, planing, scrubbing and polishing machines, to enter into contracts for the surfacing, planing, scrubbing and polishing of wooden floors, stonework and surfaces, &c.; to acquire the undertaking, goodwill, assets and contracts of H. R. Wilson, of 118, City Road, E.C. The subscribers (with one share each) are:—H. R. Wilson, 118, City Road, E.C., electrician and engineer; R. Bence-Jones, D.L., J.P., 4, Cliveden Place, Eaton Square, S.W. Private company. The number of directors is not to be less than two or more than four; the first are H. R. Wilson and R. Bence-Jones, D.L., J.P. (chairman), both permanent; W. Symons is first secretary; qualification of permanent directors, 600 shares; of ordinary directors, 300 shares; remuneration of H. R. Wilson and R. Bence-Jones, as joint managers, £5 per week in addition to directors' fees. Registered office, 86, Hatton Garden, E.C.

Photo-Telegraph and Cable Co., Ltd. (135,976).—This company was registered on May 22nd, with a capital of £5,000 in 4,500 preference shares of £1 each and 10,000 deferred shares of 1s. each, to adopt agreements (1) with T. T. Baker, (2) with Otto Fulton, (3) with the Directors' Registry, Ltd., Otto Fulton, T. T. Baker, H. J. de la Condamine and the Pictorial Telegraph Syndicate, Ltd., and (4) with the Directors' Registry, Ltd., to acquire and turn to account any patents for inventions relating to "phototelegraphy," &c. The subscribers (with one deferred share each) are:—W. H. Drummond, 4, Whitehall Court, S.W., barrister; Otto Fulton, Woodlands Park Road, East Twickenham, S.W., scientific expert. Private company. The number of directors is not to be less than three or more than seven; the first are Otto Fulton, W. H. Drummond and C. H. Parker. Registered office, 100, New Bond Street, W.

United Cablegram Co. of France, Ltd. ([illegible]).—This company was registered on May 20th, with a capital of [illegible] in 5,000 7 per cent. cumulative preference shares of £1 each and 40,000 ordinary shares of 5s. each, to carry on the business of a telegram and cablegram agency in France, the French Colonies and Dependencies or elsewhere, to construct or work telegraphs and telephones, to carry on the business of advertisement contractors and advertising agents, &c. The subscribers (with one preference share each) are:—C. A. Shepping, Hotel Astor, New York City, publisher; G. Fyall, 20, Copthall Avenue, E.C., gentleman. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. Lieut. R. Tindal, R.N., is the first secretary; qualification, 100 shares. Registered office, Trafalgar House, 11, Waterloo Place, S.W.

Samuel Booth & Co., Ltd. (135,078).—Registered May 22nd, by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C. Capital, £59,000 in £1 shares (25,000 preference). Objects: To take over all or part of the undertaking and assets of the business of a manufacturer of and dealer in gas and electric light and water and steam fittings carried on by J. Booth, at Birmingham and elsewhere, as "Samuel Booth & Co." The signatories (with one share each) are:—J. Booth, Cheapside Works, Birmingham, gentleman; R. A. Pinsent, 6, Bennetts Hill, Birmingham, solicitor. Private company. The directors are to number not more than five. J. Booth is first permanent governing director and chairman, with £350 per annum. J. Booth will appoint C. W. Blount, F. A. Ford, E. J. Garlick and A. H. Mullings as "departmental directors."

T. W. Vaughan & Co. (1914), Ltd. (135,961).—This company was registered on May 21st, with a capital of £5,000 in £1 shares, to take over the business of electric lighting, heating, ventilating and general engineers, and art metal workers, carried on by T. W. Vaughan & Co., Ltd. The subscribers (with one share each) are:—F. C. Stark, Sromna, Malford Grove, Snaresbrook, Essex, contractor; R. Long, St. Ives, Wynndale Road, South Woodford, accountant. Private company. The number of directors is not to be less than two or more than four; the first are F. C. Stark and R. Long: qualification, 50 shares; remuneration as fixed by the company. Registered office, 22, Cross Street, Islington, N.

"Sprite" Cleaner Co., Ltd. (135,981).—This company was registered on May 22nd, with a capital of £100 in £1 shares, to carry on the business of manufacturers of and dealers in vacuum cleaning apparatus, mechanical and electrical engineers, &c. The subscribers (with one share each) are:—R. B. Turner, Bromford Lane, Erdington, Birmingham, private secretary; E. Willan, 83, Hazelwood Avenue, Newcastle-on-Tyne, clerk. Private company. Table "A" mainly applies. Secretary, E. Willan; solicitor, C. G. Mitcheson, 42, Grey Street, Newcastle-on-Tyne.

Bachelet Levitated Railway, Ltd. (135,989).—Registered May 23rd, by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C. Capital, £105,000, in 100,000 ordinary shares of £1 each, and 100,000 vendors' shares of 1s. each. Objects: to acquire and turn to account any invention relating to transportation by levitation by the use of electricity, and of any apparatus therefor, and to adopt agreements (1) with Major T. P. Carington Smith and Chas. Vane for the acquisition of the patents referred to therein, and (2) with Emile Bachelet. The vendors' shares confer the right to two-thirds of the distributed profits and to two-thirds of any surplus assets in the event of winding up. The signatories (with one share each) are:—E. Alderton, 42, Piccadilly, W., gentleman, G. S. Brockelbank, Stock Exchange, E.C.; C. Vane, 11, Waterloo Place, S.W., gentleman; R. G. J. Wightman, 11, Waterloo Place, S.W.; G. A. Banks, 11, Waterloo Place, S.W., clerk: F. B. Fowler Addiscombe Court Road, Croydon, journalist; C. J. Wightman, The Elms Sherwood Park Road, Sutton, Surrey, traveller. Minimum cash subscription 20 per cent. of the shares offered to the public. The directors are to number not less than three or more than nine; no persons had consented to act as directors to May 22nd; F. B. Fowler is the first secretary; qualification £500; remuneration (except managing director), £200 each per annum chairman, £300.

CITY NOTES.

Kent Electric Power Co., Ltd.

At the annual meeting, held on May 13th, Mr. J. F. Albright, in moving the adoption of the report (see Elec. Rev. p. 837), said the revenue for the year showed an increase of £1,660 over the previous year. They had, in common with other companies, incurred a great increase in working expenses, largely due to the very abnormal price of coal and to the increase in wages and rates and taxes, and especially insurance. A new contract for coal had been made at a much lower figure than that paid last year. Reference was made in the last annual report to the passing of the Kent Electric Power Act, 1913, under which their issued ordinary share capital was reduced from £225,004 10s. to £64,000, though the priority share capital had not, of course, been affected. This had enabled the directors thoroughly to overhaul the balance-sheet and to put it into a simple and concise form, so as to show the true state of the company's affairs. They were now in a position to recommend the payment of the full dividend for the year 1913 on the 6 per cent. cumulative priority shares, together with all arrears. As it was very undesirable to deplete the company's available cash resources, the directors invited the holders of these shares to invest the amount of the dividend in taking up further priority shares at par, and practically the whole of the shareholders had agreed to do so. Further capital was urgently required for additional plant, machinery, and mains to meet the needs of the rapidly-increasing business, and they had been able to issue 15,000 further priority shares for cash, in addition to the provision of £16,500 in Lloyd's bonds, carrying interest at the rate of 6 per cent. per annum. The company was now in a sound and healthy condition, and looked forward with confidence to the future. A resolution was passed authorising the issue of additional shares to the nominal amount of £7,237, being the balance of an issue of £50,000, such shares to form a separate class to be called priority shares.

Devonport and District Tramways Co.—After transferring £1,500 to reserve, a dividend of 1 per cent. is recommended for the year ended at December, 1913, leaving £413 to carry forward.

Mackay Companies.—The directors announce the usual quarterly dividend of 1¼ per cent. announced on common shares.

Lancashire Power Construction Co., Ltd.

The annual meeting was held on May 21st at the offices, Salisbury House, London Wall, E.C., Dr. H. F. **Parshall** presiding.

The **Chairman**, in moving the adoption of the report (Elec. Rev., p. 874), stated that the classes of supply dealt with by the Parliamentary Co. had steadily increased. The Salford Corporation bulk supply contract did not, however, benefit the accounts to any considerable extent as the supply was not commenced until October, and then only on a small scale. A much larger supply was now being taken. Salford Corporation had a big installation of their own, but were not so favourably situated as that company in regard to the power house, so that the Lancashire Power Co. could sell them power at a profit to themselves for less than Salford could generate it at. That was really the strength of their position—they were selling power at a profit to themselves at less than most of the local authorities could produce it for. That was a great satisfaction in the case of a company like themselves, because they knew that when any question arose the local authority always had the preference and the interests of the power company were always second in the eyes of Government departments. They had rather an unpleasant experience of that during the last year. Heywood, which was a small local authority situated in a district that they could conveniently supply, were showing a heavy loss last year and could not profitably increase their electrical generating facilities. They applied to that company for a supply, and the company gave them a price which was practically the same that Salford found a favourable price, Salford being supplied with several million units and Heywood with a comparatively small quantity. The company were able to give Heywood the smaller supply on favourable terms as they were on the route of several local authorities requiring a supply. The company had no preferential system of charging, so that they would not give any local authority a price which would put their previous contracts in an unfavourable light. That was to say, even if Heywood were the most desirable of customers the company would not do anything to prejudice Salford or *vice versa*. Well, Heywood were neighbourly with Bury Corporation—a corporation the company encountered in the case of the Local Government inquiry at Radcliffe. Bury had an electric undertaking of their own, and it was not very dissimilar to a great many other local authorities inasmuch as they had converted what was a substantial profit into a substantial loss by undertaking to sell electricity at a lower figure than the cost of production, thinking that if they sold enough they would eventually sell at a profit. When Bury got in touch with Heywood they gave them a kind of sliding scale. Nobody knew what the eventual price would be, but it was a good thing to juggle with when they were dealing with the Board of Trade. After some considerable correspondence, in which the company showed that they were not only ready but willing and desirous of giving a supply to Heywood, and on terms which were extremely favourable, the Board of Trade thought it was a proper matter for a hearing, although if it had been the other way about the directors were perfectly satisfied that it would not have been a proper thing for a hearing. Having had some experience of this sort of thing, the company employed Mr. Honoratus Lloyd, K.C., one of the first counsel on electric light law. He said the proposition was nothing short of monstrous, and he could not understand why any local authority under such conditions could ever hope to supply electricity in the area of a power company. However, the company had its hearing, and at the hearing it came out that Heywood had no fixed price. They lived on hope and expectation that the price would be lower than that of the company. The company showed that if Bury gave a price which was as low as that of the company it would increase their present losses, and it was proved that they were proposing to supply Heywood at a price lower than they were charging their own customers in their own area, and that that was being done at the expense of the users in their own area. In other words, that supply was being given at the expense of the ratepayers in the Bury area. The Board of Trade had a protracted hearing, and they apparently found, according to precedent, as far as they could see, that they had to give the decision to the company, but, unfortunately, the company did not have so many votes as the local authority, so they called in various legal advisers and various other people to relieve the Board of Trade of any responsibility as to any decision reached, and in the final outcome Mr. Burns put his guinea stamp on a document saying the company had been unreasonable in not allowing Bury to give a supply in the company's area. The result of this decision was that other areas beyond the Bury area would be deprived of a supply, since without the Heywood supply the cost of mains to reach these areas would be excessive. The directors felt they must resist this to the fullest extent. In their opinion the power companies must in so far as was possible try to be mutually protective, and they thought that if such a decision was to be given it must affect some of the other power companies very seriously. They felt they must resist the decision to such an extent that they could not be held up and pointed at by the other power associations as the horrid example which allowed such a precedent to be created. Their present position was that it had been held in the Courts that a Government department could not give a decision *in camera*, and that they had got to lay all the documents before both parties in the case, and their position was that if the law of the land held good under present conditions they would see on what that decision was founded. That was the principal event of an unpleasant kind that had occurred. So far as they were concerned it was fundamentally wrong, but it made people wonder whether or not an Act of Parliament was any protection at all. Certainly under some conditions it appeared that Parliament made laws which were meant to be broken and not to be kept. He thought the general result in the balance sheet would appear to be good when they saw, as he had said, that they had made £22,785 profit, which was twice what the fixed charges were. They were able to put the company on a solvent basis, and in the future, with the increasing profit which it would seem reasonable to expect, all those who had invested money in the company should feel satisfied that they would have a reasonable return.

Sir **Robt. A. Hampson** seconded the resolution, which was carried unanimously.

Electric Construction Co., Ltd.

Mr. P. E. **Beachcroft** presided on May 21st at Winchester House, E.C., over the annual meeting.

In moving the report (Elec. Rev., p. 833) the **Chairman** said that in accordance with the resolution passed at the last annual general meeting the report and accounts covered a period of ten months only. Last year he was able to report that they had handled an increased output at comparatively little additional cost for fixed charges, and he was in the happy position to make a similar announcement that day. The gross profit on manufacturing and contracting for the past ten months was £57,546, as compared with £62,669 for the previous twelve months, being an increase of 10.2 per cent. per annum. The general charges for the ten months amounted to £18,324, as compared with £21,816 for the previous twelve months, an increase of 0.8 per cent. per annum only. They had, relatively, however, spent more on maintenance of plant and buildings, but this was due to a considerable amount of demolition rendered necessary by the extensions. The expenditure shown under the heading of maintenance of plant and buildings included nothing for the renewal of loose tools, which formed a very heavy item, but which, in accordance with invariable practice, had been included in factory charges, and, therefore, provided for before the manufacturing profit was stated. In pursuance of their conservative policy they had written off for the ten months for depreciation the sum of £5,000, the amount which they had hitherto appropriated for the full year. Having regard to the high state of efficiency in which the works were maintained out of revenue they considered £5,000 per annum a reasonable provision for the depreciation of fixed plant and machinery, and for writing down patents and goodwill. The amount of net profit for the ten months was £27,126, as compared with £27,501 for the whole of the previous financial year, being an increase at the rate of 18.4 per cent. per annum. This they would consider very satisfactory. Turning to the balance sheet, on the assets side they had spent £9,537 on additions to plant and buildings. This represented an important extension to the works at Wolverhampton, which had become necessary to enable them to cope with the increased demand for their manufactures. By this extension the superficial area of the shops had been greatly increased at a comparatively small cost, and he had not the slightest doubt, when they had completed the equipment of the extension, that a handsome return would be earned on the capital expended. They had a factory second to none in its substantial character, its up-to-date appliances, and splendid organisation. Their stock-in-trade and sundry debtors showed little change, but bills receivable were higher. This did not mean they they had been doing a more speculative business, the bills being all first-rate trade acceptances, but their amount at March 31st happened to be considerably more than the amount of bills they usually carried. On the other side of the balance sheet the special resolution passed last year converting the ordinary and preference shares of £2 each into two shares of £1 each had been given effect to, and the Stock Exchange quotation for the shares had been correspondingly narrowed. The only other change was an increase in the general reserve fund from £35,309 to £46,000, the difference having been provided out of the profits for 1912-13. A cursory examination of the balance-sheet would show that the financial position was unquestionably sound. Their total liabilities, apart from share capital and debenture stock, were only £20,955, whereas their realisable assets amounted to £152,397, and, in addition, they had £19,029 in cash. The only other matter he need mention in connection with the accounts was the general reserve fund, to which they proposed to transfer £12,000 out of last year's profits, increasing the amount at the credit of the account to £58,000. As his predecessors in the chair stated from time to time, they had always looked to this item as specially set aside to meet any deficit in the realisation of their holdings of shares in other companies. These shares were taken over from the old company at valuations which appeared reasonable at the time, but they recognised that it would be highly improbable that they should realise the shares at these prices. Personally, he would rather see the amount standing against shares in other companies reduced to something like its present real value by the transfer of an amount from general reserve. This would not affect the financial position one iota, being merely a book-keeping entry, and they had to consider whether this should not be done during the current year. In the latter part of the period now under review they experienced some falling off in orders, but this was inevitable. The country had been enjoying a degree of prosperity unequalled in any previous period of their history, and it was contrary to all precedent to imagine that a reaction would not occur. He was glad to note, however, that, in the opinion of those best able to judge, the depression was not expected to be of great intensity or duration. While their business was, of course, affected by the state of trade generally, he was pleased to say that their volume of unexecuted orders was quite up to the average, and he looked to the future with every confidence. The use of electrical energy for power, heating and cooking was still capable of great expansion, and that they should continue to get their fair share of the business in electrical machinery he had no doubt. He visited the works about a fortnight ago and was struck more than ever by the splendid equipment of up-to-date appliances, and by the enterprise and zeal displayed on every side. The amicable relations with their workmen remained undisturbed, and he was pleased to say that during the last year or two many of their foremen and older workmen had become shareholders in the company, thus giving them a direct incentive to do their best to promote the welfare of the concern. To their staff at the works and in London they owed much of their success, and so long as the company was served by men so capable and zealous they need have no fear of maintaining the position in the industry which they had enjoyed in the past.

Mr. James Gray (managing director) seconded the motion and it was carried.

Electric Supply Corporation, Ltd.

The directors' report for 1913 states that the gross earnings amounted to £34,690, an increase of £2,303. The sum taken into net revenue account amounts to £15,655 as against £13,499 for 1912. After paying interest upon debenture stock and the actual cost of the year's repairs and renewals, and adding the balance brought forward from the previous year, there is a surplus of £8,556. The directors have placed £2,100 to the renewals account and are distributing a dividend at the rate of 2 per cent. per annum for the year, carrying forward £2,256.

Year.	Equiv. in 32 Watt lamps connected.	Units sold.	Gross earnings.	Profit, including investments.
1911	172,202	3,070,851	£29,392	£13,167
1912	186,207	3,730,780	£32,387	£13,449
1913	201,266	3,975,091	£34,690	£15,655

The Hendon Electric Supply Co., Ltd., distributed a dividend of 12 per cent. for 1913 and the Dumbarton Burgh and County Tramways Co., Ltd., a dividend of 1½ per cent. upon its ordinary shares. The total amount received has been brought into these accounts.

The company has issued further debenture stock during the year to the amount of £14,000, bringing the total issued up to £154,914.

	Lamps connected. (Equivalent in 32 Watt lamps). 1913.	Increase.
Chelmsford	37,242	4,549
Jedburgh	3,880	252
Melrose	5,138	193
Dalkeith	8,255	250
Dollar	3,214	436
Totnes	6,175	1,116
Exmouth	17,995	2,612
St. Andrews	25,481	1,128
Hitchin	11,217	699
Dumbarton*	65,360	2,793
Falmouth	17,309	1,031
Total increase during 1913		15,059
Hendon	97,636	23,186
Dawlish	2,850	960
North Berwick	681	

*These figures take no account of the supply to the Dumbarton Burgh and County Tramways which used 636,205 units in 1913.

The annual meeting was held on May 20th at Salisbury House, E.C., Mr. J. G. B. Stone presiding.

The Chairman, in moving the adoption of the report, said that the number of lamps connected had increased during the year by over 15,000, as against an increase during 1912 of 14,005, while in addition the Hendon Co., in which that company held a large portion of the capital, had also added the equivalent of 23,186 33-watt lamps. Their capital expenditure during the year had been £4,147, for nearly one-third of which additions to plant at Chelmsford were responsible. The balance was distributed over the rest of their towns, and in most cases represented mains extensions. Their expenditure upon repairs and renewals had been £2,050. This was a heavier contribution from revenue than in the previous year. In addition they proposed to place a further £2,100 to the renewals account to further strengthen the position. During the year they issued £14,000 of debenture stock, and in order to facilitate the sale of this stock, and to increase the marketability of the old stock, powers were obtained to convert registered stock into bearer form. This change had the desired effect, and a number of holders of the old stock had converted into bearer and there had been an active demand for the bearer stock. Referring to their investment in the Hendon Co., the company now held 4,925 shares, as against 3,793 shares last year. Since their last annual general meeting certain transactions had taken place in these shares, which had resulted in a profit, the whole of which would eventually go into their reserve against investments. He said "would eventually go into their reserve against investments," for as the transactions extended into the current year only part of the profits were brought into the account now before them. The company received during September last their first dividend, amounting to 1½ per cent. upon their holding of ordinary shares in the Dumbarton Tramway Co. They also received dividends during the year amounting to 12 per cent. upon their holding in the Hendon Company. Progress had been well maintained during the year, the gross earnings having risen by £2,300. It was satisfactory to note that this increased output had been effected with an increase of only £800 in their working expenses. This extra expenditure was more than covered by the extra cost of coal. In the year 1912 their coal cost £9,131 as compared with £9,981 in 1913, a difference of £850. The average cost of coal per ton in 1912 was 12s. 5d., and in 1913 it was 15s. 6d. The cost of coal per unit sold in 1912 was .587d. and in 1913 .63d. The company had been disappointed in this matter of coal costs, because 1912 being the year of the strike they thought that they could not have had worse conditions. As it happened, however, they had in 1912 the benefit of several contracts which had been made before the strike, and for 1913 they had to make contracts at a considerable advance in prices. Their coal consumption was at present at the rate of 13,000 to 14,000 tons per annum, but they had made some very important contracts in connection with their Dumbarton business which would nearly halve this figure, by shutting down their generating station in that town. The arrangement was that they were to buy all their electricity in bulk from the Clyde Valley Electrical Power Co., with whom they had made satisfactory terms as to the rates they were to pay. Incidentally, they had secured a very large power consumer in Dumbarton with whom they had made a ten years' contract, and they had also arranged with one of their oldest and largest consumers to renew on satisfactory terms their contract with them for a period of slightly over ten years. Turning to the accounts for 1913 they found that their increased gross earnings of £2,300 were accompanied by an increase in net revenue of £2,200. The directors, however, recommended the distribution of a dividend at the same rate, namely 2 per cent., which would leave a substantial sum to be placed to the renewals account and an increased balance to be carried forward.

Mr. Francis R. Reeves seconded the motion, and expressed the opinion that the shareholders would look with satisfaction upon the state of affairs of the company. They were not going ahead at a very rapid rate, but they were progressing and improving.

Brisbane Electric Tramways Investment Co, Ltd.

The annual meeting of this company was held on May 21st at Winchester House, E.C., Mr. H. R. Beeton presiding.

The Chairman said the total gross receipts for the year 1913 of the Brisbane Tramways Co., all the shares of which the Investment Co. held, amounted to £316,244, and the expenditure, which included an item of £13,381 for law costs, etc., in connection with the proceedings in the Arbitration Court in Australia, amounted to £191,936. The profit, therefore, amounted to £124,308 which, with £5,128 brought forward from 1912, gave an available balance of net revenue of £129,436, of which £10,000 was credited to renewals account, raising that fund to £110,000, and £116,000 was paid in dividends, leaving a balance of £3,436 to be carried forward. After adding to the dividends which had been received on the shares the amount brought forward from last year, and after deducting the London and Brisbane charges, the net balance available was £115,848. A comparison of the figures of the Brisbane Tramways Co. with those for 1912 would be misleading owing to the strike which occurred in that year. The progress of the tramways company based upon that of the City of Brisbane had been very remarkable, as was evidenced by the fact that in the past nine years during which the street mileage over which the company's cars ran had been the same, the gross receipts had increased from £128,436 in 1905 to £315,477 in 1913, while the number of passengers carried had risen from 20,049,978 to 44,690,950, and that improvement continued, the receipts for the first four months of this year showing an increase of £11,095 over those of the same period of last year. The negotiations for extensions of the system had resulted in a settlement satisfactory to the authorities and the Tramway Co., and the company was now constructing 4½ miles of new line, and had applied for construction orders for a further 2¼ miles. The company's application to the High Court of Australia for an Order prohibiting proceedings on the Award made against the company in the Arbitration Court came before the full Court in March last, and after a hearing of several days the preliminary objection of the Australian Tramways Employees' Association to the application, based on the ground that the Court had no power to interfere with the Award, was unanimously over-ruled, and the case would shortly be heard on its merits. The Queensland Government, towards the close of the last Session of Parliament, introduced a Bill very similar to that promoted earlier in the year by the local authorities—but this was allowed to drop—with a view of constituting a Trust with power to purchase the tramways, in agreement with the Tramways Co., at any time, or, as an alternative, to come to a profit-sharing agreement. That Bill was read a first time in November last, and would come up again in the present Session of Parliament. The directors of the Tramways Co. had no objection, in principle, to either proposition, and if the Bill became law they would be quite prepared to discuss terms, having due regard to the company's present and prospective prosperity. In accordance with the announcement made on the 30th January last, the meeting would that day be asked to pass a resolution sanctioning an increase of capital by the issue of 30,000 ordinary shares of £5 each to be offered at par to the existing ordinary shareholders registered on the books at the date of closing the register, namely, 7th May last, in the proportion, as near as possible, of one new share for every three old ordinary shares held. The right to the allotment of those shares at par, with full rights to dividend for the current year, notwithstanding that the shares would only be fully paid on the 15th October, 1914, represented a considerable bonus to the shareholders, which was, of course, saleable on the market by the shareholders who did not desire to take up their proportion. Allotment letters would be posted that day, and acceptances must be forwarded to the company's bankers on or before the 4th June, 1914, with a deposit of £1 per share. The balance of £4 per share would be payable £2 on the 15th August, 1914, and £2 on the 15th October, 1914, after which date the new shares would rank *pari passu* with the old shares, which would entitle holders to the full interim dividend when declared. He concluded by moving that the report and accounts be received and adopted.

Mr. J. B. Concanon seconded the adoption of the report (Elec. Rev., p. 874), which was agreed to unanimously after a short discussion on matters of detail.

On the motion of the Chairman, seconded by Mr. McIlwraith, the directors were authorised to increase the capital of the company to £975,000 by the creation and issue of 30,000 new ordinary shares of £5 each ranking for dividend and in all other respects *pari passu* with the existing ordinary shares of the company.

West London and Provincial Electric Supply Co., Ltd

The annual meeting was held on Wednesday, May 20th, at 14, Ironmonger Lane, E.C., Mr. Harry Kahn presiding.

The Chairman, in moving the adoption of the report (Elec. Rev., p. 832), said he need hardly remind the shareholders again that the whole of the income of the company was derived from the dividends on its shareholding in the Chiswick Electricity Supply Corporation, together with certain management and engineering fees received from the same source. Under the circumstances the successful working of the Chiswick Corporation was of vital importance to them, and he proposed to give them some detailed figures in reference to that undertaking. In regard to their own balance sheet, the shareholders would see that their net profit of £3,419 was £63 lower than last year, due to the fact that they received slightly less in management and engineering fees. The Chiswick Corporation had made continued progress. During the past year the number of consumers had increased by 188 to 2,606, the revenue by £1,118 to £19,440, and the net profit after payment of debenture interest, trustees' fees and premium on sinking fund policy, by £341 to £4,643. The increase in the net profit was not in proportion to the increased revenue. This was owing chiefly to the fact that the Corporation had had to pay very high prices for fuel, and also to the fact that at times of pressure during the last winter their plant was utilised to its fullest extent, a condition of affairs with which the existing condensing plant was not able to deal effectively. This contingency had been foreseen, for the company had ordered a Diesel engine set which, however, was delivered considerably later than the contract with the makers provided. This set, which was installed at the end of 1913, had been running satisfactorily during the current year and would effect a considerable saving in the cost of fuel, besides enabling the Corporation to cope with the expected increased demand for several years to come. The outlook for the Corporation during the current year was favourable. The net revenue for the first quarter of 1914 showed an increase of over £300, and the second quarter, as far as it had gone, also showed signs of improvement on last year's figures.

Mr. Gerald T. Moody seconded the motion.

Sir Thomas Brooke-Hitching, in supporting the motion, said that there had been a constant increase in the revenue of the company and in the number of consumers from 1910 to 1913. The past had been a record year, and he thought the prosperity of the company would be continuous. The number of empty houses in Chiswick had been reduced by some 60 per cent., and if they could get their electric light into these houses their profits must show a continued increase. There was a large amount of land still to be developed in Chiswick, and when they had more factories there they would feel the immediate results. Altogether the outlook for the West London Electric Supply Co. had never been better, and he hoped that it would show continued prosperity.

The motion was carried unanimously

Continental Companies.

The Austrian A.E.G.—Union Co.—According to the report for 1913 of the Austrian A.E.G.—Union Elektrizitats Gesellschaft of Vienna, the works were sufficiently occupied in consequence of the large stock of orders brought over from 1912, although the high rate of interest and the slow method of payment by customers had an unfavourable influence on the results. Notwithstanding the improvement which has taken place in this direction, the arrival of orders still continues to be satisfactory. After applying £17,800 to depreciation in 1913 as compared with £15,900 in the previous year, the net profits are recorded at £64,200 as contrasted with £50,400 in 1912. The dividend is at the rate of 8 per cent. on ordinary share capital of £666,000, as compared with 8 per cent. on £500,000 in the preceding year.

Russian Companies.—The accounts of the Russian Siemens—Schuckert Works indicate net profits of £129,740 for 1913. It is proposed to pay a dividend of 6 per cent. as in 1912, but the capital participating is £1,500,000 as compared with £300,000 in the previous year, the increase being due to the amalgamation of the heavy electrical engineering departments of the Russian Siemens and Halske Co. and the Russian Schuckert Co.

The United Cable Works Co., of St. Petersburg, in which the Felten and Guilleaume Co., the A.E.G., and the Siemens and Halske Co. are interested, earned gross profits of £139,922 in 1913 as contrasted with £103,870 in 1912. After allocating £37,637 to depreciation as against £29,661, the balance permits of a distribution of 10 per cent. as compared with 8 per cent. in 1912.

The Russian Siemens and Halske Co. realised net profits of £50,443 in 1913 as compared with £43,638 in the previous year. It is intended to make a distribution of 6 per cent. as in 1912.

German—South American Telegraph Co.—The accounts for 1913 of the Deutsch Sudamerikanische Telegraphen Gesellschaft, of Cologne, after placing £7,600 to depreciation as compared with £5,300 in 1912, show net profits of £62,600, including the balance of £6,400 brought forward, as contrasted with £54,000 in the preceding year. It is proposed to transfer £2,800 to the reserve fund as against £2,300, £7,500 to the disposition fund as in 1912, and £2,500 to the pension fund as in the previous year. The balance permits of the payment of a dividend of 6½ per cent. on the share capital of £625,000 as compared with the same rate on £500,000 in 1912, leaving £6,600 to be carried forward.

The Paris Metropolitan Railway.—The report of the Compagnie du Chemin de Fer Metropolitain de Paris, after giving details of the extension works undertaken by the City of Paris and the development works carried out by the company in 1913, states that the length of line worked for the company's account remained at 43.89 miles, whilst including the lines previously operated for the account of the city the total mileage at the end of the year was 48.29. The number of employees increased from 5,308 at the close of 1912 to 5,543 on December 31st, 1913, and the system of paying premiums for the purpose of inducing the men to take a greater interest in the working of the railway was considerably extended, the payments having amounted to £52,000, or £15,000 in excess of 1912. The total receipts amounted to £2,192,000 as contrasted with £2,216,000 in the previous year, and the expenses were £938,000 as against £942,000, the ratio of the latter to the former being 42.79 per cent. as compared with 42.52 per cent. in 1912. After deducting £701,000 as the share of the City of Paris in the gross receipts, as contrasted with £711,000, the accounts show working results of £553,000 as against £563,000 in the preceding year, and the net profits, after making loan charges, are £344,000 as compared with £348,000. The dividend amounts to 21½ francs per share (8.6 per cent.), being the same rate as in 1912, on share capital of £2,684,000. The average working results per kilometre of line in operation in 1913 declined by 1½ per cent.—or by £211 per mile as compared with the preceding year, this being due to two causes. In the first place the reduction was brought about for the greater part by the sacrifices made to enhance the welfare of the employees, and secondly to a considerably less extent by a slight fluctuation in the receipts. On the latter point the report states that the result need not cause surprise or still less any alarm. The transformation of the system of horse 'buses into motor 'buses two years ago produced analogous effects, which were foreseen and discounted, but the change had scarcely been completed when the Metropolitan Company's receipts rose again. It will certainly be the same in regard to the fresh decline, which is due to the electrification and extension of the tramway system. This work, which constitutes the second and final stage in connection with the great reorganisation of transport services on the surface which was definitely decided upon in 1910, could not fail to appeal to the railway traffic in its turn, and it might have been more prejudicial than the introduction of motor-omnibuses. But the shock has been borne once again without appreciable injury. Although the tramway reorganisation has not been quite finished the railway receipts are becoming what they were before, thus showing the vitality of the undertaking, and the opinion is expressed that the curve of the receipts will before long resume its upward course.

German—Netherlands Telegraph Co.—The report for 1913 of the Deutsch—Niederländische Telegraphen Gesellschaft, of Cologne, states that although the average increase in traffic which has hitherto been observed continued, the receipts declined owing to the introduction of half rates for transmarine telegrams at the beginning of the year and the fall of 20 per cent. in the word rate for messages exchanged with the Far East in the second half of the year. It is, however, hoped to equalise the decrease by an expansion in traffic in future years. The Yap Menado cable was interrupted in the vicinity of the latter place between February 23rd and March 11th in consequence of the cable wearing, through rubbing on the bed of the sea. Concerning the German South Sea Wireless Telegraph Co., in which the company and the Berlin Wireless Telegraph Co. are each interested to the extent of one-half of the capital, the report mentions that the first two large stations on Yap and Nauru were opened for traffic on December 1st, and the stations at Apia and Rabaul would probably be set in operation in the middle of the present year. The accounts indicate cable receipts amounting to £103,200 in 1913 as compared with £104,300 in the previous year; interest receipts were £5,300, and the balance brought forward is £12,200. After defraying general expenses and making provision for interest on loans, cable maintenance and depreciations funds, etc., there remains net profits of £40,000 as contrasted with £42,000 in 1912. It is intended to pay a dividend of 6½ per cent. on the share capital of £350,000, being the same rate as in the preceding year.

Hongkong Tramway Co., Ltd.

THE directors' report for the year ended 31st December, 1913, states that after charging £10,355 for the year in respect of depreciation of track, rolling stock, cables, power plant, etc., the balance of profit brought down is £19,848, from which has to be deducted the debenture interest £9,340, showing a net profit for the year of £10,509 plus £7,127 brought forward, making an available balance of £17,636. Of this, the interim dividend for the six months ended 30th June, 1913, at the rate of 5 per cent. per annum, paid on the 29th October, 1913, free of income tax, absorbed £2,031. The directors recommend a final dividend for the six months ended 31st December, 1913, at the rate of 20 per cent. per annum, free of income tax, making 12½ per cent. for the year. This will require £8,125 and leave £7,480 to be carried forward. It is difficult to make accurate comparisons between the years 1912 and 1913, owing to the dislocation caused by the boycott during the end of the former year and the beginning of the latter year, but the position in Hongkong in this connection became normal some time since, and the traffic receipts for many months past have been very satisfactory. The Hongkong Government contributed $15,248 further as compensation towards the company's losses during the boycott, making a total contribution of $45,248. Unfortunately, however, there is still a considerable loss incurred on the Hongkong (British) subsidiary coinage, and it is difficult to foresee any amelioration in this respect in the near future. The Hongkong Government recently passed an Ordinance prohibiting the importation of foreign silver and nickel coinage. It came into operation on 1st March, 1914, and the directors hope that this will eventually have the effect of reducing the discount on the British subsidiary coinage, although they fear that the improvement will be slow. During the year the track from Praya East to the Racecourse has been extended to the Happy Valley and was opened for traffic in February, 1914. The length of the extension is about 600 yards. At the request of the Stockbrokers' Association of Hongkong arrangements are being made for the establishment of a Colonial Register in Hongkong under the control of a local committee in order to meet the convenience of shareholders resident in the colony of Hongkong. The directors again desire to place on record their appreciation of the services rendered by the manager, the agents, and the staff.

Canadian Westinghouse Co.—The report for the year ending December 31st, 1913, shows that the profits were $1,002,618, which sum was distributed as follows:—Dividends at 9 per cent., $445,026; bank interest, $28,700; reserve for insurance fund purposes, $50,000; written off property and plant, $250,000; carried forward to profit and loss account, $228,891. The total profit and loss account now stands at $1,531,491. The capital stock of the company is $5,000,000. There are no bonds.—*Canadian Electrical News.*

American Westinghouse Co.—According to the financial Press, the report of the Westinghouse Electric and Manufacturing Co. and subsidiaries for the year ended March 31st shows that the gross earnings amounted to $43,733,646, an increase of $3,756,081, and the net manufacturing profits were $4,717,222, an increase of $145,950. The total income was $5,998,078, an increase of $130,242, and the net income applicable to dividends and other purposes was $4,058,809, an increase of $894,777. The earnings on the common shares were equal to 10·73 per cent., as against 8·2 per cent. in 1913. Owing to the reaction in business this year the value of the unfilled orders shows a decrease of $4,110,088 to $7,951,385 at March 31st.

Ruston, Proctor & Co., Ltd.—For the year ended March, 1914, the profit was £119,118. The dividend on the ordinary shares is 8 per cent. for the year. £25,000 is put to reserve and equalisation of dividend account, and £16,821 is carried forward.

Japan.—The Anglo-Japanese Water Power Co., of Tokio, has decided to increase its capital by £1[illegible]0,000 to £[illegible]00,000. The company's original plant at Ochikubo on the River O., was planned to generate sufficient power to supply Hamamatsu and its vicinity. The increase in demand last year caused the company to build another power station on the River Tomoye a tributary of the Yahagi. Since then the growth of demand has steadily continued, and now again the extension of the plant has become necessary. The construction of another power station on the River Tomoye is being planned, and it is for the purpose of raising the necessary funds that the enlargement of the capital is now proposed.

Stock Exchange Notices.—The Committee has appointed a special settling day as under:—

Friday, June 5th.—Victoria Falls and Transvaal Power Co., Ltd. £650,000 6 per cent. second mortgage debentures, Series B, Nos. 11,441 to 18,940 (£100 and £20).

And ordered the following to be quoted in the Official List:—

Calcutta Tramways Co., Ltd.—Further issue of 2,705 5 per cent. cumulative preference shares of £5 fully paid, Nos. 47,296 to 50,000.

Eastern Telegraph Co., Ltd. Further issue of £10[illegible],291 4 per cent. mortgage debenture stock.

Application has been made for an official quotation in the following:—

Pennsylvania Water and Power Co.—$8,495,000 capital stock in shares of $100.

Continental.—BELGIUM.—La Société Belge pour la Fabrication des Cables et Fils Electriques, of Brussels, reports a profit for last year of £7,253.

The report of the Société des Accumulateurs Tudor, of Brussels, for the last financial year shows a profit of £9,996.

RUSSIA.—The report of the Russian Tudor Accumulator Co., of St. Petersburg, for last year show a net profit of £42,238, as compared with only £36,529 in 1912. The dividend is being increased from 10 per cent. to 12 per cent.

British Electric Traction Co., Ltd.—Financial newspapers state that the directors have decided to place £50,000 to reserve (against £40,000 last year), and to recommend the payment of the dividend on the 6 per cent. cumulative preference stock, and a dividend at the rate of 3½ per cent. on the 7 per cent. non-cumulative preference stock, upon which 3 per cent. was paid last year.

Anderston Foundry Co., Ltd.—The directors recommend a final dividend of 15s. 6d. per share, making 20s. per share for the year. £10,000, which was withdrawn from the reserve fund four years ago, is to be restored.

Elmore's German and Austro-Hungarian Metal Co., Ltd.—According to the *Financial Times*, the accounts for 1913 show a profit, after charging debenture interest, of £30, reducing the debit balance brought forward to £16,348.

STOCKS AND SHARES.

Tuesday Evening.

CONDITIONS in the Stock Exchange are a little puzzling. The financial atmosphere seems to be clearer, although, at the same time, every slight recovery in prices brings out fresh lots of stock. Recent bye-elections are considered to have brought within comparatively near range that appeal to the country, which the Stock Exchange as a whole hopes will prove in its result to be of benefit to the capitalist, large and small. Trouble threatens from Albania, but, on the other hand, the Austrian Emperor's health no longer gives cause for anxiety. Cross-currents are therefore conflicting, but Consols have hardened, and at the beginning of this week the Stock Exchange in general started off with confidence.

Home Railway stocks already show some degree of recovery from the weakness into which they were thrown on the modest proposals of Mr. J. H. Thomas, that all grades of railwaymen should receive an additional weekly wage of 5s.. It is urged by the bullish party that, if a general increase of any substantial amount is granted, it can only be on the decision of the various railway companies to advance fares all round; and while this opinion received a somewhat chilly reception, it had at any rate the effect of making prices better. The Underground group is quiet, and the negotiations between the London General Omnibus Company and its men have been quoted as reasons why the stocks and shares in this group have hung back in the improvement shown by the steam stocks. Districts are flat, the price dropping 2¼, on the apprehension of increased demands from the men.

The Underground Electric Railways Company of London, Ltd., has convened a meeting for June 15th, for the purpose of passing certain resolutions to turn the concern into a purely holding company in law, as well as in fact. According to the promoters of the scheme, this will enable distribution of dividends more quickly than might otherwise be the case; and it is explained that the proposals amount to little more than a legal formality, with this end in view. The idea was mooted at the last meeting held by the company, and promulgation of the details at the end of last week caused no change in the prices of the company's securities.

On balance the £10 shares are ⅛ harder, while the Income bonds eased off.

Disappointment is felt at the announcement that the British Electric Traction Company will pay 3½ per cent. on its 7 per cent. non-Cumulative Preference stock. This is ½ per cent. more than was distributed a year ago, but the market had looked for at least 5 per cent., and the Preference stock has fallen a point, the other stocks of the company also being unchanged. Other issues in this group are quietly steady, with business running on retail lines.

Brisbane Electric Tramways Ordinary shares have just been quoted *ex* the rights to the new shares; the price of these latter was temporarily fixed at 2 premium. Anglo-Argentine Tramways Preference shares improved a little, and the 4 per cent. Debenture stock rose with them; but Brazil Tractions have been flat, and upon resumption of selling which had the appearance of being forced, the price reacted to 77½, a drop of 3, with a point recovery later on. Calcutta Tramways Preference lost the small improvement registered a week ago. Rio Tramways bonds continued their advance.

The Mexican group is the turn harder, and that is all which can be said for it. It is something, however, for the securities to have retained their substantial improvements of last week, and these have been further added to by gains in the Light and Power Company's First Mortgage bonds and in Mexico Trams 6 per cent. bonds. Some of the recent Continental pressure to sell has been relaxed, and venturesome buyers are attracted by the big yields now to be obtained from a purchase of the bonds. So wide are the prices quoted in the shares that speculation in them is scarcely worth while, except to the man who, taking big risks, goes for big profits.

The Canadian division is a little unsteady, and a fall of 2 points took Canadian General Common shares to 105½. Canadian securities, as a whole, have received something of a fillip during the past few days by reason of reported discoveries of oil on a very extensive scale, which have served as an excuse for attracting fresh attention to the stocks and shares of the Dominion. In the Indian group, Calcutta Electric Supply Ordinary and Preference have both risen ⅛. Shanghai Electric Construction shares are wanted; the price is 5s. up at 13¾, and buyers demand the offer of further shares.

The only changes in the list of English electricity supply and power shares are another rise of ⅛ in St. James' and Pall Mall Ordinary, and a point decline in Urban First Debenture stock. Business in all the London issues is tamely quiet. There has been a little selling of County of London Ordinary by those who have elected to take up the new shares, a call on which fell due the other day. As has been pointed out here on previous occasions, there is a turn to be obtained by selling the old shares and taking up the new, since the latter can be bought at about 11⅜; the same conditions apply also to the Preference issue. The provincial shares hold all their lately-acquired strength. The course of investment markets, as a whole, has been against such a steady class as that of the Electricity Supply list. The yields on the shares, however, are sufficiently good to render it pretty certain that when business spreads, these shares will receive more attention than they are getting at the present time. A glance at the table overleaf shows that the returns derivable from good-class electric lighting shares are attractive enough, in view of the comparative cheapness of money.

West India and Panama Telegraphs have shed 5s., receding to 2 upon the appearance of the report, which was regarded as somewhat disappointing; possibly, however, the closing of a few speculative positions had as much to do with the decline as the issue of the accounts. Although there is a steady demand for other investment stocks in this division, no alterations have taken place in prices. Buyers find difficulty in obtaining delivery of stock and shares which they have purchased, and when they press for it, they are told that there is so little in the market that the sellers crave longer time than usual in which to satisfy their bargains. Under Stock Exchange rules, by the way, stocks and shares which remain undelivered ten days after the account day for which the bargain was done, can be "bought in" by the official broker in the House; and notwithstanding the fact that attempts to enforce delivery in this way are frequently unsuccessful, they are detested by people against whom the loss falls, inasmuch as they involve payment of heavy commission to the official broker. The client, of course, pays nothing at all.

Weakness continues to characterise the Marconi market. The parent shares have slipped back to $3\frac{1}{32}$, so that if the dividend is maintained at its previous rate of 20 per cent., the return at the present time, allowing for the inclusion of dividend in the price, will work out to nearly 6¾ per cent. on the money. The Preference went back with the Common, and there were small falls in the shares of the subsidiary undertakings. Chile Telephones are a trifle harder, after their recent dullness; and New York Telephone bonds remain strong at a shade below 100.

In the Manufacturing list, Willans & Robinson Preference reacted to 42, on a little stock coming to market; British Westinghouse Preference remained in the ascendant, and this week there is a rise of 3s. 9d., which has carried up the price to 35s. The buying is persistent, and although there comes every now and then a bout of profit-taking, this does not seem to damp the spirits of the supporters of the market. Castner-Kellner's went back a trifle to 2[illegible]. The Cable shares are strong, Henleys and Callenders being what the Stock Exchange calls "good markets"; and the improvement in Electric Constructions of both classes is well maintained. Rubber issues have rallied a trifle after being dull and depressed. This week's auction sale in Mincing Lane realised fair prices, and the Stock Exchange settlement showed the presence of a good many bears in the share market.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, May 27th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	per lb.	2⅞d.	..
a " Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	"	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29	..
a Bleaching powder	"	£6 5	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£17 10	..
a Copper Sulphate	"	£21 5	..
a Lead, Nitrate	"	£30 10	..
a " White Sugar	"	£27 10	..
a " Peroxide	"	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£[illegible] 10	..
a " Chlorate	per lb.	8¼d.	..
a " Perchlorate	"	8¾d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	"	7½d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	"	£8 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5 5	..
a Soda, Caustic (white 70/72 %) ..	"	£10	..
a " Chlorate	per lb.	8⅝d.	..
a " Crystals	per ton	£2 5	..
a Sodium Bichromate, casks ..	per lb.	5d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£86	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	£107 6 8	..
b " Sheet, in ton lots ..	"	£112	..
p Babbitt's metal ingots	"	£50 to £291	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c " Tube (brazed)	"	9⅝d.	..
c " " (solid drawn) ..	"	7⅞d.	..
c " Wire, basis	"	7½d.	⅛d. inc.
c Copper Tubes (brazed)	"	9⅞d.	..
c " " (solid drawn) ..	"	9½d.	..
g " Bars (best selected) ..	per ton	£78	..
g " Sheet	"	£78	..
g " Rod	"	£78	..
d " (Electrolytic) Bars ..	"	£66 5	..
d " " Sheets ..	"	£84 5	..
d " " Rods ..	"	£71 15	..
d " " H.C. Wire	per lb.	8⅜d.	..
f Ebonite Rod	"	4/6	..
f " Sheet	"	4/-	..
n German Silver Wire	"	1/10	..
h Gutta-percha, fine	"	8/-	..
h India-rubber, Para fine	"	2/10	..
j Iron Pig (Cleveland warrants) ..	per ton	51/1	8½d. dec.
l " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Pig	"	£19 5	10s. inc.
m Manganin Wire No. 28	per lb.	5/6	..
g Mercury	per bot.	£7	..
e Mica (in original cases) small ..	per lb.	6d. to 3s.	..
e " " " medium	"	3/6 to 6/-	..
e " " " large ..	"	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	"	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	"	1/1 to 1/8½	..
p " " rolled bars & rods	"	1/0¾ to 1/2	..
p " " rolled strip & sheet	"	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10⅜d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	"	£150 10 to £151 10	£4 dec.
n " Wire, Nos. 1 to 16	per lb.	2/4	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	£25 2 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co

Mackay Companies.—In our issue of March 27th last, under the above heading, the annual report of the Mackay Companies of February 16th was dealt with, and we there drew attention to the meagreness of the particulars furnished to the shareholders. There has since been issued a postcard, containing on one side an advertisement of the Mackay Companies' systems, and on the other side a balance-sheet of the Commercial Cable Co. to December 31st, 1913, giving the value of cables, electric plant and equipment as $18,437,848; property purchased, $20,000,000; spare cable on hand, $242,072; New York State and City bonds, &c., less obligations connected therewith, $13,365,413; and sundry accounts, including traffic balances and cash in banks, $2,792,576. The liabilities are:—Capital stock, $25,000,000; first mortgage 4 per cent. gold bonds and debenture stock, $20,000,000; sundry accounts, including traffic balances, $1,779,460; and reserves, $8,058,449. This is, indeed, a very conservative statement, and it might well have been more ample.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 26th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16— 5/16	..	Nil
Do. 5 % Pref.	1	5	5	⅝— ¾	..	6 18 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	14½— 16½	..	..
Do. Do. Deferred	100	..	..	5½— 7½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89½— 91½	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	7	3½	54 — 57	—1	6 2 10
Do. 5 % Perp. Deb.	100	5	5	92½— 94½	..	5 6 0
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80 xd	..	5 12 9
Central London Railway, Ord.	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	68 — 73	.	5 9 7
Do. Gtd. Assented	100	..	4	84 — 86	+1	4 13 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	—1	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1903	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref.	1	6	6†	15/32— 23/32	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord.	1	..	..	7/32— 9/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	17/32— 21/32	..	7 12 8
Do. Do. 4½ % 1st Deb.	100	4½	4½	78 — 83	..	5 8 5
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	56 — 60	..	6 13 4
Metropolitan Railway Consol.	100	1⅝	1⅝	39½— 39¾	—1	4 1 9
Do. Surplus Lands	100	2¾	2¾	61 — 63	—1	4 7 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	..	4 5 4
Metropolitan District Ord.	100	Nil	..	23¾ - 24¼	— 2½	Nil
Do. 6 % Deb.	100	6	6	138 —141	..	4 5 3
Do. 4 % Deb.	100	4	4	93 — 95	+1	4 4 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 86	..	5 4 8
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
Do. 5 % Deb.	100	5	5	85½— 88½	..	5 13 0
Potteries, Ord.	1	8½	8½	15/16— 1 7/32	..	8 0 0
Do. 5 % Pref.	1	5	5	21/32— 23/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81¾— 84¾	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	3 — 3¼	+ ⅛	Nil
Do. "A"	1/-	..	..	1/32— 3/32	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	116 —117	..	5 2 7
Do. 4½ % Bonds	100	4½	4½	99½—101½	..	4 8 8
Do. 6 % Income	100	6	6	88 — 89	— ½	6 14 10
Yorkshire (West Riding), Ord.	5	Nil	..	⅝— ⅞	..	Nil
Do. 6 % Pref.	5	3	4	4⅜— 4⅞	..	4 2 3
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends 1912	Dividends 1913	Closing Quotations May 26th.	Rise + or Fall —	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 11/16— 4 15/16	+ 1/16	5 11 4
Do. 2nd Pref.	5	5½	5½	4¼— 4¾	+ 1/16	6 2 3
Do. 4 % Deb.	100	4	4	92½— 94½	+ ½	4 4 8
Do. 4½ % Deb.	100	4½	4½	98½—101½	..	4 8 6
Do. 5 % Deb.	100	5	5	96½— 98½	..	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	103 —106	..	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾— 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½— 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	99 —101	..	4 19 0
Brazilian Traction, Light and Power	$100	6	6†	77 — 79	—2½	7 12 0
Brisbane Trams Invt., Ord.	5	8	8	7 — 7½ xd	..	5 0 0
Do. 5 % Pref.	5	5	5	4⅞— 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def.	100	8	8†	110 —114	—1	7 0 4
Do. Pref. Ord.	100	6	6	103 —107	—1	5 12 1
Do. 5 % Pref.	100	5	5	103 —106	+1	4 14 2
Do. 4½ % 1st Mort. Deb.	40	4½	4½	97 —100	+1	4 10 0
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	93½— 95½	..	4 9 1
Calcutta Trams, Ord.	5	7½	9½	6½— 7	..	6 15 9
Do. 5 % Pref.	5	5	5	5 — 5¼	— 1/16	4 15 3
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
Cape Electric Trams	1	5	5	⅝— ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5 3/16— 5 7/16	..	4 11 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½— 97½	..	5 2 6
Kalgoorlie El. Trams 5% A Deb.	100	5	5	84 — 89	..	5 12 4
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	¼— ½	..	..
Do. Pref.	1	4⅜d.	6	23/32— 31/32	..	6 5 0
Lisbon Elec. Trams, Ord.	1	6	6	1 3/32— 1 11/32	..	4 9 3
Do. 6 % Pref.	1	6	6	15/16— 1 1/16	..	5 1 0
Do. 5 % Deb.	100	5	5	95 —100	..	5 0 0
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅞— 5½	..	5 14 3
„ Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 0
Manaos Trams & Lt., 1st Deb.	100	5	5	78 — 81	..	6 3 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½—100½	..	4 19 6
Mexico Trams Com	$100	7	7	67 — 71	..	..
Do. Gen. Con. 5 % Bonds	..	5	5	77 — 81	..	6 3 5
Do. 6 % Bonds	100	6	6	75 — 80	+1	7 10 0
Para Elec. Rlys. & Lt., Ord.	5	10	10	3⅞— 4⅜	..	11 8 6
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	86½— 89½	..	5 11 8
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	96 — 98	+ ½	5 2 0
Do. 5 % Mort. Bonds	100	5	5	87½ - 89½	..	5 11 9
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	96 —100	..	5 0 0
Singapore Trams, 5 % Deb.	100	5	5	83 — 92	..	5 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video	5	7	7	4⅝— 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4½— 5½	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	92½— 95½	..	5 4 9
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½— 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends 1912	Dividends 1913	Closing Quotations May 26th.	Rise + or Fall —	Present Yield p.c.
Bournemouth & Poole, Ord.	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10⅜— 10⅞	..	5 10 4
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 9
Brompton & Kensington, Ord.	5	10	10	8¾— 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼— 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91½— 94½	..	4 4 8
Charing Cross, West End & City	5	5	6	4⅞- 5⅜	..	5 11 7
Do. 4½ % Cum. Pref	5	4½	4½	4⅝— 5	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4¼— 4⅝	..	4 17 4
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4⅝— 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	97 - 100	..	4 10 0
City of London, Ord.	10	9	10	16 - 17	..	5 17 8
Do. 6 % Cum. Pref.	10	6	6	12½ - 13½	..	4 9 0
Do. 5 % Deb.	Stock	5	5	116 -120	..	4 7 4
Do. 4½ % Second Deb.	100	4½	4½	100 - 103	..	4 8 1
County of London, Ord.	10	6	7	11¾— 12¼	..	5 14 3
Do. 6 % Pref.	10	6	6	11⅞— 12⅜	..	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	103 —106	..	4 5 3
Do. 4½ % Second Deb.	Stock	4½	4½	98 - 101	..	4 9 1
Edmundson's, Ord.	£3	..	..	5/16— 9/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3½— 4	..	7 10 0
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝— 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9
Hove	5	8	9	8½— 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7½— 8	..	5 12 0
Do. 4 % Deb.	Stock	4	4	90 - 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 - 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅝- 1¾	..	5 2 7
Do. 6 % Pref.	5	6	6	4⅞- 5¼	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	92½ - 95½	..	4 3 9
Metropolitan	5	4½	4½	3¼— 3¾	..	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½— 5	..	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort Deb.	Stock	3½	3½	83 - 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 - 101	..	4 19 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾— 10½	..	5 14 3
Oxford	5	7	7	5 13/16 6 5/16	..	5 11 0
St. James' and Pall Mall, Ord.	5	10	12	9⅜ 9⅞	+ ⅛	6 1 6
Do. 7 % Pref	5	7	7	6¾ 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	83 - 86	..	4 1 4
South London, Ord.	4	5½	5½	2¾- 3¼	..	6 10 4
Do. 5 % First Mort. Deb.	100	5	5	99 102	..	4 18 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/16— 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 - 100	..	4 10 0
Urban, Ord.	£3	Nil	..	5/16— 9/16	..	..
Do. 5 % Cum Pref.	5	3‡	4	2¼— 3	..	6 13 4
Do. 4½ % First Mort. Deb.	100	4½	4½	83 - 86	—1	5 4 8
Westminster, Ord.	5	10	10	8¼— 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4 13/16— 5 3/16	..	4 6 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 26th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5⅛— 5⅝	..	5 11 7
Calcutta, Ord.	5	8¾	9	7⅞— 8	+ ⅛	5 12 6
Do. 5 % Pref.	5	5	5	5 1/16— 5 5/16	+ ⅛	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	90½— 92½	..	5 8 0
Canadian Gen. El. Com.	$100	7	8	103 —104	—2	7 5 6
Do. 7 % Pref.	$100	7	7	117 —122	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	5	..	7/16— ⅞	..	7 12 0
Do. 5 % Deb.	100	5	5	87 — 90	..	5 11 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	83 — 88	..	6 16 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½—95½	..	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32— 3/32	..	Nil
Do. 6 % Pref.	1	6	4	½— ½	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 —105	..	4 15 2
Madras, Ord.	5	Nil	..	1¼— 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	105 —108	+1	4 12 6
Mexican El. Lt., 5 % 1st M. Bds.		5	5	58 — 63	..	7 18 10
Mexican Lt. & Power, Common	$100	4	4†	38 — 41	+1	..
Do. 7 % Cum. Pref.	$100	7	7	68 — 73	..	9 11 5
Do. 5 % 1st Mort. Gold Bds.	..	5	5	70 — 75	+2	6 13 4
Do. 5 % 2nd Mort. Bonds	100	5	5	59 — 64	..	7 13 3
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	50 — 54	..	..
Montreal, Lt., H. and Power	$100	9	10†	220 —225 xd	..	4 9 0
Northern, Lt, Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 -245 xd	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 —103 xd	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5½	6	134 —138	..	4 7 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	99½ 101½ xd	..	4 8 8
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	98 - 100 xd	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	85 — 89	—1	5 15 0
Victoria Falls Power, Pref.	1	6	6	23/32— 27/32	..	7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 26th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	23/32— 27/32	..	8 5 0
Do. 6 % Pref.	1	6	6	¾— ⅞	..	6 17 2
Babcock & Wilcox	1	16	16	2 15/16— 3 1/16	..	5 4 7
Do. Pref.	1	6	6	1¼— 1⅜	..	4 7 6
British Aluminium, Ord.	1	..	5	15/16— 1 1/16	..	4 14 1
Do. 6 % Cum. Pref.	1	6	6	13/16— 15/16	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	97 —100	..	5 0 0
Do. Deb. Stk.	100	5	5	90 — 95	..	5 5 3
B.I. & Helsby Cables	5	10	13	9½— 9¾	..	6 13 4
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	101 —104	..	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	2	Nil	5	1⅝ — 1 13/16	+ 3/16	5 10 6
Do. Deb.	100	4	4	73 — 75	..	5 6 8
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	50 — 55	+1½	8 3 8
Do. 4½ % Second Deb.	100	4½	4½	29 — 33	..	13 12 8
Callender's Cable	5	15	15	11⅞— 12⅜	..	5 18 7
Do. Pref.	5	5	5	5 — 5¼	..	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	22½	2½ — 2¾	+ 1/16	8 3 9
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	⅜— ⅝	..	..
Do. Pref.	1	6	6	23/32— 27/32	..	7 13 4
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	1	5	6	⅝— ¾	..	8 0 0
Do. Pref.	1	7	7	1 — 1⅛	..	6 4 5
Greenwood & Batley, Pref.	10	7	7	6¾— 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10½— 10⅝	..	5 14 3
Do. Deb.	100	4	4	87 — 91	..	4 8 0
Henley's, Ord.	5	15	20	14½— 15½	..	6 9 0
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	101½—103½	..	4 7 0
India-Rubber, G. & T.	10	7½	7½	10 — 11	..	6 16 5
Do. Pref.	10	5	5	8¾— 9¼	..	5 5 8
Telegraph Construction	12	20	20	36½— 38½	..	6 4 7
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	64 — 68	..	5 17 8
Do. B 4 % Cum. Pref.	100	..	£4	40 — 44 xd	—2	9 1 10

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations May 26th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾— 6¼	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 —127	..	6 6 0
Do. Collat. Trust	$1000	4	4	91 — 94	+1	4 5 0
Anglo-American Telegraph	Stock	3	3	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	108½—109½	..	5 10 1
Do. Def.	Do.	30/-	30/-	23⅛— 23⅝	..	6 7 0
Anglo - Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	6†	7¼— 7½	+ 1/16	5 6 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	+1	4 18 9
Cuba Telegraph	10	6	6†	8½— 9½ xd	..	6 6 4
Do. 10 % Pref.	10	10	10	16 — 17 xd	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4	3½— 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7¼— 7¾	..	6 9 0
Direct United States Cable	10	4	4	6½— 7	..	5 14 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	130 —133 xd	..	5 5 3
Do. 3½ % Pref. Stock	Do.	3½	3½	77 — 79 xd	..	4 8 9
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 3 4
Eastern Extension	10	7	7	12½— 13 xd	..	5 7 9
Do. 4 % Deb.	Stock	4	4	94½— 96½	..	4 3 0
Globe Telegraph and Trust	10	6	6†	10⅞ - 11⅜	..	5 5 4
Do. 6 % Pref.	10	6	6	12½— 13	..	4 12 4
Great Northern Telegraph	10	20	20	31 — 33	..	6 1 1
Indo-European Telegraph	25	13	13	56½— 58½	..	5 11 1
Mackay Companies Common	$100	5	5	81 — 84	..	5 19 1
Do. 4 % Cum. Pref.	$100	4	4	68 — 71	..	5 12 7
Marconi's Wireless Telegraph	1	20	20	3 — 3⅛	— 1/16	6 7 10
Do. 7 % Cum. Partic. Pref.	1	17	..	2⅜ - 2⅝	— 1/16	6 9 6
Monte Video Telephone, Ord.	1	6	6	13/16— 15/16	..	6 8 0
Do. 5 % Pref.	1	5	5	23/32— 27/32	..	5 18 6
New York Telep., 4½% Gen. Bnds.	100	4½	4½	99 —100	..	4 10 0
Oriental Telep. and Elec.	1	10	10	2 1/16— 2 5/16	..	4 6 7
Do. 6 % Cum. Pref.	1	6	6	1 5/32— 1 9/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	87½ - 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	7	8½— 9½	..	7 7 4
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 - 100	..	4 10 0
United River Plate Telephone	5	8	6†	6¼— 6¾ xd	..	5 18 5
Do. 5 % Cum. Pref.	5	5	5	5⅛— 5⅝	..	4 9 0
West Coast of America	2½	2½	N	⅞— 1⅛	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	1½	1⅞ - 2⅛	— 1/16	5 17 8
Do. 6 % Cum. 1st Pref.	10	6	6	9⅝ 10⅛	..	5 18 5
Do. 6 % Cum. 2nd Pref	10	6	6	8⅝ 9⅛	..	6 11 6
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	10	7	7	13⅜ 13⅞	..	5 1 11
Do. 4 % Debs.	Stock	4	4	95½ 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	94 — 97	..	4 12 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Electrical Exhibition in Turkey.—An interesting Electrical Exhibition—the first of the kind in the country—organised by the Société Ottomane d'Electricité, was opened in Constantinople on the 16th inst., and is attracting considerable attention. The display comprises all applications of electricity, from electric irons, cooking stoves and other household uses, to the more industrial departments of central station, electric tramway, telegraph and telephone equipment. Among the many exhibits that may be mentioned are those of the A.E.G., of Berlin, Messrs. L. Faure & Co., a French electrical engineering concern, Messrs. Ganz and Co., of Budapest, Messrs. Kirchner & Co. (electrically-operated wood-working machinery), the Siemens-Schuckertwerke Gesellschaft, of Berlin, and the varied display of the British Agencies Association. The last-named body, of which Mr. Robert Rowell is the managing director, is representing the interests in Turkey of a number of well-known British firms, amongst which may be mentioned Callender's Cable and Construction Co., Ltd., Messrs. Thos. Firth & Sons, Ltd., the Birmingham Small Arms Co., Ltd., Messrs. R. & W. Hawthorn, Leslie & Co., Ltd., Messrs. Dick, Kerr & Co., Ltd., the Birmingham Metal & Munitions Co., Ltd., the Cotton Powder Co., Ltd., the Weldless Steel Tube Co., Ltd., Messrs. John Musgrave & Co., Ltd., and Sir Wm. Arrol & Co., Ltd. As will be gathered, the display of the Association is an extremely varied one, and it is interesting and satisfactory to learn that, after leaving the Turkish market so long to German and Continental manufacturers, the organised efforts towards bringing British productions to the front are beginning to make themselves felt.

REVIEWS.

Transmission Line Formulas for Electrical Engineers and Engineering Students. By H. B. Dwight. London: Constable & Co., Ltd. Price 8s. 6d. net.

The title of this little book indicates with sufficient clearness its country of origin, and we are not therefore unprepared to find that the sizes of conductors are given in B. & S. gauge, and that the standard frequencies for which the tables are prepared are 25 and 60 cycles per sec. These circumstances may to some extent impair its usefulness to the British reader; but there is much material in the book which will make it helpful to the electrical engineer in this country who has occasion to make frequent estimates and calculations for long-distance alternating current transmissions.

For reasons which are given later, we do not feel able to recommend the engineering student to make use of Mr. Dwight's work, unless his previous experience in line calculations has been extensive.

The author states that the object of his book is to present a set of instructions for engineers which will enable them to make the electrical calculations for transmission lines with the least possible amount of work. He has, accordingly, prepared charts, formulæ (or ought we to say formulas?) and tables for facilitating the determination of the regulation, current, voltage, efficiency, etc. of both long and short lines for single, two and three-phase currents, with notes appended as to their limits of accuracy and application, and the methods of employing the tables, together with actual examples worked by way of illustration. This occupies the first half of the book, which is headed "Working Formulas."

The second portion is entitled "Theory," and contains the derivation of various standard expressions for the reactance of lines, their resistance due to skin effect, the capacity of lines with various arrangements of conductors, etc., carried out mathematically more according to the plan of an ordinary text-book.

Part III contains a collection of the tables used in the first part arranged for handy reference, and a number of numerical tables of constants of standard sizes of conductors with various spacings, so that the reactance, resistance, capacity, etc. can be found by inspection.

We ought to state that the book deals exclusively with overhead lines for alternating current transmission.

As a convenient book of reference in connection with calculations in this branch of electrical engineering, it should be found very useful and practical. When once the system of working employed by the author and the significance of the formulæ and data which are given have been thoroughly mastered, we can imagine that the work may become a faithful and helpful friend to anyone who has frequent calculations to make in connection with transmission schemes.

As a guide to the non-expert or to the student of limited experience, on the other hand, we fear that a word of warning must be given. Many of the approximations and the mathematical statements, while legitimate in the sense that they do not lead the author into numerical inexactitude, because he understands exactly what he is about, are likely to produce confusion of ideas in the mind of a younger colleague, and may lead him into serious blunders and practical errors.

So long as the unskilled pupil is content to accept the author's instructions to do this or that, and so long as the problem to be solved comes within the category of those for which full instructions are given—so long may he safely manipulate the machine which the book sets before him, and so long will he get a correct answer. When, however, because of native inquisitiveness or from the exigences of a fresh problem the unwary pupil glances aside from the rigid instructions and begins to use his own brains, we fear he will rapidly become involved in difficulties from which he will only be extricated after appeals to other sources.

We may indicate some of the points which appear to us likely to confuse the unskilled reader.

In the case of three phase transmission lines, the current is calculated as having a value $P \div \sqrt{3}E$ (in total amps.), where P is the total power in the three phase circuit, VA is the total volt amps., and E is the voltage between the lines.

The use of the term "total amperes" in this sense is highly unscientific and most confusing to the student, whether we agree that it is justifiable in practical calculations or not.

It is often not necessary to distinguish between vectorial and arithmetical addition or subtraction of voltages and currents in obtaining the author's formulæ within the degree of accuracy aimed at. The complete omission in many parts of the book to make any distinction between these forms of addition or subtraction might, however, lead the student far astray, if he failed to recognise this distinction between them in other cases. The use of the symbolic notation for currents and voltages appears to the author to need little explanation, but we think that his somewhat loose and confusing use of it would prove a snare to anyone not already familiar with it. The author makes no clear distinction between quantities expressed vectorially and numerically, and for some unknown reason writes the expression for impedance $Z = R + JX$, and for admittance $Y = G + JB$. The first of these is correct, but the second expression ought to have a negative sign. This change of the sign does not appear to be a misprint since it recurs several times in different parts of the book.

It is a pity that the chart which forms the frontispiece should have been gummed in in such a way that the crease which occurs at the centre makes it practically impossible to use a ruler for getting values in the manner intended.

In conclusion, we may repeat that for the experienced worker there is much valuable material in the book, and we welcome it as a useful piece of work, which must have involved considerable labour in its preparation, and which may save much labour of a similar nature on the part of those who make use of it.

Electrical Engineering. The Theory and Characteristics of Electrical Circuits and Machinery. By Clarence V. Christie, M.A., B.Sc. London: Hill Publishing Co., Ltd. Price 17s. net.

This is a good example of a carefully compiled and clearly written college text-book. Beginning with the development of the mathematical principles of electrostatics (electricity at rest) and of electromagnetics (electricity in motion), the author leads on to the theory of electrical circuits, direct-current machines, synchronous machinery, transformers, induction motors, alternating-current commutator motors, converters and transmission lines.

The treatment throughout is intentionally academic and theoretical, but the author uses excellent judgment in keeping it simple and in avoiding such matters as would require a very advanced mathematical treatment, while he introduces nothing which has a purely theoretical interest. The mathematical knowledge expected does not exceed that of a capable college student in his second or third year, who is familiar with the ordinary forms of differentiation and integration.

It is difficult to give in detail the amount of ground covered by the book, but it may be said to contain the theoretical basis of the subjects which have been enumerated above so far as they may be expected to occur in an ordinary college course. There is little descriptive matter, and questions of design do not come within the author's plan.

Where so large a field is touched upon, it is only to be expected that some portion of the theory of electrical engineering should be only briefly dealt with. We find that although the theory of commutation is discussed in some detail, the subject of interpoles is rather scantily treated. The theory of the A.C. commutator motor is also less fully given than might have been expected in view of its increasing importance.

The synchronous reactance of an alternator is obtained as the quotient of the open-circuit voltage by the short-circuit current. A little fuller explanation of the assumptions underlying this method of derivation and of the errors to which it is subject would have been advisable.

We imagine that the author would not lay claim to originality in his treatment, but we can congratulate him on having produced an excellent text-book to serve the purpose mentioned in his preface, viz.: that of a foundation for lecture courses for junior and senior students in Electrical Engineering.

The book is excellently printed, and the diagrams are clear and well reproduced.

Photo-Electricity. By H. Stanley Allen, M.A., D.Sc. London: Longmans, Green and Co. Price 7/6 net.

The study of electrical effects due to the influence of light may be said to have begun with the observation of Hertz in 1887, that the incidence of ultra-violet light facilitated the passage of the electric spark. Up to the appearance of the present volume the only connected account of these effects was to be found in Sir J. J. Thomson's book *The Conduction of Electricity through Gases*, Second Edition, 1906.

Dr. Allen has, in the book under review, given a very full account of all the photo-electric work which culminated in Professor Thomson's identification and measurement of the electron, the "atom" or natural unit of negative electricity, in 1899; and he has also incorporated the results of a large amount of research carried out since Professor Thomson's account was published. The fact that Mr. Allen has contributed considerably to the present knowledge of photo-electric phenomena by his own researches, and has also had the advice and assistance of Dr. Ladenburg, the eminent German worker in these subjects, in the preparation of his monograph, lends to it a special weight of interest and authority.

The early experiments of Hertz and Hallwachs are illustrated and described in the introductory chapters, followed by the historic researches of Sir J. J. Thomson in 1897 and onwards, on the emission of negative electrons or corpuscles in a vacuum. The classical experiments for the determination of the elementary charge e, the ratio e/m, and the electronic velocity are all described in detail.

The author then passes on to consider the photo-electric current in gases at various pressures. Whereas the current or stream of electrons liberated by ultra-violet light in a vacuum is identical with the kathode rays in the Crookes tube, except that the electronic velocities are less, the current in a gas is partly due to the comparatively slow motion of negatively charged ions, *i.e.*, electrons attached to molecules of the gas. Rutherford's experiment on the velocities of these ions in different gases is referred to. The extent to which ions or electrons predominate in producing the photo-electric current depends upon the pressure and the strength of the electric field, and the exact nature of this dependence has been the subject of extensive experimental and theoretical investigations which are all fully explained in Chapter V.

The photo-electric activities of various substances —metals, liquids, and gases—are dealt with, and also the attempts to classify substances by various experimenters, including Ramsay and Herman, according to their photo-electric activity or their capability of emitting electrons under the influence of light.

The fact that marked differences have been observed by Marconi in the transmission of electromagnetic waves by day and by night shows that the photo-electric properties of gases are of something more than theoretical interest. The study of the action of light on gases is, however, an extremely difficult one, and elaborate investigations carried out by Lenard at Heidelberg show that the presence of even minute traces of impurities produces exceptionally complicated effects. The action of ultra-violet light on a gas may produce one or more of three different actions, viz.: (1) chemical action, *e.g.*, the formation of ozone in oxygen; (2) the formation of condensation nuclei; (3) the formation of molecular electrical carriers; and since solar rays include the ultra-violet, the above actions may all be expected to occur in the atmosphere and are likely to raise important meteorological and "wireless" questions.

Important chapters are also included on the influence of the character of the light on photo-electric effects and on photo-electric fatigue—the latter being largely on account of the author's original researches.

Two delightful essays on "Fluorescence and Phosphorescence" and "Photo-chemical Actions and Photography"—both treated in the light of the most modern theories and investigations—complete a work which is unique both in subject matter and in thoroughness of treatment.—P.H.S.K.

Rays of Positive Electricity and their Application to Chemical Analysis. By Sir J. J. Thomson. London: Longmans, Green and Co. Price 5/- net.

The author gives in his book an account of experiments carried out during the last seven years in the Cavendish Laboratory on the nature of the positive rays. These have been previously known as Canal Rays, and were so designated by Goldstein, who discovered them in 1886. He found that if in a vacuum tube containing gas at low pressure a metal cathode was fixed through which a number of holes were drilled—the axes of the holes being at right angles to the surface of the plate—and if the terminals of an induction coil were connected to the anode and cathode and a discharge allowed to pass, slightly diverging bundles of luminosity streamed through the holes. The colour of this depended upon the nature of the gas with which the tube was filled. These rays have since been proved to consist chiefly of positively charged particles, hence Sir J. J. Thomson now calls them positive rays. When they strike against the glass sides of the tube they cause phosphorescence in the glass. This is different to that produced by the cathode rays, being much less bright. With some substances the contrast is very striking. With fused lithium chloride for instance, the phosphorescence produced by the positive rays is intense red, and that due to the cathode rays is light blue. As this power to cause phosphorescence is valuable in testing the deflection of the positive rays, produced by electric and magnetic forces, it was important to discover the substance which phosphoresced to the greatest extent. This was found to be willemite, a natural silicate of zinc.

The author gives an account of Goldstein's experiments, and then goes on to a description of Wien's proof that the rays are capable of electric and magnetic deflection. Unlike the cathode rays, it was for long thought that the positive rays were indifferent to electric and magnetic fields, but in

1898 Wien showed, by the use of very powerful magnetic forces, that the rays *can* be deflected, although the amount is only some 2 per cent. of that for the cathode rays under similar conditions.

The author proceeds to describe the first experiments he carried out. In these he subjected the rays to powerful electrostatic and magnetic fields acting at right angles to each other. With very low pressures of gas in the vacuum tube he found that he obtained on the willemite screen a series of parabolic curves. Now the positions of these parabolas depend, if other things are kept constant, on the masses of the positive particles; hence by means of the curves much information on the nature of the particles can be obtained.

Some apparatus of an exceedingly ingenious nature is described in connection with the experiments, and photographic illustrations of the curves are given.

The author discusses in some detail the question of atoms carrying two or more positive charges. It seems that a mercury atom can carry no fewer than 8 charges, and other substances a less number. The maximum number of charges carried by a charged atom does not seem to be related to any chemical property of the atom, such as its valency, but to depend mainly on the atomic weight. The multiple charge has been found on the atoms of all the elements tested with the single exception of hydrogen—no hydrogen atom with more than one charge has ever been observed.

The information afforded by the positive rays is of great use in the investigation of the constitution of gases and the properties of atoms and molecules. The rays indicate, among other things, the following:—(1) In some gases we have both atoms and molecules, in others only atoms; (2) the atoms and molecules of the gas can be charged with electricity, all of them with positive electricity, and some of the atoms with negative as well; (3) multiple charges on atoms except hydrogen; (4) no case of a double charge on a molecule; (5) in addition to the atoms and molecules of recognised elements, the existence of radicles and other combinations not known to exist permanently in the free state, for instance: the systems CH_1, CH_2, CH_3, are detectable as well as CH_4.

The work is a masterpiece of experiment and deduction.—W.J.C.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Prometheus Irons.

The **British Prometheus Co., Ltd.**, of Salop Street Works, Birmingham, have just brought out a series of electric flat-irons for domestic and industrial uses, guaranteed for three years. These irons are very heavily nickel-plated and highly polished, and the elements employed are of the latest Prometheus pattern. The iron illustrated weighs 5 lb., and is provided with two-pin terminals, marble connector, and spiral cable protector.

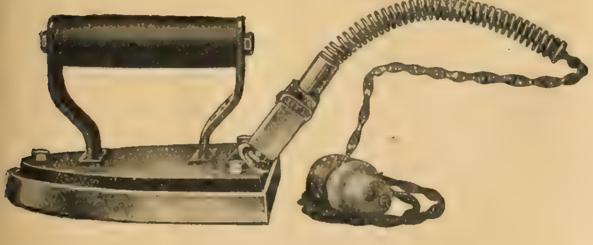
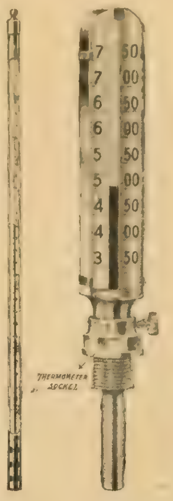


Fig. 1.—Prometheus General Domestic Iron.

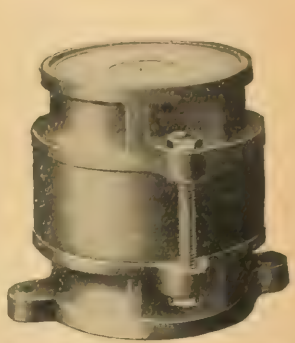
The "industrial" irons are of similar design but usually heavier—up to 24 lb.—and include irons for special purposes; and a special "colonial" series at a lower prize is also made. The heating elements can be exchanged in a few minutes by unskilled persons.

Magnifying Thermometers.

We have received from **Messrs. T. Sugden, Ltd.**, of 186, Fleet Street, E.C., particulars of their new magnifying thermometers which they are placing on the market, to get over the difficulty, in the case of ordinary thermometers when placed in inaccessible positions, of reading the scale.



Ordinary Pattern Thermometer. Sugden's Magnifying Thermometer.
Fig. 2.



A.C. Buzzer for Bell Circuits.
Fig. 3.

The magnifying thermometers are stated to be less fragile and more accurate than the ordinary types, and are made with scales up to 1,000° F., to suit almost any purpose.

A.C. Buzzer.

The London and Rugby Engineering Co., Ltd., of 10, Bush Lane, Cannon Street, E.C., have recently introduced an A.C. buzzer, shown in fig. 3, which has been designed to replace both bell and battery where A.C. supply is available, and it is intended to supersede the bell transformer and separate bell hitherto used. The primary winding is suitable for voltages of 100-130, 200-260; standard makes are suitable for 50 cycles and upwards. The device contains no working parts to get out of order.

Electric Clocks on the "Aquitania."

We understand that the "Pulsynetic" system of electric impulse clocks has been fitted throughout the *Aquitania*, Britain's largest liner, the manufacturers being **Messrs. Gent & Co., Ltd.**, of Leicester. The order was placed through Messrs. Edward and Sons, Glasgow, who are the Scottish agents for the firm, the installation being carried out under their supervision by Messrs. W. C. Martin & Co.

A very large number of dials are fitted, and they are all of special design and finish, there being hardly two alike throughout the whole vessel. Several of them are old masterpieces which have been fitted with "Pulsynetic" movements, the original dials and hands being retained. Special interest centres in the master clock, or impulse transmitter in the chart room, which is fitted with a chronometer balance, a pendulum being, of course, impossible for use on board ship. A novel and ingenious automatic advancing and retarding mechanism, fitted to the master clock, enables all the dials to be simultaneously corrected to ship's time daily. We understand that the principle of automatically advancing is an

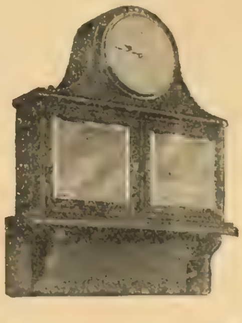


Fig. 4.—Pulsynetic Marine Transmitter.

entirely new contrivance, and supersedes the existing cruder methods of advancing the ship's clocks when sailing eastwards. Particulars are given in Messrs. Gent's Book 19, on "Pulsynetic electric clocks adapted for ship use."

Submarine Motor Ship Cleaner.

We briefly referred, on page 767, to the new apparatus for cleaning ships' hulls, which has been introduced into this country by the Submarine Motor Ship Cleaner Co., of 66, Broad Street Avenue, E.C. Through the courtesy of this firm we are now able to illustrate the principal features of this plant, which, as previously mentioned, consists of a barge equipped with a 28-h.p. four-cylinder petrol-electric set supplying energy for operating the propelling motor, a winch and the cleaning gear suspended from it. The main generator is a 10-kw. 230-volt machine, provided with suitable switchgear; the propeller motor, rated at 10 b.h.p., drives a three-bladed propeller, the petrol consumption for driving the barge being one gallon an hour.

A special four-drum winch is fitted in connection with the submersible cleaning gear, two drums being for carrying the latter suspended by ropes over the side, while one contains the cable supplying the motor for operating it; all these drums are gear-driven from a 3½-h.p. motor, the fourth drum for working the jib being hand-operated. The submersible gear consists essentially of a revolving brush, 5 ft. long and 12 in. in diameter, which is held up to the plating of the ship by the thrust of a propeller running behind it.

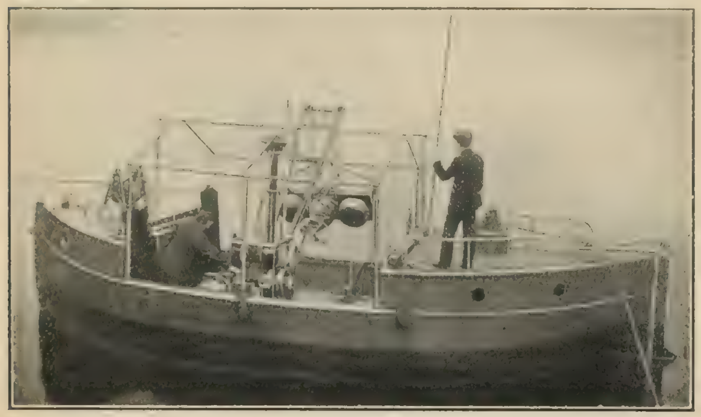


Fig. 5.—Barge Fitted with Winch, and showing Ship Cleaner Slung Overboard.

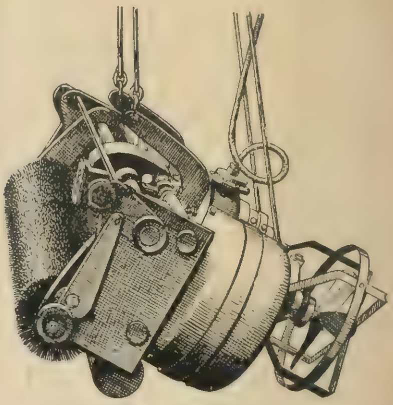


Fig. 6.—Submersible Cleaning Gear.

A 10-h.p. motor, running at 2,500 to 2,800 r.p.m., supplies the motive power, being connected by worm and chain gearing to the brush, and by concentric reducing gear to the propeller.

The revolving brush is lowered by the winch to the required depth, and raised to the surface cleaning a strip of plating, the barge then moving forward into position for cleaning the next strip. An average speed of lowering the brush is 45 ft. per min., the brush running at about 160 r.p.m. The plant is operated by an engineer and three assistants.

At a recent demonstration with the cable ship *Faraday*, it was estimated from work actually accomplished that the whole ship, of 5,000 gross tonnage and 360 ft. on the water-line, would be cleaned in about 5½ hours.

B.T.H. Alabaster Bowls.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C., have recently introduced several patterns of translucent dishes for semi-indirect lighting, cut from solid blocks of alabaster. They can be had in various tints, white, red or yellow and produce a soft and mellow illumination. We illustrate one of the dishes, and particulars of others can be obtained from the company.

Fig. 7.—B.T.H. Alabaster Dish.

Domestic Electric Refrigerators.

We have received from the A.E.G. Electric Co., Ltd., of 133, Oxford Street, W., particulars of a small electrically-operated refrigerating plant which they have placed on the market.

This consists of a cold storage chest and ice chamber in the form of a cabinet, with a smaller cabinet mounted above it containing a ¼-h.p. motor, either a.c. or d.c., direct-coupled to a small compressor. The apparatus consists of a copper refrigerator coil in which the evaporation of the cooling liquid—in this case ethyl chloride—takes place; the lower part cools the chest while the upper part contains a brine bath for ice making.

The compressor, previously mentioned, sucks the vapour from the coil, and compresses it, after which it is cooled in a condenser placed in the base of the machine (and requiring about nine gallons of cooling water an hour), and returns to the refrigerating coil through a reducing valve, producing a sudden pressure drop.

The chest is well insulated, and the refrigerator has a capacity of 880-1,000 b.th.u.; it will cool the air in the chest (127 cb. ft.) to about 24° F., and make about 2·2 lb. of ice per hour.

Some G.E.C. Accessories.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have recently introduced the new pattern suspension switch shown in figs. 8 and 9. The new switch is of neat design, being only 2¼ in. long and ¾ in. in diameter, and has the terminals arranged at each end. The cord grip is efficient, and the body is composed of non-inflammable imitation ivory, as a standard. By short-circuiting the lower terminals with a piece of copper wire, the switch can be used (as shown in fig. 9) as an ordinary suspension switch.

The company has extended its range of "Slick" tumbler switches by the inclusion of a combined switch and wall plug. Another "Slick" switch has been added for use with flush switch plates for two-way working. Fig. 10 represents a special type of bayonet lampholder for use with signs, radiators, &c., in which the back of the lampholder is quite open and the fixing of the holder very simple. A substantial backplate lampholder known as the "Excel" has also been introduced, having a deep recess at the back for the wires.

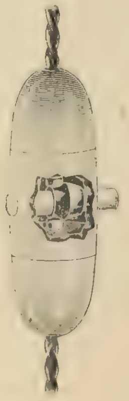


Fig. 8.

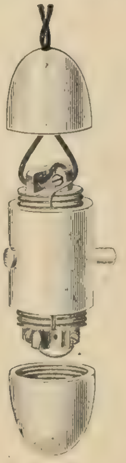


Fig 9.

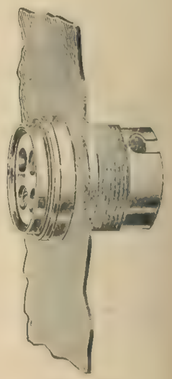


Fig. 10

Fig. 8.—G.E.C. Suspension Switch, showing Operating Mechanism.

Fig 9.—G.E.C. Suspension Switch, showing Lower Terminals Short-circuited, for use as a Plain Suspension Switch.

Fig. 10.—G.E.C. Bayonet Lamp-holder, for use in Signs, Radiators, &c.

Where insulated lampholders are required, the company is now offering an outer case of high grade fireproof insulating material instead of china. In connection with its traction supplies, the G.E. Co. has added the "Acme" splicing sleeve for splicing trolley wires.

Reyrolle Lighting Panel.

A new arrangement of panel specially constructed for use in power and sub-stations on South American railways, by Messrs. A. Reyrolle & Co., Ltd., of Hebburn, is shown in fig. 11.

The marble front is mounted on a box-shaped frame carried on a pair of wall brackets. A change-over switch operated from the handle shown on the bottom of the marble panel, enables the lighting supply to be taken from one or other of the two sources.

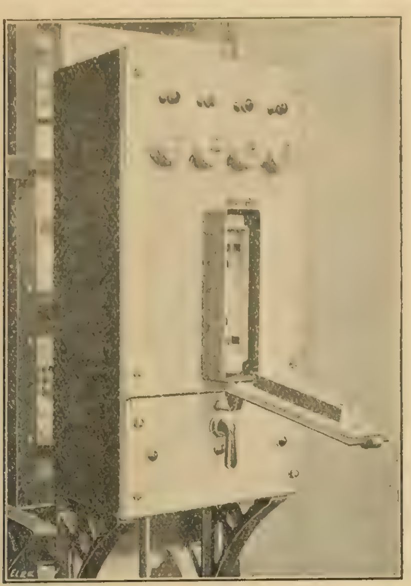


Fig. 11.—Reyrolle Railway Lighting Panel.

The lid of the main fuse is so interlocked with this change-over switch that access to the terminals can only be obtained when the switch is in the "Off" position as shown in the view.

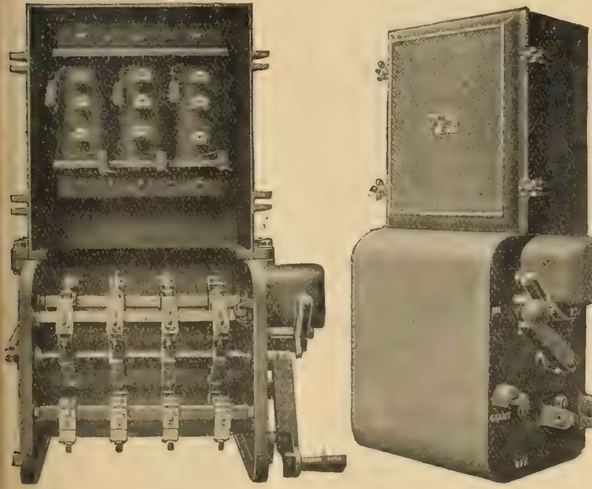
There are four lighting circuits leading away from the top of the panel through quick-acting rotary switches in porcelain covers, and fuses. The latter are of a cartridge type, provided with handles for the purpose of easy removal.

The arrangement is for taking a direct-current 800-volt lighting supply from the track circuits, one pole being earthed.

E.A.C. Starters.

We have received from the Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, S.W., particulars of their redesigned star-delta and auto-starters, which are dealt with in lists H 43/1 and H 42/1 respectively.

The improvements embodied in the new starters include: Wider spacing of adjacent fingers; definite stop in the starting position; the running position can only be reached by passing through the starting position; the switch cannot be left in the starting position so as to burn out the transformer windings; automatic features can be fitted to all types (previously they have only been fitted to oil-immersed starters) and in the larger starters, overload releases are fitted with time lags to prevent tripping on any kick which may occur when switching over from the starting to the running position.



Figs. 12 and 13.—E.A.C. Air-Break Auto-Starter, Open and Closed.

The firm supplies star-delta starters of 50-ampere size in the dry type, and for from 25 to 125 amperes in the oil immersed type both being totally enclosed, while the latter type can be made watertight, dustproof and flametight if required.

We illustrate in figs. 12 and 13 the firm's air-break auto-transformer starter which is recommended for textile mills and rated for 45-second starts four times an hour. The E.A.C. slow-motion starting device in now fitted to this as well as the oil-immersed type. The transformer is now mounted in a separate box above the switch. Automatic releases are fitted, and every part is accessible by removing the cover.

In the oil-immersed type both switch and transformer are oil-immersed, and the coils are rated for 60-second starts six times an hour. The air-break auto-starters are supplied for horse-powers between 5 and 100, while in the oil-immersed type, the sizes range from 5 to 200 H.P.

Electrical Gas Lighters.

Mr. Ferdinand Nehmer, of 173, Highbury New Park, N., has recently introduced a new patented design of electrical gas lighter, which it is claimed is both a simple and efficient means of generating sparks by statical means. The apparatus consists essentially of a stationary vulcanite disk carrying two crescent-shaped field plates of tinfoil, and fitted in a shallow cylindrical case 3 in. diameter lined with vulcanite.

In front of the stationary disk is a rotating vulcanite disk fitted with spiral tinfoil strips and metallic brushes which project at the circumference and serve to collect static electricity from the stationary disk and deliver it to a collector connected with the sparking device at the tip of a projecting tube.

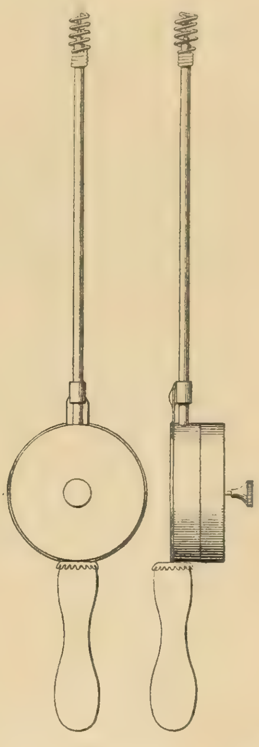


Fig. 14.—New Electric Gas Lighter

The rotating disk is mounted on a short spindle with a milled button on the projecting end, which, on being twisted between thumb and finger, imparts the necessary rotation to produce a suitable train of sparks for gas ignition purposes. Our views, fig. 14, show the external appearance of the device, which, we understand, will be much less costly than similar apparatus previously on the market.

Unbreakable Lamps.—The remarkable strength of the modern drawn-wire lamps is continually being demonstrated by their ability to withstand unpremeditated trials of extreme severity. Recently 600 "Royal Ediswan" lamps were taken in a motor-cycle side car from Calcutta to Ishapore, a distance of 15 miles, partly over wretched roads. Two of the parcels fell overboard when the car was running at full speed, but not a single lamp was damaged, although no special packing was employed.

THE FARADAY SOCIETY.

The first of a group of papers presented at the April meeting of the Faraday Society was by Mr. Charles R. Darling and dealt with recent improvements in recording pyrometers. The paper was of the distinctly practical type, and it really was more or less of a commentary on the admirable exhibition arranged by Mr. Darling of the latest instruments now on the market.

Although the first pyrometric records attempted, namely, by Le Chatelier in 1887, were made with a thermoelectric pyrometer, the Callendar resistance type soon became the more popular in the hands of investigators, and it is only within recent years that the thermoelectric method has, for the more rough and ready practical purposes, almost superseded the resistance instrument. The resistance pyrometer still holds its own as an instrument of research; we were told indeed in the course of discussion that over 400 Callendar instruments were in use, under the charge of men not specially skilled, but on the whole the thermocouple is more suitable for industrial purposes, and for most practical work it is quite accurate enough. Of late years, moreover, its cost has been considerably cheapened, for the old platinum alloy junctions have largely been superseded by base-metal couples, such as nickel and carbon, or nickel-chrome or iron-nickel alloys, which not only yield higher E.M.F.'s than the precious metals, but can be more easily made homogeneous, and, therefore, are more constant in their behaviour. For temperatures above 1,200° C., however, radiation pyrometers are still to be preferred.

The qualifications required for a modern recording furnace pyrometer are accuracy, within the limits desired, they should be strong and dust-proof, and require little skilled attention, as befits workshop use, and finally they should be capable of taking simultaneously several records. These qualifications are possessed in varying degrees by the principal types described by Mr. Darling.

The recording in most cases is effected by the periodic depression of bar on to the galvanometer needle causing it to mark its position on a moving chart. The record is, therefore, intermittent, but it is sufficiently continuous for practical purposes. Where multiple records are required on the same chart, an automatic switch throws the various circuits consecutively into the galvanometer. In the Siemens-Halske recorder, which is a workmanlike, hardy-looking instrument, the stylus is periodically pressed by clockwork against a transparent chart, on to a type-writing ribbon, forming a dot below, which is visible above. As the stylus is attached to the galvanometer pointer, the temperature scale has to be circular in shape. For a scale divided from 0° to 1,200° C. an accuracy of 5° is possible. In the Leskole recorder the presser-bar is operated by an electromagnet, and the pointer presses against a rotating drum which carries the chart, having first been drawn to the end of the scale and pressed against an inked pad. This instrument, though generally useful, is not suitable for taking simultaneous records.

In the Foster recorder, Hoskins's nickel-chromium alloys are used for the couples, yielding an E.M.F. five times as large as the platinum-rhodium couple. The larger forces available enable the galvanometer coil to be horizontal, so that a vertical pointer is able to mark a vertical circular chart, which rotates on its axis, by means of a capillary ink tube. Robust construction is a feature of this recorder.

The circular, or partly circular, co-ordinates of the charts given by the above instruments will by some be considered a drawback. In the thread recorder, made by the Cambridge Scientific Instrument Co., ordinary rectangular charts can be used. The pointer is depressed by a horizontal bar on to an inked thread, stretched parallel to the axis of the rotating chart; thus the tangential, instead of the radial, movements of the pointer are recorded. A suspended coil galvanometer is used, so that a high degree of sensitiveness is attainable. Simultaneous records can be taken, and multiple records may be secured by the use of an automatic switch.

In a recorder like the Thread, where the deflections start from zero, it is possible to open out the higher scale-readings by making the pyrometer part of a potentiometer circuit and balancing the deflection at the zero point, say, for a temperature of 500°.

Mr. R. W. Paul, following an instrument in use at the Reichsanstalt, takes a great step forward in his instruments in that the moving parts are actuated by a motor instead of by clockwork or by electromagnets. The motor is governed to a high degree of constancy, so that its speed remains constant, even if the voltage variations are 15 to 20 per cent. The motor is geared up to the mechanisms moving the chart, presser-bar and inking ribbon, and the speeds of all these movements can be varied as desired. The galvanometer is of the Unipivot pattern, and the pointer is pressed at intervals on to a typewriter ribbon above the chart. The ample power provided by the motor renders it easy to apply a simple switching device to give almost any number of records in one chart.

An American recorder, made by the Leeds and Northrup Co., of Philadelphia, also makes use of a motor drive, but it is otherwise quite different from the types already described, in that a zero deflection method is used. The pyrometer forms part of a potentiometer circuit, and the function of the mechanism is to oppose an E.M.F. equal to that of the pyrometer. The manner in which the adjustment of the opposing E.M.F. is controlled was explained in our issue of October 24th, 1913, page 649, in the course of an article by Mr. Kenelm Edgcumbe.

Brief mention must suffice of the modern types of resistance recorders described by Mr. Darling, as industrially the use of these is restricted to work of a special character where great accuracy is required; the admirable Callendar instrument, for example—it is too well known to need description—cannot be used when there is any vibration, quite apart from its high cost. A modified, more robust form of the Callendar recorder is made in America by the Leeds and Northrup Co. In this a mechanism is used to operate a resistance in one arm of a Wheatstone bridge and balance the resistance of the pyrometer. Other makers also supply a Wheatstone bridge arrangement, in which the pyrometer is balanced at 0° only, so that the movement of the pointer on the loss of balance is a measure of the temperature.

Now that in the modern motor-driven type of pyrometer considerable power is available, the instrument can be readily used to control the temperature of furnaces, in the case of an electric furnace by regulating its resistance, in a gas-fired furnace by regulating the gas supply, or the coal feed in cases like rotary cement kilns where this is continuous. Many interesting examples of such control were referred to in the course of the discussion. One was a steel works in Wales, where the influx of air into the hot-air main was automatically controlled by a recording pyrometer by which the temperature of the air was kept constant at 700° C. to within 10°. Another example was a spectroscope used for measuring the velocity of stars in the line of sight, which was kept automatically at a constant temperature within $\frac{1}{100}$° C. A further instance mentioned was a large soldering-iron used for piecing up enormous quantities of tinplate, where the whole success of the operation depended upon constancy of temperature. In another example given by one of the speakers, the temperature of a large number of vats had to be controlled. Resistance thermometers were used in conjunction with a recorder. By suitably graduating the chart and fitting the recorder with a change-over switch, the temperature of each vat is recorded in a different colour.

The Embrittling of Iron by Caustic Soda.—A most interesting study of this peculiar manifestation of passivity, or, perhaps, quasi-passivity, was communicated to the meeting by Mr. J. H. Andrew, M.Sc., of the University, Manchester. The deteriorative effect of caustic soda upon iron and mild steel has been known for some time, and Mr. Andrew's experiments were for the purpose of finding out the cause of this embrittling action. In these rough and polished specimens of wrought-iron were immersed for some months in concentrated caustic soda solution kept at 100° C. At first the corrosion of the polished metal was less than that of the rough filed, but eventually both became highly crystalline, and the corrosion rate was the same in each case. The brittleness is thus associated with recrystallisation; with prolonged immersion it disappears, and the corrosion decreases almost to nothing.

Following the well-known work of Beilly and others, it is suggested that the iron consists of a crystalline phase and an amorphous vitreous phase, the latter surrounding the crystals and binding them together. When immersed in caustic soda, a potential difference will be set up between the two phases and electrolysis will take place, hydrogen being set free. This hydrogen will diffuse into the interior of the metal, in the first instance being absorbed by the amorphous phase; first, because it is there liberated, and secondly, because there is reason to regard the amorphous phase of metals as a supercooled liquid in which hydrogen would be much more soluble than in the crystalline phase. This absorption of hydrogen will force the crystals apart, break down the crystalline cohesion and also facilitate recrystallisation, thereby forcing the crystals apart. This, it is supposed, is the cause of the initial embrittling. As both the crystalline and amorphous phases of the iron became saturated with hydrogen, the P.D. between them, which will depend on the relative concentrations of the hydrogen, will diminish, and so the corrosion will in time also become less active, and thus iron will become "passive" on immersion in caustic soda.

The special interest of Mr. Andrew's experimental facts and theory at the present moment is that they fall so well into line with the view now being so generally accepted by metallurgists, that the mechanical properties of all metals are dependent upon the amorphous cement which exists between the crystalline grains when the metals are cooled from the liquid state.

Goods Transport Reform.—On Thursday last week, Mr. A. W. Gattie, by request, addressed a meeting of members of the House of Commons on the subject of economy in the transport of goods by rail, with special reference to the establishment of a Goods Clearing House in London, to take the place of the 74 goods stations at present existing. The Clearing House, operated entirely by electric power, would be able to deal with 100,000 tons of goods per 24 hours, and besides expediting the transport of goods and eliminating enormous waste of time and money, would enable the work of 100,000 carts and vans to be dealt with by 5,000 motor lorries, with immense benefit to London traffic. The author stated that the London vans placed end to end would stretch 400 miles, and that they were on the average standing still in the streets for 9 hours a day. Under Clearing House conditions the delivery and collection of goods would be organised so that the vehicles were usefully employed all the time. Declaring that there was nothing experimental about the scheme, which had been tested on full-size scale, Mr. Gattie asked for a Board of Trade inquiry into the subject.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

FRANCE.—The Customs Authorities have decided that hanging apparatus for electric incandescent lighting with pulley and counter weights, even without the conducting wires or lamp support, are to be dutiable as "electro-technical apparatus" at rates varying from 20 to 80 francs per 100 kilogs. according to weight.

CANADA.—The following are changes in the Canadian tariff, in so far as they concern the electrical trade, which have recently been put into force:—

Carbons over six inches in circumference or outside measurement and not exceeding 35 inches in circumference or outside measurement	Free.
Carbon electrodes exceeding 35 inches in circumference or outside measurement ...	12½ p.c. *ad. val.*
Galvanised iron or steel wire, curved or not, numbers 9, 12 and 13 gauge with variations from such gauges, not exceeding four one-thousandths of an inch and not for use in telegraph or telephone lines	Free.
Electric dental machines	15 p.c. *ad. val.*
Miners' safety lamps	Free.
Electric or magnetic machines for separating or concentrating iron ores	Free.

The duties in each case are those leviable under the preferential tariff applicable to British goods.

It has also been decided that the duty on advertising matter, including catalogues and price lists, imported after July 1st, 1914, may be paid by Customs Revenue Stamps under regulations by the Minister of Customs at the rates specified in the tariff (viz., 10 cents. per pound), except that on each separate package weighing not more than one ounce the duty shall be 1 cent. The lack of facility for senders of catalogues paying the duty by affixing revenue stamps to parcels posted, which operates in certain other Dominions, will thus be removed and presumably the Government will notify at a later date where such stamps may be obtained in London.

AUSTRALIA.—The Customs Authorities have decided that advertising blotters and advertising calendars with watercolour pictures thereon are to be dutiable as advertising matter at the rate of 6d. per lb. or 35 per cent. *ad. val.*, whichever rate returns the higher duty.

SOUTH AFRICA.—The Board of Trade have received from H.M. Trade Commissioner in South Africa further rulings which have been given by the Union Commissioner of Customs to the Cape Town Chamber of Commerce regarding the composition of the value of goods for calculation of *ad. valorem* duty. In regard to the term "place of purchase," the Commissioner was asked for his decision as to the values of goods which are purchased from an inland factory—say in Great Britain—and the railway carriage is added to the cost to the importer at the place of purchase. The Commissioner decided that provided the price paid at such factory is not less than the value for consumption in the country of origin *duty should not be charged upon such* railway carriage. In the event, however, of the factory charging the same price free on rail or at the factory or at any town or other part of Great Britain, it would not be permissible to deduct the cost of railway carriage as the invoice including it was clearly the "value for home consumption." The Commissioner of Customs also stated that he was making enquiries with a view to securing uniformity of practice in the ports of the Union in regard to the assessment of duties and the interpretation of the Customs Regulations issued by the Department of Customs.

The new proposals which have been introduced by the South African Government for the modification of the tariff include the reduction of the duty on railless cars from 12 per cent. *ad. valorem* if British to "free"; if foreign the duty is to be reduced from 15 per cent. *ad. valorem* to 3 per cent. *ad. valorem*. It is also proposed to admit free of duty catalogues from oversea firms irrespective of conditions as to weight, quantity, etc., now imposed. A further proposal provides for the imposition, in the case of "dumped" goods similar to those made or produced in the Union, of a duty equivalent to the difference between the selling price of the goods for export and their true current value for home consumption. Countervailing duties are also proposed in respect of bounties equivalent to the value of the bounty.

TOGOLAND.—The Customs Authorities have decided that machinery of all kinds shall in future be free of duty on importation.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled [illegible] Electrical P[illegible] 285, High H[illegible] Liverpool and [illegible]

11,561. "Apparatus for [illegible] current." W. Otto. May 11th. (Convention date, [illegible] 24th, 1913, [illegible]). (Complete).

11,564. "Electric meter [illegible]." [illegible] May 11th. (Canadian Independent [illegible]).

11,599. "Portable [illegible] plates." J. Bristol. May 11th.

11,616. "[illegible]." H. P. [illegible]. May 11th. (Convention date, May 9th, 1913, [illegible]). (Complete).

11,612. "Wall plates or [illegible]." J. B. Mason. May 11th. [illegible]

11,621. "Machine for cutting [illegible]." Baron A. O. von Batorfz und [illegible]. May 11th. (Convention date, May 10th, 1913, France). (Complete).

11,624. "Electric igniters." F. [illegible]. May 11th. (Complete).

11,629. "Mechanism for and method of operating [illegible]." R. [illegible]. May 11th. (Convention date, May 13th, 1913, United States). (Complete).

11,630. "System for signal and motor control for [illegible]." F. [illegible] Collins. May 11th. (Convention date, May 13th, 1913, United States). (Complete).

11,644. "Metallic vapour lamps." Korting & Mathiesen Akt. Ges. May 12th. (Convention date, May 21st, 1913, Germany). (Complete).

11,654. "Telephonic receivers." G. J. Larssen. May 12th.

11,657. "Indicating-arrangements for electricity supply [illegible]." A. [illegible] Marguerond and R. F. J. D. De Roussel. May 12th. (Complete).

11,669. "Clip to connect and hold cross wires together." H. J. Roberts. May 12th.

11,676. "Construction of anodes." S. O. Cowper-Coles. May 12th.

11,677. "Apparatus for coating sheets and plates in continuous [illegible]." S. O. Cowper-Coles. May 12th.

11,708. "Arrangements for wireless telegraphy and telephony." J. Schiessler. May 12th. (Divided Application on 29,447/13. December 20th. Convention date, October 16th, 1913, Austria). (Complete).

11,709. "Antennae for wireless telegraphy or telephony." J. Schiessler. May 12th. (Divided Application on 29,447/13. December 20th. Convention date, October 16th, 1913, Austria). (Complete).

11,721. "Apparatus for detecting the presence of injurious gases in mines and like places." Scholler & Co. May 12th. (Convention date, January 12th, 1914, Germany). (Complete).

11,739. "Insulating-devices for electric traction systems." British Thomson-Houston Co., Ltd. May 12th. (General Electric Co., United States).

11,793. "Electric rear lamps." E. A. Knight. May 13th.

11,794. "Electric circuit breakers and switches." D. K. Morris and Morris & Lister, Ltd. May 13th.

11,808. "Electric and other motor driving-arrangements for looms and other machinery." J. Feyer. May 13th. (Addition to 7,237/12. Convention date, May 13th, 1913). (Complete).

11,832. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd. May 13th. (General Electric Co., United States).

11,837. "Apparatus for coverting direct into alternating currents and vice versa." E. Falkenthal. May 13th. (Complete).

11,840. "Switches." F. E. Wilson. May 13th.

11,841. "Control apparatus for electric lighting systems on motor cars." F. E. Wilson. May 13th.

11,844. "Induction meter with three-armed driving core." Allgemeine Elektricitats Ges. May 13th. (Addition to 3,912/14. Convention date, May 17th, 1913, Germany). (Complete).

11,845. "Process for the renewal of conduits with internally packed and externally lead-filled sockets." A. A. C. Boas and J. Quist. May 13th. (Convention date, May 14th, 1913, Denmark). (Complete).

11,852. "Electro-magnetic levitating-apparatus." E. Bachelet. May 13th.

11,863. "Electro-magnetic measuring-instruments. F. J. Green. May 14th.

11,870. "Automatic time switches." H. Boothroyd. May 14th

11,881. "Magnetic compasses." M. B. Field. May 14th.

11,895. "Electric motors." H. F. Christie. May 14th.

11,920. "Flash lamps." W. J. Mellersh-Jackson. May 14th. (Interstate Electric Novelty Co., United States). (Complete).

11,928. "Generating electro-magnetic oscillations or high frequency currents and methods derived therefrom for producing a continuous wave-flux or a continuous electro-magnetic flux or continuous current." R. Arno. May 14th. (Complete).

11,934. "Method and means of producing oscillatory currents of electricity of small decrement and close wave trains from alternating and continuous currents of electricity." H. Manders. May 14th.

11,937. "Electric heating apparatus." A. F. Berry. May 14th.

11,940. "Electric signalling installations." Siemens Bros. & Co., Ltd. May 14th. (Siemens & Halske Akt. Ges., Germany). (Complete).

11,942. "Flash lamps." W. J. Mellersh-Jackson. May 14th. (Interstate Electric Novelty Co., United States). (Complete).

11,943. "Electric switches." British Thomson-Houston Co., Ltd. May 14th. (General Electric Co., United States).

11,950. "Process for the treatment of ores and solid salts by electro-chemical reduction." A. A. M. Hanriot. May 14th. (Convention date, May 22nd, 1913, France). (Complete).

11,962. "Electro-magnetic levitating and propelling apparatus." A. H. Doubleday. May 15th.

11,993. "Magnetic fixing-devices." Norma Cie G.m.b.H. May 15th. (Convention date, May 17th, 1913, Germany). (Complete).

11,996. "Electrically-heated boiling plates and the like." G. Pate and A. R. Wood. May 15th. (Complete).

12,005. "Electric ignition-plugs for internal-combustion engines." D. Roberts. May 15th.

12,018. "Subaqueous sound signal receivers." Signal G.m.b.H. May 15th. (Convention date, May 29th, 1913, Germany). (Complete).

12,032. "Testing insulation." Evershed & Vignoles, Ltd. and S. Evershed. May 15th. (Divided Application on 12,723/13. May 31st).

12,035. "Control or regulation of motors." Vulcan-Werke Hamburg und Stettin Akt. Ges. May 15th. (Convention date, January 2nd, 1914, Germany). (Complete).

12,039. "Electrical machines." F. Juan. May 15th.

12,047. "Self-propelled vehicles." British Thomson-Houston Co., Ltd. May 15th. (General Electric Co., United States).

12,048. "Control or regulation of motors." Vulcan-Werke Hamburg und Stettin, Akt. Ges. May 15th. (Addition to 12,035/14. Convention date, March 3rd, 1914, Germany). (Complete).

12,057. "Electric furnace, particularly adapted for the manufacture of nitrides." G. Coutagne. May 15th. (Convention date, May 23rd, 1913, France). (Complete).

12,059. "Electric lamp holders." W. Adams. May 15th.

12,098. "Lamp-holders." C. G. M. Bennett and C. H. Jeffcoat. May 15th.

12,142. "Furnaces for cleaning vulcanite or ebonite." A. E. F. Rost. May 16th.

12,150. "Dynamo and system of electric lighting for trains and the like." H. Leitner. May 16th.

12,156. "Electric gas lamps." A. Lederer. May 16th. (Convention date, May 19th, 1913, Austria.) (Complete.)

12,157. "Electric gas lamps." A. Lederer. May 16th. (Convention date, May 19th, 1913, Austria.) (Complete.)

12,158. "Electric gas lamps." A. Lederer. May 16th. (Convention date, May 19th, 1913, Austria.) (Complete).

EXPIRING PATENTS, TAKEN OUT IN 1900.

1,617. "Carbon Contacts." Reichwald, A. (F. Krupp). January 25th. A carbon contact for switches, &c., is formed of a conical block of carbon secured in a holder by means of a collar bored to receive the carbon and screwing on to a base.

1,863. "Electromagnets." Heys, W. G. (Scott, J., Varley, R., and Anderson, J. G.). January 30th. A number of similar coils of helices are formed by winding the several conductors in layers upon separate zones of a single core, such as a paper tube, successive layers of each helix being separated from one another by insulating sheets extending throughout all the helices; alternative forms are described.

1,864. "Electromagnets." Heys, W. G. (Scott, J., Varley, R., and Anderson, J. G.). January 30th. Consists in a method of simultaneously winding a number of similar coils or helices on a single core.

2,222. "Electricity, measuring." Wright, A., and Reason Manufacturing Co. February 3rd. A mercury voltameter consists of a glass vessel, closed by a stopper at the top, or entirely sealed, containing a mercury anode in a pocket at a higher level than a mercury cathode, and having platinum connecting wires sealed into it. The vessel is filled with a solution of mercurous nitrate, or other suitable electrolyte. When the instrument is in use the **mercury cathode increases in volume and overflows a lip or ridge into a long** vertical tube, which at starting contains solution only. The position of the anode causes the dense solution produced on its surface to flow down to the cathode. The height of the mercury in the vertical tube is measured by an adjacent scale, indicating the quantity of electricity which has passed.

2,260. "Electric Lamps." Bremer, H. February 5th. A lamp has its carbons fixed, or periodically fed by clockwork, which is released by a solenoid; or the carbons may be carried in inclined holders, one of which is movable towards the other by an electromagnet in a shunt circuit, when this circuit is closed by expansion of a metal tube situated above the arc and heated by it. A long arc is produced, and is controlled by an adjacent solenoid or electromagnet, connected in series with the arc, and tending to deflect the arc and lengthen it if the main current increases. The carbons are preferably arranged side by side, either parallel, or inclined, with the deflecting-magnet between them, and the arc may be formed within a glass cylinder, open below but having a metal cover to retain hot gases. A loop of tube may lead from the cover to a lateral receptacle and back to the glass cylinder, so that gas may circulate through it and deposit impurities in the lateral receptacle. The carbons may contain metalloids or metal salts.

3,461. "Electromagnetic Brakes." Westinghouse Brake Co. (Newell, F. C., and Herr, E. M.). February 21st. One arrangement shows an electromagnetic rail brake which is adapted to apply non-magnetic wheel brakes. The core of the electromagnet is wound with three coils of wire arranged in series in a local circuit with the motor. To ensure automatic regulation of the braking according to the speed attained, the three coils are **wound with different numbers of turns of wire. The magnetic brake is sus**pended by springs and when the shoes are applied to the rail the dragging action causes the application of the wheel brakes by means of levers. Modifications are described. Another form is described in which the magnetic brakes are applied to the wheels.

3,865. "Engine Governors." Hepburn, G., and Evans, D. H. February 28th. Comprises engine governor or stop mechanism suitable for engines driving electrical generators, which is adapted to come into action in case of a breakdown, or in case the load is suddenly taken off the engine, but which is inoperative while the engine is running under normal conditions.

3,968. **"Telegraph Recording Instruments." Muirhead, A., and Edgar,** R. H. March 1st. Relates to improvements in siphon recorders of the type described in Specification No. 20,793, A.D. 1893. A coil is suspended by two adjustable threads or is pivoted to a stationary core between the magnet poles, a mirror being fixed opposite an opening. The coil is provided with pins upon which a yoke can engage. The yoke carries fibres connecting to the siphon cradle, springs being inserted in the fibres. The cradle is supported above by two wires arranged to pass over a guide-edge or equivalent arrangement, adjustments being provided for regulating the period of oscillation, the zero and the vertical position. The coil is double-wound, one part being in a shunt **connection with** a variable resistance.

5,046. "Electricity, Measuring." Wright, A., and Reason Manufacturing Co. March 16th. Mercury voltameters are provided with registering mechanism operating by means of gravity. In one arrangement a mercury anode is contained in a small glass dish attached to a vertical glass tube, the upper end of which carries a pointer near a stationary scale, and which is suspended by a helical spring. Electric connection is made with the anode by a platinum wire in a glass tube. The anode is suspended in a vessel containing the electrolyte, and a mercury cathode at the bottom. As current passes the anode becomes lighter, and the pointer rises. This arrangement may be used with the movable part connected as cathode, the cathode surface being provided by a conical coil of platinum wire, or a porous carbon block; the anode is mercury in an annular trough, above the cathode. Various modifi**cations** are described.

5,593. "Electricity, Measuring." Wright, A., and Reason Manufacturing Co. March 24th. Relates to quantity meters, more particularly to mercury voltameters such as are described in Specification No. 2,222, A.D. 1900, which are provided with various improvements.

(To be continued.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Birmingham, price post free 9d. (in stamps).

1912.

24,[illegible]. Lubrication of Dynamo-electric Machines. A. Rolfe. October 31st. (January 21st, 1913.)

1913.

2,160. Protection of Electric Contacts. C. Scott & W. Davis. January 27th.

2,302. Selective Devices for Telephone Systems. A. Katz. January 28th. (January 29th, 1912.)

7,252. Control of Accumulators from a Variable-speed Dynamo-electric Machine. J. P. G. [illegible] & Planet [illegible], Ltd. March 26th.

9,105. Method of and Means for Heating Substances by Electricity. T. W. Broadbent & F. W. Davies. October 14th. (October 14th, 1913.)

9,447. Resistance for Regulating the Current in an Electric Circuit. M. Mansell. April 22nd. (October 22nd, 1913).

9,959. Variable Resistances for Automatic Regulation of Electric Currents. A. G. Bloxam (Robert Bosch, Firm of). April 28th.

10,188. Means for Raising and Supporting Arc and other Lamps and the like. G. A. Hughes. April 30th.

10,190. Electrically or Mechanically-vibrated Diaphragm Horns or Warning Devices. G. St. B. S. Watkins. April 30th.

10,500. Electric Soldering-irons. A. H. Railing and A. J. D. Krause. May 5th.

10,609. Device for the Automatic Maintenance of Phase-equality of the Currents of Parallel-connected Alternating-current Machines. Allgemeine Elektricitats Ges. May 5th. (May 4th, 1912).

10,656. Starting of Internal-combustion Engines. H. Leitner. May 6th.

10,770. Starting and Controlling Devices for Electric Motors Driving the Blowing Apparatus of Organs or the like Musical Instruments. L. B. Cousans. May 7th.

11,313. Control of Alternating Current Commutator Electric Motors. Siemens-Schuckertwerke Ges. May 14th. (May 14th, 1912).

11,623. Electrically-operated or Controlled Valves. E. C. Irving and J. P. O'Donnell. May 19th.

11,751. Electrical Relays. J. H. Baker and A. E. McKechnie. May 20th.

12,639. Apparatus for use in Charging Electric Accumulators. H. Leitner. May 30th.

14,742. Electric Starters for Internal-combustion Engines. W. H. Scott. June 26th.

15,046. Metal Vapour Arc Lamps. Deutsche Gasgluhlicht Akt. Ges. (Auerges). June 30th. (February 4th, 1913).

15,283. Method of and Means for Determining the Electrical Characteristics of High-Frequency Oscillation Circuits. E. D. Carden. July 2nd.

15,541. Signs. E. C. R. Marks (Savage Novelty Co.). July 5th.

15,642. Electric Switches Mechanically Controlled from a Distance. F. Hodgson. July 7th.

16,084. Tail-lights of Motor-driven Vehicles. T. Norton. July 12th.

16,485. Electric and Gas Radiator. V. Lacasse. July 17th. (July 17th, 1912).

17,005. Mounting of Electromotors on Tramway Vehicles. C. Delmez. July 24th. (Patent of Addition not granted).

17,066. Apparatus for Automatically Indicating and Recording the Combined Efficiency of a Steam Motor and Coupled Electrical Generator. R. S. Xenaky and F. Gilman. July 25th.

18,902. Antiseptic Paper Cover for the Mouthpieces of Telephone Transmitting Instruments. H. Smith. August 20th.

19,022. Distribution Systems for Vapour Electric Devices. British **Thomson-Houston Co. (General Electric Co.). August 21st.**

21,509. Magneto-electric Ignition Apparatus. W. A. Hill (Apparate-Bauanstalt Fischer Ges.). September 24th.

22,127. Electric Switches for Railways. Soc. d'Electricite Mors. October 1st. (October 30th, 1912.)

22,176. Brush or like Sliding Contacts for High Frequency or Electrical Apparatus. A. S. Sorensen. October 2nd.

22,228. Generator of Electricity for Automobiles, forming a combined source of Ignition and Illumination. A. Sanchez and C. Baradat. October 2nd.

22,386. Signalling and Controlling Locomotives and the like Running on Tracks. J. Partington. October 4th.

23,035. Replacement Fuses Applicable also for Use as Electric Switches. G. O. Donovan. October 13th.

23,189. Starting Devices for the Engines of Motor Cars and the like. H. Lucas and W. C. Turner. October 14th.

23,314. Starting of Motor Cars. B. Burow & E. Burow. October 15th.

23,388. Anti-vibration Devices for Lamps. W. P. Taylor and J. Willis. October 16th.

23,720. Electrical Resistance Thermometers. W. J. Mellersh-Jackson (Packard). October 20th.

23,754. Brushes for Electric Contacts. J. E. Colas and Soc. d'Electricite "Nilmelior." October 20th. (November 26th, 1912.)

24,162. Oil Transformers. H. Weiss. October 24th. (October 26th, 1912.)

24,355. Magnetic Separators. Fried. Krupp. Akt. Ges. Grusonwerk. October 27th. (November 27th, 1912).

24,419. Electric Toasters. C. P. Madsen. October 28th. (October 28th, 1912).

24,471. Electric Batteries. F. S. B. De Mello. October 28th. (December 4th, 1912.)

24,898. Apparatus for Electrically Lighting Road Vehicles and the like. E. P. Prior. November 1st.

25,675. Connection Plugs for Electric Circuits. F. H. Chapman and **O. E. Kenney. November 10th. (February 24th, 1913).**

26,150. Springs Used in Electrical Work. S. G. Leach and H. F. Joel, Junr. November 14th.

26,287. Telephone Systems. E. A. Graham. November 15th.

29,003. Flexible Connections for Electric Conductors. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.). December 16th.

29,203. Ventilation of Dynamo-electric Machinery. Siemens Bros. Dynamo **Works, Ltd., and E. O. Kieffer. December 18th.**

29,763. Rectifier for Alternating Polyphase Currents. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.). December 24th.

1914.

83. Apparatus for Converting Telegraphic Code Figures into Words. A. W. C. Voigstberger, H. West and J. West. January 1st. (Addition to 9,195/12.)

106. Packing Enclosure for the Cells of an Electric Battery. B. Pordes. **January 2nd.**

2,843. Electric Incandescent Lamps. F. Loewenstein. February 3rd.

2,850. Electrolytic Meters. British Thomson-Houston Co. (General Electric Co.). February 3rd.

3,004. Electric Releasing Device for Drawing-off Apparatus composed of a Plurality of Weighing or Measuring Devices and intended for use in connection with Goods Packing Machines. Fr. Hesser Maschinenfabrik Akt. Ges. February 5th. (March 7th, 1913.)

3,252. Means or Arrangements for Controlling a Source of Light. S. Leiner. February 7th.

4,082. Impulse Transmitting Mechanism for Telephone Systems. R. C. M. Hastings. February 17th. (Divided applications on 9,986/13, April 28th.)

5,037. Telegraphy. W. Judd, B. Davies, & Eastern Telegraph Co. February 26th. (Divided Application on 9,768/13. April 25th.)

5,070. Interrupters for Electric Circuits. A. Pollak. February 27th. (February 27th, 1913).

5,831. Telegraphy. W. Judd, B. Davies, & Eastern Telegraph Co. March 7th. (Divided Application on 9,768/13. April 25th.)

5,928. Rotors for Dynamo-electric Machinery and Cooling Arrangements for the same. Siemens Schuckertwerke Ges. March 7th. (March 10th, 1913.)

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

WORKMEN AND INCOME-TAX.

UNLESS Mr. Lloyd George and the present Government alter their tactics in relation to employé and employer, it is going to be bad for this country, because the British workman is being spoiled, and spoilt children generally end in ruin, not only to themselves, but to everyone connected with them. The latest budget of the Chancellor of the Exchequer is another sop to the workman at the expense of his master, by the increase in the income-tax. "Look you," in effect says Mr. Lloyd George, "I will not tax you, my poor hard-working man, but will tax the ill-gotten gains of your master," and the workman honestly believes the socialistic labour leader when he says that without the worker no one would have anything, and therefore the worker should have everything. Hence restlessness is increasing, the workers' demands are becoming more and more outrageous, and their insubordination is fast becoming a serious menace to all law and order. Yet this is at a time when the hours worked are shorter and wages higher than they have ever before been in the industrial history of this country, and we believe, taking everything together, the workman is better paid in this country than in any other country in the world. And yet the Government pats them on the back, calls them poor fellows, pities them, and frees them from taxation. Why is it that the hundreds of thousands of workmen who are well enough known to be earning wages of £4 a week and over are not asked to pay income-tax? Why do not the surveyors call for a return of the earnings of, say, the miners, shipyard workers, steel smelters, and workmen employed in other industries on piecework, many of whom are earning wages of from £4 to £10 per week? Apparently the occupants of all houses below a certain rental are not to be bothered by the surveyors, yet all clerks and members of the staff of any industrial undertaking cannot escape, as the firm must give a return of the salaries, and the poor individual with £180 or £200 a year, must pay, while the workman in the same firm earning a like sum or more escapes scot free. A clerk or draughtsman with £200 a year must pay income-tax, which is about equal to the sum of 6d. per week, while a workman with less responsibility, earning £300, pays nothing. If the employer must give a return of the salaries of his staff, why should he not be asked to include all workmen earning over £3 per week? Let the workmen be subjected to the inquisitorial searchings of the surveyor, and they will then begin to recognise at least what the income-tax means. Or why should it not be enacted that every man in receipt of a weekly wage of £4 should be paid in part with a 6d. stamp? Even if he do not earn £4 every week, he by paying the 6d. when his wages do amount to £4 is only paying his proportion of the tax at the rate per annum which he would have to pay if he received a salary of £200 a year. The man who was paid £5 would have a stamp, or stamps, equivalent to 1s. 6d. on his pay cheque, and so on in proportion. By this mean a vast sum of money would flow into the

National exchequer, which it is fully entitled to receive, and would receive were it not either for indifference or fear. We say "fear" because we believe that when once the machinery was put in motion to make the workman pay tax on his income there would be an immediate outcry and possibly fresh legislation.

Probably no tax is so hated by the British taxpayer as the income-tax, not because he hates to pay taxes—these he is aware must be paid somehow or other—but because it intrudes so much into his private business affairs, and because of the dictatorial, inflexible, and inquisitorial attitude adopted by the surveyors and commissioners. Moreover, it is often very difficult for a business man to say what his earnings may be for the current year, and frequently rather than appeal, which would mean a disclosure of all his affairs, probably to a commissioner who is a rival in his business, he agrees to be over-assessed.

Again, the anomalies of the method of income-tax assessment are so harassing to the average business and professional worker that he is induced to take every means to give an incorrect return. Quite recently a small firm which showed an actual loss on the year's working was called upon to pay income-tax on the higher scale on amounts which were either written off or allowed for; this course was necessary for the purpose of carrying on the business on a sound financial basis, but these amounts were not allowed by the surveyor. We believe there are many similar cases where firms have no profit to pay dividends yet must pay income-tax. Surely this ought not to be. There can only be a profit when everything has been paid and properly allowed for, and the stronghold of this country is the soundness of our business from a financial standpoint.

It is the industrial middle class who not only bear the burden of taxation, but are really responsible for the carrying on of this great country, and it is well for the workman and the Government to bear this in mind. Left to himself the workman would soon quarrel with his leader, as at least 50 per cent. of the workmen are only in the Union through actual fear; only recently a leader in the Durham Miners' Association boasted that "they succeeded, by approaching the management, in having some men paid off because they would not be members of the Association." At a Cumberland colliery a week or two ago the management were requested to collect the arrears of payment on behalf of the Union from some members who had got into arrears, or dismiss them, or ——! The management agreed, and the money was stopped off the men's wages at the colliery office. Some of the men are earning £4 and £5 a week, for an eight hours' day. The manager works 12 or 14 hours for little more, bears all sorts of responsibilities, and has to pay income-tax, while the "spoilt children" go free. Tyranny!

THE I.E.E. MODEL GENERAL CONDITIONS FOR CONTRACTS.

The perusal of the new edition of the "Model General Conditions for Contracts," which has recently been issued by the Institution of Electrical Engineers, carries our minds back 15 years. At that time the want of uniformity on the one hand, and the imposition of unfair conditions on the other, were fast making electrical contracting for public undertakings a lottery rather than a business, and with many misgivings as to the final success of our efforts, we embarked on a systematic attempt to educate public opinion to the injustice of the prevailing practices. For two years we examined week by week the publicly issued specifications for electrical plant, and commended or criticised the conditions attached to the contracts. The arbitrary character of some of the clauses almost passes belief to-day. The claim for the engineer to be the sole judge of any dispute was a very usual one; payment clauses were so drawn up that settlements were long delayed; contractors were to be responsible for many things over which they had little, if any, control, and often they were to follow the purchaser's whims in regard to the execution of the work and yet be responsible for the results. The controversy was carried to the floor of the Institution, and eventually a committee was appointed which drew up the first "Institution Model Conditions," which were issued in 1906. These represented the best practice of the time, and their gradual adoption eliminated the excesses of previous years. The lapse of time and the growth of a better spirit have rendered advisable a further consideration of the subject, and the new issue represents the result of the labours of another committee.

The new clauses show how far we have travelled along the path of mutually fair dealing. They are not perfect, but one may accept them *en bloc* without fear of being unfairly dealt with. In a few important points they differ from the 1906 Institution draft, and in some directions they follow the lead of the draft contract conditions prepared by the British Electrical and Allied Manufacturers' Association, while in others they take an independent line. We understand that the Council of the B.E.A.M.A. on May 21st formally adopted the text of the present edition. As a consequence, the I.E.E. Model Conditions will be used by members (in substitution for the Association's conditions) in respect of tenders to municipalities, district councils, public authorities, and in respect of all publicly-advertised contracts where full General Conditions are issued.

The first clause gives the usual definitions, and this is followed by the stipulation that the tenderer shall carefully examine the specification and drawings and obtain the engineer's ruling on all doubtful points.

Clause 3 deals with the sealed agreement, which is to be drawn up at the purchaser's expense wherever the contract value exceeds £100. The value of the surety is to be 15 per cent. of the value of the contract.

Should the contractor decline, or unduly delay, the completion of the agreement, it is open to the purchaser to annul the contract, the same rights being given to the contractor for the purchaser's default.

In the next clause, dealing with drawings, which are to be furnished by the contractor and signed by the engineer acting on behalf of the purchaser, it is stipulated that the engineer is not to be held responsible for mistakes made in the drawings by the contractor, unless such mistakes are the result of incorrect information given to the contractor by the engineer. This is a decided advance, as hitherto there has been an implication that once the engineer signed the drawings, he was responsible for any and all the contractor's mistakes they might embody. Paragraphs follow dealing with sub-letting, which is not to be done without the consent of the engineer, which is not to be unreasonably withheld; indemnity against patent actions, and quality of materials. All tools, haulage, tackle and labour are to be found by the contractor, who will be supplied free with a reasonable amount of water, but he must find all hose, tanks and cocks. The next stipulation expressly relates to street work, and places on the contractor the duty of providing temporary footways, guards, fencing and lighting.

The engineer is to have power to vary or alter the work during progress, with the provisoes that any extra work is to be paid for, and, without the consent of the contractor, the total variation from the contract price is not to exceed 10 per cent. An important improvement in this clause is the power given to the contractor to protest against any alteration which may affect any obligation for which he is responsible. If the alteration is insisted upon, the contractor is to be freed from the consequences. Should the alterations involve the abandonment of work already done, a reasonable sum is to be allowed.

Negligence on the part of the contractor is then dealt with, and power is given to the purchaser to get the work done by other parties at the expense of the contractor. This is followed by the procedure to be followed in the event of the death or bankruptcy of the contractor.

The important subject of inspecting and testing is next dealt with. The engineer must give seven days' notice of his reasons for rejecting the plant or materials; he must inspect or test work within seven days of being advised that it is ready. The conditions are given upon which tests at the makers' works, or on site, are to be carried out.

If there is undue delay in accepting delivery of the plant, the purchaser is to be held responsible not only for storage and insurance, but is to make payments as though the plant had been delivered, allowance being made for the cost of carriage to site and erection.

The contractor is not to overload a crane of which he has the temporary use. The use of tools brought to the site by the contractor, the liability of the contractor for all measurements on site, and the obligation of the contractor to keep a competent representative on the site, are dealt with, and there follow a number of paragraphs dealing with the liability of the contractor for accidents, damage, and insurance against fire. Defective work on site condemned by the engineer is to be altered.

In the important matter of payments, instalments up to 80 per cent. of the work done are to be paid during the progress of the work, half the balance, *i.e.*, a further 10 per cent., one month after acceptance, and the balance 12 months later. The retention periods are a little longer than in the old conditions.

An important point is that the existence of minor defects is not to hold up payments, but in calculating the amounts payable allowance is to be made for the cost of rectifying such defects.

The vexed question of the disposal of provisional sums is decided by giving the engineer the right to allocate or appoint sub-contractors for certain defined parts of the work. These sub-contractors are to be paid by the contractors, who shall have the right to charge 10 per cent. profit on all sums so disbursed.

The next clauses deal with the issue of certificates by the engineer as they fall due, the reservation that the issue of the engineer's certificates does not affect the purchaser's legal rights, and the obligation on the part of the engineer to grant extensions of time for certain specified causes which are admitted to be out of the power of the contractor. The amount of damages to be payable by the contractor in the case of late completion is left blank, and in this there is another difference from the last draft.

There is a considerable amount of attention given to the question of the tests on completion, the right to make beneficial use of the plant before the tests, the time of taking over, and the rejection of plant which does not comply with the guarantees. If the purchaser decides to purchase other plant, he must do this under competitive conditions within a reasonable time, and the contractor's full and extreme liability is to be the payment or refunding to the purchaser of such competitive cost. If the plant is not so replaced within a reasonable time, it is to be returned to the contractor, who shall refund all moneys paid in respect of it, and any claim for damages made by the purchasers shall not exceed 25 per cent. of the value of the plant. Should the purchaser after rejection make beneficial use of the plant, a reasonable allowance is to be made for such use.

The liability of the contractor during the maintenance period next receives attention; this is followed by an injunction to the contractor that all local by-laws and regulations are to be observed, and, finally, there is the arbitration clause. This is very comprehensive and fair to both sides. Any dispute may be taken to arbitration before an arbitrator to be appointed by the President of the Institution of Electrical Engineers, whose decisions and award of costs shall be final.

A note attached to the general conditions stipulates that in the advertisement inviting tenders, a place shall be specified where contracting firms may be able to see the specification and drawings without payment. This is a very useful suggestion, as it enables firms to see whether they are in a position to tender or not.

From the foregoing it will be seen that on the whole the present issue meets all reasonable requirements, and we anticipate that for a very long time these will be treated as the usual standard conditions on which electrical contracting work is carried out.

Lead.

The position of the lead market has again been very puzzling, the alternations of firmness and ease proving problems which are exceedingly difficult of solution upon visible grounds. At the back, however, hovers the Mexico trouble, which has introduced unexpected and incalculable factors, and the possibility is that although the shortage of supplies from this important source is not reflected in the import returns so far as the United Kingdom is concerned, it may yet play a part though not an apparent one in connection with requirements on the Continent. Some such theory seems required to account for the price of the metal to-day. The imports of lead into the United Kingdom for the first four months of this year amounted to 77,265 tons, which compares with 73,507 tons in 1913, which total records an increase of nearly 1,000 tons in spite of the practical cessation of shipments from Mexico. The extent to which Mexican output has been cut off, is shown by the fact that the British imports from that country from June, 1913, till the end of April, 1914, amounted to only 2,210 tons, while for January to June last year the total was nearly 6,000 tons. This shutting off of Mexican lead has also affected the production of the United States refineries, and accordingly the British imports from the United States for the first four months this year, were 5,700 tons, against 9,000 tons in 1913, but it is very significant of the poor state of American trade that this year the United States should have actually shipped domestic lead to Europe. Hitherto the United States exports have been limited to lead refined in bond from Mexican bullion, but what with tariff alterations and the dullness of home trade, Missouri producers this year sold domestic lead to Europe, while there has also been some selling of the usual metal recovered from imported raw material. With the spurt in prices seen recently, further sales were just on the eve of being effected and the business was only prevented by a sudden sharp drop in the London market. Business, however, seems possible again now. This all goes to show that America is still keeping a very watchful eye upon the position on this side of the Atlantic, and the movements in the London market, therefore, become still more difficult to explain. On merits, and from all outward indications, it would reasonably be assumed that lead was too high at anything round £19 a ton for current month contracts of soft foreign material, but there are days when the market wears a very strong appearance, for which, as has been said, it is difficult to account. Possibly the bear account is still being covered up. This has certainly been considerably larger than had been thought, and there is a very natural inclination to make the most of opportunities which are put in the way of holders, but this hardly seems to meet the case, and, for the time being, the entire market position is exceedingly difficult to read. There is, however, no doubt that the United States stocks of lead have within recent months been very materially reduced, for not only were substantial quantities shipped to Europe, but there was a very considerable tonnage disposed of to the Canadian market. The market is affected by local conditions which have temporarily set it above the usual current of trade affairs, and it thus stands in an exceptional position. Taking a moderately long view, however, there is no reason why lead should not come into line with other commodities, and a reasonable line to take is that to-day's prices are at least sufficiently high on the general trade and industrial situation.

The I.E.E. and the Industry.

In view of recent proceedings of the Council of the Institution, it may be of interest to consider some points which have a bearing upon the question of its relationship with the electrical industry. In the first place, the view is sometimes advanced that the Institution is prevented by its Memorandum of Association from dealing with matters other than scientific and technical. As a matter of fact, however, the Memorandum confers upon the Institution the widest powers that could be desired. The objects for which the Institution was established are stated by Clause 3 (B) to be, *inter alia*, "to promote the general advancement of electrical and telegraphic science *and its applications*," and after detailing, in addition to holding meetings, the promotion of exhibitions of apparatus, and the publication of any papers or other works on the said science *or its applications, or subjects connected therewith*, and the provision of grants of money for the purpose of promoting invention and research in the science *or its applications or in subjects connected therewith*, the same Clause in Sec. (D) broadly authorises the Institution "to do *all such other lawful things* as are incidental or conducive to the attainment of the above objects." (The italics are ours.) What further powers could be needed? It will be noted in particular that "the applications of electrical science, and subjects connected therewith," are specifically and repeatedly included within the scope of the Institution's activities. The objection on this score is absolutely baseless. If it had possessed any solid basis, we should have heard of it when the broader policy was enunciated by the President, and accepted by the Council, of the Institution.

That it was accepted by the Council is not disputed. Members of Council followed the then president, Dr. Ferranti, in debate, backing him up; members of Council accompanied him on a tour of the Local Sections, in support of the new Articles, which were avowedly intended to facilitate the admission of leaders in the commercial sphere to the counsels of the Institution, and to furnish the funds needed to carry out the Broader Policy. At the general meeting on November 2nd, 1911, the President said that the only body that could really represent electrical interests was that Institution, which should, therefore, put itself into such a form that it could be really useful to the interests of all concerned in electrical work. Therefore, it was desirable not to limit the membership to purely technical people; they wanted to bring in many able men who were not purely electrical engineers, and to get them to help in conducting this business. Mr. Hammond said they could now carry out various new developments, open an employment bureau, and supply technical and commercial information to individual members, and spoke of their desire to enlarge the scope of the Institution. At the meeting on November 16th Mr. J. F. C. Snell approved of the "broader and better policy." Mr. J. E. Kingsbury said they had extended their outlook; they had a greater perception of what the Institution was, and what it could be, and he referred to the wider scope of the Institution, which was "so obviously necessary." Mr. Hugo Hirst supported the Council's proposals, and of the 17 speakers, only one opposed the broader basis. But there is no need to labour the point: two years ago the Institution had set its face in a new direction; now the Council is turning its back upon the promises it then made.

Commenting on the fate of the Industrial Committee, which is the subject of its leader of last week, the *Electrician* supports the policy of the Council, with an "inspiration" worthy of a better cause, putting forward highly improbable hypothetical cases in which the interests of different sections of the Institution would be diametrically opposed—if such cases could arise. We cannot refrain from smiling at the confiding disposition of our contemporary, which meekly welcomes the Council's determination to take such action in future, *as in the past*, as may be to the general advancement of electricity and its applications, &c.

Our contemporary proceeds to find fault with the views expressed in our leader of May 22nd, but in so conjectural and half-hearted a manner as to give us the impression that the writer would much rather have endorsed our remarks. Indeed, towards the end the tone of the article is strongly in favour of action on the part of the Council in industrial matters, and it concludes with an expression of regret that the Council did not indicate its intention of appointing a new Committee to deal with such matters; so that, after discounting for the obvious inspiration of the earlier comments, we feel justified in claiming that our contemporary in reality agrees with us. Seeing that with the rest of the technical Press it welcomed the forward policy of the Council in 1911, it could not have given its unqualified support to the reactionary tendency at present exhibited without incurring the same reproach for inconsistency as the Council itself.

10,000 MILES FROM BRITAIN.

Some Notes on the Arrival of Machines Exported.

By PROF. C. A. MIDDLETON SMITH, M.Sc.

During the past twelve months about 500 cases and packages of machinery and engineering and scientific appliances have arrived in the British University of Hongkong. The following reflections concerning the way in which different firms arrange their export work are made in the hope that readers of this journal may obtain some slight benefit from the experiences related.

It is, of course, with great diffidence that the writer records his impressions of the way in which British engineers manage their business; because, first of all, all the apparatus sent out to us in Hongkong has been, to use a Chinese expression, "Cumshaw" (which means "a gift"), and it is obviously hardly fair to criticise those friends who have come forward so splendidly in answer to the appeal to maintain British engineering prestige in the Far East, and also because the writer is no business man but merely has an academic position. No names are mentioned, and it will be fully understood that these lines are merely sent for the benefit of the electrical and allied trades, and in no way with any idea of hurting the feelings of those who may recognise a criticism of some of their own methods, but to whom all Britishers in China are grateful for their help in equipping our showroom laboratories.

Advice Concerning Shipments.

In our particular case we were fortunate enough to have as hon. shipping agents Messrs. Matheson & Co., 3, Lombard Street, E.C. This firm has probably had more experience of shipping goods to the Orient than any other house in Britain. Their associates in Hongkong are Messrs. Jardine, Matheson & Co., Ltd., and they have throughout arranged all deliveries. Their usual procedure has been to advise us a few days before the delivery of the goods that a certain vessel will be due on such and such a date. To give an actual example: "We have been advised of the following shipments, viz.:—per s.s. 'Oanfa,' expected here on the 19th instant, 5 cases electrical machinery from the British Westinghouse Electric and Manufacturing Co., Ltd." We have not handled the bills of lading, nor have we arranged with local contractors for coolie hire. Our local friends have done all of that class of work, while we have been engaged in checking over contents of cases, unpacking the same, erecting the machinery, and communicating with our numerous friends in Britain concerning various details of our work. At the same time regular instruction has gone forward, and all of the sixty engineering students have received their full course of laboratory classes and lectures. New buildings are already being erected for a machine shop and an hydraulic laboratory, and these plans, etc., have been prepared by our own staff, for every effort has been made to economise the very limited funds at our disposal.

Apparently what has always happened with regard to shipments is that manufacturers have communicated with our hon. shipping agents, who have, in turn, advised them as to which particular ship and port they must send the goods to. In most cases the manufacturer has also advised us as follows: "We beg to inform you that, as instructed by Messrs. Matheson & Co., we have this day despatched per Birkenhead for freight by the s.s. 'Achilles' the engine presented by us to the University of Hongkong," and so on. But in some cases we received no such notice. Probably our friends thought the shipping agents would advise us by post, and in all cases we had advice a few days before delivery. But when goods are being sent 10,000 miles the sender should not be afraid of supplying too much information, and a line to the person to whom the goods are consigned is advisable.

Concerning Drawings.

Some of our friends sent us detailed drawings almost as soon as they promised to send out the machine, and that was generally a great advantage. It enabled us to prepare foundations. In one case it was a disadvantage—because the drawing was wrong. As a result of the mistake by the draughtsman we had the felicity of chipping out about twelve cubic feet of solid concrete. And we had been at such pains to make that concrete as hard as possible!

In another case the machine had various parts and there were several foundations. We received a drawing which was all that we desired, and, best of all, it came out some weeks before the machine was shipped. All piping was coming out with the apparatus. We set to work on the foundations and felt quite sanguine that we could have the machine running within a week of its arrival in the Colony. We should have done so, but the lengths of the delivered piping were quite different to the lengths shown in the drawing. "Only a small matter," says the man at home who is used to erecting; but things are different in the Far East. Hongkong is very advanced, as compared to China proper, but it was difficult to screw the pipes, etc., even in this Colony. The job was delayed. If it had been in Canton or in the interior the foundations must have been scrapped. Most probable—the whole of the apparatus would have been allowed to fall into disuse. The home firm would, in the mind of the Celestial, have been guilty of a breach of faith. There are thousands of pounds' worth of machinery which have been delivered to the Chinese and have never been at work because the Celestial cannot fit them together. The Orient is not London, and the Easterner hates to "lose face" by asking questions. He informs his superior that there has been fraud, *not* that he is ignorant of what is wrong.

The Complete Outfit.

Another most irritating thing to happen is for only part of a machine to arrive. We badly needed a lathe, and great was our delight when our shippers said they were delivering the first of the half-a-dozen lathes promised by different makers. It duly arrived, but there was no face plate and no chuck. Our alert Chinese mechanic immediately remarked upon this: "I talkee one man Canton-side, he belong my velly good fliend, he wanchee me catchee one piecee lathe. My talkee he more better my catchee one piecee Jones lathe allee same come England-side. He say, can do. My catchee one piecee lathe allee same Tai Hoc Ton" (University) "no man can work. He belong velly sorry. He plenty bobbery my." In other words, our Chinese friend would say that he bought a lathe, but only a part of a lathe was delivered.

The same sort of thing has happened, to the writer's knowledge, concerning small generating plants. The dynamo has been delivered with no shunt resistance, or the engine with no oil tank. The sort of complete outfit that deserves all possible praise in a country like this is the "Lister-Bruston" automatic lighting plant, presented by Messrs. R. A. Lister and Co., Ltd., Dursley, England. There are good working drawings, instructions for erecting, starting, and working, and the whole outfit is no sooner unpacked than it is erected.

Concerning Packing.

It has been most interesting to notice the way in which different firms manage a not altogether unimportant portion of their business—the packing of goods. In this matter the electrical firms have been splendid. They use tin-lined cases, and do not stint wood. In one case, sad to say, the tin lining was all right, but damp straw was used, and the result was most unfortunate for us.

Terminal boxes seem to be the fragile parts of electrical machines. We have had three delivered broken, but no other troubles in connection with electrical gear. In other branches of engineering work we noticed that makers did not always assemble the machine before export. On the whole the packing was extremely good, but machinery makers must realise that cases are very severely handled, and unless strongly made they will be damaged.

It is an advantage for the receiver of goods to be able to identify, easily, the packing cases sent to him. We give the prize for packing to Messrs. Archdale, Ltd., of Birmingham, who sent out a large radial drill, and a motor, kindly supplied by Electromotors, Ltd. The case was strong, the machine was bolted and wedged, the motor was inside a box built inside the case, and, in addition to the usual shipping marks, there was painted in bold letters on the case "From ———." We had no doubt as to the contents of that case, and we placed it in the most convenient position for unpacking before the twenty odd Chinese coolies who hauled it up the 300 ft. above sea level had departed.

British Consulting Engineers.

One of the lessons which we are doing our utmost to drive home to the visitors and students here is perhaps worth mentioning. It is that, for any big engineering scheme in China to succeed, there must be someone in Britain (for that is the country we in this colony are concerned with) whose duty it is to inspect the machinery and pass it, from the manufacturer, as suitable for its work. That is an advantage also for the manufacturer. Our progressive friends in Shanghai, who have done so admirably in the matter of electricity supply, have this arrangement, and, of course, it pays them. British engineers throughout China should endeavour to persuade our Chinese friends to adopt this system. The University has great reason to be grateful to its Hon. Consulting Engineers in London.

There is in China a vicious idea that it is possible to save pennyworths of tar in engineering work, and that is entirely due to the ignorance of applied science which exists in this part of the world. The success of German firms is, to some extent, due to their accommodation in this respect. It is a pleasure to record that, already, we find the students in this University are beginning to appreciate that shoddy goods are not the cheapest, but that if you want a good article you must pay for it. In the tropics it pays to have good electrical apparatus.

Finally, a word about catalogues. It is advisable to give prices. You may cover yourself with all sorts of phrases such as "Subject to discounts," or "Subject to no increase in the price of labour or raw material," but it is most difficult to persuade the Oriental to look at a proposition until he has some sort of an idea as to the price of the outfit.

These few notes are put together in the hope that they will be of value to exporters, but they would be incomplete without a passing reference to the fact that all Britishers in the Far East admire greatly the efforts which have been made during the past two years by British manufacturers to regain our national prestige for enterprise in the Orient. We, in Hongkong, believe that there will be a great deal of trade in the near future, and beyond all else we want the home country to have a full share of it.

Fire Prevention.—The International Fire Service Council is holding an Executive meeting in London on June 15th, 16th and 17th, at the invitation of the British Fire Prevention Committee, when the principal items under consideration will include the preparation of an International Fire Dictionary, *i.e.*, a dictionary of fire-technical terms in three languages and the arrangements for a conference on certain fire-service and fire-preventive subjects to be held at Copenhagen in 1915.

THE RATING OF PUBLIC UTILITIES AND THE BUDGET.

By JOS. J. H. STANSFIELD.

Until recent years the provisions of the Budget were usually completely carried out by means of a Finance or Revenue Bill, and though persons connected with public utility undertakings were concerned as taxpayers, general rather than financial legislation dealt with those proposals of the Government of the day which would particularly affect undertakings of this nature.

The financial basis of social legislation is, however, becoming increasingly recognised. Whether the individual may consider this to be for better or for worse, present methods cannot be ignored, and the object of this article is to draw attention to the proposals of the Chancellor of the Exchequer in so far as they relate to the electrical industry in connection with the levying of rates for local purposes on site values, and the suggestions hinted at with respect to new legislation for the revaluation of rateable property.

The requirements of spending authorities are constantly increasing, partly through local needs and partly in consequence of obligations placed upon local authorities by Parliament. It has often been pointed out that many of these obligations are of a national rather than a local character, and the Government in the Budget of this year have recognised this by promising increased subsidies in part payment of such services, and indicated that further assistance will be given by means of legislation enabling local authorities to levy rates on site values.

The laws of rating still in force outside the Metropolis in the greater part of England and Wales are of long standing. After the dissolution of the monasteries in the reign of Henry VIII. in 1535-6 and 1539 and in acts passed up to the year 1597, the parish was recognised as a suitable area for the collection and expenditure of monies received from persons charitably disposed.

At first such payments were voluntary, but it was gradually considered to be necessary to apply compulsion, and in 1552 the Bishop was authorised to put pressure upon the parishioners, until in 1601, in the reign of Queen Elizabeth, this duty was delegated to overseers of parishes by an act which is still in force, and though amending acts have since been placed on the Statute Roll, the important principles laid down in that act of assessing the rateable value separately for each parish and rating the occupier only, still form the basis of modern law and practice.

The act of Elizabeth stated that "the occupiers of lands, houses, tithes impropriate or propriations of tithes, coal mines, and saleable underwoods should be liable to be rated for the relief of the poor." Since the passing of that act very few additional classes of property have been made expressly assessable for local rating purposes, whilst on the other hand a very large class, stock in trade, etc., have been directly exempted.

The term "lands" and "houses" now have a far wider application than they had 300 years ago, and have been extended to classes of property which were not and could not at that time be in contemplation because of their non-existence, such as warehouses, sheds, and manufactories containing machinery, and public utility services in the hands of local authorities and companies, such as railways, tramways, light railways, gas works, electrical, water and other works of an analogous nature which have come and are coming into existence from year to year in increasing numbers.

For many years the incidence of rating was very unequal, until in 1836 an act was passed which provided that the standard by which the value of property for rating purposes should be determined should be "an estimate of the net annual value of the several hereditaments rated thereunto; that is to say of the rent at which the same might reasonably be expected to let from year to year free of all usual tenants' rates and taxes, and tithe commutations, rent charge, if any, and deducting therefrom the probable average annual cost of the repairs, insurance and other expenses, if any, necessary to maintain them in a state to command such rent."

The estimated rental value and not the actual rent paid was thereby fixed as the basis of assessment, but where property is rented, or where it can be compared with rented property the rent paid is usually taken as the gross assessment, the rateable value being arrived at by deducting a percentage varying with the class of property, the actual percentage varying somewhat with different Assessment Committees.

This method is obviously not applicable in the case of many classes of rateable hereditaments such as railways, tramways, and electricity undertakings, because such property is not rented nor comparable with similar property in the parish, a further difficulty arising in consequence of many of such undertakings extending to other parishes and often being situated in the areas of different Assessment Committees.

As the unit area of rating is the parish, it necessarily follows that the assessment of undertakings of this kind is complicated, and unless there is a serious legal principle involved, it is often not worth while proceeding to an appeal, as the costs that are likely to be incurred may be such that it will take many years of reduced rates in the parish to recoup them even if the appeal be successful. In 1869 an act was passed dealing with the rating of property in the Metropolis, but the difficulties of laying down a specific method of arriving at the assessments of rateable hereditaments, such as we are considering, were found to be so great that they are in London, as in the Provinces, still determined "according to the circumstances and the general principles of law."

It is not the purpose of this article to explain in detail the method of valuation applied to public utility undertakings, but the underlying principles may be generally stated. The gross profits are first ascertained by deducting the expenditure from the receipts, both these being subject to certain deductions as a result of many legal decisions. From the gross profits a percentage on tenants' chattels is deducted together with a further sum representing the amount which would have to be set aside to replace the capital expenditure at the end of their assumed life, the balance being the net rateable value of the undertaking.

Considerable capital expenditure must usually be incurred before such undertakings can be made to pay, and the proportion of standing charges are often such that several years must pass before the method of valuation shows a net rateable value for assessment. The basis of the assessment is the rentable value, and it is obvious that a tenant from year to year could not afford to pay any rent if the future prospects of the undertaking were eliminated, a fact which is usually recognised by assessment committees, the assessments made being frequently small and in the nature of an acknowledgment.

The defects in the method of valuation have been recognised for a number of years, and in 1897 a Royal Commission was appointed to enquire into the present system under which taxation is laid for local purposes, the Commissioners being directed to report whether all kinds of real and personal property contributed equally to such taxation, and if not what alterations in the law were desirable in order to secure that result.

Various attempts have been made by the Legislature to remedy these defects, the Valuation

(Metropolis) Act having met these to a certain extent, so far as London is concerned, by securing one valuation as the basis for both Imperial and Local taxation, by a revaluation of all properties once every five years with power of revision during the intermediate period, by fixing a scale of maximum deductions for certain classes of property and by the furnishing of returns similar to those obtained under the Income Tax Acts from owners and occupiers, and the extension of this act has been frequently recommended to other parts of the country.

The first report of the Commissioners was issued in 1899, in which will be found details of several bills introduced for establishing one uniform mode of rating, and after consideration of these and the hearing of expert evidence, recommendations were made which will doubtless be carefully considered before a new Valuation Act is introduced.

The principal suggestions are those contained in the Valuation (Metropolis) Act, and also that there should be one valuation authority in each county (and, if so desired, in each county borough) and that their valuation lists should be the basis on which rates and taxes for all purposes should be raised. These areas would be divided into convenient districts with representative committees, assisted where possible by professional surveyors, notice being given to the ratepayers when it was proposed to increase any valuation or include one for the first time.

Special properties such as railways, canals, mines, tramways, docks, telephones, and gas, water and electric light works are to be valued in the first instance by a valuer appointed by the valuation authority, objections being heard by that authority and appeals lying to the railway commissioners or a special tribunal created for that purpose. It is not mentioned, but doubtless some further arrangement would be necessary to deal with undertakings that are in the area of more than one Valuation Authority.

In the final report, issued in 1901, recommendations are made with respect to the rating of land values either by placing thereon a separate or additional burden, it being stated that it could not be contended that land on which buildings are erected escaped taxation under the present system.

The proposals of the Government should be carefully considered on behalf of the electrical industry by institutions and other representatives of that industry, special attention being given to general exemptions from rateability already granted to analogous undertakings.

The rating of such classes of property should bear some relation to the advantages conferred. Parks, libraries, town halls and the like in parishes situate away from the principal offices and works, are of little benefit to the owners of tramways, light railways and electricity undertakings. This has already been recognised in the case of railways, and in Scotland under the provisions of the Poor Law (Scotland) Act 1845, railways and tramways (excluding stations, depôts and buildings), and the underground pipes of gas and water companies, are in burghs to be valued for rating purposes at one-fourth the gross valuation, this system being considered to be in the words of the late Sir John Skelton as "a rough method of adjusting the assessment to the taxable capacity of the ratepayer," a system which appears to have grown out of the original endeavour to tax on means and substance, and indicates an effort to grant to those occupiers whose rentable value may be considered higher in proportion to their income a proportionate relief.

In this question of partial exemption of rateability the interests of railway companies, and the owners of tramways, light railways, water, gas and electricity undertakings are practically identical, and should the necessity arise it would doubtless be of assistance if means were devised to combine forces in order to bring such pressure to bear upon the powers that be as would adequately protect their interests. As a matter for consideration, a joint committee of representatives of the Railway Clearing House, the Light Railways and Tramways Association, the Institution of Electrical Engineers, the Incorporated Association of Power Companies, and the Incorporated Municipal Electrical Association is suggested, the committee to co-opt such expert assistance as they may consider best.

Until concrete proposals are made there must be an open mind, for whilst no one can reasonably object to public utility undertakings bearing their fair share in local burdens, any attempt to impose an unfair basis of rating which would retard the progress of such quasi-public industries should be strenuously resisted.

WASTING OF THE VERTICAL PIPES OF FUEL ECONOMISERS.

By EDWARD INGHAM, A.M.I.Mech.E.

In the working of fuel economisers of the Green type, the most prolific source of deterioration is probably wasting of the cast iron pipes, which takes place both internally and externally.

Unfortunately, as everybody who has had any practical experience of the working of this plant knows, it is a most difficult matter to make a satisfactory examination of the pipes. In fact, all that can usually be done to make an internal examination is to pass a light down the pipes, and by means of this try to discover any signs of wasting. As regards external examination, only the outer tubes can be thoroughly examined, but in view of the fact that the outer tubes at the cold end, *i.e.*, the inlet end, generally suffer the most severely, the condition of the inner tubes is a matter of secondary importance in the majority of cases.

With regard to internal corrosion, much of course depends upon the nature of the feed water. A water which contains corrosive ingredients will naturally give rise to more or less serious wasting. Internal wasting of fuel economiser pipes, however, is not always due to the use of a corrosive water. It is not very uncommon to find severe wasting even where the water used is exceptionally good, such as for instance the water from Loch Katrine, in Scotland, which supplies Glasgow. The wasting which results from the use of good water is of a very peculiar form, because the surface of the metal of the pipes remains apparently unchanged, but on applying a chisel, the wasted material, which takes the form of blacklead, may be easily pared off. It will be obvious that this form of corrosion is more or less dangerous, because there is no apparent reduction in the thickness of the metal, and the defect is thus very liable to escape detection. A number of failures of economisers have occurred owing to the wasting having been overlooked.

The defect alluded to is known as "graphitic" wasting, and in making examinations of economisers, it is always advisable to keep a sharp look-out for this form of wasting, particularly where the feed water used is comparatively pure. When the feed water contains much scale-forming matter in solution (such as the salts of lime and magnesia), the economiser pipes gradually become coated with scale which serves to protect the internal surface of the pipes from "graphitic" wasting, and hence it is that where hard waters are used, the trouble is not likely to be met with. With soft waters, no such protective coating is formed, and hence, it is usually only in connection with such waters that the trouble is experienced.

"Graphitic" wasting occasionally proceeds with great rapidity. In the "Journal of the Society of Chemical Industry," 29 (1910) 1141, Steel reports a case where the cast iron pipes of a Green's Economiser were dissolved away within a few months, only a thin outer shell remaining. About 84.5 per cent. of the iron and the whole of the combined carbon and silicon had disappeared, and a residue remained in the pipes containing the whole of the graphite, phosphorus, and silicon, the latter as oxides which formed a thick layer of plumbago-like material on the inside of the pipes. The water used in this case was the town water of Sydney, N.S.W., which is very soft in character.

Although cases of "graphitic" wasting are not very uncommon, the usual cause of internal wasting of economiser pipes is due to the presence of acids in the feed water. Where the feed contains such acids it should be treated with suitable reagents which will neutralise the acidity and at the same time cause precipitation of any scale-forming matter contained in the water. The reagents required can only be correctly determined from a chemical analysis of the water.

Whilst internal corrosion of economiser pipes is frequently difficult to prevent, the same can scarcely be said of external corrosion. The latter is generally the result of damp or moisture in contact with the external surfaces of the pipes, and if proper care be taken to keep the surfaces dry, the trouble is not likely to be experienced to any serious extent.

It has already been pointed out that the outer pipes at the cold or inlet end of the economiser are the pipes most liable to suffer from external wasting, and the wasting of these pipes is usually brought about in the following manner. The waste gases, or products of combustion, coming from the boilers contain a certain amount of steam, which, when it comes in contact with the economiser pipes at the cold end tends to become condensed and settles on the pipes, thus setting up external corrosion. When the coal used in the boiler furnaces contains much sulphur, the products of combustion will probably contain sulphur dioxide or sulphur tri-oxide, in addition to steam. These gases, in combination with water, form sulphurous and sulphuric acids, which have a powerfully corrosive action on iron. Hence it is very important that condensation of the steam in the waste gases should be prevented as far as possible if serious wasting is to be prevented. To attain this end, the feed water should not be allowed to enter the economiser at a lower temperature than 90 or 100 degrees Fah. If the condensed steam from a condensing engine be used for feeding the boilers, or if the feed be passed through a feed water-heater before going to the economiser, the temperature of the water when it reaches the economiser will be well above 100 degrees, so that trouble is not likely to be experienced.

In other cases, however, the water will be cold, and some means should therefore be adopted for raising the water to the desired temperature. A convenient method of doing this is to connect, by means of small wrought iron piping, the delivery pipe of the economiser with the suction pipe of the feed pump. By means of such connection some of the heated water leaving the economiser may be mixed with the cold water going to the feed pump. A small valve placed on the wrought iron pipe connection will enable the engineer-in-charge to regulate the amount of hot water passing into the cold feed so as to raise the temperature of the latter to what is required for preventing condensation of the steam in the waste gases. Generally speaking, a temperature of 100 degrees will be found sufficient to prevent condensation, but in some instances trouble has been met with even when the temperature has been as much as 120 degrees.

External wasting, not only of the pipes, but of the economiser generally, frequently results through allowing the brickwork setting to become damp. Brickwork is porous and readily absorbs moisture, and hence special care should be taken to prevent drainage or waste water from the valves, etc., from soaking into the setting. Care should also be taken to prevent water draining into the soot chambers, as otherwise severe wasting of the bottom boxes and the lower portions of the vertical pipes is liable to be set up. Some soot chambers are naturally damp, in which case it is not an easy matter to prevent external wasting. If, for instance, the soot chamber is below the level of the drains, any water which collects in it cannot be drained off. Under such circumstances it may be advisable to dig a well in the vicinity, and to provide suitable arrangements for draining the water which collects in the soot chamber into the well. It will, of course, be necessary to empty the well of its water from time to time.

Owing to the fact that economiser pipes are liable to become thinned and weakened both internally and externally, it is most important that their condition be carefully observed, as far as possible, from time to time. It is a great mistake to suppose, as many do, that owing to their small diameter and great thickness, there is very little likelihood of the pipes failing, and further, that even should failure occur, the results can only be of a mild character. It is quite true that an economiser pipe is capable of withstanding an enormous pressure so long as it remains of its original thickness, but it will be obvious from what has been said that the thickness of metal may become gradually reduced to such an extent owing to either internal or external wasting, or to both combined, that it is eventually quite unfit for sustaining the pressure to which it is exposed. Further, it should not be forgotten that the pipes are liable to be weakened by overheating, and when in addition to this, the fact that the pipes may have been cast eccentrically so that one part is much thinner than the other, due to shifting of the core, is taken into account, it will be seen that failure is not by any means to be regarded as impossible. A reference to some of the reports on boiler explosions which are issued from time to time by the Marine Department of the Board of Trade will provide abundant evidence of the fact that failures do frequently occur. With regard to the belief that even should failure of a pipe occur, the results can only be of a mild character, this possibly arises from the fact that an economiser is only intended to be exposed to water pressure, and as water is practically incompressible, there is no great expansive force to be relieved in the event of failure occurring. The belief is no doubt strengthened by the fact that vessels and structures which have to be exposed to internal fluid pressure are invariably tested by hydraulic pressure, because no great harm is done should any part fail under the test. With an economiser, however, the case is very different. The water in the economiser, or at least a portion of it, is usually at a temperature considerably greater than 212 degrees (the temperature of boiling water at atmospheric pressure). Hence, should a pipe fail, the escaping water would immediately flash into steam, the accompanying violent expansive force of which might easily cause other pipes to explode, until, eventually, the whole economiser was shattered. In the case of a vessel being tested by cold water, if any part fails, the pressure is instantly relieved, with very little increase in the volume of the fluid, and with no expansive violence therefore, and thus little harm is done. That fuel economisers can and do explode with disastrous results is proved by the explosion which occurred at a tin works in South Wales not very long ago, when one section (96 pipes) of an economiser of 192 pipes was so completely shattered that it could not be re-assembled.

In order to ascertain the internal condition of the pipes, a lighted candle or a small electric glow lamp should be dropped down the pipes and a visual examination, as far as practicable, then made. Should any internal wasting be discovered, the depth of which is uncertain, the best plan is to withdraw a pipe here and there, and either to drill or break up the pipes so drawn, so that the actual thickness of metal remaining may be correctly ascertained and a general idea of the internal condition of the pipes thus be obtained. Drilling, it may be mentioned, is not so reliable as breaking up the pipes. The extent to which external wasting has taken place is, of course, easily ascertained by calipering the outside diameter, and comparing this with the original diameter.

Whilst withdrawing and breaking up defective or corroded pipes is the only really satisfactory method of ascertaining their true condition, this procedure is a troublesome and an expensive one, and consequently hydraulic testing is frequently resorted to as a substitute for visual inspection. The hydraulic test, if carried out under the supervision of an expert, is certainly of great value in discovering seriously wasted or fractured pipes, but it cannot be regarded as an infallible test. By some it is believed that hydraulic testing to a pressure of from one and a half to twice the safety valve load is distinctly harmful, because serious defects may be aggravated without their existence being revealed. Indeed, cases are not wanting to show that failure of boilers and similar vessels has occurred very shortly after hydraulic testing, with a pressure of little more than half that of the test load. A vessel under steam is a very different structure from one under water pressure. In the former case, the racking strains resulting through differences of expansion in different parts of the structure are brought into play, whilst in the latter case no such strains exist, the whole of the structure being exposed to one constant temperature. Hence hydraulic testing cannot be regarded as absolutely reliable.

In the case of the explosion in South Wales already referred to, the economiser had been hydraulically tested to about twice the working pressure only a few months previously, and had shown no sign of weakness.

Notwithstanding, however, the possibility of more harm than good resulting from the application of the hydraulic test, it will generally be found that such means of testing economisers is extremely valuable if carried out with care and under proper supervision. Weakened and fractured pipes are constantly being discovered in this way, which pipes would no doubt have sooner or later led to an explosion had the test not been applied.

When hydraulic testing is resorted to, it is important that the pressure applied should be maintained for some time, not less than twenty minutes or half an hour, because experience has shown that the weakened parts usually fail after the pressure has been on for some time.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Picking up Telegrams with a Pipe.

So much is heard, when wireless telegraphy is under discussion, of the secrecy of cable telegraphy that the following account of a little experiment with a surprising result may be of interest.

The writer is in charge of an engine-room built at a spot close to where a telegraph cable leaves the island of Guernsey for the shores of England. Overhead wires from the cable hut pass within 5 ft. of this building, and in the course of experiments the writer found that by connecting a telephone receiver to any part of an engine and putting the other terminal to earth the Morse code signals passing along the telegraph wires became audible.

Incoming messages from England were too attenuated to be read, and outgoing messages sent automatically were too rapid, but hand-transmitted messages from the local post office it was possible to pick up.

As a matter of fact, the experiment was discontinued so soon as one message to London had been read, which merely announced the sailing of a ship from the nearest harbour, which a few minutes later was seen sailing outwards.

An iron air pipe in connection with the engine, running for 20 ft. beneath the roof of the engine room, parallel with the wires outside, and then dropping to earth, appears to be the means by which messages can be inductively received.

The experiment seems to be of interest as showing the eavesdropping that might possibly be carried on in secrecy within a building with no outside connections whatever, and this seems to the writer to form another argument in favour of armoured underground cables for all important land lines.

Edwin O. Catford.

Review of "Electrical Meters."

Referring to the letter from Messrs. Everett, Edgcumbe and Co., Ltd., in your issue of April 24th, concerning the inkless type of graphic instrument, may I be permitted to point out that recording instruments of the kind referred to, which make a dot once every five seconds or so on the chart, instead of a continuous trace, are not suited for use on rapidly-fluctuating loads such as traction loads. In such cases large variations of load frequently occur between two successive dots, with the result that the dots are scattered disconnectedly about the chart; no definite curve can be traced, and outlying dots (which are often the most important part of the record, since they represent maximum or minimum readings), may readily escape notice, as they are often a long way from any other dots. Moreover, it is quite a chance whether the dots happen to hit the tops of the peaks and so record the full extent of the fluctuations, while entire peaks may even occur in between two dots, and so escape record altogether.

On the other hand, instruments of this kind are, no doubt, well adapted for use on loads which do not fluctuate too rapidly, and, in fact, may be particularly advantageous for use in cases where the fluctuations are very small, and are hardly sufficient to overcome the pen friction of the more ordinary type of recorder, as, for instance, for recording the voltage of a well-regulated lighting circuit.

I quite appreciate the difficulties due to pen friction, which is, undoubtedly, a serious drawback to the ordinary pen type of recorder. I once saw an ingenious, but simple, device which had been fitted to a recorder, in the shape of an electric bell, the hammer of which tapped on the chart; at every stroke the pen jumped off the paper momentarily, and this seemed to overcome friction effectively, without making the trace too discontinuous. It would be interesting to learn whether any of your readers have had experience of any such device.

Was not a device on a similar principle used long ago by Thomson for overcoming pen friction in his siphon recorder?

G. C. Allingham.

London, N.W., *May 26th*, 1914.

Is Aluminium Diamagnetic?

With reference to the above question, I would refer you to a book entitled "Aluminium, its History, &c." by J. W. Richards, A.C., Ph.D., published in England by Sampson Low, Marston & Co., Ltd. On page 67 the author refers to the magnetic properties of aluminium, and quotes Prof. Frank Very, of the Allegheny Observatory, Allegheny, Pa., who finds "Aluminium with only a trace of iron to be absolutely non-magnetic. With 0·05 per cent. of iron, none could be observed. An ingot containing 1·5 per cent. iron showed faint polarity, while with 2 per cent. the polarity was very decidedly observed."

G. J. Freund.

London, E.C., *May 27th*, 1914.

The Institution and the Electrical Industry.

I read with pleasure the excellent leader on "The Institution and the Electrical Industry" in your issue of the 22nd inst., and it is to be sincerely hoped that it will awaken a genuine interest in the policy of the Institution.

The recent correspondence on the I.E.E. meetings has certainly shown that "there is life in the old dog yet," although the progressive policy so ably introduced during the presidentship of Dr. Ferranti has shown decided symptoms of acute decadence.

To one who has been a student of the Institution for six years, and has taken an interest in the affairs of three of the local sections (including membership of a local students' Committee), it is undeniable that amongst the membership there is a spirit of dissatisfaction of which even an academic or scientific Council cannot be entirely oblivious.

It is not so long ago since there was a great fanfare in Westminster over the increased status of the I.E.E. and the inauguration of the weeding-out process by the institution of examinations, while the subscriptions and entrance fees were raised, as it was pointed out that they were below the average contributed by members of the other great Institutions.

The hopes of many members ran high, for it seemed that at last the Council had wakened up and were going to put their house in order, while there were indications that the Institution would pursue a broader policy and look after the interests of its members engaged in the industrial side of the profession.

The practical results of the Council's policy do not seem to have been eminently successful, for the spirit of dissatisfaction still exists amongst the membership, and the fact that the Institution has failed to look after the interests of its members is proved by the existence of new associations of electrical engineers to deal with matters which properly are the duty of the Institution Council.

The inauguration of an entrance examination has come rather late in the day, and it would be interesting to know how many candidates have passed the Associate Membership examination (and, incidentally, how many of the existing 5,103 corporate members could pass it), for the Council's report states that 112 candidates have been approved for admission to that class on condition that they pass the Institution examination.

It seems only logical that A.M.I.E.E.'s by examination (or under the new regulations) should be distinguished in some way or other, for, personally, I know of many corporate members whose training and qualifications would certainly not satisfy any Students' Committee, and there is little inducement for highly qualified engineers at present to add the mystic letters A.M.I.E.E. to their names. The passing of a written examination is, of course, no criterion of an engineer's abilities, and it is to be hoped that even an academic Council will recognise this fact, for no amount of academic training will compensate for a sound and varied practical experience, coupled with a fair technical knowledge such as can be obtained at, say, an evening technical institute, with classes and teachers registered by the City and Guilds of London Institute.

It would seem necessary that greater discriminative powers be brought to bear by the Council on admission and transfer questions, or that a specially qualified Committee be appointed to deal with such matters, which have a vital bearing on the future of the Institution.

Presumably the contributions of the members were raised so as to bring the membership into line with other engineering bodies, such as the Inst.C.E. and the Inst.Mech.E., but the Associate Member's subscription is now, I believe, actually more than that paid by corporate members of these Institutions, whose status is admittedly higher, and this may account for the decreased membership during the past year. The graduate class does not seem to have been a great success as far as the weeding-out process is concerned, unless, of course, the Council had in view the fact that it was desirable to have a sort of "mixed pickles" class or dumping ground for those whose Studentship had expired, or who for various other reasons could not qualify for corporate membership, and whose subscription would be very welcome from the point of view that it "brought grist to the mill."

The change in the publication of the *Journal*, and its arrival in a state of collapse, hardly seems compatible with the increased status of the Institution (or subscription either!) and in this and other matters the I.E.E. could afford to take a leaf out of the book of its American cousin. There are many other matters which require ventilation amongst the membership, and I sincerely hope that before the new session commences these will have been discussed in the "Correspondence" columns of the Review through the kind permission of the Editors.

Mere Student.

May 27th, 1914.

One cannot help but admire the frank expression of opinion offered by Mr. Wordingham in his article entitled "Should the Council be blamed?" with much of which I heartily agree.

On the other hand, putting aside the fighting propensities which one would naturally expect in the chief electrical engineer of the "first line of defence," surely all history proves, and people are beginning to realise, that "fighting to a finish" does not result in real progress, and certainly tends to impoverish as well as embitter both sides.

It is, I think, perfectly clear that opposing interests require some Authoritative Body to whom they may submit their troubles for reasonable arbitration in order to avoid the very necessity of "furiously fighting." Such an Authoritative Body could not, of course, from the very heterogeneous nature of its membership, adequately advance the commercial interests of any one particular section of its members, because of the natural lack of interest of the members generally in the commercial affairs of this particular section.

The Institution should surely not be out to further the interests of any one section of its members. I would submit, Sir, that the highest interests of the industry would best be served by the Institution fostering and developing good feeling between its various sections by providing the means for ready exchange of views and arbitration when necessary, and also providing a channel whereby the results of scientific research may be presented and widely discussed to the advantage of the industry as a whole.

M.I.E.E.

Frequency Changer.

With reference to Mr. Taylor's letter in to-day's Electrical Review under the above heading, I must thank him for pointing out my error. What I should have said is that the "pulsations" would be halved, which would, on an electric lamp and the like, have the same effect as halving the frequency.

F. W. T.

Comparative Economics of Tramways and Railless Electric Traction.

Mr. Gribble's letter in the Electrical Review of May 29th in its third paragraph gives away the whole of the case on which his I.C.E. paper was based, *i.e.*, that the car he assumed for the purpose has the earning capacity of a tramcar. No assumption that a railless car of equal earning capacity cannot be built was made in the criticism he replies to. If he had assumed such a car in his paper, all the figures of capital cost, weight, current consumption, and most other working expenses would have been different, the results of his comparison would have been different, and the criticism also different.

Mr. Gribble does not apprehend the relation between the maximum carrying and earning capacity of a tramcar and its average earnings per car-mile, perhaps because it has never been his lot to deal with and provide for tramway traffic first hand.

It will be quite easy for him to get a lesson at the cost of a few hours' personal observation. I suggest the L.C.C. service at Blackfriars or Westminster Bridge, about 6 p.m. on a week-day or 1 p.m. on a Saturday.

He will see trains of outward cars, frequently a dozen in succession, marked "Full," *i.e.*, in most cases carrying 78 passengers each; and a similar procession of inward cars, with an average of four to six passengers apiece. Taking both directions, the average occupation of these cars will be somewhere about 40, but it will be clear at once to Mr. Gribble that nothing smaller than the 78-passenger cars can carry the traffic presenting itself, and that even that capacity is insufficient for a considerable period of time. He will appreciate why tramway managers and engineers have, during the last 16 years, advanced from single truck to double-trucked cars, have adopted double decks, have roofed in the upper decks, have increased weights from about 7 tons to 18 tons; that this has not been done for fun, or for megalomania, but because the carrying and earning capacity so augmented are necessary to meet the conditions; and he will, I feel sure, admit to himself that railless cars, run on similar routes and fares, must have equal carrying capacity to render the same service to the people, and to obtain the same gross receipts. That this can be done on the working expenses set out in the paper criticised will be recognised as entirely out of the question.

This is the answer to Mr. Gribble's question about York. Trackless cars of equal individual carrying capacity, on similar services and fares, would earn as much as the tramcars per car-mile; but they could not be worked at the working expenses, and could not be bought for the same price as the cars assumed in Mr. Gribble's paper. Those small cars, he himself says, would not be suitable for York. But in his paper he holds them up as in every respect capable of replacing an equal number of tramcars for city services of any density.

As a side remark, it can be said that it is not easy to keep the 28 or 34-passenger cars within the weight limit enforced in Great Britain, and, speaking with a long experience of the Board of Trade in such matters, not to mention Parliamentary Committees or the Home Office, the suggestion to run trailers on trackless 'buses does not seem very hopeful.

As Mr. Gribble mentions Rotherham, one may add that the overcrowding of the small cars shows that tramcars on the same route, with the same fares and services, would earn more money; that the Rotherham tramcars earn 12·5d. on the average per car-mile, against the 10·35d. of the trackless cars; that the latter take about 3d. per passenger, and a fraction over three passengers per car-mile, and that the traffic is practically a point-to-point traffic. The Rotherham route looks a very proper one for a pioneer trackless service, and might not support the capital expenditure for a tramway, but the surveyor to the West Riding County Council gave evidence to a House of Lords Committee a few days ago that the Rotherham trackless cars cost 4d. per car-mile for wear and tear of roads; it is pretty clear, therefore, that the total cost with a tramway would be less, though differently distributed.

The question of power distribution and losses is, I agree, trivial on lines of the extent and character hitherto constructed in this country. But Mr. Gribble suggested in his paper systems comparable with those of the largest tramway undertakings; where the cost of distribution—capital charges and losses together—is of serious importance. A tramway has the equivalent of from 2 to 4 sq. in. of copper for its negative conductors, provided gratuitously, so to speak, but the trackless service has but one or two trolley wires on the negative side. Therefore it must have a duplicate feeder system, and little less than double the cost in capital charges and loss of energy in comparison with a similar tramway. This is said with full knowledge of the effect of the voltage-drop limitation on the use of the rails for return. It is also said after working out and constructing the distribution systems for a good many tramways, and calculating those for a few trackless lines. In extensive systems, feeders soon overtop the overhead construction in cost per mile, even on tramways.

Now, as to road costs, capital and maintenance, "Comparative Economics" means, surely, the comparison of all costs on an even basis.

If it is taken that it is the duty of the road authority to provide and maintain adequate roads for mechanically propelled vehicles plying for hire for profit, without charge to the owners thereof, very well, then we drop on both sides of the comparison the cost of concrete, substructure, and of paving, capital and annual. Then the tramway is only charged with its rails and fastenings and electrical equipment. On that basis, instead of the present unfair burden of paving, maintenance, and rating, there can be no question at all that a public transport service on definite routes can be given at a smaller total cost by electric tramways than by any other means at present known, wherever the traffic demands anything better than a 30-minute service: Mr. Gribble's own diagrams, corrected, prove it.

Or take it the other way. Charge the public service vehicles with the actual cost—capital charges and maintenance—of the roadway they use, and still the electric tramway comes out best, though by how much will depend on the special conditions of each case.

It has fallen to the writer's lot to give responsible advice in a great many cases, always after study of the particular conditions, without which such advice should never be given; and in some cases railless traction has been recommended; but as a general preliminary statement, under British conditions, and accepting the unfair burdens put upon tramways by those conditions, in any case where traffic calls for a headway of 20 minutes or less, the presumption is for a tramway as against trackless or petrol 'buses.

It is strange to hear that roads of the character of the London streets have scarcely any impression made on them by mechanical traction. That statement is emphatically contradicted by the statements, and by the accounts, of all the London road authorities, and by the extensive reconstruction of London streets still in progress; not to mention visual inspection of many of the streets carrying heavy motor-'bus traffic.

As to fares, any transport service which seeks to replace the electric tramways in large towns and cities has got to reckon with the same fares unless it gets a subsidy from public funds. Tramways have spread and are spreading, the working classes to an enormous extent to the outer suburbs, and a good thing too; it is utterly impracticable, having got the people out by low fares and frequent services, to substitute either higher fares or inferior services, and it is no use talking about Parliamentary rates of 1d. per passenger-mile for these cases.

Mr. Gribble and his colleagues have an ample field open to their enterprise and talent; they will only damage their own interests by trying to apply them to unsuitable conditions, and it does not seem very likely that they will get the opportunity to do so in this country for some time to come.

The Critic.

"Schoeller" Miners' Lamp Gas Detector.

In response to Mr. Turquand's further letter in to-day's issue, I beg to say the answer to the question he raises is in the affirmative.

W. Schmahl.

London, E.C., *May 29th*, 1914.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Recording Instruments.

Messrs. Elliott Brothers, of Central Buildings, Westminster, recently issued a new list of recording instruments, showing the improved types that they have introduced. Amongst these is a line of recording ammeters and voltmeters of the drum type, for use with charts changed daily; these are made in the portable form or for switchboard use, for A.C. or D.C. The design of the mechanism is generally similar to that of the other well-known instruments made by the firm.

The list includes a D.C. combined moving-coil ammeter and voltmeter with both records on one chart, that shown being a drum chart suitable for a feeder log. The instrument can also be supplied for any combination of two records, and with charts of unequal widths, as shown, or both alike. The two charts being printed on the same sheet of paper, absolute synchronism of the records is thus ensured.

Siemens Cables and Joint Boxes.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, have recently issued a catalogue of paper-insulated cables for pressures up to 11,000 volts, and an exceptionally-comprehensive list of joint boxes, dividing boxes, service boxes, &c., from which we have selected a few examples. Fig. 1 shows an inverted end dividing box for underground to overhead lines, suitable for use out of doors for pressures up to 20,000 volts. Fig. 2 illustrates a straight-through joint box, showing the standard bonding method adopted for wire-armoured cables, in accordance with the Home Office rules; the sheathing wires are clamped to the box against tinned brass plates, which are coupled together by a copper strap.

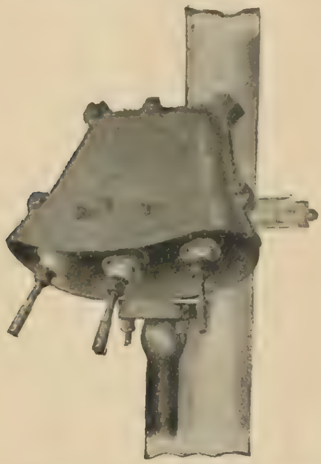


Fig. 1.—Siemens Out-door End Dividing Box.

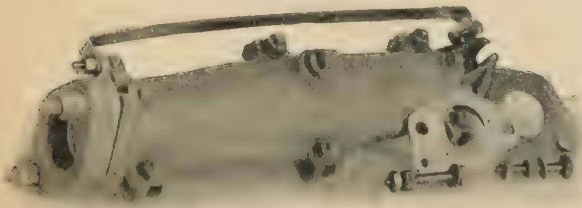


Fig. 2.—Straight-through Joint Box.

The company makes a speciality of crane boxes, of which large numbers have been supplied. A separate section is devoted to mining accessories, and the Home Office regulations for the use of electricity in mines are given in full.

A Vickers Motor Drive.

An example of a Vickers motor drive is given in fig. 3. Each of the three motors is of 3 H.P., 1,100 R.P.M., and drives 24 sewing machines, arranged in a double row of 12, and the 2-H.P. motor on the extreme left operates 14 machines. In the latter case, however, the sewing benches are located in sections. The 2-H.P. motor seen on the right is driving the single row of 10 sewing machines. A general view of the sewing machine room is given in fig. 4.

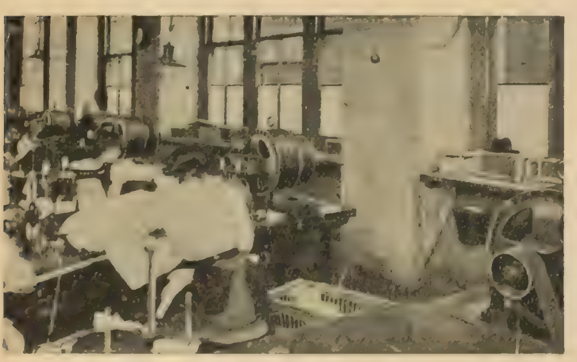


Fig. 3.—Vickers Motors Driving Sewing Machines.

The average daily run of the machines and motors is 10 hours, which has been well maintained for years. Among the advantages of this drive are no liability of dropping oil from the shafting, and better light and ventilation for the operators.

Fig. 4.—General View of Sewing Machine Room with Electric Drive.

The views are of Messrs. Greenlaws' (London) shirt-making factory, and the motors are by the Electric and Ordnance Accessories, Ltd., of Aston, Birmingham.

Simplex Factory Fitting.

Fig. 5 shows a special fitting which has been designed for factory installations by Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, and has been found to be most convenient and suitable for the severe conditions in this class of work. It is designed to provide a convenient form of pull-switch, and consists of a special water-tight box with a 5-ampere standard type of switch fitted inside, operated externally by a lever and chain. The movement is similar to that obtaining in the company's standard form of water-tight switch, and gives a very quick and independent break. The dome cover, as will be seen from the view, is fitted with a standard type of water-tight lampholder, so that in this case the light would be actually on the ceiling, but, where required, the fitting can be provided with any length of tubing drop, so as to lengthen the distance between the light and the ceiling.

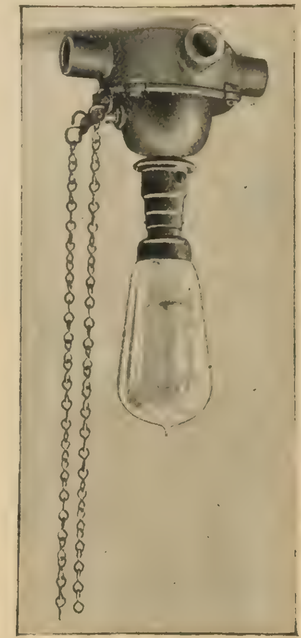


Fig. 5.—Factory Fitting with Pull-switch.

Resistance Nets.

We have received from the Schniewindt Electric Co., of Staniforth Street, Birmingham, a sample of a new type resistance net manufactured by them, in which the ribbon is woven perpendicularly to the webbing instead of flat as formerly, enabling nets to be produced with 300 per cent. greater ohmic resistance for a given capacity. Messrs Schniewindt can supply the new type net to carry up to 200 amperes; they can be woven with ribbons up to 1 in. in width, and with two or more ribbons in parallel. The convenience of the Schniewindt resistance net is well known, and the new type appears to be a great advance on the old

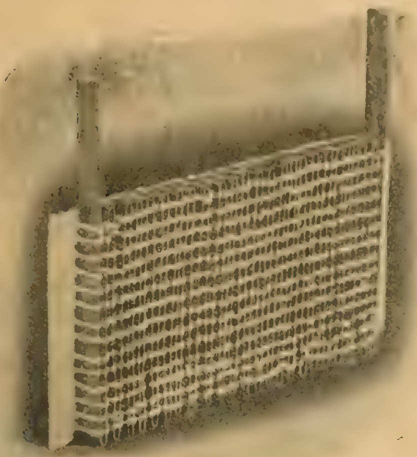


Fig. 6.—New Type Resistance Net.

Insulating Materials.

The Radium Electric Co., of 82, Hatton Garden, E.C., which has taken up the sole representation in this country of Messrs. Gebrüder Adt A.G., has brought to our notice a wide range of insulating materials for electrical purposes; of these a great variety are made of compressed paper, for use in dry places, such as spools for small coils, casings for switches and fuses, bushes and washers, dry cell cases, &c. Some of these are shown in fig. 7; those that we have seen are hard, resonant and admirably moulded to shape. Others are made of a very different material called "Australit," which is hard, dense, and fire-resisting to a high degree, being capable of withstanding a temperature of 200° C. permanently, or 250° C. temporarily, without any deformation. Australit is suitable for switch-handles, lamp-holders, hand-wheels, parts of heating and cooking apparatus; it can be moulded accurately, and has a high tensile strength while it is a good insulator for electricity and heat. Some of the forms that it may take are shown in fig. 8, including, besides those mentioned above, a portable lamp and an example of special moulding to pattern. The material is tough, and almost unbreakable, and should be found useful for many purposes.

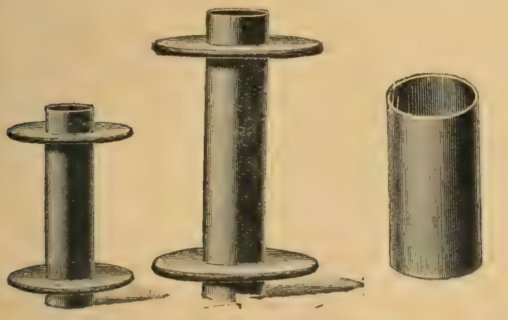


Fig. 7.—Compressed Paper Articles.

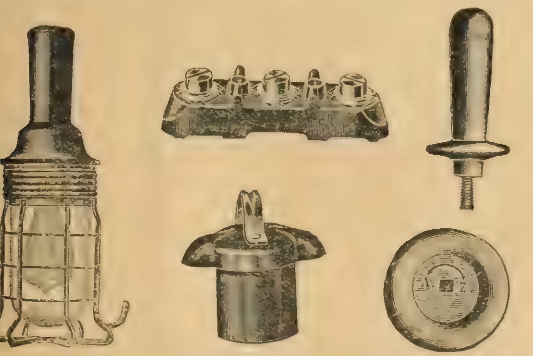


Fig. 8.—Articles Made of Moulded Australit.

Self-Cleaning Water Strainer.

The London Electric Supply Corporation, Ltd. of 25a Cockspur Street, S.W., having overcome the troubles met with in straining the Thames water for use in their surface condensers have placed their experience at the service of others, by bringing out the "Deptford" patent self-cleaning water strainer. This device occupies very little space, although it has a large straining surface, which is constantly being thoroughly cleaned; the strainer is a gun-metal drum perforated with small holes through which the water passes inwards, being afterwards led away to the condenser through one of the end covers. The drum revolves three or four times a minute, in contact with a sharp scraper; the solid matter adhering to the drum is thus removed and falls into a hopper below the drum, whence it can be discharged by opening a sludge-valve. Two of these strainers have been at work with satisfactory results for three years, during which period no renewals have been required, and the cost of maintenance has been trifling. The strainer is made in four sizes; the largest dealing with one million gallons of water per hour; the design is simple and inexpensive, and the power required for its operation is practically negligible.

The "Kingsway" Tolling Bell.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have brought out a new type of electric bell for use in factories as time-bells, fire-alarms, &c., in which an improved contact-making device is employed. As shown in fig. 9, the bell is carried on a cast-iron bracket, and the mechanism is housed in a cast-iron box from which the striking hammer is seen depending in the stationary position. When current is switched on, an electromagnet attracts an armature connected to the hammer, and causes the latter to strike the bell; the circuit is broken at the same time, and the hammer swings back as a pendulum without remaking the circuit; but when the hammer commences the forward swing towards the bell, the circuit is again completed, and the hammer strikes a very powerful blow on the bell, the cycle of operations continuing at regular intervals so long as the pressure is on the circuit. The essential feature of the device is the contact-making mechanism, which is self-cleaning, and is so arranged that the circuit is only closed during the forward stroke of the hammer. Sparking at the contacts is prevented by a non-inductive resistance connected across them. The bell is struck twice per second, or at a slower rate if the hammer-rod is lengthened; it is made in two sizes, of the best bell metal, the one illustrated being 12 in. in diameter, and weighing about 42 lb., while the larger one is swung from a massive cast-iron table, weighs 132 lb., and is 17 in. in diameter. These bells take only 1 ampere at 15 and 25 volts respectively, so that primary cells can be employed to toll them. The mechanism is weather-proof, and can be fitted to existing bells.

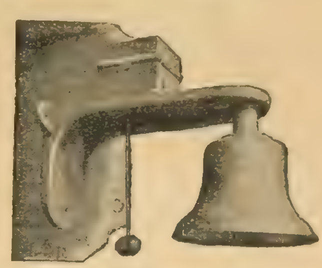


Fig. 9.—Kingsway Electric Tolling Bell.

A New Lamp Lock.

An extremely ingenious lamp-locking device has been brought out by Messrs. C. G. M. Bennett and C. H. Jeffcoat, of 148, Addison Gardens, W., for use in conjunction with the Benjamin china back-plate lampholder. The "Lamlok" locking devices introduced by the same inventors are inapplicable to this holder, owing to its construction almost wholly of porcelain; and as the holder is much used in places accessible to the public, the need of a lock is evident. It happens that in order to produce the bayonet-fastening in the china barrel, the manufacturing process necessitates the presence of two slots extending through the base of the holder; a suitably-designed brass trigger can be dropped into one of these slots, and is so shaped at the lower end that while it offers no obstruction when the lamp is inserted, it absolutely prevents its unauthorised removal. Nothing could be simpler, and the inventors' ingenuity deserves all praise. The lamp can easily be removed with the aid of a key, equally simple, but further public reference to this part of the device might defeat the object of its existence. We, therefore, content ourselves with the statement that we have seen and tried the invention, which has been provisionally protected, and it seems admirably adapted for its purpose.

E

A Witton Motor Drive.

An installation which has been [illegible] medicinal lines is found in the [illegible] Messrs. [illegible] & [illegible], Newcastle-on-Tyne. In this factory power is used for driving mixing vats employed in the preparation of metal polish and sauces, and for driving bark disintegrators used in the preparation of medicines, for the mixing of health salts, baking powder and other similar products. In the proximity of the grinders and mixers there is naturally a certain amount of fine dust, and the Witton motors employed for driving are, for the most part, enclosed in glass houses, several motors being grouped in one house wherever possible. The motors are fixed sometimes on the ceiling, but more usually on brackets projecting from the wall, and drive the plant through belting. The switchgear is mounted on the wall and is readily accessible.

A view in one of the large motor houses is shown in fig. 10.

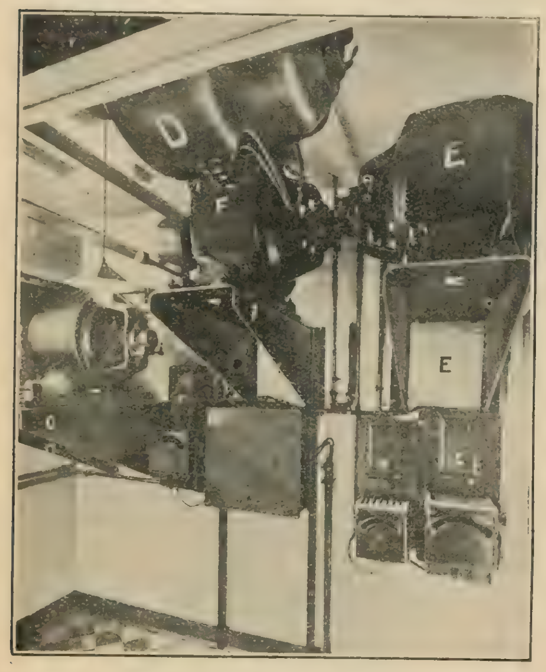


FIG. 10.—INTERIOR OF MOTOR HOUSE AT A CHEMICAL FACTORY SHOWING WITTON MOTORS AND G.E.C. SWITCHGEAR.

This motor house contains four motors of 18 H.P., 15 H.P., 7½ H.P. and 6 H.P. respectively. In addition to the purposes previously mentioned, electric drive is also used for the working of hoists and a number of ventilating fans, a considerable number of motors of similar size to those mentioned above being utilised in various parts of the works.

The installation was carried out by Messrs. T. Toward & Co., Ouseburn, Newcastle-on-Tyne, the motors and switchgear being supplied by the General Electric Co., Ltd., of Witton, Birmingham.

A Table Cooker.

We illustrate in fig. 11 a 600-watt cooker and stove by MESSRS. DRAKE & GORHAM, LTD., of Felix Street, Westminster Bridge Road, S.E., with which special flat-bottom utensils are not required.

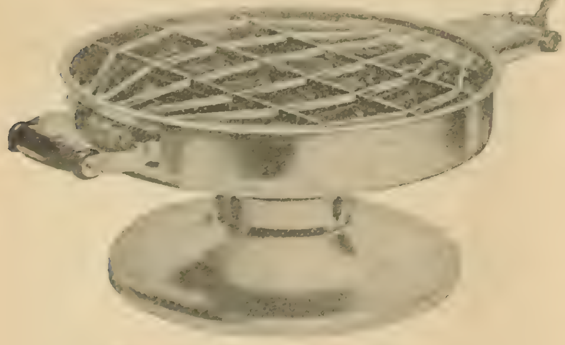


FIG. 11.—AN ELECTRIC TABLE COOKER.

The stove heats up to full temperature in 50 seconds, and can be connected to an ordinary lamp socket.

It consists of a nickled pressed steel frame with a burnished head reflector and a coil [illegible] heating elements arranged to give a [illegible], and can be used for frying, toasting, boiling and heating generally. It is 7½ in. diameter and 4 in. high overall.

Contact Suspension Devices.

We illustrate in fig. 12 a new type of contact-suspension device for extra-high-tension circuits, which has been introduced by the LONDON ELECTRIC FIRM, of Croydon.

Both the body and plug are mounted on special corrugated and petticoated porcelain insulators; the suspension feature is the well-tried one, embodying two ratchets in circular form, one superimposed above the other and set at an angle from it. Every alternate tooth in the lower ratchet is cut away to first allow the pins to enter and trap the plug, the second cycle releasing the same and allowing it to pass out.

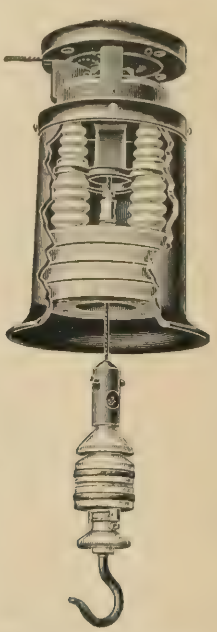


FIG. 12.—NEW CONTACT-SUSPENSION DEVICE.

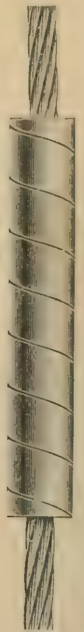


FIG. 13.—WIRE-ROPE PROTECTOR.

To operate the gear, the winch line is drawn up, and the pins, or horns, on the plunger engage with the ratchet and travel up the inclined face of the upper half until the line can be drawn no further; the winch is then slightly reversed, gravity brings the pin straight down, where it is trapped in the ratchet. To lower, the winch line is hauled up again until the pin reaches a dead stop, and a second reversal of the winch lowers the plug with its lamp clear to the ground for trimming. The wire rope is only used for hauling and lowering the lamp, and not for suspending it—an important feature where the continual swinging, due to wind, &c., might cause the rope to give out and drop the lamp to the ground.

In addition to its self-sustaining winch, the firm evolved (to meet the modern high-speed conditions of trimming 80/100 lamps per day) a quicker operating one, which practically fulfils the condition of "dropping the lamp," and at the same time possesses the valuable feature of being self-sustaining both in raising and lowering, without any small ratchets, pawls, springs or triggers; this assures the absolute safety of the lamp under all conditions, whether the handle slips or breaks or the winch becomes otherwise interrupted in operation.

Fig. 13 shows an improved wire rope protector, which is sufficiently flexible to go round the swan neck or other restricted part of a lamp column, and effectually overcomes the old trouble of chafed cables inside the lamp pillar, as the rope works in what is practically a closed conduit throughout its length.

The Wilson Trust.—LOANS TO YOUNG MEN.—It is an axiom among business men that the third year of trade is the most critical. The late Mr. Samuel Wilson, no doubt, had this fact in mind when he originated the important bequest which provides for the loaning of sums ranging from £100 to £300 to young men who have carried on business for one year, and not more than three years, in the City of London, or within five miles thereof. The loans are granted for five years upon unquestionable personal security being provided. Full particulars of the bequest may be obtained from the Clerk of Wilson's Trust, Chamber of London, Guildhall.

WIRELESS TELEGRAPHY.

In the course of a paper read before the North-East Coast Institution of Engineers and Shipbuilders on April 23rd, the author, Mr. H. Fothergill, admirably summarised the present state of the art of wireless telegraphy. Some extracts from the paper are given below.

Fig. 1 shows diagrammatically a popular arrangement of the Marconi system. The electric current is generated by an alternator and passed through the primary coil of a low-frequency, iron-core transformer by which its voltage is increased to that required for charging the condenser in the oscillatory circuit. "The low-frequency or alternating circuit includes additional inductance either in the transformer primary or secondary circuit adjusted so that the natural period of the alternator-transformer-condenser circuit corresponds with the alternator frequency; this adjustment is provided so that the condenser charging current may be about zero value when the condenser is about to discharge." The oscillatory circuit comprises a condenser, the primary coil of a high-frequency air-core transformer, a variable inductance for altering the wave length, and a disc discharger by which the condenser is discharged. This discharger consists of a revolving toothed wheel placed between two stationary teeth, so that every time a pair of teeth comes opposite the stationary teeth, the current sparks across and the condenser is discharged. The time of charge corresponds to a half cycle of the alternator, and to the period during which there are no moving teeth opposite the two stationary teeth.

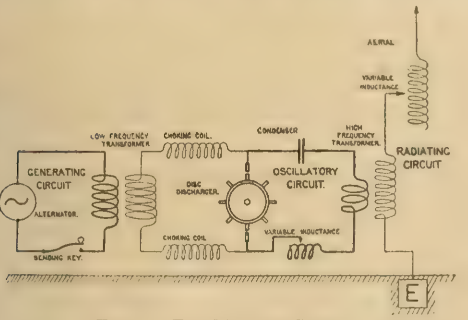


Fig. 1.—The Marconi System.

The radiating circuit in Fig. 1 includes the secondary coil of the high-frequency transformer by which energy is absorbed from the oscillatory circuit and radiated from the aerial wire in the form of electromagnetic waves. A variable inductance is included in the radiating circuit for the purpose of varying the wave length so that it may be brought into tune with the oscillatory circuit. To send a signal, the sending key is pressed down and thus allows the current from the alternator to flow through the primary coil of the low-frequency transformer, which induces a high-voltage current in the secondary coil. This high-pressure current passes round the circuit and charges the condenser, which is periodically discharged, say 450 times per second, by the revolving toothed wheel. Each condenser discharge produces a group of electric oscillations, which by passing through the high-frequency transformer, induce oscillations in the radiating circuit which alternately charge the aerial wire in opposite directions, and in so doing produce electromagnetic waves which are propagated outwards in all directions over the surface of the earth. Choking coils are placed between the low-frequency transformer and the oscillatory circuit, for the purpose of preventing the high-frequency oscillations from passing into the low-frequency transformer and doing possible damage.

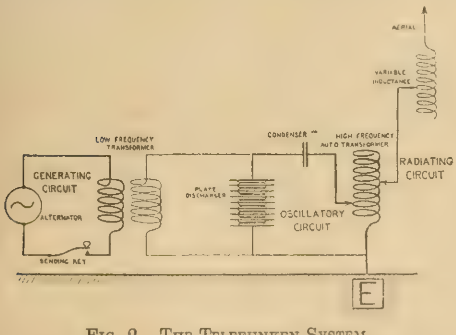


Fig. 2.—The Telefunken System.

The Telefunken system is illustrated diagrammatically in Fig. 2, from which it will be seen that it is similar to the Marconi system; the two companies, however, agreed upon terms which avoided litigation. The principal differences between the two systems are the method of discharging the condenser, and the method of exciting or producing oscillations in the radiating circuit. The discharger, which is illustrated diagrammatically in section in Fig. 3, consists of circular plates of copper separated from each other by mica distance-pieces about 2 mm in thickness. The spark forms at any point on the flat surface of the plates, it is then forced towards the periphery in a radial direction by the electromagnetic field, and is eventually extinguished on its path by a circular groove which the spark cannot bridge. Between each pair of plates is a large disc of thin copper, which is effective in radiating the heat generated by the spark. Short-circuiting plugs, which can be inserted between the copper discs, are provided in order to short-circuit as many gaps as may not be required. The quenched-spark discharge may thus be adjusted to suit the voltage and consequently permit of variations in the power utilised. Since the energy transmitted varies as the square of the number of spark gaps, the regulation by short-circuiting covers a wide range. The pressure per gap is approximately 1,200 volts. The radiating circuit is not indirectly coupled to the oscillatory circuit as in the Marconi system, but is directly coupled by what may be called an auto-transformer, consisting of a copper helix, one part of which is included in the oscillatory circuit, the other part forming a portion of the aerial or radiating circuit.

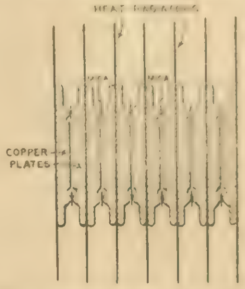


Fig. 3.—Quenched-Spark Discharger.

The action of a coupled-circuit transmitter, whether on the Marconi or Telefunken system, is less simple than would appear at first sight. Just as the currents flowing to and fro in the oscillatory circuit induce similar oscillations in the radiating circuit, so do the induced currents oscillating in the radiating circuit tend to react on the oscillatory circuit.

It was with the object of obviating this wasteful surging and usefully employing the whole of the energy for the radiation of waves, that the Marconi and Telefunken dischargers were introduced, and with this object in view the spark is cut off or extinguished immediately the energy in the oscillatory circuit is first absorbed by the radiating circuit.

If a Marconi revolving disc discharger is suitably designed and run at a predetermined speed, the period during which two moving teeth are passing the two stationary teeth is equal to the period during which the whole of the energy is originally transferred to the radiating circuit; and as the spark is then extinguished, the teeth having moved on, it is impossible for the energy in the radiating circuit to flow back into the oscillatory circuit. The result is that the oscillations continue in the radiating circuit with a steadily decreasing amplitude. During this time the condenser is again being charged ready for discharge by the next two moving teeth which pass the two stationary teeth, when a new series of oscillations will be induced in the radiating circuit. This true effect is obtained with discs running with high peripheral speed, and working with long waves and loose coupling, as the disc may then be arranged to cut off a discharge or spark before any material part of the energy communicated to the aerial is returned to the oscillatory circuit.

In the Telefunken discharger the extinguishing of the spark is effected by the electromagnetic field in which the spark occurs, the field having the peculiar property of forcing the spark outwards at a high velocity. Thus as soon as the energy in the oscillatory circuit is at a minimum and the spark is weakened, it is blown out during its passage through the air space between the copper plates. The oscillatory circuit is therefore broken when the energy absorbed from it by the radiating circuit has reached a maximum, and consequently the oscillatory circuit is unable to reabsorb energy from the radiating circuit, in which the oscillations continue until the next condenser discharge occurs. The action of these quenched-spark devices, particularly the large Marconi discs, is very important, as by their use it is possible to produce series or groups of slightly damped electric oscillations which compare very favourably with the undamped or persistent oscillations produced by continuous-wave systems.

At the present time there are two notable systems which produce undamped or continuous waves.

In theory the Goldschmidt system approaches very closely to the ideal; but so far it has been unfeasible to carry out in practice what appears so desirable in theory.

The inventor has not yet exceeded a frequency of 40,000 per second, which is a long way short of 1,000,000, the frequency required for the 300 metre wave. The system is therefore unsuitable for short wave lengths, and is not likely to come into use for ship-to-shore signalling.

The wave length corresponding to a frequency of 40,000 per second would be 7,500 metres, a wave length which has been frequently used, and therefore the system could be employed for long-distance signalling, but apparently from the negotiations between the Postmaster-General and the Goldschmidt Company in Germany, the system has not yet proved itself reliable.

If the arc employed in the Poulsen system could be constructed of such a size that it could deal with sufficient energy for long-distance signalling, and maintained in a stable condition, then there seems to be no reason why such a system should not become popular, even though its efficiency is very low. But the arc does not remain steady, and it would seem unreasonable to expect it to do so.

The most serious objection to the Poulsen system is not, perhaps, the weakness of radiation, but the variations in the length of the waves transmitted, which result in the signals disappearing at the receiving station owing to the transmitter getting out of tune.

The advantage of a continuous-wave system—if any—must be looked for in better tuning at the receiving station, and in less loss while the waves are travelling over the space between the transmitting and receiving station; neither of which advantages has up to the present time been satisfactorily demonstrated.

As the load on the Goldschmidt and Poulsen generators must not be varied in signalling, as this would affect the frequency, in both systems the generator is continually under load, and the intermittency necessary for the dots and dashes of the Morse code is produced by varying the wave length in the aerial circuit so that at times it is out of tune with the receiving station. In the damped-wave or spark system, the generator supplies energy only when the sending key is pressed down, and as the average spacing time between signals transmitted is 40 per cent. of the total time, it will be seen that a saving of 40 per cent. is obtained with the undamped-wave or spark system.

The efficiency of the Marconi disc discharger at Clifden is in the neighbourhood of 75 per cent., this figure representing the proportion of energy in the aerial as compared with the output of the dynamo. The efficiency of the arc method is only 14 per cent., this figure having been given by Dr. Poulsen himself. The efficiency of the Telefunken system compares very favourably with the Marconi system, and is said to be about 60 per cent. It should be stated, however, that it is doubtful how far these efficiencies are applicable for the purpose of comparison between the different systems, as the only satisfactory comparison is between the primary energy at the transmitting station and the strength of the signals received at the receiving station.

Interference from atmospherics is liable to be greater in the case of the Poulsen and Goldschmidt continuous-wave systems than in the case of a discontinuous-wave system, which may be either a damped-wave system or a variation of the Marconi continuous-wave system, wherein the continuous waves are cut up at the transmitting station. It will perhaps be of interest to state that in the Marconi continuous-wave system the waves are produced by impulsing the aerial at frequent, regularly spaced intervals, the impulses being timed so as to maintain the oscillations in the aerial. As the wave length is determined by the inductance and capacity of the circuits, and as the impulsing is regulated by a disc running independently, and not affected by the load, the transmitted wave length is independent of the load also, and consequently the system lends itself to the highest degree of selective working, in contradistinction to the Goldschmidt and Poulsen continuous-wave systems, where the transmitted wave depends in the one case on the speed of the alternator, and in the other case on the condition of the arc.

The Marconi Company have been working on a commercial scale for several years between Clifden in Ireland and Glace Bay in Canada, a distance of about 2,300 miles, and it should be mentioned that messages can be sent at night a distance of 5,849 miles from Clifden to Buenos Ayres. The Telefunken system, although largely used, has not yet been commercially employed for distances of 2,000 miles; but experiments are now being made at night between Nauen and Togo, a distance of 4,000 miles. The Poulsen system has been tried between San Francisco and Honolulu, a distance of 2,100 miles, but no evidence has been obtained as to its practicability over this distance, and it is doubtful whether a stable arc can be produced of sufficient size to charge an aerial with high power. There appears to be no evidence to show that the Goldschmidt system has been used over long distances, although it is anticipated that long-distance transmission will be accomplished at an early date.

Some particulars are given of the Marconi stations in course of erection in connection with the Imperial wireless chain. The wave lengths of all stations will be as great as possible within the limits of 15,000 and 50,000 feet (consistent with keeping the capacity, inductance and size of the aerials within reasonable limits) in order to ensure reliability of reception at all times of the day and night; but the wave lengths transmitted from any one station will be in all cases at least 25 per cent. different from those transmitted from other stations within its normal range, and with which it has to communicate. In all cases there will be a difference of 5 per cent. between the wave lengths emitted from any one station in order that each corresponding receiving station with which this station has to communicate may be able to tune out the waves emitted by the said station for the other station or stations with which it is also communicating. Where a station is required to communicate in more than one direction, a separate transmitting aerial and a separate receiving aerial will be provided for each direction. The note of each station will be different from those of any other stations within its range, but the notes of each transmitting circuit in any one station will be identical.

The power plant at each station will be in duplicate, and will include two water-tube boilers, each capable of generating sufficient steam for the whole requirements of any one transmitting circuit. In the case of stations required to send in two directions three boilers will be provided; and in the case of the station in Egypt, which is required to transmit in three directions at the same time, four boilers will be provided.

The boilers will supply steam to turbines directly coupled to alternating-current generators which in turn will be coupled to revolving disc dischargers. The total power, including spares and auxiliaries at the terminal stations, will be approximately 1,300 H.P., and the power at the intermediate stations will vary from 1,900 H.P. to 2,500 H.P. Two auxiliary sets will be provided at every station, each consisting of a turbine coupled to a direct-current generator for supplying exciting current to the alternators and current for lighting and other auxiliary purposes.

The transmitting aerials will be of the multiwire-directional type and will consist of a number of horizontal parallel wires supported 300 feet high by 10 masts, each wire being composed of seven strands of No. 19 S.W.G. silicon bronze wire and brought down at one end to the transmitting station. The masts will be of the sectional steel tubular type, the aerial wires passing through insulators attached to triatics stretched between pairs of masts, each mast being capable of withstanding a permanent horizontal strain of not less than 2 tons at the head of the mast, in addition to windage calculated at the rate of 30 lb. per effective square foot. The centre line through the horizontal portion of the aerial will coincide with the line of direction of the station with which it is desired to communicate, the free or elevated end of the aerial pointing directly away from the communication station. The size of the aerials in each case will depend upon the length of wave emitted, but in no case will the length of each aerial be less than one-twelfth the wave length that the aerial is required to radiate.

The earth system will consist of a series of galvanised iron plates buried in a symmetrical position relatively to the station house and connected to it by a system of radial conductors of galvanised iron wire leading to each plate from another set of plates buried around the station building. This arrangement will be supplemented by a number of longitudinal earth wires running parallel to and below the horizontal wires of the aerial.

Each transmitting circuit at each station will be provided with five transformers and a condenser consisting of about 500 cells. The high-frequency transformer for each circuit (refer to Fig. 1) will comprise a multistranded primary conductor forming part of the oscillatory circuit, and a secondary winding connected to the radiating circuit and consisting of a special solenoid of similar cable to the primary winding but of smaller size. These primary and secondary windings will be entirely separate and arranged to be moved away from each other so that the coupling of the two circuits may be varied. The disc discharger in the oscillatory circuit will consist of a studded wheel, the number of studs corresponding to the number of the alternator poles, so that the condenser can be discharged at the moment of maximum amplitude in each alternation of the current. The two side electrodes, between which the moving studs pass, are of special construction and consist of slowly revolving discs so as continually to present a cool surface for the electrical discharge between them and the studs.

The receiving and operating stations will be not less than 10 miles distant from the transmitting stations, and will be provided with balancing aerials so as to prevent interference by the waves radiated from an adjoining transmitting station. The receiving aerials will consist of one or more silicon-bronze, stranded conductors about 8,000 feet long and arranged similarly to the wires of the transmitting aerials. The operating room will be fitted with Morse hand keys and Wheatstone or other automatic transmitters of similar type. These will be connected by means of wires to the transmitting station which will be operated from the receiving station.

An Undesirable Bed-Warmer.—A fire, which might have been accompanied by disastrous results, was recently caused in a curious way by a storage battery which had been temporarily placed beneath a bed. The occupant of the room in sitting on the bed caused the springs to sag, short-circuit the battery terminals, and fuse, thereby burning a hole in the mattress and setting fire to the bedding. The battery had been removed from an automobile and was being stored for the rest of the winter beneath the bed.—*Electrical World.*

BUSINESS NOTES.

Catalogues and Lists.—Sunderland Forge and Engineering Co., Ltd., 31, Budge Row, Cannon Street, E.C.–40-page catalogue containing full descriptive matter, with photographs and prices, relating to electric winches for ships, shipyards, docks, &c. A list of some of the vessels provided with these winches is given in a separate folder.

Edison & Swan United Electric Light Co., Ltd., Ponder's End.—Six-page illustrated price list of electric fans, some new patterns of convertible table or bracket fans, ceiling, ring, or porthole fans, for the current season, being included.

British Thomson-Houston Co., Ltd., Rugby.—Price list No. 2,520 contains brief illustrated particulars and fully tabulated prices of their motor and generator pulleys.

Adnil Electric Co., Ltd., Artillery Lane, London, E.C.—List AE 61 gives tabulated speeds, voltages, prices and code-words of small power A.C. and D.C. motors and sewing machine equipments. List AE 64 is a 12-page illustrated pamphlet showing a number of fittings for half-watt lamps—outside shop window and indoor fittings—shade-holders for Goliath screw sockets. Goliath holders with spring-tongue contacts, and semi-indirect half-watt fittings. Prices, shipping weights and dimensions are tabulated.

The London Electric Supply Corporation, Ltd., 25a, Cockspur Street, London, S.W.—Illustrated list describing the "Deptford" patent self-cleaning water strainer for condensing plants, &c.

Mr. E. Ingram-Hill, 26, Stanton Road, Wimbledon, S.W.—Pamphlet concerning technical advertising and his readiness to assist firms in the electrical and engineering industry.

The Sloan Electrical Co., Ltd., Conradty House, 12, Golden Lane, E.C.—Price list showing the "Hofmann" patent rivet jointers, and "S L" wire-joining tubes and tools, with which sound electrical joints can be made very quickly, without solder.

Messrs. Edison Accumulators, Ltd., 2 and 3, Duke Street, London, S.W.—28-page publication entitled "All about Edison Accumulators." Some notes regarding the invention of the battery are followed by details of its construction, advantages, "the Edison guarantee," the application of the battery for traction and non-traction services, tabulated data, prices, dimensions and characteristics, instructions and general information. The list is well illustrated, and should be useful to those interested in electric vehicles, ignition, &c.

The Electrical Apparatus Co., Ltd., South Lambeth Road, London.—Folder No. 5 gives illustrations and brief particulars of starters for direct-current motors up to 200 H.P.

Bankruptcy Proceedings.—William Henry Pease, electrical engineer, 19, Princess Royal Terrace, Scarborough, York.—The adjourned public examination of the above debtor was held last week at the County Court Hall, Bank Street, Sheffield. In reply to questions by the Official Receiver, debtor stated that he owed £769 and £4 odd for rent. The assets were estimated at £249. His total losses during the past two years had been £560. In February, 1912, and in August last, he had had recourse to moneylenders. He commenced business in Scarborough in March last because he thought there was an opportunity as there was only one man to compete against. He attributed his failure to bad health and losses on contracts. The case was concluded.

J. W. Garsden (J. W. Garsden & Co.), electrical engineer, Blackburn.—July 6th is fixed for the hearing of debtor's application for discharge, at Blackburn County Court House.

Chas. Blake (Bilston Electrical Co.), electrical engineer, Bilston.—An amended notice appears in the *Gazette* to the following effect:—"First and final dividend 8s. 3d., payable June 3rd, at Official Receiver's Office, 30, Lichfield Street, Wolverhampton."

Joseph Swainson (J. Swainson & Co.), electrical contractor, 22, Bootle Street, Manchester.—June 16th is the last day for receipt of proofs for dividend. Mr. A. Yearsley, 27, Brazennose Street, Manchester, trustee.

C. H. Kitching, plumber and electrical engineer, Hull.—Application for debtor's discharge is to be heard on July 8th.

F. J. Behrens, electrical engineer (trading as Fred. Burns), Market Street, Barnsley.—June 17th is the last day for the receipt of proofs for dividend. Trustee: Mr. B. S. Briggs, Official Receiver, 21, King Street, Wakefield.

Book Notices.—"Electric Light Accounts and their Significance." By H. M. Edwards. London: Hill Publishing Co., Ltd. Price 8s. 4d. net.

"The Mechanical Design and Construction of Generators." By R. Livingstone. London: *Electrician* Printing and Publishing Co., Ltd. Price 9s. net.

Messrs. W. & G. Foyle, of 121-123, Charing Cross Road, W.C., have sent us a copy of their catalogue of technical and scientific books, both new and second-hand, including a wide range of works on electricity and electrical engineering and the allied sciences.

Dissolutions and Liquidations. — Cambridge Electric Tramways Syndicate, Ltd.—This company is winding up voluntarily with Mr. A. W. Langbam as liquidator. A meeting of creditors is called for June 13th.

Hopkins and Darley, electrical, mechanical and motor engineers, St. Alban's Road, Watford.—Messrs. J. Hopkins and L. Darley have dissolved partnership. Mr. L. Darley attends to debts.

Wheatley Engine Co., oil engine makers, Armley, Leeds.—Messrs. J. R. Wheatley and A. M. Lowery have dissolved partnership. Mr. Wheatley will attend to debts and continue the business.

Trade Announcements.—The Davis Electrical Co. are giving demonstrations of "Delcoblast" and its use at 17, Moor Street, W., twice a day during June.

Messrs. Pritchetts & Gold, Ltd., have just removed to their new works at Dagenham Dock, Essex, to which address communications such as have hitherto been sent to Feltham, should in future be sent. The new works have facilities for a greatly increased output, and have better access to rail and river. The address of the London office, 58, Victoria Street, S.W., remains unchanged.

Mr. Fred. S. Lee has recently commenced business in electric supplies on his own account at 418, George Street, Sydney, N.S.W., and he invites manufacturers and agents to send him information respecting electrical apparatus, particularly accessories. Mr. Lee was for seven years with Messrs. Lawrence & Hanson; for 4½ years with Messrs. Noyes Bros., as manager of their electrical supplies department; and was manager of the G.E.C., South Australian branch.

The British Insulated and Helsby Cables, Ltd., are about to build new offices at their Helsby works.

The telephone number of the Record Electrical Co., Ltd., of Caxton House, has been changed to "Victoria 6700" (two lines).

LIGHTING and POWER NOTES.

Atherton.—Proposed Loan.—The U.D.C. has decided to apply to the L.G.B. for sanction to borrow the following sums to meet the cost of supplying electricity to Laburnum Mills:—£900 for transformers, £250 for switchgear, and £1,850 for mains.

Barnstaple.—Year's Working.—The gross profit for the past year of the Corporation electricity department amounted to £2,201, a decrease of £136 on the previous year, which is more than accounted for by the increased price of coal. Net sales yielded £5,222, an increase of £414, and there is a net surplus of £104.

Belfast.—Expert Advice.—The Tramways and Electricity Committee has approved of a recommendation that the services of Mr. J. F. C. Snell and Mr. W. J. Pratten (Belfast) be obtained to report on the present condition of the plant at the generating station, and the future development of the electricity undertaking.

Bexley.—The U.D.C. has informed the Foots Cray E.S. Co. that, subject to the necessary loans being sanctioned by the L.G.B., and to the agreement being determinable by either side at the end of 7 or 14 years by two years' notice, the Council will supply electricity to the company at an average price of 1·45d. per unit.

Blackburn.—Annual Accounts.—We have received from Mr. Wheelwright, the borough electrical engineer, a copy of the year's accounts of the electricity undertaking. The income for the year was £48,400, the gross profit £24,217, and the surplus £5,037, as against £5,545 in 1912-13. Some 7,200,000 units were sold, including 3,800,000 for power, motors of 6,000 B.H.P. being connected to the mains. In view of the demand for energy from adjoining areas and for local industries, it is pointed out that the site of the proposed new power station will require to be settled in the near future. The report contains a series of excellent charts showing the ordinary and power load curves, the latter being for the three-phase mill supply.

Extension of Supply.—The Electricity Committee has decided to extend the supply of electricity to the Mill Hill district.

Blackpool.—Electric Cooking.—All the cooking at the new dining and tea room of the Blackpool Tower Co. is to be done by electricity, the equipment having been supplied by Messrs. Jackson, Ltd., of London.

Blean (Kent.).—Overhead Wires.—The R.D.C. has decided to refuse consent to the erection by the Whitstable E.L. Co. of poles for overhead wires in the Council's area for the supply of electricity, on the ground that the poles would be unsightly and dangerous to traffic.

Brighton.—E.L. in Workmen's Dwellings.—The Health Committee has decided to install E.L. in 12 more houses in Tillstone Street; the electrical engineer has reported that the scheme so far has given every satisfaction, and the cost to the tenants works out at 6d. per week per house.

Workhouse Lighting.—The B. of G. has decided to have the E.L. installed in the North Ward of the workhouse, at a cost of £42 for materials, the work to be carried out under the supervision of the master.

Burnham (Somerset). — Street Lighting. — The U.D.C. has accepted a scheme for improved public lighting by electricity.

Cannock (Staffs.).—Workhouse Lighting.—The B. of G. has appointed a Sub-Committee to consider the question of lighting the workhouse premises and offices with electricity.

Colne.—Proposed New Plant.—The Electrical Committee has further considered the report submitted by the electrical engineer upon the proposed installation of new generating plant, and has recommended that Mr. S J. Watson, electrical engineer, of Bury, be consulted upon the scheme.

Colwyn Bay.—The Council has retained Mr. E. M. Lacey to advise regarding the proposed new electricity works.

Continental Notes.— Germany. — Messrs. Brown, Boverie & Co. have on order a 40 000-h p., 10,000-11,000-volt, 50-cycle turbo-generator, which, with condenser, will weigh 385 tons, and is to be installed in the public generating station at Elverlingsee, near Hagen.

An electrical exhibition is to be held in Frankfort-on-Main in August and September. The hall has an area of over 10,000 sq. metres, and is likely to be well filled. It will be remembered that the 1891 Frankfort Exhibition played an important rôle in the history of electrical transmission.

The Westfalen Elektricitatswerk has decided to expend £300,000 in the construction of a generating station at Stockum, for the supply of the towns and villages throughout Münsterland, in Westphalia.

The District Council of Münsterberg has resolved to construct departmentally, on communal ground, a large generation station for the supply of 14 districts in the north and west portions of the Government district of Oppeln. The establishment will be, it is stated, the largest of its kind in Prussia, and will work in conjunction with an existing station.

Italy.—La Società Imprese Idrauliche ed Electtrichi del Tirso has just been formed in Leghorn with a capital of £140,000, to utilise the waters of the River Tirso, on the Island of Sardinia, in the generation of electricity. It is stated that 20,000 h.p. is available.

Russia.—The Council of Ministers has authorised the town of Nijni-Novgorod to raise a loan of about £124,000 for the installation of electric light in the town. The loan is subject to the usual proviso that all orders for material and equipment must be given to Russian firms, unless special authority to purchase outside Russia is obtained from the Ministers of the Interior and of Commerce.—*Board of Trade Journal.*

The Technical Committee appointed by the Senate to consider the question of the exploitation of the waterfalls on the Vuoksa, in Finland, has expressed itself contrary to the grant of the concession to the St. Petersburg Electricity Transmission Co. for the construction, near the village of Kermanpochiya, of a power station of 360,000 h.p., connected by a canal with the Saimensk Lake, for the supply of electricity to St. Petersburg and district.

The Russian Minister of Traffic has completed the preliminaries for a Draft Bill for the utilisation of Russia's water resources. The following definitions and considerations form the basis of the Bill :—The right to utilise the available water resources belongs exclusively to the State, which can either develop them itself or grant concessions for their utilisation. Such a concession can never be apportioned for all time as a private possession, but must be restricted to specified periods, whereby it may be possible to control both the terms under which the utilisation of the water resources will be accorded to private individuals, and also their object. The State's right of inspection is specifically laid down in the Draft Bill.

According to the *Financier*, the St. Petersburg T.C. on May 4th considered the report of the committee chosen to examine the question of the purchase by the Council of the lighting concerns within its area, in connection with the electric lighting of the capital. The conclusions of the committee were that the operations of the lighting companies were far from satisfactory, and were unprofitable to the citizens; that to improve and cheapen the electric light it was necessary for the town to have the lighting in its own hands, to construct its own electric generating station, and to extend the mains along all the streets or purchase the electric concerns now in existence. According to the agreement, the town has the right to take them over in 1917, and this would be necessary, even if for a time an annual payment were made exceeding the net profits received by the town, considering that the chief object of the proposal, as far as the town is concerned, consists in suiting the convenience of the inhabitants as far as possible, and not altogether in extracting profits. The committee advises the Duma to ascertain the revenues of the concerns in order to fix the redemption sum. The Council did not immediately accept the suggestions of the committee, but appointed another committee to further elucidate the situation, and has allocated 10,000 roubles for its use in the inquiry.

Holland.—An electric supply station is to established at Groningen to supply current to the province of Groningen, the northern part of Drenthe and part of Friesland. In order to advertise the scheme, an exhibition showing the applications of electricity to farming and dairying is to be held in August.—*La Gazette de Hollande.*

Crompton.—L.G.B. Inquiry.—An unopposed inquiry was held on May 28th into the application of the U.D.C. for a loan of £4,012 for a refuse destructor and steam disinfector.

Derby.—Proposed Loan.—The T.C. has applied to the L.G.B. for a loan of £12,550, including £6,000 for mains, £600 for services, £5,000 for motors, £300 for transformers and switchgear, £350 for ash elevator and bunker, and £300 for a motor vehicle.

Dudley.—The B. of G. has retained Mr. E. M. Lacey to report on the electric lighting and heating of the infirmary, and to prepare a scheme.

Durham County.—Proposed Overhead Wires.—The County of Durham E P.S Co. has applied to the B. of T. for consent to erect a 20 000-volt overhead line from the sub-station at Hylton to Southwick, through the areas of the Sunderland R.D.C. and the Southwick U.D.C., both of which have consented.

Easington (Co. Durham).—Workhouse Lighting.—The B. of G. has decided to install electric light at the Workhouse and Poor Law Offices.

Gillingham (Kent).—Price Reduction.—As a temporary measure, until a revised list of charges is adopted, the T.C. has decided to reduce the price of electricity for domestic purposes other than lighting from 1d. to ¾d. per unit.

Glasgow.—New Power Station.—The erection of the generating station at Dalmarnock, which will in time supply the whole city, the present stations acting as auxiliaries, has been commenced. The work will be carried through in two sections, the cost of which will be £250,000 each.

Grimsby.—Annual Report.—The net profit of the Corporation electricity department for the past year amounted to £4,061, compared with £3,147 in the previous year. The total income was £24,016, against £21,230, and the working expenses totalled £12,896, against £11,441. After meeting various expenditure of a capital nature on plant, amounting to some £3 500, £500 was allocated to rate relief. Of the increased revenue £2,144 was from private consumers, which, the engineer states, is due to canvassing, as the price of current has not been reduced for three years.

Lancaster.—Year's Working.—The income of the Corporation electricity department for the past year was £9,185, against £9,217 in the previous year, and the total expenditure was reduced by £42. There was an increase of 12,714 units sold for lighting, and 38,522 for power. The net profit was £349, against £339.

London.—Bethnal Green.—At a meeting of the B.C, last week, the Electricity Committee reported the receipt of a letter from the Association of Consulting Engineers, concerning the proposal of the B.C. to advertise for an engineer for its electricity scheme, and stating that it was against the rules of the Association for members to reply to advertisements. In the circumstances, the Committee again recommended that Mr. J. F. C. Snell be appointed, at a fee of £5 per cent. An amendment that the fee be fixed at £953 was defeated. A letter was then read from Mr. Snell, in which he stated that, after the proceedings at the previous meeting, he declined to act in any way in the matter. In his opinion, the Council's arrangements as to the appointment of an engineer to carry out the scheme would lead to difficulties, and possibly increased expenditure, and he declined to accept any responsibility for the scheme or estimates which he had prepared if the work was carried out by an unqualified man. The letter was referred to the Electricity Committee.

Hammersmith.—The Electricity Committee has recommended the B C. to supplement the main in Goldhawk Road, at a cost of £1,153.

Manchester. — Year's Working. — For the past financial year the Corporation electricity department earned a revenue of £513, 589; working expenditure absorbed £276,484; interest, £66,992; debt redemption, £111,764; and £22,343 was transferred to renewals. The net surplus was £36,006, and of this £28,705 was devoted to rate aid. The sales of energy during the year totalled 118 million units.

Monmouth.—L.G.B. Inquiry.—An inquiry has been held into the application of the T.C. for sanction to borrow £1,800 for electricity mains, &c., which broke down in December last. New cables have been laid, and the application was to cover the expenditure incurred.

Padiham.—The Burnley T.C. has asked the Council if, in the event of Burnley acceding to its request to extend its tramways into the town, it will take a supply of electricity for lighting purposes from the Burnley T.C.

Perth.—Station Lighting.—The Joint Station Committee having experimented with gas in all forms, including high pressure, has decided to install electric lighting throughout the station, including the signals. It is also proposed to introduce E.L. in the post office buildings in High Street.

Rawtenstall. — Loan Sanction. — The L.G.B. has sanctioned the borrowing by the T.C. of £9,900, for extensions at the electricity works, and £1,000 for street lighting.

Reigate.—Electricity in Road Making.—The T.C. has offered to supply electricity for power to the Surrey C.C., to be utilised at a local depôt for making bituminous surfaces for roads, at 1¼d. per unit on the minimum consumption of 30,000 units per annum for three years.

Southborough. — Proposed Bulk Supply. — The U.D.C. has appointed a Committee to discuss with the Lighting Committee of the Tunbridge Wells T.C. the question of the supply of electricity in bulk, and is communicating with the Tonbridge U.D.C. on the same matter.

Stalybridge.—Proposed New Station.—The Joint Tramways and Electricity Board has decided to apply for powers to erect and equip a new generating station.

Stockton Heath.—Proposed E.L.—The Warrington T.C. has intimated that, in the event of powers being obtained, it is prepared to supply electricity in Stockton Heath for lighting purposes upon similar terms to those in force in Warrington, and the P.C. has decided to support any application for powers by the T.C.

Sunderland.—Annual Report.—The report of Mr. Blackman, the borough electrical engineer, for the year ended March 31st, 1914, shows that the total sales amounted to 14,870,527 units, including 9,727,844 for power, 1,839,420 for lighting and heating, 816,787 for small motors, 682,257 for public lighting, and 1,804,219 for traction. The works cost per unit was ·37d., a reduction of ·03d. on the previous year, and the total cost ·97d. per unit, a reduction of ·1d. The total income was £73,518, and the expenditure £36,221; £10,739 was paid for interest on loans, £15,800 for the repayment of loans, and £9,011 has been carried to the renewals fund. The maximum load was 6,700 kw., and the load factor 25 per cent. Capital expenditure now approximates £40 per kw.

Swinton (Lancs.).—All the machinery in the new works which are being built by Messrs. Gerrard & Sons, builders, is to be electrically driven.

Swinton (Yorks.).—Last week a mishap occurred at the works of Messrs. Hattersley, stove grate makers, of Swinton, involving a stoppage of the plant which was driven by steam power, and work was suspended. The firm, however, arranged with the Mexboro' and Swinton Tramways Co. to connect the works with the tramway system and install a large electric motor, and work was resumed after only one or two days' stoppage.

Todmorden.—Proposed Loan.—The Electricity Committee has decided to apply to the L.G.B. for sanction to the borrowing of £1,000 for mains, and £200 for meters.

Torpoint.—E.L. Scheme Abandoned.—A poll of the ratepayers on the question of using electricity or gas for street lighting resulted in a majority of 55 for electric lighting. The Council had sealed an agreement with an E.L. Co. which was being promoted, but as sufficient support was not forthcoming, the company last week decided not to proceed to allotment.

West Bromwich.—Year's Working.—The total income of the Corporation electricity undertaking for the past year was £18,313, an increase of £650 compared with the previous year. The total expenditure was £12,518, an increase of £298. The net profit was £29.

Worcester.—Year's Working.—The income of the Corporation electricity department for the past year amounted to £21,523, compared with £19,418 in the previous year. The gross profit was £10,879. After paying £3,640 for interest, and £6,777 for reduction of capital, there was a net profit of £463, which has been appropriated for further improvements in connection with the undertaking, the total cost of which was £968, and there was therefore a deficiency of £535 on the year's working. Altogether 432,745 additional units were sold, including 33,289 for lighting, and 388,811 for power and heating. The total costs per unit was ·930d., compared with ·941d. for the previous year.

TRAMWAY and RAILWAY NOTES.

Accrington.—Workmen's Fares.—The Tramways Committee has decided to issue double workmen's tickets, which enable passengers to travel to and from work twice, at a charge of 2d. Bundles of 1d. tickets are to be issued at seven for 6d.

Argentina.—Subway Projects.—Two directors of the Lacroze Tramways Co., Drs. Miguel and Teofilo Lacroze, left on April 10th on a visit to Europe and America to study the underground railways and electric tramways systems, in connection with the proposals of the Lacroze Co. to extend its system. A short stay will be made in London, in order to study the financial side of the subject, and a visit will be paid to the Panama Exposition, at San Francisco, where the exhibits will represent the last word in tramway construction. The directors will return to Buenos Ayres towards the end of 1915, when the extensions will be commenced.—*Financial News.*

The Government has ordered civil proceedings to be instituted against the Port and City of Buenos Ayres Tramways Co. for the recovery of $232,749 m/n., which is claimed for paving dues.—*Review of the River Plate.*

Asiatic Turkey.—La Societe des Tramways de Smyrne has secured a concession for the supply of electricity in the town of Smyrna, and has also obtained sanction to convert its tramways to electric traction.

Bingley.—Tramway Extension.—The D.C. has decided to apply to the B. of T. for powers to borrow £10,000 for the completion of the tramway extension from Nab Wood to Bingley, on which £26,000 has already been spent.

Burnley.—Proposed Extensions.—The T.C. is to seek powers for several tramway extensions, including a link with the Rawtenstall Corporation tramway at Loveclough, a distance of nearly 3 miles, and until this is constructed, a railless trolley or motor-'bus service will be installed. A report is to be obtained on advisability of running motor-'buses generally throughout the borough.

Canada.—Nova Scotia.—A Bill has been introduced to incorporate the Nova Scotia Tramways and Power Co. The directors are largely the same as those of the Halifax Electric Tramway Co. The capital is to be $5,000,000, with powers to increase it to $10,000,000, and there is to be an authorised bond issue of $9,000 000. The measure authorises the new company to purchase the Halifax Electric Tramway Co.

Colne.—The T.C. has approved a scheme for the repainting and rebuilding of the whole of its tramway cars, at a cost of £2,414.

Continental Notes.—Germany.—The trials of multiple-unit trains on the Silesian mountain railways have proved very satisfactory, and the service is to be extended to Fellshammer, and shortly to the Austrian frontier, at Halbstadt, a total distance of 35 km. The full electrical service will be put into operation before the end of the year, and the working of through trains by locomotives will commence during this summer. To the existing motor-generator station at Nieder-Salzbrunn will be added others at Ruhbank, Hirschberg and Lauban. The power station is in Mittelsteine.

A light electric railway from Neunkirchen (near Saarbrücken) to Spiesen and Elversberg is to be commenced forthwith, and completed before the winter.

Italy.—A company has been formed at Bologna, under the style of the Società Anonima Elletrovie Emiliane, with a capital of 1,500,000 lire, for taking over and working concessions for electric railways and tramways.

Terms have been agreed upon between the Government and the Subconcessionary Co. constructing the Ambertide-Todi-Terni railway and the branch to Ponte S. Giovanni Perugia for the conversion of the system to electric traction. Instead of a subsidy of 7,500 lire per km. for 70 years, the Government is to pay 10,000 lire for 50 years, and to accept 15, instead of 20 per cent. of the profits. These modifications are induced by the special importance of the projected lines, and the advantages accruing to the public from their electrification.

La Societa Filovie di Cuneo has secured a concession for the construction of a narrow-gauge electric railway, about nine miles long, between Cuneo, Peveragno and Chiusa.

Coventry.—Annual Accounts.—The accounts of the T.C. tramways department for the year ended March 31st, 1914, show that the total revenue was £43,484, against £39,153 for the previous year. The car-mileage run was 1,125,705, against 994,207. Working expenses amounted to £29,116, against £24,118. The net profit was £696, which has been carried forward. The total receipts per car-mile were 9·271d., as compared with 9·451d. in the previous year. Six motor-omnibuses have been introduced to provide transit facilities to those districts not served by tramways.

Glasgow.—Year's Working.—The working of the Corporation tramways department for the year ending May 31st, 1914, resulted in a total revenue of £1,078,691, an increase of £71,038 on the previous year. The car-miles run were 24,403,482, an increase of 1,068 474, and the passengers carried numbered 336,654,624, an increase of 25,174,538. Traffic receipts per car-mile worked out at 10·609d., an increase of ·245d., and receipts per passenger at ·769d., a decrease of ·007d.; 211 million passengers were carried at ½d. fares.

Huddersfield.—Extensions Approved.—The Corporation's tramway extension from Elland to West Vale was inspected and improved by Col. Druitt, B. of T. Inspector, on Friday last.

Hull.—Year's Working.—The net revenue of the Corporation tramways department for the past financial year was £33,571, and the net profit £14,526, an increase of £1,091. The passengers carried numbered 45,679,094. The traffic revenue was £165,893, and the working expenses £117,795. The reserve fund now stands at £136,304.

Keighley.—Year's Working.—During the year ended March 31st last, the tramways carried 3,606,218 passengers, and the cars ran 241,917 miles; the motor-'buses carried 402,158 passengers and ran 64,742 miles, and railless traction vehicles carried 98,264 passengers and ran 17,114 miles. There was a surplus of £450 on the tramways and £284 on the railless traction, and these amounts were transferred towards meeting a deficiency of £964 on the motor-omnibus account. The T.C. hopes that the railless traction systems to Oakworth and Eastburn will be ready in a month or two, and the Tramways Committee apparently wishes to get rid of the motor-'buses altogether; one speaker said they had cost the town upwards of £10,000.

Lancaster.—Year's Working.—The traffic revenue of the Corporation tramways department for the past year was £5,779, against £5,437 in the previous year. The net deficit, after paying interest and redemption, was £1,928, against £2,254.

London.—Electric Vehicles.—We are informed that there were 13 electric vehicles in the commercial motor parade on Monday last. All of these were fitted with Edison batteries.

L.C.C.—The Tramways Conciliation Board has issued its award in connection with the demands of the employés of the tramways department of the L.C.C. The hours of labour of the men on shift duty at the generating station are to be reduced to 52 per week as from June 1st, 1914, and concessions have been granted to the permanent way staff. The cost of the award to the Council is estimated at £5,600 per annum, and no further applications for increased pay are to be considered for two years.

Stainland.—Proposed Tramway Extensions.—The U.D.C. has decided to ask the Huddersfield T.C. to extend its tramway system from West Vale to Stainland, thus making a circular route.

Stalybridge.—The 1d. minimum fares on the tramways of the Joint Board have so far resulted in increased receipts but fewer passengers, compared with the figures for last year. The receipts during the eight weeks since the system was adopted increased by £313, while the decrease in the number of passengers was 70,849.

Sunderland.—Annual Report.—The total revenue of the Corporation tramways department for the year ended March 31st last was £75,226, as against £68,507 in 1913. The passengers carried numbered 18,475,671, as against 16,972,537. The working expenses were £42,661, or 6·805d. per car-mile, as compared with 6·334d. in the previous year. The net revenue was £32,565, of which £6,837 is absorbed by interest on capital, and £9,948 by repayment of loans; £9,718 has been placed to the renewals fund and £5,000 in aid of the rates. The reserve and renewal fund now stands at £39,508. During the year 500 rail joints were cut and inserts electrically welded by the Tudor Co., and 250 joints were dealt with by oxy-acetylene welding.

West Bromwich.—The General Purposes Committee of the T.C. has considered the question of transit between the centre of the town and the outlying districts, and has now issued a report advocating the introduction of motor-'bus services. The principal reason which induced the Committee to come to this decision was that the capital cost of four motor-omnibuses and garage would be about £4,000, as compared with £10,514 for trolley vehicles. It is estimated that there will be a deficiency on the undertaking of £640 per annum, to be met out of the borough fund.

Year's Working.—The net profit on the past year on the Corporation tramway undertaking was £261, which has been carried forward.

TELEGRAPH and TELEPHONE NOTES.

China.—It is announced from Peking that preparations have been started for the establishment of four wireless telegraph stations in China, at Peking, Hankow, Shanghai, and Chefoo. It is also reported to be the intention to establish similar stations at Canton and Chengtu.

German Trans-Atlantic Wireless Telegraphy.—The Compagnie Universelle de Télégraphie et Téléphonie sans Fil, of Paris, whose shares are held mostly by the English Marconi Co., has acquired the foreign (extra German) Goldschmidt patents from the Hochfrequenzmaschinen-A.G., together with an option on the Eilvese station near Hanover. It also bought the Tuckerton station in America, which was built to communicate with Eilvese. The German Telefunken Co. has now bought from the above French company the option on the Eilvese plant in order to secure an influence on the trans-Atlantic communication with Tuckerton. If this option is exercised the Telefunken Co. and the Hochfrequenzmaschinen-A.G. Co. will form a joint operating concern, but it is not yet decided which system will be adopted for working.

Portsmouth.—The transfer of the Corporation telephone system to the Post Office, comprising 10 exchanges and 2,000 subscribers, has been completed, the price paid being £30,000.

South Africa.—Attention has been called in the Union Parliament to the grievances of telegraph servants, the grounds for dissatisfaction being questions of salary, promotion, leave, &c., but principally the trouble would seem to be that the department is grossly understaffed. Johannesburg is the busiest telegraphic centre in the Union, and understaffing, especially at transmitting centres, is chronically in evidence; complaints have been made regarding delays which could easily be avoided were the stations properly staffed. It appears that fully-qualified operators have not been drafted into offices when necessary, but only juniors, who are not capable of taking on the responsibilities of qualified operators, and the result has been a burden upon the shoulders of the capable men.

Television.—Last week, in the course of a lecture before the Institute of Automobile Engineers, Dr. A. M. Low exhibited an apparatus for seeing at a distance by electric transmission. The apparatus was in somewhat crude form, but is stated to have reproduced a picture more or less successfully. The principle employed is well known; the picture is projected upon a screen of small selenium cells, which are successively and very rapidly connected by line wires to a corresponding series of receivers, persistence of vision being relied upon to give the effect of simultaneous reproduction. The image consists of a pattern of small squares, and necessarily flickers. The inventor admitted that the experiment was expensive, and that the invention was not yet commercially practicable. The method is known to be feasible in theory, but there are great difficulties, not least of which is the heavy cost, in the way of its practical development.

The Telephone Service.—It is reported that the telephone authorities in London are about to install a small number of meters in subscribers' offices, to register the number of calls made, with a view to ascertaining whether the apparatus are satisfactory in service and whether they are likely to solve the difficulty often experienced when subscribers dispute the accuracy of the records made by the exchange operators.

A correspondent of the *Financial News* has discovered that a telephone subscriber who has several lines can call up two other subscribers, connect their lines, and listen to the subsequent argument as to why they called each other up. He sees in this possibilities of fraudulent practices; the Post Office, he says, is also concerned, mainly because a subscriber who is on the "unlimited-service" tariff can put through a "message-rate" subscriber to other subscribers without the calls being metered at the exchange.

West Indies.—Arrangements are being made for the reduction of cable rates between the West Indies and Great Britain and Canada, by the payment of a subsidy of £16,000 a year by the British and Canadian Governments to the West India and Panama Telegraph Co., Ltd., in addition to the £10,300 a year paid by the Colonial Governments. The rates will be 2s. 6d. to this country, and 1s. 6d. to the first zone of North America; and half these rates for deferred telegrams in plain language.

Wireless on Board Ship.—The text of the Bill introduced into Parliament to give effect to the International Convention for the Safety of Life at Sea, which was signed in London on January 20th, was published last week. The Bill provides for British participation in the establishment and maintenance of a patrol service in the North Atlantic, and enjoins ships that receive a wireless distress signal to proceed at once to the rescue of those in distress. Every British ship which carries 50 or more persons is to be provided with a wireless installation.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—Corporation. Electric lighting and heating work for the additions to Police offices. Mr. John Rust, City Architect, 224, Union Street.

Australia.—Sydney.—July 20th. Box compound, meters, maximum-demand indicators, arc lamp carbons, and straight-stem insulators, for the Council. Specifications for each section 10s. 6d., from City Electrical Engineer, Town Hall.

July 8th. N.S.W. Railways and Tramways Department. One battery booster set to Specification No. 453. Specification (2s. 6d.) from the Electrical Engineer's Office, 61, Hunter Street, Sydney.

Hobart.—July 20th. Telegraph and telephone material, for Postmaster-General. See "Official Notices" to-day.

Perth.—July 22nd. Telegraph and telephone material, for Postmaster-General. See "Official Notices" to-day.

August 5th. Copper wire and binders, for Postmaster-General. See "Official Notices" to-day.

August 12th. Cable, lead-covered and various, for Postmaster-General. See "Official Notices" to-day.

Melbourne.—July 28th. Testing apparatus for the P.M.G. See "Official Notices" to-day.

July 6th. Rotary converters and frequency changes, for Melbourne Suburban Railways. See "Official Notices" to-day.

Austria.—Vienna.—June 15th. Supply of a year's requirements of carbons and glow lamps. Particulars and forms from the k.k. Staatsbahndirection Vienna (enclosing postage).

Pilsen.—June 15th. The State Railway Direction at Pilsen invite tenders for a quantity of machinery, including a 10,000-kg. travelling crane, with rails, a rotary current dynamo, an exciter, a motor dynamo (rotary and constant current), sundry fittings for a high-pressure station, a switchboard, leads, &c. Particulars from Alterlung IV., der Staatsbahndirection, Pilsen (enclosing postage)

Szigetvar—June 15th. Concession for the erection of an electric installation and public and private supply of current for lighting and power purposes. Deposit, 5 per cent. Particulars of the Gemeindevorstehung or Vikhor Martos, E.E., 30, Erzsebetkorut (enclosing 30 kronen), Budapest.

Gorlic.—June 20th. Concession for electric lighting, the Commune providing the ground. Particulars of the Magistratsbureau, Gorlic, Austria-Hungary.

Barrow-in-Furness.—June 8th. 6,000 tons of coal for the Electricity Department. Forms of tender from the Town Clerk.

Belgium.—June 13th. The municipal authorities of Lokeren. Concession for the supply of electrical energy for lighting and power purposes in the town.

The authorities of the Fonderie Royale des Canons, in Liége (80, Quai St. Leonard). Supply and installation of the plant and apparatus for the distribution of electrical energy for lighting and power purposes in the various buildings at the military camp at Brasschaet.

Bootle.—June 9th. 5,000 tons of slack, 2,000 tons of steam coal, and 1,000 tons of nuts, for Pine Grove and Marsh Lane electric light stations. Electricity Works Office, Pine Grove.

Canada.—June 12th. For the Winnipeg Municipality. 5,500 ft. of three-core paper-insulated lead-covered 13,000-volt cable. Specifications from the Light and Power Department, 54, King Street, Winnipeg.—*Canadian Engineer.*

Chelmsford.—Refuse destructor for the T.C. Borough Engineer.

Colne.—Workshops for the Corporation Electricity Department. Borough Surveyor.

Dartford.—June 15th. U.D.C. One 500-KW. high-pressure steam turbine, generator, condenser, &c. See "Official Notices" May 22nd.

June 17th. Installation of telephones and domestic bells, &c., at Orchard Hospital, for Metropolitan Asylums Board. See "Official Notices" to-day.

Dublin.—June 25th. Corporation. Feed pump, tanks, pipework, &c. See "Official Notices" to-day.

Eccles.—June 22nd. 5,000 tons of slack for the Electricity Department. Borough Electrical Engineer, Electricity Works, Cawdor Street, Patricroft.

Erith.—June 8th. 8,000 tons of coal for the Electricity Department. Forms of tender from the Clerk to the U.D.C.

France.—June 13th. The Prefectural authorities of the Seine Department in Paris (Tribunal de Commerce) are inviting tenders for an installation of electric lighting in the tunnel portion of the St. Martin Canal below the Boulevard Richard Lenoir and the Place de la Bastille.

Harrogate.—June 22nd. Corporation. Economiser, 288 pipes, for Electricity Department. See "Official Notices" May 29th.

Hungary.—June 20th. The municipal authorities of Gorlic. For the concession for the establishment of a central electric lighting station in the town on land belonging to the municipality.

Leeds.—June 29th. Corporation. Air-cooled transformers. See "Official Notices" May 22nd.

London.—L.C.C.—June 23rd. 50, 100 or 150 complete trailer-cars, and equipment of 200 existing electric motor-cars with couplers and traction gear for drawing trailer-cars. See "Official Notices" May 29th.

BATTERSEA.—June 24th. B.C. Coal telpherage plant. See "Official Notices" May 29th.

HAMPSTEAD.—June 11th. B.C. One 1,500-KW. turbo-alternator, barometric jet condenser and pipework, cooling tower and tanks. See "Official Notices" May 22nd.

STEPNEY.—June 11th. B.C. Three years' supply of meters, demand indicators, time switches and carbons. See "Official Notices" May 22nd.

ST. PANCRAS.—June 25th. B.C. Large water-tube boilers. See "Official Notices" to-day.

Manchester.—June 10th. The Education Committee is inviting tenders for a complete electric lighting installation at Soss Moss Special School. Specifications, &c., £1 1s. (returnable) from the Education Offices, Deansgate.

Merthyr Tydfil.—June 8th. Steam boiler and electric motor for Mardy Isolation Hospital laundry, for the T.C. Borough Engineer.

Morecambe.—June 25th. Corporation. 2,500 tons of coal or slack, for the Electricity Supply Department. See "Official Notices" May 29th.

New Zealand.—WELLINGTON.—July 9th. City Council. Electric chassis for a 2,000-lb. parcel delivery van, and an electric car, for the Electric Tramway Department. Specification may be seen at the Board of Trade Commercial Intelligence Department in London.

July 27th.—New Plymouth B.C. (2) Overhead wiring and permanent way (5 route miles). (3) Sub-station equipment (converting plant, battery, booster, switchboard, &c.). (4) Rolling stock (six complete cars) for electric tramways. Specifications from Mr. F. Black, Consulting Engineer, Wellington, or B. of T. Offices, London. Deposit (2) £4 4s.; (3) £2 2s.; (4) £2 2s.—*N. Z. Shipping and Commerce.*

AUCKLAND.—August 6th. Three 750-KW. D.C. mixed-pressure turbo-generators; one 1,500-KW. three-phase turbo-generator, including auxiliary plant and sub-station equipment. See "Official Notices" May 22nd.

Salford.—June 15th. 24 car bodies, also trucks, motors, controllers, &c., for same. General Manager, Corporation Tramways, 32, Blackfriars Street.

Sherburn Hill (Co. Durham).—E.L. installation, Primitive Methodist Church, for the Trustees.

South Africa.—WORCESTER, CAPE PROVINCE.—July 15th. According to a notice in the *African World* the Municipal Council invites tenders for electricity supply works as follows:—Buildings; two 60 H.P. turbo-generators (water), 70-H.P. crude-oil engine set, booster, &c.; switchboard, storage battery, transmission lines; network and street lighting; electricity meters and house wiring. Specifications, &c., from Prof. Bohle, 25 Rosmead Avenue, Cape Town, or the Town Clerk; deposit, £2 2s.

Stockton-on-Tees.—June 12th. Corporation. Supply of E.H.T. lead-covered paper cables. See "Official Notices" to-day.

Sutton Coldfield.—12 months' supply of steam slack coal for the Electricity Department. Forms of tender from the Engineer, Riland Road.

Swansea.—June 25th. Corporation. Main generating station and sub-station. Extra H.T. and L.T. switchgear. See "Official Notices" to-day.

Wallasey.—June 6th. Steel-framed buildings for the generating station in Dock Road, Poulton. Drawings, &c., £2 2s., obtainable from Mr. J. A. Crowther, Borough Electrical Engineer, Seaview Road.

Walthamstow.—June 12th. U.D.C. E.H.T. cable and stoneware conduits. See "Official Notices" to-day.

Wimbledon.—12 months' supply of coal for the E.L. Committee.

Winchester.—June 8th. 12 months' supply of small steam coal for the Electricity Department. Forms of tender from the City Electrical Engineer, Gordon Road.

Wrexham.—The Borough Electrical Engineer has been instructed to prepare a specification and invite tenders for a 300-KW. set including condenser.

CLOSED.

Belgium.—La Société de l'Electricité de l'Est de la Belgique, of Verviers, has secured the concession for the supply of electrical energy for lighting and power purposes in the little town of Olne (Province of Liége).

Bolton. — The Electricity Committee has accepted the following tenders in connection with the Back-o'-th'-Bank Station:—

Chadburn's Ship Telegraph Co., Ltd.—Signalling gear.
Herbert Morris, Ltd.—Workshop crane.

Canada.—Messrs. Babcock & Wilcox, Ltd., have received a contract, at $183,800, for the complete equipment of the new boiler house at the Edmonton electricity works.—*Canadian Engineer.*

Derby. — The T.C. has accepted the following tenders:—

Edison Electric Co., Ltd.—Motor tower wagon, £680.
British Thomson-Houston Co., Ltd.—Switchboard instruments, £328.

The E.L. Committee has accepted the tenders of Messrs. Parr and Son, Mr. Thos. Walker, the Derby Coal Co., Ltd., and the Derby Kilburn Colliery Co., Ltd., for coal, for the electricity works.

Edinburgh.—Messrs. Grindlay, Ross & Co., of Glasgow, have received the contract for the installation of electric light at Pierhill Barracks.

Falkirk.—Messrs. Chamberlain & Hookham, Ltd., have received the contract for D.C. meters for the coming year.

Gillingham.—The tender of the Electrical Co., Ltd., has been accepted by the Town Council, at £67, for the installation of transformers.

Glasgow.—The T.C. has accepted the tender of Messrs. Johnston, Park & Co. for re-wiring the sewage disposal works, at £125.

Hastings.—The Borough Education Committee has accepted the tender of Mr. G. Tester, of Hastings, for installing the E.L. at three schools, at £81.

Hindley.—The U.D.C. has awarded a contract for low-tension cable and joint-boxes and feeder-pillars to the B.I. & Helsby Cables, Ltd.

Hull.—The Property Committee of the T.C. has decided not to comply with the request of the T.C. that tenders be advertised for, for the supply of electrical fittings for the new Council Chamber. At the meeting at which this decision was arrived at, the architect (Mr. E. Cooper) said that it would be difficult to obtain competitive prices, as the estimate had been based on Mr. Smith's prices, after working out the designs in consultation with himself. It was decided to accept Mr. Smith's prices.

Ilford.—The following tenders have been accepted by the U.D.C :—

Pritchetts & Gold, Ltd.—Two storage batteries, £1,580, and maintenance for 10 years, £115 per annum.
Mawdsley's, Ltd.—Battery booster set, £161.
Bertram Thomas.—Two automatic battery regulating switches, £57 each.

The electrical engineer has had under consideration the question of fitting mechanical stokers or other smoke-consuming devices to the boilers at the electrical works which are not already fitted, and in accordance with his suggestion, the U.D.C. has decided to accept the offer of the Boiler Air Bridges, Ltd., to fit No. 1 boiler on trial with their apparatus. The name of the Electrical Apparatus Co is to be added to the Council's list of contractors for the supply of meters.

Leyton.—The U.D.C. has entered into contracts with Messrs. Venner & Co., the Electrical Apparatus Co., Ltd., and the British Thomson-Houston Co., Ltd., for an annual supply of ordinary meters. Also with Messrs. Venner & Co., and the B.I. and Helsby Cables, Ltd., for a similar supply of slot meters. The tender of Messrs. Lewis & Son, at £45, has also been accepted for the supply of a new set of pipes for No. 3 boiler at the electricity works.

London.—Kensington.—The B. of G. has awarded the contract for wiring the Infirmary to Messrs. Lund Bros. & Co., at £1,783.

G.P.O.—The tender of Messrs. G. E. Taylor & Co. has been accepted for electric lighting at the N.W. District Post Office.

Southwark.—The B C. has received the following tenders for ·5 by ·5 by ·5 and ·3 by ·3 cable :—

British Aluminium Co.	£223	0	0
Connolly Bros.	190	0	0
Macintosh Cable Co.	188	9	10
Callender's Cable and Construction Co.	179	9	0
W. T. Glover & Co.	176	10	0
W. T Henley's Telegraph Works Co.	176	5	0
General Electric Co.	175	16	0
Pirelli, Ltd.	175	15	0
Johnson & Phillips, Ltd.	173	0	0
Union Cable Co.	173	0	0
British Insulated and Helsby Cables, Ltd.	172	15	0
Western Electric Co.	171	7	6
Siemens Bros. & Co.	169	1	0
H. W. Butler & Co (agent)	164	11	8
Electrical Engineering and Equipment Co. (recommended)	163	2	6

Councillor Abbott proposed that the tender of Messrs. Siemens Bros. & Co., Ltd., be accepted, at £169. He said that the latter firm manufactured the cable in this country, and, therefore, paid Trade Union wages and observed Trade Union conditions. The Council would be able to ascertain whether those clauses in the contract were carried out. In the case of the Electrical Engineering Co., they could not supervise that, as the cable would be made abroad. Councillor Bird seconded. Alderman Boyd said that Messrs. Siemens had larger works abroad than they had in this country. Councillor Ward said that the firm recommended for acceptance was a Swiss firm, and they had ascertained that their hours of labour and rate of pay were equal to those of any firm in England. The wages involved amounted to only £20 in the contract, and the question merely was whether this small sum should be paid in wages in this country or on the Continent. The amendment was defeated by 28 votes to 25, and the recommendation was approved.

The tender of the General Electric Co., Ltd., for the supply of all types of Osram lamps has been accepted by the Comptroller of Stores, G.P.O., Bedford Street, London, W.C.

Manchester.—The tender of Messrs. Spagnoletti, Ltd., has been accepted by the Corporation for electrical equipment at the head post office.

Merthyr Tydfil.—The question of rejecting the lowest tender, that of the South Wales Accessories Co., at £303, for E.L. work at the Poor Law Institution at Aberdare, referred to in the Electrical Review on May 22nd, was discussed by the B. of G. at its last meeting. In the absence of the clerk and several members, who were transacting business in another room, a motion was carried to the effect that a special meeting should be held to reconsider the tenders, owing to the public controversy raised. On the clerk's return to the room, he said that the accepted contract was ready for sealing, and he advised the board to accept the tender already decided upon, as it was perfectly justifiable to do so. In the end the contract was sealed, and the special meeting decided upon abandoned.

Nuneaton.—The T.C. has accepted the offer of Messrs. Willans & Robinson, Ltd., to fit a "claw" type coupling on the 500-kw. turbo-generator.

Sunderland.—The Corporation Tramways Committee has accepted the tender of the North-Eastern Steel Co. for 50 tons of new rails. Two English, two German and one American firm competed. The lowest tender was German.

United States.—Messrs. the B.I. and Helsby Cables, Ltd., have received an order from the Edison Electric Illuminating Co., of Boston, for 55,000 ft. of three-phase, 25,000-volt cable This is stated to be the first order for British cable for the United States, and it is also to be laid under the supervision of the British company.—*Canadian Engineer.*

Warrington.—Messrs. Johnson & Phillips, Ltd., have received from the Corporation a contract for E.H.T. and medium tension cable.

West Bromwich.—The T.C. Highways Committee recommends the acceptance of the tender of Messrs. G. L. Wells, Ltd., for four motor-omnibuses, and the tender of Mr. G. Jones for the erection of a motor garage on land of the Corporation at Cronehills, the latter being estimated to cost about £1,000, including heating, lighting and equipment.

Wimbledon.—The T.C. has recommended for acceptance the offer of Messrs. E. Bennis & Co., Ltd., at £408, for the supply of two of their chain grate mechanical stokers.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Friday, June 5th. At 9 p.m. At Albemarle Street, W. Paper on "X-rays and Crystalline Structure," by Prof. W. H. Bragg, F.R.S.

Thursday, June 11th. At 3 p.m. Lecture (II) on "Faraday and the Foundation of Electrical Engineering," by Prof. Silvanus P. Thompson, F.R.S.

Institution of Electrical Engineers (Scottish Local Section).—Tuesday, June 9th. Excursion to Arran.

Rontgen Society.—Tuesday, June 9th. At 8.15 p.m. At Institution of of Electrical Engineers, Victoria Embankment, W.C. Annual General Meeting, Exhibition and Lantern Demonstration.

Faraday Society.—Thursday, June 11th. At 8 p.m. At Institution of Electrical Engineers. Presidential address on "Advances in the Metallurgy of Iron and Steel," by Sir Robert Hadfield, F.R.S.

Physical Society of London.—Friday, June 12th. At 8 p.m. At Imperial College of Science, South Kensington, S W. Papers on "A Magnetograph for Measuring Variations in the Horizontal Intensity of the Earth's Magnetic Field," by Mr. F. E. Smith. "The Atomic Weight of Copper by Electrolysis," by Mr. A. G. Shrimpton. "An Improvement in the Einthoven String Galvanometer," by Mr. W. H. Apthorpe.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued :—

Friday, June 5th.—"D" Company. Infantry drill, 7 to 8.30 p.m. Technical instruction, 8.45 to 10 p.m. Miniature range instruction, 8.45 to 10 p.m.

Saturday, June 6th.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

Monday, June 8th.—"A" Company. Infantry drill, 7 to 8 p.m. Technical instruction, 9 to 10 p.m. Miniature range instruction, 9 to 10 p.m.

Wednesday, June 10th.—All Companies. Rating examination, 7 to 10 p.m.

Thursday, June 11th.—"C" Company. Infantry drill, 7 to 8.30 p.m. Technical instruction, 8 45 to 10 p.m. Miniature range instruction, 8 to 9 p.m.

Friday, June 12th.—"D" Company. Infantry drill, 7 to 8.30 p.m. Technical instruction, 8 15 to 10 p.m. Miniature range instruction, 8.15 to 10 p.m.

Saturday, June 13th.—All Companies. Annual course of musketry at Purfleet rifle ranges. Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

NOTES.

Engineering Trades and a 48-Hour Week.—The *Financial Times* states that the adjourned conference between the Engineering Employers' Association and representatives of the Unions affiliated to the Engineering and Shipbuilding Federation, on the demand of the latter for a 48-hour working week, was resumed in London on May 26th.

At the previous sitting the Employers' Council asked the Unions for a guarantee that, in the event of them agreeing to a reduction of working hours to 48 weekly, the output per week would not be reduced. The Federation representatives stated last week that they were unable to give any guarantee, but they believed that, by better time-keeping and other economies, the reduction in output would be kept at a minimum. Under these circumstances no decision was arrived at, and the matter was referred back to the whole of the members of the Employers' Association for their opinion. It is considered unlikely that they will accede to the demand, in which case a serious situation may possibly arise.

Institution and Lecture Notes.—THE ELECTRICAL ASSOCIATION OF NEW SOUTH WALES.—This Association held a dinner at Sydney, on April 24th, to celebrate the twenty-third year of its existence. Dr. J. F. V Madsen, of Sydney University, presided over a large attendance, and in the course of his speech said that in New South Wales the greater part of the electrical development had been confined to the Sydney area. Victoria, on the other hand, had seen development in electric lighting in the small centres, and New South Wales had much to make up in this direction. This state of affairs was largely due to the law.

In the course of a lecture before the Irish Technical Congress in Killarney, on May 26th, MR. J. F. CROWLEY, of Messrs. Siemens Bros. Dynamo Works, Ltd., described the evolution of the modern system of driving textile machines by separate small motors, which has resulted in an increase of production amounting in some cases to as much as 20 per cent. The electrical Jacquard also is making good progress, and the introduction of special glass has enabled the effect of normal and unvarying daylight to be obtained with incandescent electric lamps, so that colours can be matched with precision.

INSTITUTION OF ELECTRICAL ENGINEERS. — A party of the Yorkshire Section visited Hull on May 20th as the guests of Mr. H. Bell, the city electrical engineer. A visit was paid to the deep-water docks, and afterwards the party was shown over the electricity works at Sculcoates. In the evening a dinner took place at the Grosvenor Hotel.

VICTORIAN INSTITUTE OF ELECTRICAL ENGINEERS.—At the meeting held on April 30th, Mr. E. H. W. Westwood read a paper on "Electric Searchlights in Theory and Practice, and their Applications." The report of the Council for 1913 shows the total membership as 189, and the average attendances at meetings have been 36·6 members and 12·1 visitors per meeting.

INSTITUTION OF ELECTRICAL ENGINEERS.—The *Journal* for June 1st contains the result of the Associate Membership Examination held in May; only seven candidates' names appear in the pass list, though it was announced in the Annual Report that 112 had been approved by the Council for admission subject to their passing the examination or otherwise satisfying the examination regulations. The number of candidates who sat for examination, unfortunately, is not stated, and it may be that many of the 112 were exempt from examination owing to their possession of recognised qualifications. The examiners were:—English Essay, Mr. C. C. Hawkins; Translation from French, Dr. H Borns: Applied Mechanics and Physics, Prof. A. W. Porter; Chemistry, Prof. H. Jackson; Electricity Supply, and Electric Lighting and Power, Mr. J. F. C. Snell; Electric Traction, Mr. Roger T. Smith; Telegraphy, Major W. A. J. O'Meara; Manufacture of Electrical Machinery, Mr. M. B. Field; Design of Electrical Machinery and Apparatus, Mr. J. S. Peck.

The report of the Committee of the NEWCASTLE LOCAL SECTION, presented at the meeting on May 25th, shows a total membership of 303, or four less than in the previous year. An Entertainment Guarantee Fund has been formed to adjust the balances of social events controlled by the Committee. Arrangements are in hand for a Summer Outing on July 18th. The Students' Section possesses 76 members. The principal officers elected for the next session are as follows:—Chairman, Mr. P. V. Hunter; vice-chairmen, Messrs. H. W Clothier and A. H Marshall; hon. treasurer, Mr. C. Vernier; hon. secretary, Mr. J. R. Andrews. Mr. L. E. Mold is chairman, and Mr. R. C. Phillip hon. secretary of the Students' Section Committee.

Fatalities.—Circumstances attending a narrow escape from a serious tramway accident at Middlesbrough were related at an inquest on May 28th, held on a tramcar driver named John William Atkinson, aged 59. Wilfred Alderson, the conductor of the car driven by Atkinson, said that on May 9th he noticed that the latter was behaving rather strangely. At several stopping places Atkinson failed to pull up his car, and even when witness rang the bell the driver did not obey. Shortly after 9 p.m. the driver ran through the Devonshire Road loop instead of stopping, although another car was approaching on the single line. Witness pulled out the back switch to avoid an accident, and the driver of the approaching car reversed his motors, and when Atkinson's car was stopped only two yards separated the two vehicles. Witness found Atkinson in a semi-conscious state. He complained that he had had a shock. Dr. Mather said Atkinson bore no signs of electric shock. A post-mortem showed that death was due to cerebral hemorrhage, which was not traceable to electric shock. A sudden attack of hemorrhage would cause collapse and paralysis, similar to that produced by shock. A verdict of "Death from natural causes" was returned. Mr. Freshwater, the general manager of the Imperial Tramways Co., said he would see that Alderson and Braithwaite (the driver of the approaching car) received some reward for their prompt action.

A St. Petersburg dispatch to the *Daily Express* says that two soldiers were killed and three others were paralysed on May 28th by a curious accident at the military baths at Czaritzin. Some of the men who were bathing had slung their clothing across an electric light wire, which gave way, the broken end striking a group of soldiers.

Our Cape Town correspondent states that a native employed at the Wharf at East London, was killed on May 13th by an electric shock. He left his work to get a drink of water at a tap, and shortly afterwards was found lying dead, apparently from electric shock. It is supposed that there was a leakage of current from a cable which conveys energy to the electric cranes.

Thomas M'Coll, employed as a lineman by the Lanarkshire Tramways Co., was on a tower wagon, when in pulling a wire it gave way and he overbalanced and fell to the ground, sustaining fatal injuries.

According to a Reuter dispatch from Charleroi, three men were killed by electric shock while working an electric borer in a building yard at Dampremy on Tuesday.

The Electric Vehicle Committee.—At the last meeting of the Committee, held in Birmingham sample charging plugs fitted with earth connection contacts were inspected, and a particular design was selected for standardisation; consideration was also given to the method of gripping the flexible cable to the plug and the connecting of the earth wire to the plug shell. It was decided to recommend that the plug receptacle on the vehicle should be fixed under the driver's seat, preferably with the plug pointing upwards so as to make it impossible for the driver to take his seat without noticing that the charging connection was attached to the vehicle. Cases were mentioned where serious damage had been caused by a driver starting his vehicle away without disconnecting the charging plug—the connection for the latter being placed at the rear or at the side of the vehicle. It was also decided to recommend that the fixed receptacle in the garage, for taking the charging connections, should be placed in an accessible position, preferably horizontal; and that the centre contact of the plug should always be the negative—the arrangement adopted by the Electric Vehicle Association, of America.

A communication was read from the Secretary of the B E.A.M.A. stating that the Accumulator Manufacturers' Section of the Association had decided to recommend for standardisation a plate for electric vehicle batteries having dimensions of 8⅝ in. × 5¾ in., with lug centres 4⅝ in; the accumulator manufacturers had under consideration standardisation in the sizes of the cells. Up to date 51 municipal electric supply undertakings and three company undertakings had agreed to a rate of 1d. per unit or less for "off peak" charging.

Further progress was made in the matter of arrangements for publicity and for garage and charging-station signs.

The Committee decided that the time had now arrived when it must be in possession of adequate funds. It was resolved that at least £200 should be obtained for carrying on the work up to the end of next December, any surplus available at that date to be carried over to the Committee's account in the next year or to the account of any other organisation which might be formed to take its place. Amounts totalling 35 guineas were promised at the meeting, and the secretary was instructed to approach the principal municipal-owned electricity supply undertakings and others with a view to obtaining contributions towards such a fund.

Five firms are arranging to send one or more vehicles each to the demonstration of electric vehicles at Birmingham in connection with the I.M.E.A. Convention.

Walking Races.—We are informed that the third annual London to Southend 41¾ miles walking race, promoted by the Hackney Walking Club, which took place on Whit-Monday, was a great success, splendid weather again favouring the event. Out of an entry of 10, eight started and six finished, C. H. Malivoire, of the Crypto Electrical Co., retiring at about 30 miles. The first three to finish were S H. Smith (Hornsey), 7 hr. 24 min. 43 sec.; E. F. Newstead (Ilford), 7 hr. 27 min. 7 sec.; H Gregory (Crypto Electrical Co.), 7 hr. 39 min. 58 sec. The times of the first three were considerably better than that of last year's winner, S. C. Haynes (Associated Fire Alarms, Ltd.), who took 7 hr. 54 min. 9 sec. for the journey.

Mine-Shaft Signalling.—An exhibition of shaft-signalling apparatus for mines, specially designed to meet the requirements of the new Mines Regulation Act, and brought together on the initiative of the Council of the South Wales Institute of Engineers, was held at Cardiff last week. The collection included types by the Adnil Electric Co., London; G. J. F. Black, Burton-on-Trent; John Davis & Son, Derby; Gent & Co., Leicester; Heyes & Co., Wigan; General Electric Co., London and Cardiff; Mechan & Sons, Glasgow; and Siemens Bros. & Co., Woolwich.

An Edinburgh Dispute.—The employés in the Edinburgh electrical contracting trade recently made application to the employers for a rise in wages of a penny per hour, and negotiations have taken place between representatives of the employers and representatives of the employés. Terms have now been arranged on the following basis: that an increase of ½d. per hour shall be given, to take effect on 15th inst., and that an additional ½d. per hour shall be given, to take effect on June 15th, 1915, provided that before that date there is no general fall in wages in the kindred trades, and it has further been agreed that these increases shall be binding on both sides for a period of one year.—*Edinburgh Evening News.*

Bradford Electrical Exhibition.—We are asked to state that on the recommendation of the B E.A.M.A—I.M.E.A. Exhibitions Joint Committee, the Council of the former Association has remitted its standing rule in respect of an electrical exhibition to be held under the auspices of the Bradford Corporation from October 6th to 24th, this year.

Chinese Minister visits Steel Works.—According to the *Times*, his Excellency Lew Yuk Lin, the Chinese Minister to England, paid a visit to the steel works of Messrs. Cammell, Laird and Co., and other Sheffield works, on May 26th.

Appointments Vacant.—A lecturer in physics (£250) and a lecturer in chemistry (£200) are wanted for the new Central School of Science and Technology. Technical assistant and testing engineer for Stoke-on-Trent Electrical Engineers' Department; jointer and fitter, for Bacup Corporation (45s.). Particulars are given in our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Bermondsey B.C. received 100 applications for the position of third engineer-in-charge at the electricity works. Of this number the Electricity Committee interviewed 12. The Council appointed Mr. E. Jackson, of Guildford.

The salary of Mr. F. C. Whitehead, charge engineer at the Accrington electricity works, is to be increased.

On leaving Nuneaton electricity works to take up the appointment of junior shift engineer at the Hinkley station of the Leicestershire and Warwickshire Electric Power Co., Mr. G. Anderson was presented with a case of pipes and tobacco by the working staff.

On Wednesday evening last week, at the Tower Hotel, at a smoking concert arranged by the employés of the Urban Electric Supply Co., Hawick, Mr. H. C. Babb, chief assistant, who presided, presented Mr. Henry Joseph, the engineer and manager, with a wedding present from the staff. It took the form of an illuminated address, together with a travelling bag, a case of pipes and a pouch. Mr. Inglis (accountant) spoke of the excellent feeling that existed between the manager and the staff, and on behalf of the employés wished Mr. Joseph every happiness. Mr. Joseph feelingly replied, and the remainder of the evening was enjoyably spent in song and sentiment.

Tramway Officials.—Mr. R. O. Pickmere, for seven years chief engineering assistant to the West Ham tramways manager, has resigned his position, and has joined the firm of Messrs. Geo. W. Green & Co., of Feltham, Middlesex, makers of tramway overhead specialities.

General.—Major Harland Bowden, the new Member of Parliament for North-East Derby, will be remembered by all of our readers as a former President of the Electrical Contractors' Association who, for two years, put such spirit into the propaganda work of that organisation at a time when it was necessary to build up the anti-municipal contracting fighting fund. Congratulations!

Mr. Arthur Vernon Hayne, of the Buenos Ayres staff of the Western Telegraph Cable Co., son of Mr. Arthur Hayne, of Southsea, a director of the company, who was married at Parkstone on Saturday, has been presented by his colleagues with a collection of plate.

Mr. C. F. Butler, late of the County of London Electric Supply Co., Ltd., is leaving England to-day to take up a temporary position in India, and he expects to be away for about six months.

Mr. Albert Isaac Belisha has been elected a director of the Metropolitan Railway Co.

It is announced in the Press that the Home Secretary has appointed Mr. W. Walker, H.M. Inspector of Mines in charge of the Scotland division, to the newly-created post of Deputy-Chief Inspector of Mines at the Home Office.

Mr. F. G. Maxwell Williams, B.Sc., manufacturers' agent, Montreal, Canada, is at present in this country on a business visit, and he will be glad to hear from firms engaged in the electrical industry who are desirous of opening or extending business connections with the Dominion. His address is Motley Bank, Camberley.

Obituary.—Mr. A. Bruce Anderson.—For the second time in a space of little more than two years, the world has been shocked by a terrible calamity at sea involving a colossal death roll. The British race, true to its great traditions, thinks lightly of the sea, and never travelled more than now. Every year many thousands journey westwards from these islands in pursuit of business or fortune in the great territories of Canada. In recent years few British electrical men had paid more frequent visits thereto than Mr. A. Bruce Anderson, who had devoted such close attention to the developments of the Ferranti business there. On May 2nd he left England to attend to various matters on that side; unfortunately, he began his homeward journey on the ill-fated *Empress of Ireland*, and unhappily is not among the survivors of the catastrophe which occurred on May 29th before the vessel was out of the St. Lawrence. We are quite sure that the whole industry, in the ranks of which Mr. Anderson was so widely known, will desire to offer its deep sympathy to the widow and three children who are left to mourn his loss. Mr. A Bruce Anderson joined Mr. S. Z. de Ferranti in Charterhouse Square, London, E.C., about 1892 as an accountant. With the transference of the works to Lancashire, he moved to Hollinwood about the year 1897, and gradually rose in position until he became general manager; subsequently, in 1908, he was appointed managing director. We understand that he was held in the highest esteem by every employé of the company, and particularly by the staff, in every one of whom he took a personal interest. Mr. Anderson was also a director of Messrs. Bruce Peebles & Co., Ltd., chairman of the British Electrical and Allied Manufacturers' Association, and an ordinary member of the Council of the Institution of Electrical Engineers. He was recently appointed to the Council of the London Chamber of Commerce. He was also the president of the Failsworth and District Branch of the Tariff Reform League in which he took a great interest. His election to the chairmanship of the B.E A M.A. for the third year in succession was evidence of its members' appreciation of his powers in leadership, and of his organising abilities. A frequent text for his speeches was the necessity of subordinating individual or sectional interests to those of the whole body. Mr. Anderson was a young man—only 44 years of age—and his friends looked forward to many years of practical achievement at his hands. From the above it will be observed that it was just 22 years ago, when 22 years of age, that he first came into touch with Mr. Ferranti, to whom, as well as to the firm of Ferranti, Ltd, his loss comes as a personal one.

Elliott & Fry] [*London.*

The Late Mr. A. B. Anderson.

Sir Joseph Wilson Swan.—The funeral of Sir Joseph Swan took place on Saturday last, May 30th, in the beautiful churchyard of All Saints, Warlingham, Surrey. Among those present were the following members of the family:—Lady Swan (widow); Mr. Donald Cameron-Swan, F.R.P.S., F.S.A.Scot. (eldest son) and Mrs. Cameron-Swan, also their sons, Ewen and Duncan; Miss Swan (eldest daughter); Mrs. Sharpe (daughter) and her daughter Viola; Mrs. Reginald Morcom (daughter) and Mr. Reginald Morcom; Mr. Kenneth R. Swan (son); Mr. Percival Swan, M.Inst.M.E. (son); Mr. John Cameron Swan, J.P. (brother); Miss White (sister-in-law); Miss Louisa White (sister-in-law); Mr. J. Arnold White (cousin of Lady Swan); Mr. George Swan (nephew) and wife; Mr. John W. Harvie (nephew); Mr. Carl Leyel (nephew); Mrs. Aneurin Williams (niece) and Mr. Aneurin Williams, M.P.; Mrs. Valpy (niece); Miss Atkinson (niece); Mrs. John Lion (niece); the Misses Mary and Emily Swan (nieces); Lt.-Col. Sir Charles Bedford, D Sc., M.D. (nephew of Mr. J. Cameron Swan).

The following were among the friends present:—Sir Thomas Barclay; Prof. Carey Foster, F.R S. (representing the Royal Society and University College, London, and the Institution of Electrical Engineers); Mr. Louis Brennan, C.B.; Mr. Payne, F.I.C. (of Mawson & Swan, Ltd., Newcastle); Mr. Robert Mond (Royal Institution); Mr. A. A. Campbell Swinton, M.I.E.E. (representing Institution of Electrical Engineers); Mr. John Spiller, F.I.C., F.C.S., F.R.P.S. (representing Royal Photographic Society); Prof. Harker, D.Sc., F.R.S. (representing National Physical Laboratory); Mr. Stuart Reid, D.C.L. (representing University of Durham); Mr. Morse; Mr. W. H. Patchell and Mr. Cyril Hitchcock (Institution of Mechanical Engineers); Mr. Walter Hibbert, F.C.S.; Mr. Hyde (former laboratory assistant); Mr. Greig (laboratory assistant); Prof. John Perry; Mr. H. O. Gover (formerly secretary of the Edison & Swan United Electric Light Co., Ltd.); Mr. F. W.

Reynolds (City of London Electric Lighting Co.); Dr. M. Perkin (British Science Guild). The Institution of Electrical Engineers was also represented by Col. R. E. Crompton, C.B., and Mr. James Swinburne, F.R.S., past-presidents; Mr. J. E. Kingsbury, member of Council, and Mr. P. F. Rowell, secretary. Over 70 wreaths and floral tributes were sent. The President of the Royal Society and the Lord Mayor of Newcastle were unable to carry out their intention of being present.

MR. N. L. WATT.—A Scottish correspondent writes:—"Mr. Norman Leslie Watt resident engineer at Brakpan for the Victoria Falls and Transvaal Power Co., whose death as the result of an accident is announced, was well known in Glasgow and the West of Scotland. Deceased was only 35. After serving his apprenticeship with Messrs. Grant and Ritchie, Kilmarnock, he studied electricity in Glasgow. Later he held an important post in one of the large London electricity works, and was selected from a long list of candidates for the Transvaal post. Mr. Watt, who was married about three years ago, leaves a widow and daughter."

MR. FREDERICK THOMAS, senior partner in the firm of Fredk. Thomas & Co., makers of electric light fittings, Drummond Street, Hampstead Road, N.W., who has been connected with the electrical industry for the past 25 years, passed away peacefully on Saturday last, after an illness lasting some months.

We regret to learn of the death of MR. S. L BENTLEY, partner in the firm of H. W. Butler & Co., Kingsway, W.C., which occurred somewhat suddenly from diabetes, on Saturday last, after an illness of only eight days. Mr. Bentley studied in the Polytechnics of Buda-Pest and Zurich, and in the Polytechnic School in Paris. He was a member of the Société Internationale des Electriciens. He joined the Electrical Power Storage Co., Ltd., in 1900, acting as their representative at the Paris Exhibition of that year, and at the Glasgow International Exhibition of the following year. He was for several years stationed in Glasgow as the E.P.S. representative for Scotland, subsequently adding to this the North of England. He left the company in 1912, joining Mr. Butler as partner. Mr. Bentley was at his office on May 20th, and up to the 27th ult. was expecting to be back at his post within a few days. Arrangements are being made for the business of H. W. Butler & Co. to be continued as heretofore.

Wills.—According to the *Financial Times* MR. JOHN GOTT, of Hove, chief engineer to the Commercial Cable Co., left £23,439 gross, and £22,268 net.

SIR RICHARD MOTTRAM, J.P., a director of Galloways, Ltd., left £9,320 gross, and £8,762 net personalty.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Magneta Time Co., Ltd.—A memorandum of satisfaction in full on April 30th, 1914, of debentures dated October 6th, 1911, May 24th, 1912, and February 3rd and December 10th, 1913, securing £2,240, has been filed.

Debenture dated April 30th, 1914, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Colonial Bank of Australia, Ltd., 33, Bishopsgate, E.C.

Edmundsons' Electricity Corporation, Ltd.—A memorandum of satisfaction in full on July 12th, 1912, of trust deed dated August 14th, 1908, securing £100,000 prior lien stock, has been filed (notified May 5th, 1914).

Edmundson's Electricity Corporation, Ltd.—Mortgage dated May 6th, 1914, to secure £18,000, charged on the undertaking authorised by a provisional order granted to the Urban District Council of Cromer, and land and buildings in Central Road, Cromer, &c. Holders: Commercial Union Assurance Co., Ltd., 24, 25 and 26, Cornhill, E.C.

Marbro, Ltd.—Particulars of £1,150 debs., created April 16th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Naylorgraph, Ltd.—Deb. dated April 29th, 1914, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital, subject to prior debs. for £3,000. Holder: J. M. Hunt, Fairlawn, Park Road, Southborough, Kent.

Wellingborough Electric Supply Co., Ltd.—Issue on May 5th, 1914, to secure £500 debentures, part of a series of which particulars have already been filed.

Pernambuco Tramways and Power Co., Ltd.—Issue on May 5th, 1914, of £100,000 debentures, part of a series of which particulars have already been filed.

Simplex Conduits, Ltd.—Capital, £100,000, in 10,000 preference shares of £5 each and 50,000 ordinary shares of £1 each. Return dated March 17th, 1914, 10,000 preference and 40,000 ordinary shares taken up, £50,000 paid on the preference, £40,000 considered as paid on the ordinary. Mortgages and charges: Nil.

James Keith & Blackman Co., Ltd.—Issue on May 15th, 1914, of £200 debentures, part of a series of which particulars have already been filed. A memorandum of satisfaction in full (*a*) on April 14th, of second deb. dated February 9th, securing £100, and (*b*) on May 15th, 1914, of debs. dated May 15th, 1906, and May 15th, 1911, securing £1,100, also notified.

Lord Howe Electrical Engineering Co., Ltd.—Particulars of £500 debentures, created May 11th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Godfrey Manufacturing Co. Ltd.—Mortgage on stores, offices, machine shop, dynamo house and land, &c., dated April 23rd, 1914, to secure all moneys due or to become due from the company to London City and Midland Bank, Ltd., 5, Threadneedle Street, E.C.

Para Electric Railways and Lighting Co., Ltd. ([illegible]).—Capital, £[illegible] [illegible] Return dated March [illegible], 1914 [illegible] [illegible] as paid on [illegible] pref. and 77,[illegible] ord. Mortgages and charges: [illegible] per cent. first deb. stock.

County of Durham Electrical Power Distribution Co., Ltd. (61,591).—Capital, £[illegible] in [illegible] ord. and [illegible] pref. shares of £[illegible] each, return dated March [illegible], 1914, all shares taken up; £[illegible] paid. Mortgages and charges: £250,000.

Crossley Brothers, Ltd ([illegible]).—Capital, £[illegible] in 10,[illegible] pref. and 57,031 ord. shares of £10 each, return dated March [illegible], 1914, all shares taken up; £478,200 paid on 27,[illegible] ord.; £[illegible] considered as paid on 12,519 pref. and 57,031 ord. Mortgages and charges: Nil.

Rugby Lamp Co., Ltd.—Issue on May 13th, 1914, of £1,000 debentures, part of a series of which particulars have already been filed.

Eckstein, Heap & Co., Ltd. (126,262).—Capital, £50,000 in £1 shares. Return dated April 13th, 1914, 30,000 shares taken up, £7,500 paid; £22,500 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

New General Traction Co., Ltd.

THE directors' report for the year ended March 31st, 1914, states that the revenue received and accrued amounted to £21,753. The general expenses, including directors' fees and legal charges, amounted to £2,038, and the debenture interest, less income-tax, to £7,231. The accounts show a profit of £12,484 plus £4,498 brought forward, making a total of £16,982 available for distribution. The directors recommend that £10,480 be devoted to the payment of a 4 per cent. dividend, less income-tax, and £6,502 carried forward. The accounts of the Norwich Electric Tramways Co. show that there was an increase in the traffic receipts for the year, and also an increase in the expenses. A dividend of 3 per cent. was received from that company for the year ended June 30th, 1913. The dividend received from the Coventry Electric Tramways Co. for the year ended December 31st, 1913, was 1s. 1d. per share. The Douglas Southern Electric Tramways, Ltd., paid 7 per cent. on its preference shares and 3½ per cent. on the ordinary shares, in respect of the year ended October 31st, 1913. The income received from the Philadelphia undertaking for the 12 months ended December 31st, 1913, amounted to £13,922. The directors' reports and accounts of the Coventry Electric Tramways Co., the Norwich Electric Tramways Co., and the Douglas Southern Tramways, Ltd., respectively, are circulated with the report of this company.

Merthyr Electric Lighting and Traction Co., Ltd.

MR. C. G. SOMERVILLE presided at the meeting held on May 27th at Electrical Federation Building. He moved the adoption of the report, which showed that the revenue during the year had been £24,167, an increase of £2,962. The directors recommended that £1,000 be put to reserve account, £1,500 was required for dividends on preference shares and at the rate of 7 per cent. per annum on the ordinary shares, carrying forward £606. On the electricity supply there had been an increase due to the extension of the main down the valley, and the units sold showed an increase of 18 per cent. This did not include the supply to the light railway, on which the increased receipts amounted to £12,600. The passengers carried were 2,174,102, an increase of 233,000, the largest number of passengers they had carried in any one year. Since the close of the year business had been progressive. The extensions at Cefn Coed were now being carried through.

MR. C. S. TEGETMEIER seconded, and the report was adopted.

At an extraordinary meeting a resolution was passed authorising the issue of the remaining 5,000 cumulative preference shares as ordinary shares. The CHAIRMAN said this was to facilitate obtaining new capital.

Nairobi Electric Power and Lighting Co., Ltd.

THE directors report that the progress of the company's working during the year 1913 is as under:—

	1912.	1913.	Increase.
Units generated	604,394	723,852	19·76 %
Customers connected at December ..	558	610	9·31 %
Motors connected B.H.P. at December ..	248	373	50·40 %
Private lights connected, 8-C.P. equiv. ..	10,658	13,745	28·96 %
Street lighting, 8-C.P. equiv.	2,000	2,000	—
Net profits	£2,642	£4,983	88·60 %

Negotiations with the Government have been satisfactorily concluded for the extension of the company's concession from 25 years to 50 years, and the grant of important falls on the Thika River for the generation of electricity, and arrangements are being made for the prompt extension of the company's plant for the production of electric current, which is urgently called for by the increased demand at Nairobi. In order to provide the necessary capital for the new installations of machinery and plant now required, the remainder of the ordinary shares of the company and of the authorised debentures will be issued.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—An interim dividend of 3 per cent. on the 6 per cent. cumulative preference shares is announced.

Hongkong Tramway Co., Ltd.

The annual meeting was held on May 27th at the offices, 19, St. Swithin's Lane, E.C., Mr. E. C. Morgan presiding.

In proposing the adoption of the report (see Elec. Rev., p. 921), the Chairman said that the boycott to which he referred at length last year had ceased and the traffic receipts for many months past had been very satisfactory. They would note that the Government had made a further payment of $15,248 towards the loss incurred by the company during the boycott, making, with the amount previously contributed, a total of $45,248. The currency question was as yet unsolved, and it would be seen from the profit and loss account that the loss on subsidiary coinage showed no abatement. They hoped, however, that the Government Ordinance which came into force on March 1st last might produce an improvement in the stability of the British subsidiary coin. They, however, did not look for any rapid change by reason of the fact that the British subsidiary coin was still in such excessive supply. A comparison of the various averages given at the end of the report showed a decided increase in the number of passengers carried and some increase in the mileage run. The earnings and the expenses were naturally higher in consequence, but they would see that the average fare per passenger had been well maintained, which indicated that the popularity of the tramways had not been prejudiced by the long period through which the boycott was in operation. A small increase had been made in the carrying capacity of the lines during the year. Representations had been made by certain of the shareholders and by the Stockbrokers' Association of Hongkong requesting the directors to take steps to establish a Colonial register to facilitate the transfer of shares in the colony, and arrangements were being made accordingly. Having regard to the difficulties they had had to contend with, he thought it was a very good report, and the figures of the traffics since the commencement of the present year would appear to indicate that it was reasonable to expect further improvement in their net receipts as soon as they were able to see more clearly the effect of the legislation upon the coinage question. They might have seen reports in the newspapers during the last few days regarding the increase of plague cases in Hongkong. Plague was always present there in some degree, but as it appeared to be somewhat more serious than usual, and might result in driving away some of the Chinese from the colony and thus adversely affecting their traffic receipts, they thought it desirable to cable to the manager for news. He had replied that in his opinion the worst was over, and he (the Chairman) hoped, therefore, they need not fear any serious consequences.

Mr. Robert Miller seconded the motion and the report was adopted.

West India and Panama Telegraph Co., Ltd.

The directors' report for the six months ended 31st December, 1913, states that the amount to credit of revenue is £38,699 against £38,505 for the corresponding half-year of 1912, and the expenses have been £25,630 against £24,428. The result is, therefore, a balance of £13,069 plus £1,837 interest on investments, and £3,185 brought forward, making an available total of £18,091. This amount is to be dealt with as follows:—First preference shares, dividend, six months to 31st December, 6s. per share, £10,369; second preference shares, dividend, six months to 31st December, 6s. per share, £1,401; ordinary shares, 1s. per share (free of income tax), £4,416; balance to current half-year's account, £1,905. The traffic receipts for the six months show an increase of £201 as compared with those for the corresponding period. In the directors' report for 31st December, 1911, it was stated that the exclusive rights, granted by Spain to the company for landing cables in Porto Rico, expired on 15th February, 1912, and that the United States Government had not acceded to the company's application for an extension of those rights. The Government subsequently granted permission to the Compagnie Française des Cables Télégraphiques to land their cable in Porto Rico; and since December last that company has been competing for Porto Rico traffic.

The annual meeting was held on May 28th at Winchester House, E.C.

Mr. G. von Chauvin (the Chairman) said that he was occupying the chair because Mr. Kingsford, the Chairman of the Company, was in the West Indies. He had visited almost the whole of their stations. During his stay he had looked into the business of the company and taken particular pains to see how the organisation was working, and he had put himself into communication with the Governors of the various colonies. Mr. Kingsford had also got into personal contact with the staff and settled a number of matters which it was difficult to handle by correspondence. He (the speaker) thought it would be found that the visit of their Chairman had distinctly benefited the company. Proceeding to propose the adoption of the report, the Chairman said that the total receipts for the half-year had amounted to £38,699, which was about £200 more than those for the corresponding half-year, which amounted to £38,505. The expenditure in the half-year was £25,629 against £24,427, an increase of £1,203. It was very striking to note how very near the expenses and the receipts had kept for the two half-years. As he had pointed out, as far as the income was concerned the difference was only £200, and while the expenditure was £1,203 more, that excess arose from the fact not that the ordinary expenditure had materially differed but that in the corresponding half-year the company received an amount derived from the use of their repairing ship by a neighbouring company which could be set off against the expenditure. The very closeness of the figures pointed to the fact that the management was carefully looking after all the details and that the usage which had been established by long time of the company's lines was a regular and steady one. The evenness of the expenditure was also very largely due to the excellent management of the repairing work. They had on board their ship a staff which was extremely valuable, and they had continually to congratulate themselves on the certainty with which they localised interruptions and faults and the rapidity with which those faults were taken cut and repaired. With a large experience of cable companies, he was in a position to say that their staff was an exceedingly good one and the work done by it was exceedingly efficient. At the last meeting Mr. Kingsford referred to negotiations which were pending between the British Government and the company in which the Canadian Government and the Governments of the Colonies in the West Indies were concerned. Certain arrangements were then foreshadowed and he was sure the shareholders would be pleased to know that the Canadian Government had put that portion of the subsidy which was to be given to the company on to its Parliamentary estimates, and the British Colonies in the West Indies had all voted the continuation of those subsidies for ten years. They did not raise the subsidies which had been given up to the present, but they had given them for a fixed period of ten years. The consideration which the company had to give for the subsidies was a considerable, and in some cases a very drastic, reduction in the rates. They trusted that in course of time through the operation of the lowering of the rates traffics would be considerably increased, and that the payment which the company would have to make for the subsidies would be to a considerable extent set off by increased earnings. With regard to the competition which they had in Porto Rico, they had felt the effect of that competition on their receipts to a considerable extent. He had to say that there had been a considerable decrease in the traffics since the close of the financial year equal to very nearly 9½ per cent. of the total traffic. That was accounted for by the competition in Porto Rico and by the interruption of the Colon cable so that no traffic was at the present time coming to them from that part of the system.

Mr. W. H. Birks seconded the motion and the report was adopted.

Calcutta Electric Supply Corporation, Ltd.

The annual meeting was held, on May 28th, at Salisbury House, E.C., Mr. Paget V. Luke, C.I.E., presiding.

In proposing the adoption of the report (see Elec. Rev. p. 879), the Chairman said that considering the period had been a critical one in the history of the company, involving the closing down of all their old generating stations and the concentration of the whole supply at a new source, the record for last year would, he thought, be considered satisfactory. With an increased output and an increased revenue there was a reduction in working costs, and the accounts showed an increased net profit of nearly £17,000 as compared with 1912. The capital account had been increased by £67,959, due to the completion of their high-tension scheme, and to general expansion. When they remembered the size of the area, and the district covered by the company's licences, it was evident that a very large amount of work had to be done in order to cope with the constantly increasing demand for current, a demand which it would be unwise not to be prepared to meet. There must necessarily, therefore, be a constant extension of mains and additions to plant. That involved additional capital, and the directors, wishing to be in a position to raise whatever capital might be required, recommend that they be empowered to increase the capital by £500,000. The board had no intention of thowing that additional capital at once on the market, but proposed as money was required, that a portion of the issue be offered, on such terms as they might consider suitable, taking into account the state of the money market at the time of the issue, with the understanding that any new shares would be first offered to the existing shareholders. Turning to the revenue account, on the debit side there was a large saving in coal and wages at the generating stations, which was owing to the more economical plant and to the closing down of four generating stations and concentrating work at Cossipore. Against the saving thus effected, however, must be set the increased cost of wages, under distribution, owing to the number of men employed in the different sub-stations required under the new conditions. The sum of £7,564, under special charges, was an abnormal one, and represented work done for the new scheme and paid for out of revenue. While 1912 saw the opening of the high-tension generating station at Cossipore, 1913 had been occupied with its consolidation, the final closing down of the old generating stations, the opening of new sub-stations, and the disposal, so far as it had been possible, of the superseded plant. It must be understood that, in disposing of this plant, it was probable some loss, even on its depreciated value, would be sustained, and provision was made for this prospective loss by additional transfers to the depreciation and renewals fund. In addition to work on the new scheme there had been extensions of mains which were constantly becoming necessary, and further additions to plant. One of the objects for which the directors sanctioned the large capital outlay necessary to reform the whole system of supply had been satisfactorily attained, and although the new plant was not fully at work until August last considerable economy in generating costs had already resulted. At the same time the company had been placed in a position to offer current to the manufacturing industries in Calcutta at a very low price. This was bringing a large number of consumers on to the mains which would materially add to the revenue. On the credit side there had been a gratifying increase in the receipts from sale of current, the net revenue having nearly doubled in the last five years. Applications for current for fans and lights showed no signs of falling off, and the demand for supply, from both small and large consumers, continued very encouraging. The street lighting contract for Howrah, which was mentioned last year, had been successfully started, and a number of thoroughfares were now lit by electricity. The result was very effective and would probably mean further extensions, not only in this district, for it had also led to enquiries from other districts of Calcutta. Owing to the satisfactory results of last year's working the directors felt justified in recommending an increase of the dividend for the year 1913, from 8½ per cent., at which it stood in 1912, to 9 per cent. While they were able to recommend an increased division of profits among the shareholders the board was of opinion that it was only fair that their customers should participate in the prosperity of the company. They were therefore considering the best means of making a reduction in the price for current for lighting purposes. They hoped to arrive at a decision very shortly and to make an announcement which they trusted would be satisfactory to the public in Calcutta. The directors, however, in considering this concession, had to remember that, while electric supply companies appeared to be only just recovering from the reduced demand due to the larger use of metal filament lamps, which consumed less current than the old carbon lamps, there was a possibility of the early introduction of a half-watt lamp which would again reduce the consumption of current for an equal amount of light. So far this half-watt lamp, which had been talked about for some time, had not yet been placed on the market in small sizes, but there was no saying how long it would be before the small size lamp was evolved. The preliminary report on the Calcutta improvement scheme, referred to last year, had now been published, and involved the widening of many roads and the pulling down of a large number of old houses. When those new roads were laid out, and the new buildings erected, the company might expect increased demands for electrical energy for lighting and fans. They had lately signed a contract for a supply of alternating current, on a large scale, to a jute mill, the supply to commence before the end of the current year. Other important contracts were under negotiation, and there seemed every reason to anticipate a period of increasing prosperity. Their agent and chief engineer reported that he had been loyally supported by the staff in Calcutta during the year, and the new bonus scheme, which was outlined when he (the chairman) last addressed them, had come into operation for the first time for the year 1913. Under its provisions a bonus of one per cent. on the net profits would be divided among the staff in India, in proportion to their salaries. This year the sum to be divided amounted to £1,271, which should prove to the staff the company's desire to associate them with its prosperity, and should act as an incentive for their loyal co-operation in keeping down expenses. The provident fund, to which the whole of the staff as well as the company, contributed, now exceeded £12,000, and was much appreciated by the employees. As stated in the report, in consequence of the increase of work in Calcutta, it had been found necessary to remove to new and larger offices. The company had been able to secure excellent premises, with plenty of room for the staff, without incurring much additional expense. For the same reason it had been decided to remove the office in London. New premises had accordingly been taken at No. 1, Broad Street Place, to which the work would be transferred early next month. That change would necessitate the retirement of Mr. Reeves, their secretary, but he was glad to say that that gentleman had consented to still serve the company in an advisory capacity.

Sir Guilford Molesworth seconded the motion.

Replying to questions the Chairman said the board recognised that the services of Mr. Reeves to the company were very great, but it was impossible to add that gentleman to the board because the number of directors was limited to five by the articles. As he had said, they were retaining his services in an advisory capacity.

The report was adopted.

Subsequently a resolution was passed increasing the capital of the company from £1,000,000 to £1,500,000 by the issue of 100,000 new shares of £5 each.

The Chairman, in reply to questions, said it was impossible to say when they would be issuing any of the new shares, but he thought it would be necessary to raise some portion of the additional capital before the close of the year.

Madras Electric Supply Corporation, Ltd.

The directors' report for the year ending 31st December, 1913, states that the number of units sold was 4,553,883 compared with 3,579,131 units in 1912, an increase of 974,752. 253 new consumers came on to the mains.

Year.	Consumers connected.	Total connections in KW.	Equivalent in 8-C.P. lamps.	Units sold	Gross revenue
1910	719	2,260	75,329	1,882,787	£17,454
1911	1,038	3,172	105,737	2,583,326	£25,598
1912	1,335	4,226	140,878	3,579,131	£33,890
1913	1,571	4,941	164,707	4,553,883	£41,175

The result of last year's working shows a loss, after meeting debenture and all other charges, of £10,526. The board forewarned the shareholders in their last report that the result for the year 1913 could not be otherwise than unsatisfactory, consequent upon their having to rely upon the old plant to meet the increasing demand. Unfortunately, the position was aggravated by the breaking down of the boiler plant in the early part of the year, necessitating the starting up by the Tramways Company of its own plant, which has since had to be kept running continuously in order to supplement the company's load; added to this, the coal situation showed no improvement, either as regards prices or deliveries. The new plant, the first portion of which it was anticipated would have been erected and in commercial operation before the end of last year, is not yet in commission, but from the latest reports from Madras, a start will take place about the end of June. On account of the condition of the old generating plant, no serious effort was made to procure new consumers, but the amount of energy sold during the year increased by over 27 per cent., and the directors are satisfied that there is plenty of scope for development. The scheme for the consolidation of the management of the company's and the tramways business referred to in the last report, was brought into operation on 1st December last, and the anticipated saving to both concerns has been fully realised. The result of the working of the tramways for the year 1913 showed, after providing for debenture interest, and transferring £7,000 to depreciation and renewal fund, an available balance, including the amount brought forward, of £12,553, compared with £10,523 for the previous year. A dividend of 5 per cent. was paid on the ordinary shares which are owned by this company, and £3,320 was carried forward. Mr. A. M. H. Walrond and Sir W. J. Cuningham, K.C.S.I., have resigned their seats on the board, and the directors desire to place on record their appreciation of the valuable services rendered by these gentlemen. Mr. James Gray (who has been a director of the Tramways Company since its incorporation) has been elected to fill one of the vacancies and has been appointed chairman. It is not proposed to fill the other vacancy at present.

Units generated	5,345,359
Units sold	4,553,883
Units used on works	181,832
Units lost and unaccounted for	609,644
Units sold—Street lighting	62,675
Lighting, fans, and small motors by meter...	1,590,786
Power	2,900,422
Consumers connected	1,571
Maximum demand in KW.	1,648

Bachelet Levitated Railway.—It is reported in the daily Press that a prospectus of this company will shortly appear, offering 90,000 ordinary shares of £1 each. The directors, according to the *Times*, will include Major W. H. Houghton-Gastrell, M.P., Admiral Sir A. Paget, and Sir Harry Samuel, M.P. They propose to erect a full-sized track about a mile in length, on land placed at their disposal by the Great Central Railway. We have already made our position clear with regard to the prospects and possibilities of this system, and will only repeat that from an engineering point of view it is based on utterly fallacious ideas, the development of which can lead only to disaster. The cost of construction, working and maintenance will be so great as to render its operation on commercial lines impossible.

Since writing the above lines we have received a copy of the prospectus; the subscription list opened yesterday and closes to-morrow for town, and on Monday for the country. It is stated that no portion of the issue has been underwritten. The ordinary shares are entitled to one-third of the profits, the vendor shares to the remainder. Mr. Emile Bachelet is named as consulting engineer, and Mr. W. E. Lloyd as chief engineer. The company is to acquire the Bachelet patents in various countries. The exhibition and toy rights are not included in this sale. It is stated that the model track has been "examined" by many eminent engineers, scientists and experts. The present is a parent company, and its business will be confined to demonstrating the utility of the invention and to the promotion of companies in other countries; "from this source alone very large profits should accrue." The patentee will receive £20,000 in cash and £4,500 in vendor shares of 1s. each; the vendors to the company receive £35,000, namely £20,000 in cash, £10,000 in ordinary shares and £5,000 in vendor shares. The flotation is made on the strength of the impression made on the public mind by the toy track at Great Saffron Hill, and is supported only by a report signed by Mr. Bachelet, who, without a particle of experimental evidence, declares that on his system a speed of 300 miles an hour can be easily maintained throughout a journey of any length. He estimates the cost of a line for mail purposes at less than £5,000 per mile, and states that 1 KW. will carry a weight of 5 lb. At present only mail and express carriers are to be constructed. We earnestly advise our readers on no account to invest in this scheme.

Cuban Telephone Co.—The directors report that at March, 1914 there were 16,514 subscribers' stations connected to the system, a net gain for the year of 4,014, or a monthly gain of 334·5 telephones. That the gain was not larger was due to the impracticability of completing during the year the new automatic plants at Santiago and Sagua. According to the *Financier*, in the last annual report it was estimated that the gross annual earning capacity of the company would reach the million-dollar mark; not only has this been accomplished, but the figures for the closing months of the year indicate an advance at the rate of nearly $120,000 per annum beyond that point. It is believed that there will be an increase of 3,500 telephones in the present year, thus bringing the system to 20,000 subscribers one year hence. That this increase will produce a proportionate increase in earning capacity, and that the net earnings will be even greater in proportion are equally certain. This will be due to increased facilities for toll service and the increased number of subscribers, without a proportionate increase in operating and maintenance expenses.

Argentina.—The report of the Compania Telegrafico-Telefonica del Plata, for the year ended December 31st last, states that the revenue amounted to $292,814, as compared with $289 101 in 1912. There was, however, an increase in expenditure of $45,557. Due to the fact that the Compania Telegrafico-Telefonica Nacional did not earn sufficient to pay more than the guaranteed interest on the preferred shares, the company has not received anything, and for that reason the profit on the year's working only amounts to $2,931. The rebuilding of the lines has necessitated heavy expenditure, and the company has been compelled to borrow; on this account creditors figure in the balance-sheet for $425,739. —*Review of the River Plate.*

J. Stone & Co., Ltd.—The directors report an increase, both in volume of trade and in profit for 1913. It is proposed to pay a dividend on the ordinary shares at the rate of 10 per cent., together with a bonus of 3s. per share, adding to reserve £20,000, and carrying forward £125,162.

Birmingham District Power and Traction Co., Ltd.—The directors recommend a dividend of 3½ per cent. (7s. per share) on the preferred ordinary shares for the year to December 31st, £5 000 being placed to reserve and £11,457 carried forward. The annual meeting was held on Wednesday.

Consolidated Gas, Electric Light and Power of Baltimore, Co.—A dividend at the rate of 6 per cent. per annum on the common stock for the quarter ended June 30th is announced.

STOCKS AND SHARES.

Tuesday Evening.

It is not to be pretended that the Stock Exchange is in a particularly happy frame of mind. The principal bull point in the situation—and it would be an important one were there any confidence, any buying—is the ease of the money market. This shows signs, too, of becoming more pronounced, on the strength of which Consols started with a rise after the Whitsun holiday. The advance, however, was soon lost. Some of the financiers in Paris, with a ring of French speculators and another in St. Petersburg, seem to have as much as they can do at the present time to meet their obligations, and incessant sales from both centres have pressed harshly upon prices.

The news from Mexico read more hopefully at the end of last week, but the news that Carranza had taken active steps in the direction of Tampico, caused a lull in the rise of prices. On balance, however, they are decidedly better. In Brazilian issues, too, the tone is firmer, thanks to a substantial rise in the rate of exchange, this causing brisk demand for Brazilian Tractions and some of the other securities of Brazil that just lately have been most depreciated.

Home Railway stocks are in a state of suspended animation, in which whatever movement occurs is mostly towards lower levels. The Whitsun traffics failed to galvanise life or energy into the market, and most sections have suffered. Underground Electric Railways issues managed to shake themselves free from the prevailing dulness, and both classes of shares have improved—this in consequence of the proposed legal alteration in the form of the company, to which reference was made here last week. It is generally supposed that the resolutions will be adopted, and the £10 shares are ⅛ harder at 3¼, while the 1s. shares improved to 9s. 3d., the Income bonds rising a point to 89½. Districts, however, are a point down at 23, there being still some uneasiness as to what will be the upshot of the deliberations over the 'busmen's charter. Metropolitans contrived to gain ½. British Electric Tractions show recovery from the disappointment felt with the dividend recently declared on the 7 per cent. Non-Cumulative Preferred stock, the price of this security rising 3 points to 58½, while the other stocks of the company are a firmer market. London and Suburban Preference improved to 12s. 6d., though the Debenture stock lost 2 points. Yorkshire (West Riding) Ordinary shares are 1/16 lower.

Electricity Supply issues are mostly firm, and there are rises of ⅛ in Charing Cross City Undertaking Preference and St. James' and Pall Mall Ordinary. County of London are steady at 12, which, by the way, seems to be a favourite figure at which both buyers and sellers fix limits for their orders, declining to give way 1/16 either side of this figure. The death of Sir Joseph Swan had no effect upon the price of the Edison & Swan descriptions. Electric Construction shares of both classes are *ex*-dividend.

Amongst other manufacturing concerns, British Westinghouse stands out as the most conspicuous from the Stock Exchange point of view. In the case of the company's Preference Shares, fresh buying occurred towards the end of last week, hoisting the price to 36s., the greater part of the rise being held. Glowing reports continue to reach the Stock Exchange of the Company's present prosperity, while the electrification of the North London Railway has, no doubt, much to do with the favour which the shares are enjoying just now. The rise, it may be pointed out, has been rapid, and, so far, little profit-taking has attended it. General Electric Preference moved up 1/16. Dick, Kerr Preference had a swift rise to 16s. 3d., and there are many inquiries for low-priced shares in this department which have not yet experienced improvement.

Latin-Canadians have experienced all-round recovery. Various bond issues of Mexican railroad companies are to have their current interest "satisfied" in scrip, but the prospect is regarded as being not all black, and (whatever shall happen next week) the rises in Mexican utility descriptions are quite respectable this time. Mexico Trams are 4 higher, Mexican Light and Power Common have gained 5½, while the various bonds are 1 to 3 points up. The market is better generally. Canadian Electrics exceptionally remain weak, but Montreal Light and Power rose 5 points to 227½. In the Brazilian group, Rio Tramway Firsts are once more within a point of par, and the Seconds at 89 are ½ better. Sao Paulo fives, *ex* dividend, look tempting at 97, considering the nature of their security. Para Electrics are unchanged. Brazil Traction spurted 3½, thus more than regaining their fall of the previous week. It should be emphasised, however, that the market in the various Latin-Canadians is still remarkably narrow, so that what in ordinary days would be considered mere normal buying or selling, has now an inordinate effect, either way, upon prices.

The dreadful disaster in the St. Lawrence River is a reminder, inevitable as melancholy, of the *Titanic* loss, with its amazing sequel, the Marconi boom. So rapidly have events—maritime, financial and political—marched since two years back, that the life-saving part again played by the Marconi apparatus in the latest disaster is scarcely mentioned even by the halfpenny papers. The market in Marconi shares continues dull, its usual Continental supporters allowing prices to sag quietly, though in official quotation the levels are maintained.

West India and Panama Ordinary shares are flat. There has been a little forced selling, and most of the Stock Exchange markets resent having shares, or stock, pressed upon them in dull days. Both Preference issues are lower, too. Western Telegraphs went back ⅛. The Eastern division keeps noticeably steady. Globe Preference, however, weakened slightly, and the Anglo-Americans are dull, Directs losing ⅛, Anglo-American Deferred following suit. Reuters at 8½ are *ex* dividend. Anglo-American Preferred stock and New York Telephone bonds remain in demand from investors. Callenders, *ex* dividend and bonus, are obtainable at 12, making the return 6¼ per cent. on the money. India-Rubber shares fell 5s., and the Rubber market, with the price of the product about 2s. 4d. per lb. has relapsed into a state of semi-somnolence.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	May 28	4,039	+ 473	20	16,603	+ 1,329	..	..
Blackpool-Fleetw'd	„ 21	1,[illegible]24	–1,792	20	8,529	– 1,076	8	..
Bristol	„ 22	3[illegible],915	+1,713	21	160,613	+ 13,151	30·5	..
Brit. Elec. Trac. Co.	„ 15	219,973	5,251		..	+12,177	429·8	..
Chatham and Dist.	„ 21	3,578	– 116	20	17,489	+ 275	14·58	..
Cork	„ 21	2,118	+ 183	20	9,544	+ 217	9·89	..
Dublin	„ 22	23,965	+ 54	21	111,674	– 2,643	54·25	..
Hastings	„ 20	3,691	– 377	20	..	– 173	19·5	..
Lancashire United	„ 20	6,711	+ 421	20	32,321	+ 3,819	42	·3
Llandudno-Col. Bay	„ 22	93[illegible]	– 548	25	4,740	– 457	6·5	..
London United ..	„ 22	26,211	1,559	21	120,794	+ 3,316	..	..
Tyneside	„ 20	2,117	+ 55	20	10,159	+ 627	11	..
Anglo-Argentine ..	„ 20	217,016	2,322	20	1,126,715	+ 9,689	..	..
Auckland	„ 8	21 662	– 6[illegible]6	44	236,392	+ 5 419	25 42	1·31
Calcutta	„ 23	17,3[illegible]3	+ 89[illegible]	..	..	+ 4,330	..	..
Kalgoorlie, W.A. ..	April	2,820	..	17	9,805	..	20·5	..
Madras	May 15	4,[illegible]33	+ 814	19	17,481	+ 1,353	15·25	..
Montevideo ..	April	29,645	– 442	26	200,176	+ 414	..	..
Cen. London Rly.	May 23	19,731	+ 314	21	105,915	– 3,771	6·78	·4
City & S. Lon. Rly.	„ 23	10,115	– 618	21	57,415	– 4,313	7·26	..
Dublin-Lucan Rly.	„ 22	[illegible]92	+ 3	20	2,578	– 43	7	..
L'pool Overh'd Rly.	„ 24	7,245	+ 213	21	85,968	+ 1,265	6·6	..
London Elec. Ry. Co.	„ 23	54,720	– 120	21	301,205	– [illegible]20	21·25	..
Mersey Railway ..	„ 23	[illegible]880	– 98	21	47,352	+ 85	4·5	..
Metropolitan Rly.	„ 24	71,984	+4,60[illegible]	21	376,036	31,592	29·25	8·5
Met. District Rly.	„ 23	51,712	– 208	21	275,915	+ 800	25	..

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 2nd.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	½ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	14½ — 16½	..	..
Do. Do. Deferred ..	100	..	..	6¼ — 8¼	+1	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89½ — 91½	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	3	3½	57 — 60	+3	5 16 4
Do. 5 % Perp. Deb. ..	100	5	5	92½ — 94½	..	5 6 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 80	..	5 12 9
Central London Railway, Ord. ..	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref. ..	1	6	6†	15/32 — 23/32	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord. ..	1	..	..	3/16 — 9/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	9/16 — 11/16	+1/32	7 5 8
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	75 — 80	−2	5 12 5

NAME.	Stock or Share.	Dividends for		Closing Quotations June 2nd.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	56 — 60	..	6 13 4
Metropolitan Railway Consol. ..	100	1⅝	1⅝	39½ — 40	+ ½	4 1 3
Do. Surplus Lands	100	2¾	2¾	61 — 63	..	4 7 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	80 — 82	..	4 5 4
Metropolitan District Ord. ..	100	Nil	..	22¼ — 23¼	—1	Nil
Do. 6 % Deb.	100	6	6	138 —141	..	4 5 3
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 86	..	5 4 8
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 13 0
Potteries, Ord.	1	3½	3½	9/32 — 13/32 xd	..	8 12 10
Do. 5 % Pref.	1	5	5	17/32 — 21/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81¾ — 84¾	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	8⅛ — 8⅝	+ ⅛	Nil
Do. "A"	1/-	..	..	7/16 — ½	+1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	115 —117	..	5 2 7
Do. 4½ % Bonds	100	4½	4½	99½ —101½	..	4 8 8
Do. 6 % Income	100	6	6	89 — 90	+1	6 13 4
Yorkshire (West Riding). Ord. ..	5	Nil	Nil	¼ — ½	−1/16	Nil
Do. 6 % Pref.	5	3	4	4⅝ — 4⅞	..	4 2 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations June 2nd.	Rise + or Fall	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 11/16 — 4 15/16	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4¼ — 4½	..	6 2 3
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	98½ —101½	..	4 8 6
Do. 5 % Deb.	100	5	5	94 — 96 xd	..	5 4 0
Auckland Trams, 5 % Deb. ..	100	5	5	103 —106	..	4 14 3
Bombay Elec. S. & Trams, Pref,	10	6	6	10¾ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % 2nd Deb.	100	5	5	99 —101	..	4 19 0
Brazilian Traction, Light and Power	$100	6	6†	80½ — 82½	+3½	7 5 5
Brisbane Trams Invt., Ord. ..	5	8	8	6⅝ — 7⅛ xd	..	5 12 3
Do. 5 % Pref.	5	5	5	4¾ — 5¼ xd	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	110 —114	..	7 0 4
Do. Pref. Ord.	100	6	6	103 —107	..	5 12 1
Do. 5 % Pref.	100	5	5	103 —106	..	4 14 2
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	97 —100	..	4 10 0
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	93½ — 95½	..	4 9 1
Calcutta Trams, Ord.	5	7½	9½	6½ — 7	..	6 15 9
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5 3/16 — 5 7/16	..	4 11 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90 — 94	+2	5 6 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie El. Trams 5% A Deb.	100	5	5	84 — 89	..	5 12 4
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations June 2nd.	Rise + or Fall	Present Yield p.c.
La Plata Elec. Trams, Ord. ..	1	..	..	¼ — ½	..	..
Do. Pref.	1	4⅜d.	6	23/32 — 31/32	..	6 5 0
Lisbon Elec. Trams, Ord. ..	1	6	6	1 3/32 — 1 11/32	..	4 9 3
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	95 —100	..	5 0 0
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
" Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17
Manaos Trams & Lt., 1st Deb. ..	100	5	5	78 — 81	..	6 3 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ —100½	..	4 19 6
Mexico Trams Com	$100	7	7	71 — 75	+4	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	78 — 82	+1	6 2 0
Do. 6 % Bonds	100	6	6	75 — 80	..	7 10 0
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	3⅞ — 4⅜	..	11 8 6
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	86½ — 89½	..	5 11 8
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	98 —100	+2	5 0 0
Do. 5 % Mort. Bonds	100	5	5	88 — 90	+ ½	5 11 1
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	94 — 98 xd	..	5 2 0
Singapore Trams, 5 % Deb. ..	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	92½ — 95½	..	5 4 9
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations June 2nd.	Rise + or Fall	Present Yield p.c.
Bournemouth & Poole, Ord. ..	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10⅜ — 10⅞	..	5 10 4
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 9
Brompton & Kensington, Ord. ..	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	89½ — 92½ xd	..	4 6 8
Charing Cross, West End & City	5	5	6	4⅞ — 5⅜	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	+ ⅛	4 14 9
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	97 —100	..	4 10 0
City of London, Ord.	10	9	10	16 — 17	..	5 17 8
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	..	4 9
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 7 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 —103	..	4 8 1
County of London, Ord.	10	6	7	11¾ — 12¼	..	5 14 3
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜	..	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	103 —106	..	4 5 8
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	..	..	5/16 — 9/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3½ — 4	..	7 10 0
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations June 2nd.	Rise + or Fall	Present Yield p.c.
Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	[illegible]	7½ — 8	..	5 12
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅜ — 1¾	..	5 2 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	92½ — 95½	..	4 3 9
Metropolitan	5	4½	4½	3¼ — 3¾	..	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford	5	7	7	5 13/16 — 6 5/16	..	5 11 0
St. James' and Pall Mall, Ord. ..	5	10	12	9½ — 10	+ ⅛	6 0 0
Do. 7 % Pref	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2¾ — 3⅜	..	6 10 4
Do. 5 % First Mort. Deb. ..	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	Nil	..	5/16 — 9/16	..	..
Do. 5 % Cum Pref.	5	3‡	4	2½ — 3	..	6 13 4
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord.	5	10	10	8¼ — 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4 15/16 — 5 3/16	..	4 6 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 2nd.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Adelaide, 6 % Pref.	5	6	6	5¼ — 5½	..	5 11 7
Calcutta, Ord.	5	8½	9	7⅞ — 8	..	5 12 6
Do. 5 % Pref.	5	5	5	5 1/16 — 5 5/16	..	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	5 8 0
Canadian Gen. El. Com.	$100	7	8	103 — 108	..	7 5 6
Do. 7 % Pref.	$100	7	7	117 — 122	..	5 18 10
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 — ⅞	..	7 12 0
Do. 5 % Deb.	100	5	5	87 — 90	..	5 11 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	83 — 88	..	6 14 10
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ — 95½	..	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	5	4	½ — ¾	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 — 105	..	4 15 2
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	105 — 108	..	4 12 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	61 — 66	+3	7 11 6
Mexican Lt. & Power, Common	$100	4	4†	43 — 47	+5½	..
Do. 7 % Cum. Pref.	$100	7	7	71 — 75	+2½	9 6 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	73 — 78	+3	6 8 4
Do. 5 % 2nd Mort. Bonds	100	5	5	59 — 64 xd	+2½	7 13 3

NAME.	Stock or Share.	Dividends for		Closing Quotations June 2nd.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	51 — 55	+ 1	..
Montreal, Lt., H. and Power	$100	9	10†	225 — 230	+ 5	4 7 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 — 245 xd	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 — 103	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	101 — 103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 — 102	..	4 8 8
Shawinigan Water, Capital	$100	5½	6	134 — 138	..	4 7 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 — 109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	99½ — 101½	..	4 8 8
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	98 — 100 xd	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	85 — 87	..	5 15 0
Victoria Falls Power, Pref.	1	6	6	23/32 — 25/32	..	7 18 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 3

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 2nd.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	23/32 — 27/32	..	8 5 0
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	6 17 2
Babcock & Wilcox	1	16	16	2 15/16 — 3 1/16	..	5 4 7
Do. Pref.	1	6	6	1¼ — 1⅜	..	4 7 6
British Aluminium, Ord.	1	..	5	15/16 — 1 1/16	..	4 14 1
Do. 6 % Cum. Pref.	1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	97 — 100	..	5 0 0
Do. Deb. Stk.	100	5	5	90 — 95	..	5 5 3
B.I. & Helsby Cables	5	10	13	9¼ — 9¾	..	6 13 4
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	101 — 104	..	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	2	Nil	5	1 21/32 — 1 27/32	+ 1/32	5 8 6
Do. Deb.	100	4	4	73 — 75	..	5 6 8
Do. 6 % Prior Lien	100	6	6	100 — 103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	8/- — 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	50 — 55	..	8 3 8
Do. 4½ % Second Deb.	100	4½	4½	29 — 33	..	13 12 8
Callender's Cable	5	15	15	11¾ — 12⅛ xd	..	6 3 8
Do. Pref.	5	5	5	5 — 5¼	..	4 16 5
Do. Deb.	100	4½	4½	97 — 100	..	4 10 0
Castner-Kellner	1	20	22½	2⅜ — 2⅞	— 1/16	8 11 5
Do. Deb.	100	4½	4½	104 — 107	..	4 4 1

NAME.	Stock or Share.	Dividends for		Closing Quotations June 2nd.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	⅜ — ⅝	..	..
Do. Pref.	1	6	6	¾ — ⅞	+ 3/32	6 17 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	1	5	6	9/16 — 11/16xd	..	8 14 6
Do. Pref.	1	7	7	1 — 1¼	..	6 4 5
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 18 9
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10 5/16 — 10 9/16	+ 1/16	5 15 9
Do. Deb.	100	4	4	87 — 91	..	4 8 0
Henley's, Ord.	5	15	20	14½ — 15½	..	6 9 0
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	99½ — 107½ xd	..	4 8 8
India-Rubber, G. & T.	10	7½	7½	9¾ — 10¾	— ¼	6 19 5
Do. Pref.	10	5	5	8¾ — 9¼	..	5 5 8
Telegraph Construction	12	20	20	36½ — 38½	..	6 4 7
Do. Deb.	100	4	4	98 — 100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	63 — 67	— 1	5 19 8
Do. B 4 % Cum. Pref.	100	..	£4	40 — 44 xd	..	9 1 10

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 2nd.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾ — 6¼	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 — 127	..	6 6 0
Do. Collat. Trust	$1000	4	4	91 — 94	..	4 5 0
Anglo-American Telegraph	Stock	3	3	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	108½ — 109½	+ ½	5 9 7
Do. Def.	Do.	30/-	30/-	23 — 23½	— ⅛	6 7 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	..	4 16 2
Chili Telephone	5	8	6†	7¼ — 7½	..	5 6 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	..	4 18 9
Cuba Telegraph	10	6	6†	8½ — 9½	..	6 6 4
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7¼ — 7¾	..	6 9 0
Direct United States Cable	10	4	4	6¾ — 6⅞	— ⅛	5 16 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	130 — 133	..	5 5 3
Do. 3½ % Pref. Stock	Do.	3½	3½	77 — 79	..	4 8 9
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 3 4
Eastern Extension	10	7	7	12½ — 13	..	5 7 9
Do. 4 % Deb.	Stock	4	4	94½ — 96½	..	4 3 0
Globe Telegraph and Trust	10	6	6†	10⅞ — 11⅜	..	5 5 4
Do. 6 % Pref.	10	6	6	12⅜ — 12⅞	— ¼	4 13 4
Great Northern Telegraph	10	20	20	31 — 33	..	6 1 1
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	5	5	81 — 84	..	5 19 1
Do. 4 % Cum. Pref.	$100	4	4	68 — 71	..	5 12 7

NAME.	Stock or Share.	Dividends for		Closing Quotations June 2nd.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph	1	20	20	3 — 3¼	..	6 7 10
Do. 7 % Cum. Partic. Pref.	1	17	..	2⅜ — 2⅞	..	6 9 6
Monte Video Telephone, Ord.	1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Pref.	1	5	5	23/32 — 27/32	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99½ — 100½	— ½	4 9 6
Oriental Telep. and Elec.	1	10	10	2 3/16 — 2 7/16	..	4 6 7
Do. 6 % Cum. Pref.	1	6	6	1 5/32 — 1 9/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	4 0 0
Reuter's	10	10	7	8 — 9 xd	..	7 15 7
Submarine Cables Trust	Cert.	6	6	126 — 129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 — 100	..	4 10 0
United River Plate Telephone	5	8	6†	6½ — 6¾	..	5 18 5
Do. 5 % Cum. Pref.	5	5	5	5½ — 5⅝	..	4 9 0
West Coast of America	2½	2½	N	⅞ — 1⅛	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	— ⅜	4 0 10
West India and Panama Teleg.	10	1¼	1¼	1½ — 1¾	..	7 2 10
Do. 6 % Cum. 1st Pref.	10	6	6	9¼ — 9¾	— ⅜	6 3 1
Do. 6 % Cum. 2nd Pref	10	6	6	8½ — 9	— ⅛	6 13 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	10	7	7	13½ — 13¾	— ⅛	5 1 11
Do. 4 % Debs.	Stock	4	4	95½ — 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	94 — 97	..	4 12 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

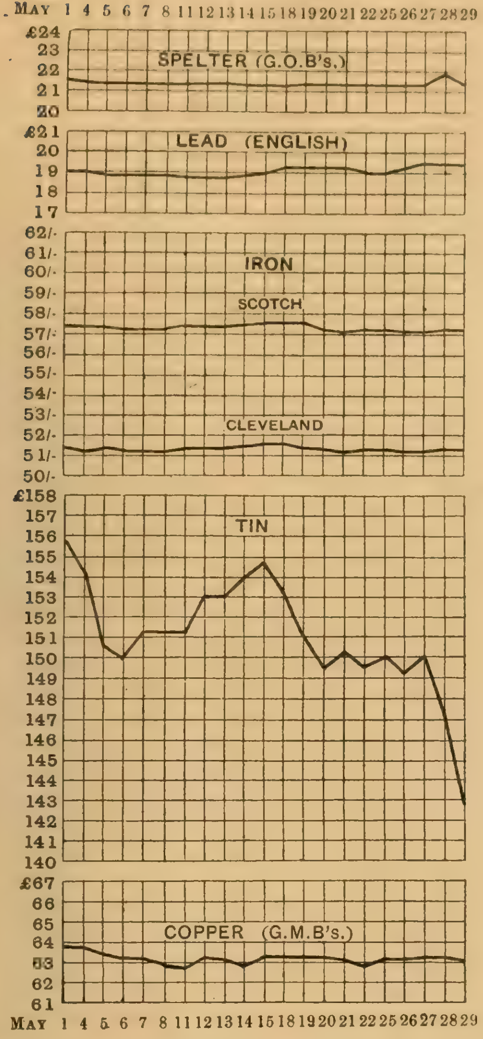
Bank rate of Discount 3 per cent., January 29th, 1914.

A Twenty-First Anniversary.—On May 23rd the staff of the Newcastle branch of Messrs. Siemens Bros. Dynamo Works, Ltd., celebrated the 21st anniversary of the establishment of the branch by an enjoyable outing. On the invitation of the firm, they, together with their wives and friends, were conveyed by motor to Rothbury, where they were entertained at dinner. Mr. Campbell proposed the health of Messrs. Siemens, thanking them for their hospitality, and Mr. Ball responded on their behalf. Owing to the bad weather, the sports programme had to be somewhat curtailed and a whist drive was substituted. The evening, however, was fine, and the following events were carried out, concluding a most successful day:—Egg and spoon race for ladies; blindfold race; 100 yds. staff consolation handicap; and tug-of-war.

Electric Clocks.—We understand that when Messrs. Vickers, Ltd., went three years ago into their new office buildings at Westminster, they decided to equip them with electric clocks, and invited three manufacturers to equip a couple of floors each on trial. We are informed that the period of test has now expired, and the firm's decision has been in favour of the Synchronome system with which their works at Sheffield, Barrow-in-Furness and Montreal are also equipped. At 10 days' notice the Synchronome Co., Ltd., were instructed to extend their system of 73 clocks by the addition of a further 52 of a special type suitable to the building. This extension was successfully carried out between the time of closing on Saturday and re-opening on Tuesday morning of the Whitsuntide week-end.

METAL MARKET.

Fluctuations in May.



Electricity Supply Rifle League.—The following matches have been decided during May :—Brimsdown (Mursell, 97), 541, Ilford (Tufnell, Brown, 97), 564 ; Brimsdown (Dartnall, 97), 552, Westminster (H. Pearman, 97), 558 ; Brompton (Austin, 98), 565, Ilford (Bailey, McKelvey, 96), 569 ; Brompton (Furneaux, 96), 561, Shoreditch (Harrison, Weekes, 99), 585 ; Central (Cope, 97), 561 ; City Co. (Harlow, 98), 554 ; Central (Robinson, 98), 567, Hackney (Hilling, Matthews, Self, 97), 570 ; Central (Robinson, 98), 573, Shoreditch (Ebner, 99), 578 ; City Co. (Harlow, 96), 549, Westminster (W. Pearman, 97), 557 ; City Co. (Harlow, 96), 557, Ilford (Tufnell, 95), 555 ; Hackney (Self, 97), 561, Poplar (Randall, Cruickshank, 95), 548 ; Hackney (Hilling, Matthews, 96), 562, Ilford (McKelvey, Bailey, Haeger, 98), 563 ; Poplar (Randall, 96), 545, Westminster (Horley, 95), 555 ; St. James's (Cockburn, 95), 555, Westminster (Winchcombe, 98), 569. The following are the positions to date :—

	Matches.				Scores.		Average
	Shot.	Won.	Lost.	Pnts.	For.	Agnst.	per match.
Shoreditch ...	6	5	0	12	3,456	3,316	576·0
Central ...	7	5	2	10	3,991	3.868	570·14
Westminster	7	5	2	10	3,898	3,898	556·85
Brompton ...	7	4	3	8	3,958	3,933	565·43
Ilford ...	8	4	4	8	4,673	4,422	559·12
Hackney ...	6	3	3	6	3,314	3,323	552·3
St. James's ...	5	2	3	4	2 783	2,805	556·6
City Co. ...	5	2	3	4	2,761	2,776	552·2
Brimsdown ...	5	0	5	0	2,726	2,801	545·2
Poplar ...	6	0	6	0	3,172	3,390	528·66

REVIEWS.

Wireless Telegraphy and Telephony. By C. R. Gibson. London: Seeley, Service and Co. Price 5/- net.

This is a popular account of the past and present of wireless telegraphy and telephony which assume no previous knowledge of the subject on the part of the reader. On the whole the author fulfils his aim very successfully, though it is as well to state at once that systems other than the Marconi system hardly receive proportionate treatment. The second objection which is apparent from a preliminary survey of tne book is that, although the latter is excellently arranged and produced, its price is too high. It is surely a mistake to bring the price of a work into conformity with that of a series to which it is to be added if the amount of matter which is or can be usefully presented to the reader does not justify this price. In the writer's opinion, the price of this book could and should be at least 30 per cent. lower.

The author is to be complimented on the care and skill with which he leads the reader step by step from elementary facts which are general knowledge, through suitable analogies, to the ultimate goal in view. In Chapter I the reader is given a working conception of ether waves, and made to realise the relation existing between light and "wireless" oscillations. There is a slight laxity of construction in Paragraph 2, p. 22, which implies, at present, that fluorescence is a phosphorescent *substance*, etc.; in several places there are unjustifiable changes in tense in succeeding sentences, which blemishes should be removed at the earliest opportunity. In Chapter II a number of fundamental principles, including the nature of electric discharge and the meaning and action of electromagnetic induction, are dealt with in a manner that should easily be followed by the lay reader, yet which introduces no serious technical inaccuracy. The electronic theory is clearly explained in simple language in Chapter III, but the author seems here to wander considerably outside the bounds of strictly pertinent matters; the matter actually presented is excellent, but a considerable percentage of the space occupied by this chapter might profitably have been devoted, say, to a more extended description of methods and apparatus, and a treatment of the applications of wireless telegraphy.

Chapter IV is devoted to an account of early proposals and experiments, and as one reads this and the two following chapters (which deal respectively with the advent of true wireless telegraphy and with Sir William Crookes's remarkable forecast in 1892), one is more than ever impressed and saddened by the extraordinary series of accidents by which—from the date of Faraday's induction experiments in 1831, to Thomson's experiments in 1874, Hughes's wireless communication in 1879, and Lodge's remarkable work in the nineties—the immediate commercial application of known facts and methods was overlooked. It has been said that we are a nation of fortunate blunderers, but our blunders—if this be not too harsh a word in this connection—are not always fortunate as regards the commercial application of scientific research. Nevertheless, we can now read with no more than a feeling of regret for opportunities missed, the author's graphic description of the work of Faraday, Morse, Lindsay, Preece, Maxwell, Hughes, Hertz, Lodge, and others. Following excerpts from the extraordinary prophecies by Crookes in 1892, we are presented with a pleasing description of the advent and rapid preliminary successes of Marconi. The first indications of the services which wireless telegraphy were to render in saving life at sea were given fifteen years ago, when mishaps to the East Goodwin Lightship were reported promptly by this means.

In Chapter IX the author considers what other inventors were doing at this time, and presents a brief description of the Lodge-Muirhead, Slaby-Arco, Braun-Siemens, and De Forest systems as used at the end of the nineteenth century. The use of wireless during the Boer War is recalled, as well as the fact that in 1892 the maximum distance of wireless transmission was 100 miles, whereas the Atlantic was bridged three years later. How this further rapid advance was made is discussed in Chapter X, the subjects covered being tuning, the production of lightly damped oscillation and the magnetic, electrolytic and barretter detectors. The stations and apparatus first and now used to bridge the Atlantic form the subject of Chapter XI. "Other Systems" are dealt with in the dozen pages forming Chapter XII. This brevity is rather unfair, and we would suggest that in a later edition the author should elaborate this section of his work, and include, say, two more chapters dealing with methods of recording wireless messages and with actual and potential applications of wireless communication. We find no mention of the important time and weather services now in regular operation, and the applications of wireless telegraphy to fishing fleets, and to wireless "beacons," etc., are surely worth treatment in a popular volume.

Chapters XIII and XIV deal with the general principles of telephony and of wireless telephony; the treatment given is brief (2½ pp. and 5½ pp.), but very useful considering the small space occupied. Chapter XV comprises a useful chronological index of the evolution and development of wireless telegraphy, and in the Appendix is given a glossary of terms. The outstanding criticism concerning this excellent work is that its scope should be widened somewhat or its price reduced.

Modern Electrical Theory. By Norman Robert Campbell, Sc.D. London: Cambridge University Press. Price 9/- net.

Though this is a second edition it is really a new book. The great increase in our knowledge of radiation effected during the last six or seven years has necessitated the rewriting of nearly the whole of it. It is written for the man who has a sufficient acquaintance with the older physics and who desires to study in detail the more modern developments. Its chief concern is not with facts; it attempts to clothe the results of modern experimental work with a suitable garb of theory.

Electrical theory of to-day differs little in change or progress of idea from what it was six years ago. The electronic hypothesis is just as firmly established, but we have greater knowledge of where to look for difficulties attending it. The book under review takes these difficulties firmly by the hand and endeavours, by a comprehensive look round, to account for them. It opens with a discussion on the properties of electricity and deals with Faraday's theory, Maxwell's theory, and the electron theory. Then dielectrics are taken up and Lorentz's theory, refraction of light, dispersion, selective reflection and the consequences of applying the electronic hypothesis to these discussed. Thereafter we have a summary of the properties of electrolytic and metallic conductors, worked out on the electron theory, due consideration being given to such phenomena as the Peltier effect, the Thomson effect and the Hall effect. Gaseous conduction comes next, and this is taken up and discussed by the help of the most modern experimental research, that of Sir J. J. Thomson on positive rays being prominent. Bragg's work also receives here, as throughout the book, full consideration. Magnetic susceptibility and magneto-optics are then touched upon, and this concludes Part I of the work.

Up to this point the author has endeavoured to explain in terms of the electronic theory the electrical and magnetic properties of material substances. The results arrived at are much as would be expected, namely:—

(1) That electric charges are distributed discontinuously.

(2) That the charge of any particle is a multiple of a universal unit.

(3) That there are charged particles which are common constituents of all bodies.

(4) That the mass of these particles is very much less than that of any atom.

(5) That the charge on these particles is -4.7×10^{-10}.

Part II deals very fully with radiation. Indeed, the subject is here treated in much more detail than we remember seeing it elsewhere. All theories are taken up in turn and investigated by the aid of mathematics and experiments on radio-activity. The chapter towards the end of the book on the structure of the atom will perhaps be of greatest interest to those who deal with the practical applications of electricity, and at the same time desire to keep abreast of modern conceptions. A few of the points enunciated about the atom, as deduced from the comprehensive treatment the work gives to the subject, may be stated as follows:—

(1) It is probable that the whole number of electrons in any atom is not very different from that expressing its atomic weight when that of hydrogen is taken as unity, and that the number increases regularly with the atomic weight and is not a periodic function of it.

(2) In every atom there are a few electrons differing greatly from the rest in the way in which they are attached to the atom. These are more easily detached from the atom. The author calls them "valency electrons," and the others "fixed electrons."

(3) The atom does not consist wholly of electrons. It contains a positive charge equal and opposite to the sum of the negative charges on all the electrons.

(4) There are two chief hypotheses to account for (3). (a) The positive charge is distributed uniformly throughout a sphere the radius of which represents the "radius of the atom"; (b) the positive charge is concentrated on a single particle round which the electrons are arranged.

(5) Helium being a product of the disintegration of all the known radio-active elements, the structure of the helium atom is involved in that of all atoms.

Stark's theory that a chemical combination between two atoms represents not a direct attraction of one atom for the other, but a simultaneous attraction of both atoms for the same electron, which thus forms a bond between the atoms, is fully discussed and several interesting diagrams are given.

The work can be thoroughly commended to all those who, having a sufficient knowledge of mathematics and physics, desire to bring themselves right up-to-date in the fascinating realm of the structure of matter and of electricity.

A New Era in Chemistry. By Harry C. Jones. London: Constable & Co., Ltd. Price 8s. 6d. net.

The period fixed for the New Era begins in 1887, the year in which the first volume of the Zeitschrift fur physikalische Chemie was published. This volume contained the well-known papers of Van't Hoff, on the "Relations between Solutions and Gases," and Arrhenius on the "Theory of Electrolytic Dissociation." The year 1887 therefore saw the birth of the new science of physical chemistry. The chemistry of to-day has progressed considerably from that of twenty-five years ago, the difference being most marked in the methods of correlating this science with its neighbours, especially physics and mathematics. Before the New Era, a student of chemistry was occasionally initiated into the mysteries of physics, but the two sciences were studied as entirely independent subjects. Mathematics was rarely or never introduced into chemistry.

The present volume was written to point out the differences existing between the physical sciences of to-day and those of twenty-five years ago; also the manner in which the development has been brought about. No special appeal is made to any one class, and the book should therefore prove of interest to physical scientists in general. The treatment throughout is comprehensive, only the most elementary chemistry, physics, and mathematics being discussed. Not only is the subject of the simplest, but the author's style is free and easy.

The book begins with a discussion of the condition of chemistry in 1887, and gives a brief outline of the introduction of Mendeléeff's periodic system, Kekule's theory of the constitution of carbon compounds, and other similar modern conceptions of this science. Chapter 2 gives the historical development of the law of Mass Action, and chapter 3 deals almost entirely with Thermo-chemical data. The four following chapters are devoted chiefly to the work of Van't Hoff, whose epoch-making papers are now known to all students of physical sciences. Chapter 8 gives the historical data leading up to Arrhenius' Theory of Electrolytic Dissociation. Chapter 9, which gives a résumé of the author's work, is extremely interesting, but the matter is scarcely of sufficient importance to rank with the writings of the great scientists. The author, however, places great emphasis on the importance of his own work. The next two chapters are devoted to the researches of Ostwald and his students. The amount of work covered by these pioneers is really astounding, and it may be safely said that no single scientist has ever made his influence felt in such a marked manner as Ostwald. Ostwald was undoubtedly the father of Electro-chemistry, and the Leipzig School under his direction became the birthplace of most of the modern conceptions of this New Era. The final chapter deals with Radiochemistry and the new electron theory, which are dealt with in a very able and interesting manner, and show the trend of modern research. The subject is undoubtedly a difficult one, but the author deals with its salient points in such a manner that it appears quite simple. A short appendix is also added, which describes the personal appearance and general characteristics of the great scientists Mendeléef, Kekule, Gibbs, Ramsay, Van't Hoff, Arrhenius, and Ostwald. This is a very interesting addition, and gives a personal touch to the volume.

The book contains very few blemishes, but some of minor importance have been noted. On page 52, while discussing the work of Le Bel on the optical activity of tartaric acid, the author has confused the reason for the inactivity of the meso acid with the inactivity of the racemic acid. Again on page 123, the writer ignores the fact that there is still a school of scientists who do not accept the Theory of Electrolytic Dissociation; in fact, some advanced chemists pin their faith entirely to a Theory of Association. The explanation of the action of pure zinc on sulphuric acid (see pages 189-190), is by no means clear. Pure zinc refuses to dissolve in pure sulphuric acid, in spite of its high solution tension, the reason being that zinc is a metal of high super tension, as has many times been proved by different authors. The views given by the writer, however, are somewhat confusing. The method of separating metals according to their decomposition values (page 242), was worked out in a practical form by Sand. The discovery of argon is attributed to Sir William Ramsay (page 284), as the result of Lord Rayleigh's determinations of atmospheric nitrogen. It should be remembered, however, that Lord Rayleigh also discovered argon by methods quite independent of Ramsay's. There is an obvious error on page 294. While discussing the radio activity of certain metals, it is stated that some of them, such as potassium and radium, have been shown to be slightly radio-active. The word radium is evidently out of place. These small errors, however, are of minor importance, and in no wise detract from the value of the book. The writer has presented a volume of surpassing interest, and quite up to the standard of his previous publications. The interest is sustained from cover to cover, the book reading more like a novel than a scientific publication. It is written in a manner suitable for scientists in general, and requires no great knowledge of physical chemistry for its complete understanding. It should, therefore, appeal to a very large number of students, whose outlook on the view of chemical science will be materially enlarged thereby. The best thanks of all scientists are due to the author for this valuable contribution.

Soft Soldering, Hard Soldering and Brazing. By J. F. Hobart. London: Constable & Co., Ltd. Price 4/- net.

Although apparently a simple operation, demanding little skill and easily learnt, the art of soldering covers a wide field and affords scope for a high degree of intelligence and technical achievement. It also presents opportunities, especially in electrical work, for bungling and inefficiency which result in the execution of jobs to all outward appearance sound and workmanlike, yet rotten at the core. How many a cable-end has been imperfectly sweated into a terminal lug, with consequent heating and separation, resulting in a switchboard fire! To prevent such mishaps there is nothing so effectual as a course of instruction at the hands of a qualified teacher; failing this, however, those who desire to acquire a sound knowledge of the subject cannot do better than study this book, and practise the various operations at the bench until they are able to turn out a neat and trustworthy job. The author, a man of wide experience, deals with the subject exhaustively, minutely describing the various fluxes and alloys, and explaining how they are employed for all kinds of work. The tools and appliances that are used are also fully described, with the aid of numerous illustrations, specially drawn and lettered to facilitate detailed explanation. The book abounds in "kinks" and sage remarks, and many examples of defective work are shown, as warnings of the consequences of inexpert or careless workmanship. One chapter is devoted to electrically heated tools, of which the author has a high opinion, though he points out that electrical tools must be handled carefully and that trouble with them is the fault not of the tools but of the user.

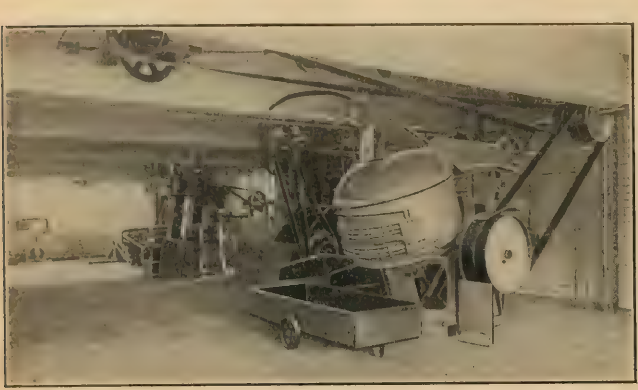
The substance of the work has evidently been published in serial form in some periodical, for we find references to the "February number," etc., and the table of contents has no relation at all to the numbers of the pages; but a good index, correctly numbered, makes up for this defect, and on the whole we can strongly recommend the book.

A Quick Change.—The two electric motors which are used for printing the *Jewish Express* recently broke down, and the owners were faced with the alternatives of stopping printing for two days or sending their paper to be printed elsewhere. In this emergency they approached the Stepney Borough Council's electricity department at 11 a.m. The latter showed its sympathy in a very practical manner, for within three hours a new 9-H.P. British Thomson-Houston motor was in the works, making it possible to continue publication without interruption. The proprietors expressed their very best thanks to the Council for this smart piece of work.

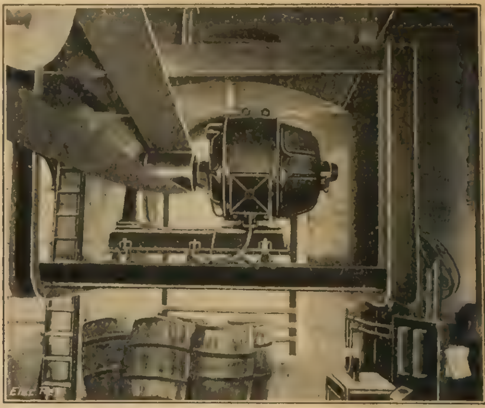
ELECTRICAL EQUIPMENT OF MODERN BAKERIES.

The application of electricity to the baking industry is most desirable in the interests of cleanliness, economy, efficiency, speed, regularity and reliability, and also, since baking operations are generally carried out at night, from the point of view of efficient lighting.

A typical example of this class of work is the bakery of Messrs. J. & B. Stevenson, at Cranstonhill. In one of their bakehouses a 60-B.H.P. motor, by the British Thomson-Houston Co., was installed to replace a steam engine and boiler, thereby saving a great deal of floor space. This motor is suspended by steel hangers from the ceiling of the ground floor, and connected by belting and countershafting to two groups of machines, viz.:—



Kneading Machinery, &c., with 30-h.p. B.T.H. Motor Drive.

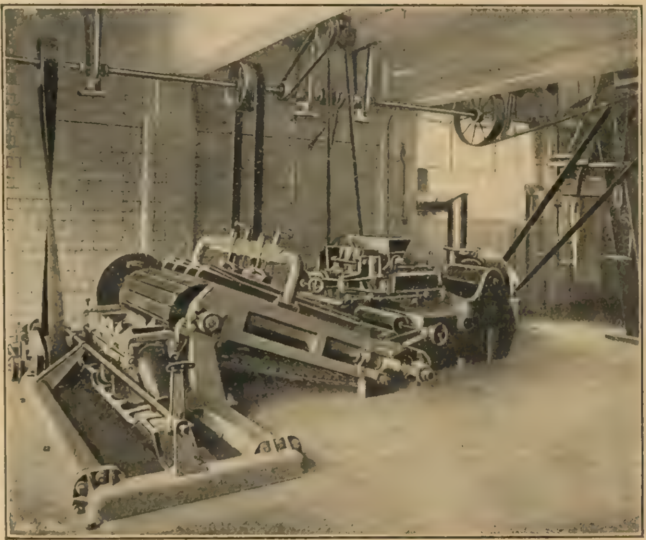


60-h.p. Motor Drive, Cranstonhill Bakery.

Ground floor: Two kneading machines and one dividing and handling machine two stirrers, and a ventilating fan; basement: Two kneading machines and one dividing and handling machine.

It is ultimately intended to install a duplicate motor on a third floor where it will replace a gas engine driving a power lift, two kneading machines, one stirrer, a fruit cleaner, and automatic machines, with provision for its being connected to the main shafting on the lower floors.

In the latest premises of this firm, two floors are completely equipped with electrical drives, and two others are to be similarly equipped at a later date.



B.T.H. Pipe-Ventilated Motor driving Automatic Plant in a Bakery.

Two B.T.H. motors are used, of 30 and 12 B.H.P. respectively, and are of the pipe ventilated type. These are specially designed for use in a dusty atmosphere and are totally enclosed, ventilation being obtained by means of a pipe led outside the building. Airtight glass windows are let into the casing to enable a close view of the commutator and brush gear to be obtained.

The two groups of machines driven by these motors are as follows:—(1) Two kneading machines, flour sifter with elevator and conveyor, and a stirring machine. (2) Automatic plant—chaffing machine, prover and handing-up machines.

By means of a clutch on the counter-shafting, the two groups of machines may be connected together so that either motor alone may be utilised to drive the automatic plant and a limited number of the other machines.

Substantial terminal boxes are fixed to the motor frames, and the whole of the wiring between the motors and control panels and the supply is enclosed in metallic tubing, thus eliminating any danger due to flour dust in the atmosphere.

The control panels, which are fitted with no-volt and overload releases, interlocking shunt regulators and fuses, thus effectively protecting the motors from injury due to careless starting, &c., are enclosed in glass-fronted cast-iron cases, through which the control handles project.

Special push-button switches are fitted beside the handing-up machine of the automatic plant to enable the attendant to stop the machine immediately, if necessary.

The supply is obtained from the three-wire system of the Glasgow Corporation. The incoming leads are connected to a main switchboard in the basement, where connections may be made to distribution boards situated at convenient central positions on each floor.

Satisfactory lighting is obtained by the use of 30-watt 250-volt metal-filament lamps connected between the outers and the neutral, while the motors are connected across the 500-volt outers.

In addition to the fact that the electric drive offers the best conditions for clean and efficient work, the low cost of such an installation as that described above should be a strong recommendation for its adoption.

It is always difficult to obtain reliable information as to the relative cost of various methods of power supply, but statistics issued by the Corporation Electricity Department show that the cost of current supplied to bakeries in Glasgow and Birmingham during 1913 was as low as £1 19s. and £1 15s. 7d. respectively per H.P. installed.

The above schemes were adopted on the advice of Messrs. James E. Sayers & Caldwell, consulting engineers, of Glasgow, who prepared the necessary specifications and supervised the work.

Aluminium in Norway.—The Norwegian Nitride Co. has erected a new manufactory at Eydehavn, near Arendal, for the production of aluminium. The factory has now been completed, and work was started at the end of April last. The amount of electrical power required for this concern is 10,000 E.H.P. The company has recently increased its capital to £555,555, and it is reported to have the intention of extending the aluminium factory with the view of raising the production to double the present output. It is further proposed to erect a factory for the manufacture of electrodes, for which there is now a big market in Norway alone.

SWISS RAILWAY ELECTRIFICATION REPORT.

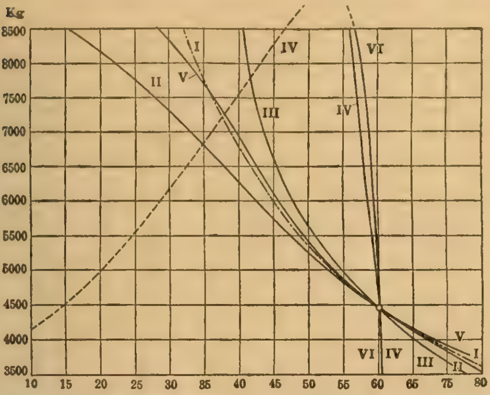
A TRANSLATION in abstract of the report of the Swiss Electrification Commission recently appeared in the *Electric Railway Journal*, from which the following particulars and curves are taken.

The conditions underlying Swiss railway electrification are the use of water power to the greatest advantage. The systems considered were :—

Direct current with third-rail up to 800 volts and trolley up to 3,000 volts, with the possible ultimate use of a 6,000-volt, three-wire system. Three-phase alternating current with two overhead lines having 5,000 volts to 8,000 volts between phases and a frequency of 15 cycles.

Single-phase alternating current with line voltage at 15,000 volts and a frequency of 15 cycles to 25 cycles.

The following limits were considered admissible for the propulsion apparatus itself : Direct current, 1,500 volts per commutator and 3,000 volts per motor ; single-phase, 300 volts to 500 volts for purely series motors and 6,000 volts for motors without commutators. A frequency of 15 to 45 cycles was held admissible for three-phase motors.



I—Ideal motor of constant output ; II—Steam locomotive ; III—D.C. series motor ; IV—D.C. shunt-wound motor ; V—Single-phase motor ; VI—Three-phase induction motor.

FIG. 1.—MECHANICAL CHARACTERISTICS OF DIFFERENT MOTORS WITH THE SAME NORMAL TRACTIVE EFFORT AND NORMAL SPEED.

The report states that any of the three systems would be capable of hauling trains of any desired length. The possibility of speed variation is then considered, and the curves (figs. 2, 3, 4 and 5) are produced to demonstrate that the single-phase motor is the most efficient in giving the desired range of speeds and tractive efforts without loss in resistance. Further, the single-phase commutator motor is the only one which, because of transformer control, can maintain the service despite extremely heavy drops in voltage. It is superior to the D.C. motor and equal to the three-phase motor in operating at the maximum speed permissible on grades. The possibility of making up time is another advantage of single-phase apparatus, even if it is not the cheapest. It is true that an increase in speed could be obtained with D.C. field-control motors or with three-phase induction motors by using a special resistance, but the single-phase motor is the one that meets this condition to the greatest satisfaction.

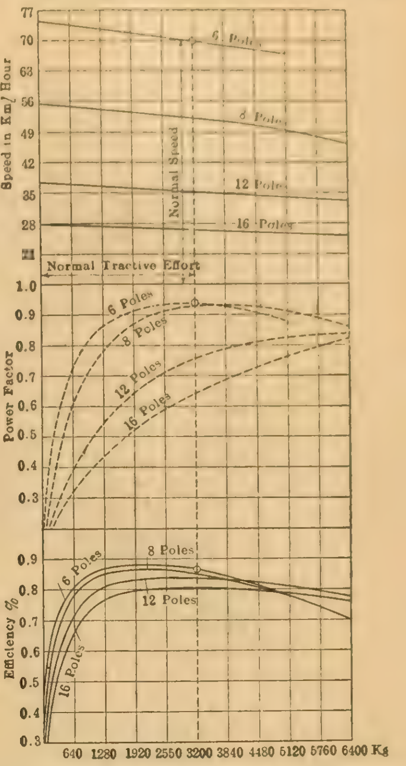
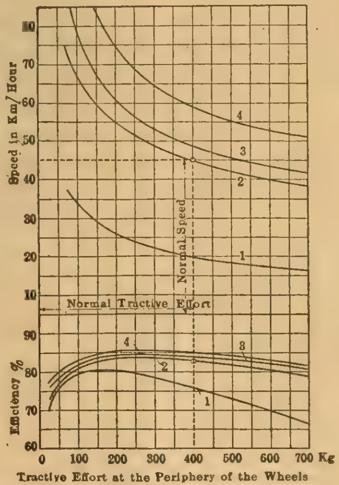


FIG. 2.—CHARACTERISTIC CURVES OF BROWN-BOVERI THREE-PHASE INDUCTION MOTOR, 850 H.P., 3,000 VOLTS, 15 CYCLES, WITH FOUR CHANGES OF POLES.



1—Connected in series ; 2—connected in parallel ; 3—connected in parallel with 30 per cent. of current in shunt ; 4—connected in parallel with 60 per cent. of current in shunt.

FIG. 3.—CHARACTERISTIC CURVES OF ALIOTH D.C. SERIES MOTOR, 66·5 H.P., 750 VOLTS.

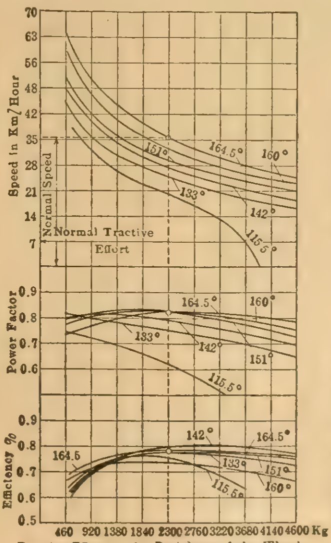


FIG. 4.—CHARACTERISTIC CURVES OF DERI TYPE BROWN-BOVERI SINGLE-PHASE MOTOR, 300 H.P., 1,000 VOLTS, 16⅔ CYCLES, WITH SIX BRUSH POSITIONS.

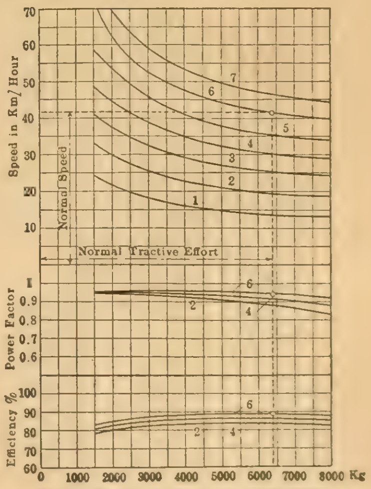


FIG. 5.—CHARACTERISTIC CURVES OF OERLIKON SINGLE-PHASE MOTOR, 1,000 H.P., 500 VOLTS, 15 CYCLES, WITH SEVEN VOLTAGE STEPS.

Fig. 1 shows the characteristics of different motors based on the same normal tractive effort and normal speed, the output being taken on a one-hour basis. A curve has also been calculated for an ideal motor of constant output, namely, one which would exert a uniform demand on the hydroelectric plant. Table I gives some examples of tractive efforts and the corresponding energy requirements of the motors represented in the curves of figs. 2 to 5 inclusive. Assuming that the energy required for acceleration is double that for normal running, it is found that the three types of motors are fairly equal in efficiency, but the single-phase motor calls for the least energy output from the hydroelectric station.

TABLE I.—Tractive Effort and Power Taken by Different Types of Motors.

	Tractive effort in percentage of normal effort					
	50	100	150	200	250	300
Alioth motor, type G.T.M. 65, 750 volts, 65 H.P., one-hour basis.						
Consumption in KW. of the motor alone	2·4	4·7	7·0	9·4	11·7	14·0
Consumption in KW. of the motor and resistances for acceleration at constant and normal voltage	10·0	14·8	16·1	18·6	22·0	24·0
Three-phase locomotive motor, Brown, Boveri & Co., type D-16-6, 500-320, 16 cycles, 3,000 volts, 350 H.P., one-hour basis.						
Consumption in KW.	210	420	630	840	1,050	1,260
Consumption in kv.-ampere	320	640	960	1,280	1,600	1,920
Power factor	0·655	0·655	0·655	0·655	·0655	·0655
Single-phase commutator motor, Deri type, Brown, Boveri & Co., 16 2/3 cycles, 1,000 volts, 300 H.P., one-hour basis.						
Consumption in KW.	65	92	122	154	190	228
Consumption in kv.-ampere	265	395	530	670	810	950
Power factor	0·24	0·24	0·24	0·24	0·24	0·24
Series commutator motor, Oerlikon type, 12 WB, 15 cycles, 500 volts, 100 H.P., one-hour basis.						
Consumption in KW.	20	60	97·5	140	190	250
Consumption in kv.-ampere	138	280	420	560	700	860
Power factor	0·15	0·19	0·23	0·25	0·27	0·29

It was considered preferable to compare the motors on the basis of torque rather than horse-power, because the latter varies so much with speed. Table II is a comparison of the three systems, indicating that their dead weight is much less than steam equipment. It also shows that they do not differ materially from one another, the slightly higher weight of single-phase equipment being considered an advantage in speed regulation. The report also points out that the system should be considered as a whole, and that the actual efficiency of motors of the same output in the same service does not vary much, despite differences in system of energy supply.

TABLE II.—Weight of Motor per H.P. Output and Torque in Meter-Kilograms.

	D.C.	*Three-phase.*	*Single-phase.*
Electric locomotives for speeds of 40 to 60 km. per hour.	50-55 kg./H.P. 11 mkg.	45-60 kg /H.P. 10-12 mkg.	50-75 kg./H.P. 11-13 mkg.
Motor-car equipment for speeds of 40 km. per hour.	28-30 kg./H.P. 6-7 mkg.	30-35 kg./H.P. 7-8 mkg.	30-35 kg./H.P. 7-8 mkg.

The characteristic curves in figs. 2 to 5 are based on the assumption that the speed regulation of the different motors is obtained without resistance losses; therefore, for D.C. and three-phase operations only a limited number of speed steps would be obtained, and it would be impossible to avoid the use of resistance if better regulation were wanted. Thus, if the total efficiency based on complete runs is considered, both D.C. and three-phase motors lose whatever superiority they might have if a limited number of fixed speeds were permissible. The Commissioners arrive at the following values of efficiencies of entire trains:—Direct current, 70-80 per cent.; three phase current, 65-70 per cent.; single-phase current, 68-75 per cent.

The efficiency of the transmission and feeder contact lines is much the same for the three systems.

According to calculations, it was found that the ratio between minimum and maximum energy requirements is 1 : 3·5, and on this basis the superiority of the single-phase system was agreed on, in view of the necessity of equalising hydro-electric demands.

The series motor is preferable because, instead of taking more energy on up grades, it simply decreases in speed.

In theory, regeneration would seem to be of great importance in a mountainous country like Switzerland. In reality, regeneration in the form of braking is but a very small part of the total requirements, while regeneration in the form of liberated energy is of importance only on really severe grades which do not obtain generally on the trunk lines. The estimated energy saving of 4 per cent. would not be great enough to justify regenerating apparatus on D.C. rolling stock, although its application to the A.C. systems might still be considered.

The reliability of the line is considered even more important than the reliability of the propulsion equipment, because disturbances on the former cripple the entire system, whereas disturbances on the latter cripple merely the individual train.

The third rail is substantial, easily accessible, less obstructive than an aerial line, and free from wind troubles; but it is difficult to maintain the third-rail covering, and impossible to use it when very high voltages are employed, because of the danger to employés and passengers. On the other hand, overhead lines have been developed to such a degree of reliability, that their construction and maintenance for high-tension work offer no disadvantages. Finally, in comparing aerial lines themselves, the single-phase trolley is certainly preferable to the double trolley of three-phase lines.

The possible influence of propulsion currents on near-by telephone and telegraph circuits received careful attention.

The Commission states that there is no important difference in the influence of each system on weak-current circuits as a whole.

The choice of frequency for single-phase operation was based upon the most efficient ratio, namely, 1 to 3, which could be obtained if it was necessary to install frequency changers. From existing 40-cycle and 50-cycle central stations a frequency of 13½ cycles to 16⅔ cycles, or an average of 15 cycles, could thus be secured.

Considering all technical features, the Commission concludes that the single-phase system is the one most advantageous for Swiss conditions.

When the first comparisons were made no definite figures were available on the unit costs of energy at the power stations, but more detailed calculations later showed that the relations between the systems were not changed by more exact generating costs.

In general, it was found more advantageous for all systems not to use a storage battery power station auxiliary. The cost of energy for single-phase operation is less than for direct-current or three-phase. To remove all doubt, the comparative costs of car equipment were also considered. The Commission concluded that the most advantageous system is single-phase, 15 cycles, with 10,000 to 15,000 volts on the contact wire.

TABLE III.—Efficiency in Percentage of the Three Systems on Daily and Annual Basis.

	D.C.	*Three-phase.*	*Single-phase.*
Trains	70 to 80	65 to 75	68 to 76
Contact lines and rails	94 „ 98	94 „ 98	94 „ 98
Transformation in rotating equipment.	70 „ 90	94 „ 98	94 „ 98
Transformation in static equipment—			
Old transformers	70 „ 90	(70 „ 80)	(80 „ 90)
Recent transformers ...	70 „ 90	80 „ 90	90 „ 95
H.T. transmission lines	90 „ 95	90 „ 95	90 „ 98
Net efficiency from the generating plant to the wheels of the vehicle.	42 „ 67	44 „ 63	53 „ 63

Although the primary object of the electrification is to free the Swiss railways from the necessity of importing coal, it is expected that train speeds will be increased also. Complete data was worked out for the St. Gothard line. The estimated increase in carrying capacity by electric haulage is 185 per cent. as compared with the average steam traffic of 1904, and 130 per cent. as compared with the same for 1907. The corresponding increases in maximum traffic would be 255 and 150 per cent. respectively. The electrical maxima are near the ultimate capacity of the St. Gothard line. The total estimated cost of this installation is 67½ million francs, of which 29 million francs represents power station and distribution expenditure. The route is about 160 km. long.

Employers and Evening Institutes.—Writing to the *Times* regarding the work of the London County Council Education Committee's report respecting the increased attendances at the Junior Commercial and the Junior Technical Institutes, Mr. George Sutton states that his company, W. T. Henley's Telegraph Works Co., Ltd., has for several years made it a condition of employment in London offices that lads under 18 years of age should attend evening classes; the present record of the office is that out of 33 lads under 18, 25 are attending evening institutes.

ELECTRICAL TERMS AND DEFINITIONS.

Soon after the formation of the International Electrotechnical Commission, the British National Committee appointed a Nomenclature Committee, which proceeded to consider and draft definitions of the electrochemical terms in current use in the English language. In our issues of August 7th and 14th, 1908, we printed the first instalment of the list of terms and definitions, and further instalments were published in our issues of August 16th and 23rd, 1912, bringing the list up to and including the letter Q. The Committee has now completed the first set, which was published in the *Journal* of the Institution of Electrical Engineers on May 1st. The definitions are not identical with those which were approved by the Nomenclature Committee of the International Electrotechnical Commission at the Berlin meeting last year, the intention of the British Committee being to put on record the usage in this country; it is hoped that the next revision will bring the two lists more nearly into line. The present list, therefore, must not be taken as final, and the Committee will be glad to receive suggestions (addressed to the Secretary of the Institution) which will tend to eliminate errors and to set up standard definitions which may be definitely accepted in this country.

Comparing the present complete list with the instalments that we have already published, we have noted cases where material changes have been made in the definitions, and we reproduce these below, together with supplementary items, followed by the terms and definitions from R to Y, which we have not previously published.

ACTIVE CURRENT.—Component of the current in phase with the voltage.

ALTERNATOR.—A generator producing alternating electromotive forces and currents, either single-phase or polyphase. An alternator may be described as a single alternator, a two-phase alternator, a three-phase alternator, &c. The exciting current is generally supplied by a separate machine called an exciter. (The word Dynamo is usually reserved for a continuous-current generator.)

AMMETER OR AMPEREMETER.—An instrument with a scale graduated in amperes for measuring the value of an electric current.

AMPERE-HOUR.—A practical unit of quantity of electricity. One ampere for one hour, or its equivalent, such as four amperes for 15 minutes, &c. One ampere-hour is 3,600 coulombs.

ANION.—The ion which is carried to the anode.

ANTIKATHODE.—A target hit by the kathode rays in a vacuum tube.

APPARENT POWER.—In an alternating-current circuit the product of volts and amperes.

ARC.—A luminous discharge of electricity through a gas in which the material of one or both the electrodes is volatilised and takes part in the conduction of the current whether continuous or alternating.

ARMATURE (*a*) of a generator or motor.—That part of the machine which consists of active windings, core, and supports, and which is acted upon inductively by the magnetic flux. In the case of a generator it supplies the main current to the terminals; in the case of a motor it receives the main current from the terminals.

Note to (*a*).—In continuous-current machinery the armature usually rotates; in alternating-current machinery it is usually stationary. *See* Stator, Rotor.

ASTATIC.—A system of magnets or coils is said to be astatic when the polarities of its parts are so adjusted that no directive effect is exerted on the system by a uniform magnetic field.

BALANCER.—A motor-generator or accumulator used to equalise differences of potential between the different wires of a multiple-wire system.

CALIBRATE.—To mark the scale of an instrument, or to adjust the instrument to conform with the scale. (Sometimes used as the equivalent of "to verify." Not recommended.)

CANDLE-POWER.—A measure of the luminous intensity of a source of light in a given direction.

CAPACITY.—(*a*) Of an accumulator. The quantity of electricity in ampere-hours which may be taken from a cell, at a given rate of discharge.

(*b*) Of a condenser. (1) Electrostatic. The capacity of a conductor at an infinite distance from other conductors is the quantity of electricity that must be imparted to it in order to raise its potential from zero to unity, *e.g.*, the capacity of a sphere equals its radius.

(2) The self-capacity of an insulated conductor is the charge on the conductor when its potential is unity, all the other conductors in the field being at zero potential. If the position of any of the other conductors is altered, the self-capacity will generally be altered also. Maxwell called this the capacity of the conductor and also the coefficient of self-induction of the conductor for electrostatic charges.

(3) The mutual capacity between two insulated conductors when all neighbouring conductors are at zero potential is the induced charge on either of them when connected with the earth, the other being maintained at unit potential.

(2) and (3) are also called the capacity coefficients.

(4) The capacity between two insulated conductors when all neighbouring conductors are at zero potential is numerically equal to the charge on either of them when the potential between them is unity, and they are given equal and opposite charges. This is the capacity in general use by electrical engineers; *e.g.*, the capacity of a concentric main, the capacity between two overhead wires, between two cores of a multicore cable, &c. Many useful formulæ for this capacity are known.

(*c*) Of a machine or of a generating station. This use of the word capacity is not recommended. The term Rating should be used.

CATENARY. In railway work. A wire or cable from which electric wires or cables are hung. See Messenger.

CONTACT RESISTANCE. A quality acting like a resistance which appears at the surface of contact between two conductors (*e.g.*, as between brushes and commutator or slip rings).

CONTACT RING. A conducting ring for effecting a connection between a revolving conductor and a fixed conductor, as in a crane, a searchlight, a ship's turret.

CONTINUOUS RUNNING.—Running for such a time, under specified conditions, that the final state is sensibly attained.

COPPER LOSS. The total losses in the copper windings.

CORONA.—The luminous discharge which appears round a conductor when its potential exceeds a certain value depending on barometric pressure, the diameter of the conductor, &c.

DIELECTRIC RIGIDITY OR DIELECTRIC STRENGTH.—The property of a dielectric to resist the passage of sparks. (In practice measured in volts per centimetre under specified conditions.)

DISRUPTIVE VOLTAGE.—Difference of potential producing a spark discharge.

ELECTROLYSIS.—The decomposition which takes place when an electric current passes through a chemical compound.

EXCITATION.—(*a*) Production of the magnetic flux in an electromagnet by means of an exciting current.

(*b*) Number of ampere-turns producing the flux.

Note.—The excitation may be produced by several windings traversed by different currents.

FREQUENCY.—Reciprocal of the time for a complete period of a periodic quantity. In practice, the number of periods per second.

GAUSS.—A name given to the absolute electromagnetic unit of magnetic force in the C.G.S. system. *See* Field, Magnetic, and Line.

GRID.—(*a*) In an accumulator. The framework supporting the active material.

(*b*) A form of cast or stamped resistance.

HIGH TENSION.—Term sometimes used for High Pressure.

INDUCTION, MAGNETIC.—(*a*) When a mass of iron, &c., is brought into a magnetic field, thereby causing magnetic poles to appear on the mass, these poles are called Induced Poles, and the magnetism so acquired is called Induced Magnetism; and the operation is termed Magnetic Induction.

(*b*) When a uniform magnetising force H acts on a medium it produces a flux of induction, the density of which is B. Flux of induction is also called Magnetic Flux. The ratio B/H gives the permeability of the medium for the value H. The unit line of magnetic induction (the Maxwell) is called a Magnetic Line.

INDUCTIVE CIRCUIT.—A circuit in which the reactive effect of self-induction at the working frequency or at make or break is appreciable compared with its resistance.

INPUT.—The total power received at the shaft or terminals of a machine or apparatus.

(*a*) Power supplied to a generator or transformer.

(*b*) Power supplied to the terminals of a motor.

INSULANCE.—A term proposed in place of the expression Insulation Resistance.

INSULATION.—(*a*) Process of insulating.

(*b*) Material employed to insulate.

(*c*) Quality resulting from the process.

INSULATION RESISTANCE.—The resistance of the insulation between two conductors or systems of conductors, or between a system of conductors and earth. (Usually expressed in megohms.)

INTERPOLE.—An intermediary pole placed between the principal poles of a machine to assist commutation.

LAGGING LOAD.—Any load on a machine or apparatus in which the phase of the current lags behind that of the voltage at the terminals.

MAGNET, PERMANENT.—A body which having been magnetised retains a substantial portion of its magnetisation.

MAGNETIC FORCE.—The force at any point in a magnetic field experienced by a unit pole placed at that point, divided by the permeability of the medium; sometimes called Field Intensity or Strength of Field.

MAGNETIC LINE.—The unit (*a*) of magnetic flux **B**, or (*b*) magnetic induction **B**. The rate at which the number of magnetic lines linked with a circuit alters equals the electromotive force induced in the circuit.

MAGNETIC SUSCEPTIBILITY OR MAGNETISABILITY. — The number obtained by dividing the intensity of magnetisation by the magnetic force producing it.

MAGNETISATION.—The process or result of communicating magnetism to a body.

MAGNETOMETER.—An instrument for measuring the magnitude and direction of magnetic force.

MAXWELL.—The name given to the magnetic line of force or (*a*) unit of magnetic flux, (*b*) unit of magnetic induction.

NETWORK.—A system of conductors consisting of mains, feeders, and distributors interconnected for the distribution of electrical energy in a supply system.

LOAD.—(*c*) Any load on a machine or apparatus in which the current is in phase with the voltage at the terminals.

OVER-COMPOUNDED.—A compound-wound generator or motor is said to be over-compounded (*a*) when the potential difference between its terminals increases with the load; (*b*) when the speed increases with the load.

POLYPHASE.—A supply is said to be polyphase when it consists of alternating currents displaced in phase with regard to one another by equal portions of a period.

POWER FACTOR.—The ratio of the watts to the volt-amperes. In the case of voltage and current of sine form the power factor is cos ϕ.

(*To be continued.*)

LEGAL.

THE CONSOLIDATED LANGLAAGTE MINES, LTD., v. THE VICTORIA FALLS AND TRANSVAAL POWER CO., LTD.

This action was commenced in March last in the Supreme Court, Johannesburg, before Mr. Justice Ward. Plaintiffs claimed an amount of £42,104 for breach of agreement in connection with the supply of electric power. The claim was made up as follows:—Loss in extraction, £4,080; deferred profits, £27,833; loss on developments, £6,910; loss on shaft sinking, £3,281; total, £42,104. The action depended primarily on agreements entered into between the parties in January, 1909, and January, 1910. It was claimed by plaintiffs that under these agreements defendants undertook to supply additional power on certain conditions. The condition for an additional supply, not exceeding 2,000 KW., was 15 months' notice. On February 25th, 1911, it was alleged that proper notice was given for an additional supply to operate new reduction works about to be installed of 1,200 KW. at 525 volts. On March 6th it was claimed the defendants agreed to supply this additional power, which would be due on July 1st, 1912. Defendants, however, it was stated, did not commence delivery before September 29th, 1912. Plaintiffs claimed that by reason of this alleged failure they were for a period of three months, from July 1st, 1912, to September 30th, 1912, unable to extract gold as completely and effectively as they could have done had the power been supplied, the profits which would otherwise have been made had been deferred, and there had been consequent loss in development and shaft sinking.

The defendants pleaded that they were not obliged to supply additional power till such power was *bonâ fide* required. Under a clause of the first agreement, in the case of an additional supply exceeding 2,000 KW., but not exceeding 3,000 KW., defendants were not obliged to give such supply, except after 18 months' notice, and in case of an additional supply exceeding 3,000 KW., defendants were not obliged to give such supply except in accordance with arrangements to be mutually agreed upon between them and the Johannesburg Consolidated Investment Co. It was contended that the notice of February 25th, 1911, was not duly given in terms of the agreement by reason of the fact that the additional supply was not required *bonâ fide* by the plaintiffs within the meaning of the agreement. Alternatively, it was contended that if the notice was given in terms of the agreement, the total additional supply by the plaintiffs in terms of the notice of February 25th, and of other notices, exceeded 3,000 KW., and defendants were accordingly not bound to give such additional supply, or any part thereof, except in accordance with arrangements to be mutually agreed between defendants and the Johannesburg Consolidated Investment Co. It was admitted that the defendants did not commence the supply of the additional 1,200 KW. till September 29th, 1912.

MR. JUSTICE WARD gave judgment on May 14th for the plaintiffs for £36,268 19s., which was allocated under the following heads:—(1) Loss in extraction, £4,233; (2) deferred profits, £25,750; (3) extra cost in development, £4,344 19s.; (4) extra cost of shaft sinking, £1,941. From this must be deducted the present value of £25,750 deferred profits at 6 per cent. payable in 22 years.

It is understood that the total amount of damages will be £29,123.

VENNER'S SIGNS, LTD., v. STELLAR SIGNS, LTD.

IN the Chancery Division, on Thursday, before Mr. Justice Astbury, MR. F. RUSSELL, K.C., again mentioned this case upon a motion to restrain alleged infringement of patent. He said the other side had handed him a bundle of affidavits, which he had not yet read, and the motion must again stand over. He suggested an adjournment till the first Friday of next sittings—June 12th.

His LORDSHIP assented.

TRADE STATISTICS OF SOUTH AFRICA.

THE following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1913, has been taken from the recently issued official trade statistics. The figures for 1912 are added for purposes of comparison, and notes of any increases or decreases are given.

	1912.	1913.		Inc. or dec.
Asbestos manufactures.—	£	£		£
From Great Britain ...	3,000	4,000	+	1,000
,, Other countries	2,000	4,000	+	2,000
Total ...	5,000	8,000	+	3,000
Brass manufactures.—				
From Great Britain ...	37,000	31,000	—	6,000
,, Germany ...	2,000	2,000		—
,, Other countries	2,000	2,000		—
Total ...	41,000	35,000	—	6,000
Copper, plate and sheet.—				
From Great Britain ...	4,000	4,000		—
,, Other countries	—	1,000	+	1,000
Total ...	4,000	5,000	+	1,000
Copper manufactures.—				
From Great Britain ...	4,000	5,000	+	1,000
,, Other countries	1,000	2,000	+	1,000
Total ...	5,000	7,000	+	2,000
	1912.	1913.		Inc. or dec.
Electrical cable and wire.—	£	£		£
From Great Britain ...	142,000	170,000	+	28,000
,, Germany ...	30,000	71,000	+	41,000
,, Other countries	4,000	10,000	+	6,000
Total ...	176,000	251,000	+	75,000
Electrical fittings, including posts.—				
From Great Britain ...	170,000	155,000	—	15,000
,, Germany ...	87,000	67,000	—	20,000
,, Holland	1,000	3,000	+	2,000
,, United States ...	23,000	30,000	+	7,000
,, Other countries	8,000	9,000	+	1,000
Total ...	289,000	264,000	—	25,000
India-rubber of all kinds.—				
From Great Britain ...	33,000	29,000	—	4,000
,, Germany ...	2,000	3,000	+	1,000
,, United States ...	7,000	3,000	—	4,000
,, Other countries	—	1,000	+	1,000
Total ...	42,000	36,000	—	6,000
Lamps and lampware.—				
From Great Britain ...	19,000	19,000		—
,, Germany ...	16,000	21,000	+	5,000
,, United States ...	11,000	15,000	+	4,000
,, Other countries	1,000	3,000	+	2,000
Total ...	47,000	58,000	+	11,000
Machine bands and belting.—				
From Great Britain ...	102,000	100,000	—	2,000
,, United States ...	29,000	37,000	+	8,000
,, Other countries	2,000	4,000	+	2,000
Total ...	133,000	141,000	+	8,000
Electrical machinery.—				
From Great Britain ...	140,000	142,000	+	2,000
,, Germany ...	238,000	253,000	+	15,000
,, United States ...	50,000	51,000	+	1,000
,, Other countries	7,000	5,000	—	2,000
Total ...	435,000	451,000	+	16,000
Cranes, elevators and lifts.—				
From Great Britain ...	33,000	45,000	+	12,000
,, United States ...	4,000	11,000	+	7,000
,, Other countries	2,000	7,000	+	5,000
Total ...	39,000	63,000	+	24,000
Mining machinery.—				
From Great Britain ...	483,000	512,000	+	29,000
,, Germany ...	72,000	74,000	+	2,000
,, United States ...	128,000	161,000	+	33,000
,, Other countries	7,000	19,000	+	12,000
Total ...	690,000	766,000	+	76,000
Machinery not specially mentioned (other than agricultural, manufacturing, &c.).				
From Great Britain ...	359,000	341,000	—	18,000
,, Germany ...	38,000	39,000	+	1,000
,, United States ...	45,000	39,000	—	6,000
,, Other countries	12,000	8,000	—	4,000
Total ...	454,000	427,000	—	27,000
Railway rails.—				
From Great Britain ...	13,000	13,000		—
,, Belgium	4,000	1,000	—	3,000
,, Germany ...	51,000	61,000	+	10,000
,, United States ...	3,000	4,000	+	1,000
Total ...	71,000	79,000	+	8,000
Telegraph and telephone material—				
From Great Britain ...	9,000	10,000	+	1,000
,, Germany ...	1,000	1,000		—
,, Sweden	4,000	3,000	—	1,000
,, United States ...	1,000	1,000		—
,, Other countries	2,000	3,000	+	1,000
Total ...	17,000	18,000	+	1,000
Tramway rails.				
From Great Britain ...	1,000	2,000	+	1,000
,, Germany ...	7,000	14,000	+	7,000
,, United States ...	3,000	5,000	+	2,000
Total ...	11,000	21,000	+	10,000
Tramway rolling-stock.—				
From Great Britain ...	4,000	16,000	+	12,000
,, United States ...	2,000	12,000	+	10,000
Total ...	6,000	28,000	+	22,000

Other tramway materials.	1912.	1913.	Inc. or dec.
	£	£	£
From Great Britain ...	9,000	11,000	+ 2,000
,, Germany ...	1,000	1,000	—
,, United States ...	1,000	5,000	+ 4,000
Total ...	11,000	17,000	+ 6,000

In addition to the above the following goods were imported as "Government Stores":—

Brassware.—			
From United Kingdom	4,000	8,000	+ 4,000
Copper, plate and sheet.—			
From United Kingdom	19,000	20,000	+ 1,000
Electrical cable and wire.—			
From United Kingdom	57,000	63,000	+ 6,000
,, Germany ...	2,000	—	– 2,000
Total ...	59,000	63,000	+ 4,000
Electric fittings.—			
From United Kingdom	14,000	24,000	+ 10,000
,, Germany ...	1,000	2,000	+ 1,000
,, Other countries	—	1,000	+ 1,000
Total ...	15,000	27,000	+ 12,000
India-rubber.—			
From United Kingdom	5,000	4,000	– 1,000
Lampware.—			
From United Kingdom	2,000	4,000	+ 2,000
Cranes and elevators.—			
From United Kingdom	1,000	25,000	+ 24,000
Electrical machinery.—			
From United Kingdom	22,000	12,000	– 10,000
,, Germany ...	—	1,000	+ 1,000
,, France	—	1,000	+ 1,000
Total ...	22,000	14,000	– 8,000
Other machinery.—			
From United Kingdom	58,000	56,000	– 2,000
,, Other countries	4,000	4,000	—
Total ...	62,000	60,000	– 2,000
Railway rails.—			
From United Kingdom	319,000	388,000	+ 69,000
,, Germany ...	53,000	—	– 53,000
,, United States ...	44,000	—	– 44,000
,, Belgium ...	34,000	—	– 34,000
Total ...	450,000	388,000	– 62,000
Telegraph and telephone material.—			
From United Kingdom	88,000	125,000	+ 37,000
,, Sweden	32,000	31,000	– 1,000
,, Other countries	—	1,000	+ 1,000
Total ...	120,000	157,000	+ 37,000
From United Kingdom	—	3,000	+ 3,000

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

DENMARK.—The Danish Customs Authorities have decided that transformers are to be dutiable at the rate of 7½ per cent. *ad. val.*

COLUMBIA.—With reference to the translation of the new Columbian tariff recently published by the Board of Trade, extracts from which were inserted in the ELECTRICAL REVIEW, it is now pointed out that No. 797 of the tariff, which formerly read "lamparas de acero" (lamps of steel), should really refer to "arc lamps" and all lamps for outside lighting, the rate of duty being 2 cents. per kg.

The Board of Trade are also informed that the 2 per cent. surtax imposed in 1909 on imported goods for the creation of a currency redemption fund was not abrogated by the new Tariff Law, and is therefore still in force.

New regulations have been laid down regarding the tariff treatment of commercial travellers' samples. Samples of goods imported will be admitted free of duty provided the following conditions are fulfilled:—

(1) That samples of all kinds of merchandise having no commercial value are presented in such a form as to be useless for any other purpose than that of taking orders.

(2) and (3) refer to tissues only.

(4) That cables and metal wires do not exceed 4 cm. in length.

(5) and (6) refer to wines and spirits and printed ware only.

(7) Other samples of merchandise which cannot be rendered useless and which may, therefore, be capable of being sold, will pay Customs duty on importation. The importer will, nevertheless, be entitled to a refund by the Customs Authorities of the amount paid in respect of import duty with a reduction of 25 per cent. provided he re-exports them within one year from the time of declaring them for importation.

AUSTRALIA.—The Customs Authorities have issued a decision providing for the free importation of the following machine tools, with effect from February 16th last:—Electrical hand riveting and hand chipping machines for hammers.

NEW ZEALAND.—The Customs Department have decided that "Ceag" electric miners' safety lamps may be admitted free of duty on importation; cells for the same, if imported detached, will be liable to a duty of 20 per cent. under the British preferential tariff and 30 per cent. under the general tariff on foreign goods.

FRANCE.—The French Customs have decided that cylindrical or semi-cylindrical conduits of common earthenware for laying wires or cables are to be dutiable on importation as drain pipes at the rate of 40 cents. per 100 kgs. gross. (2d. per cent. gross). Tools imported with the machines for which they are intended, in so far as such tools can be fitted on the machine at one and the same time, are to be considered as integral parts of the machine and included in the dutiable weight thereof.

UNITED STATES.—The Treasury Department have laid down that travellers' samples entered under bond for re-exportation, if they can be used otherwise than as samples are to be marked by the Customs by means of a cord and seal in such a manner as will prevent the removal of the cord and seal without either breaking the same or destroying the article. A tag bearing the name of the port of entry, the number of the entry, the name of the importer and the numbers of the bond must also be attached to the cord. Articles not readily susceptible of marking by cord and seal may be marked for identification in such a manner as the nature of the article will allow, and the examiner must give on the invoice a description of the manner in which the articles have been marked. Such marking and labelling is to be done at the expense of the importer.

NICARAGUA.—The Nicaraguan Government have issued an order providing that, to date from May 1st, the fees which are charged for Consular invoices for goods consigned to Nicaragua must be paid at the port where the goods are discharged in Nicaragua and not, as hitherto, at Nicaraguan Consulates in the United Kingdom where the invoices are obtained.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

12,189. "Means for giving a series of electric flashes of light from a bicycle or the like when in motion." C. H. HULBERT. May 18th.

12,191. "Apparatus for electric lighting, heating, and ventilating of railway carriages or other moving vehicles or for equivalent purposes." T. FERGUSON and J. R. JOHNSTONE. May 18th. (Addition to 9,009/13.)

12,210. "Electric fuse devices, safety cartridges, or the like." SIEMENS BROS. DYNAMO WORKS, LTD. May 18th. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

12,232. "Telephone-call recorders." D. J. MCGAURAN. May 18th. (Convention date, July 22nd, 1913, Australia.) (Complete.)

12,233. "Telephone-call recorders." D. J. MCGAURAN. May 18th. (Convention date, July 22nd, 1913, Australia.) (Complete.)

12,253. "Relays." I. LASSNER and J. LASSNER. May 18th. (Convention date, May 21st, 1913, Hungary.) (Complete.)

12,259. "Method and means for the production of sustained electric oscillations, particularly for radiotelegraphy and radiotelephony." W. J. MELLERSH-JACKSON. May 18th. (Fratelli Marzi di G.B., Italy.) (Complete.)

12,277. "Apparatus for electric signalling, especially applicable to wireless telegraphy." A. F. SYKES. May 18th.

12,282. "Polyphase dynamos and motors." A. HEYLAND. May 18th. (Convention date, June 14th, 1913, Germany.) (Complete.)

12,285. "Electric motors." H. F. CHRISTIE. May 19th.

12,347. "Electric ignition mechanism for combustion engines." E. MICHIELS. May 19th. (Convention date, May 19th, 1913, Belgium.) (Complete.)

12,350. "Magnetos and the like." H. FORD. May 19th. (Addition to 15,636/13.) (Complete.)

12,358. "Manufacture of wire." WESTINGHOUSE METALLFADEN GLÜHLAMPENFABRIK G.M.B.H. May 19th. (Convention date, May 26th, 1913, Austria.) (Complete.)

12,359. "Electric incandescent lamps." WESTINGHOUSE METALLFADEN GLÜHLAMPENFABRIK G.M.B.H. May 19th. (Convention date, May 27th, 1913, Austria.) (Complete.)

12,361. "Selenium cells especially adapted for use in connection with telegraphy." J. S. WITHERS. May 19th. (Kenwrick Cecil Cox, Norfolk Isle.)

12,364. "Improvements in or relating to receivers for wireless telegraphy and telephony for diminishing atmospheric influence on such receivers." P. O. PEDERSEN. May 19th. (Complete.)

12,372. "Light-ray switch." P. DRESLA. May 19th. (Complete.)

12,386 "Electricity prepayment meters." British Insulated & Helsby Cables, Ltd., and L. B. Wilson. May 20th.

12,402 "Burglar alarm to be used in connection with a telephone or power whistle." W. Jackson. May 20th.

12,404 "Connectors for electric cables." F. Priddle. May 20th.

12,408 "Reinforced plaster composition electrical cooking-stove and grid combined." S. Turner. May 20th

12,430 "Holder for shades of electric incandescent lamps." R Pfeiffer. May 20th. (Complete.)

12,443. "Insulator for the overhead conductors of electric lines." F Libano. May 20th (Convention date, May 31st, 1913, Germany.) (Complete.)

12,451. "Electric liquid-heating means." J. J. Glass. May 20th.

12,455 "Dynamos." H. Leitner. May 20th.

12,479. "Electric welding." Allgemeine Elektricitats Ges. May 20th. (Addition to 8,595/14. Convention date, May 20th, 1913, Germany.) (Complete.)

12,483. "Circuit arrangements for automatic or semi-automatic telephone installations." Siemens & Halske Akt. Ges. May 20th. (Addition to 16,538/13. Convention date, May 20th, 1913, Germany.) (Complete.)

12,493. "Method of controlling the attachment of lump iron to suspended electro-magnets." J. D. Latimer. May 21st.

12,495. "Automatic contact-breaker controlled by the foot or feet." May 21st. F. R Francke.

12,551. "Electrical heating-apparatus" A. F. Berry. May 21st.

12,555. "Mountings or fittings for incandescent electric lamps." W. C Wise (trading as P Chappius & Co.). May 21st. (Complete.)

12,562. "Relays." A. C. Brown. May 21st.

12,576. "Safety interlocking system preventing erroneous tripping of substation electric machines and the like." F. V. Gough. May 22nd.

12,599. "Fittings for metallic conduit systems for housing electrical conductors." Simplex Conduits, Ltd., and L. M. Waterhouse. May 22nd.

12,605 "Electric heating-devices." G. Pate and A. R. Wood. May 22nd. (Complete.)

12,614. "Combined switch and ignition tell-tale." G. F. Metzger. May 22nd.

12,633. "Systems of radio-control." J. H. Hammond, Jun. May 22nd. (Divided application on 13,310/13. June 9th.) (Complete.)

12,641. "Dynamo electric machines." N. W. Storer. May 22nd. (Convention date, May 22nd, 1913, United States.) (Complete.)

12,642. "Overcharge preventers for the charging circuits of secondary batteries." W. A. Trier. May 22nd.

12,643. "Motor-car and like electric lamps and their attachment to supporting brackets." W. W. Soutter. May 22nd.

12,652. "Cathodic detectors." F. Holweck. May 22nd. (Addition to 2,206/14.) (Complete.)

12,656. "Telephone set." P. L. Jensen and E. S. Pridham. May 22nd. (Complete.)

12,659. "Controlling apparatus for electrical lifts." A. W. Penrose & Co., Ltd., and M. Owen. May 22nd. (Complete.)

12,662. "Construction of apparatus for automatically controlling locomotives or electric motors when passing signals at danger or rounding curves." W. C. Minifie and J. H. Barclay. May 22nd.

12,666. "Electro-magnetic talking machines." C. Sontag. May 22nd. (Convention date, May 24th, 1913, Germany.) (Complete.)

12,682. "Switch for incandescent lamp fittings." W. J. Mellersh-Jackson. May 22nd. (Geb. Jaeger, Germany.) (Complete.)

12,720. "Light high-power electric accumulator." Marquise des Ligneris nee C. M. B. Tailhandier du Plaix. May 23rd. (Complete.)

12,721. "Electrical signalling-apparatus." W. A. Heyes and L. O. Heyes. May 23rd. (Complete.)

12,722. "Method of producing electric currents by induction." H. Munro. May 23rd.

12,746. "Electric light pendants." W. O. Teasdale. May 23rd. (Complete.)

12,757. "Lamp holders." C. G. M. Bennett and C. H. Jeffcoat. May 23rd.

EXPIRING PATENTS, TAKEN OUT IN 1900.

(*Continued from page 932.*)

5,649. "Electric Telegraphs." Brown, S. G., and Dearlove, J. A. L. March 26th. Relates to arrangements especially for submarine working by duplex and other systems. The relays, such as described in Specification No. 1,434, A.D. 1899, are preferably coupled up by means of insulating-springs to a second heavy damping-coil which may be double-wound and arranged in the relay circuits so as to emphasize the signal currents, otherwise distorted by the charging of the condenser.

6,034. "Fire Alarms." Oatway, G. H. March 31st. Relates to an alarm which is only started by sudden rises of temperature, and which may be used in mines and ships as well as in other places. A wire, preferably of copper, is stretched between the ends of a more massive frame of the same material. When this system is suddenly heated the wire expands faster than the frame, and the consequent sag lowers a weight till it makes contact with a terminal and thus closes the alarm circuit, which also contains one of the magnets of the indicator, and thereby indicates the locality of the fire. Several modifications are described.

6,701. "Electrolysis." Strecker, O. C. April 10th. Plates of metals or alloys for use in lithographic printing are provided by electrolysis with a water-retaining layer. To form the layer, the plate is arranged as an anode, if a continuous current be used, the electrolyte employed being dilute aqueous salt solution, of which the anion forms with the metal of the plate the required insoluble or nearly insoluble layer, or forms a layer which may be subsequently converted into the required layer by chemical treatment. To remove the layer, the plate is used as a cathode. Various modifications are described.

7,108 "Magneto-electric Machines." Simms, F. R, and Bosch, R. April 17th A magneto-electric machine, chiefly for use in connection with electric ignition devices for internal-combustion engines, is so arranged that the armature, or an inductor enclosing the same, shall be continuously rotated, either directly or indirectly, by the motor crank shaft.

7,272 "Electrolysis." Baker, H. April 19th Carbon electrodes, such as rods, are passed through the side or top of a cell, and their projecting ends are connected in pairs by two rigid contact-plates having a bolt and a tightening-nut The several pairs of electrodes are connected up in parallel by a copper band

7,471. "Electric Telegraphs" Brown, S G. April 23rd. Relates to arrangements and systems of diplex telegraphy capable of being duplexed and thus converted to quadruplex. The transmitting apparatus may be run synchronously, or the signals may be allowed to overlap, in which case the receiving-apparatus is provided with rotating curbing relay arms by which a varying resistance is thrown into the local correcting circuit for the purpose of varying the local correcting current in accordance with the varying signal current, due to overlapping. The signals may be received by a siphon recorder, in which case the curve traced by the pen will be a compound curve; or the signals may be analysed by employing a rotating drum relay such as described in Specification No. 1,434, A D 1899, and separating the signals out to the distinct receivers.

7,678. "Electric Telegraphs." Pollak, A., Egger, J., and Silberstein, F. April 25th. Relates to a system of telegraphy in which perforated code signals are automatically transmitted and reproduced at the receiving-station in the form of written characters. The apparatus is described for use when an alphabet of forward or open loops only is employed, or when the alphabet includes backward or closed loops; in the latter case the code signals are divided between two lines, so as to produce two motions, preferably at right-angles, at the receiving station.

8,208. "Electric Switches." British Thomson-Houston Co. (Hewlett, E. M.) May 3rd. A switch, which is adapted for high-potential currents, is arranged with the breaking points in closed vessels containing oil, and is operated preferably by pneumatic means controlled from a distance.

(*To be continued.*)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of **Messrs. W. P. Thompson & Co.**, 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

3,103. Wireless Telegraph, Telephone or Submarine Sound-signalling Systems. Radio Signal Co., W. H. Shephard and A. E. McKechnie. February 6th

5,568. Gas-detecting Apparatus for Portable Electric Hand Lamps. G. J Ralph. March 6th.

7,365. Sparking Plugs. H. G. Longford, W. W. Longford and W. A. Clark. March 28th. (September 20th, 1913.)

7,784. Dynamo-electric Machines. Allgemeine Elektricitats Ges. April 2nd. (April 2nd, 1912.)

7,805. Electrical Conductors and supporting means for same. British Insulated & Helsby Cables, Ltd., W. M. Mordey, J. M. Astley and D. B. Saunderson. April 3rd.

10,282. Apparatus for Synchronizing Motion and Sound Reproductions. E. H. Amet. May 1st.

10,396. Electrically-operated Diaphragm Signal Horns. F. Knabl, M. Greenwald and H. A. Farman. May 2nd. (Cognate application 24,907/13.)

10,416. Electric Motor Control Apparatus. A. H. Railing and C. C. Garrard. May 3rd.

10,608. Windings of Dynamo-electric Machines and other Electrical Apparatus. Allgemeine Elektricitats Ges. May 5th. (May 3rd, 1912.)

10,655. Apparatus for Receiving Submarine Sound Signals. Signal Ges. May 6th. (December 27th, 1912.)

10,704. Signalling Apparatus. Graham & Latham, Ltd., and L. J. Graham. May 6th.

10,717. Electric Switch Operating-mechanism and the like, for causing the Actuation of Signals on Moving Objects. E. J. Pace and O. E. Kellum. May 6th.

10,864. Telephone Exchange System. M. L. Johnson. May 8th.

10,918. Incandescent Electric Lamps. British Thomson-Houston Co. (General Electric Co.) May 8th.

10,919. Windings for Dynamo-electric Machines. British Thomson-Houston Co. and H. W. Taylor. May 8th.

10,987. Devices for Securing Contact with the Earth at Specified Depths for Electric Testing Purposes. E. Ryan and H. W. Brown. May 9th.

11,106. Wireless Telegraphy. Marconi's Wireless Telegraph Co. and C. P. Ryan. May 10th.

11,158. Mariners' Compasses. Kelvin and James White, Ltd., F. A. King, and G. H. Alexander. May 13th.

11,240. High Frequency Dynamo-Electric Machines. British Thomson-Houston Co. (General Electric Co.). May 13th.

13,308. Electric-Magnetic Friction Couplings. P. Forster. June 9th. (June 8th, 1912.)

14,167. Machines for Covering Wire and Other Cores with Yarn and the like. N. Stott. June 19th.

15,348. Electrically Illuminated Letters. H. Bey. July 3rd.

15,643. Wiring of Electric Lighting Installations. F. Hodgson. July 7th.

15,968. Contact Devices for Electrical Testing Purposes. Evershed and Vignoles, Ltd., W. Clark and G. Senior. July 10th.

16,684. Electric Batteries and Accumulators. F. Sablon. July 21st.

17,189. Starting-Gear for Internal Combustion Engines and the like. H Leitner. July 26th.

18,900. Detachable Desk for use with a Table Telephone or other suitable Support. J. D. Joyce and H. C. Lumb. August 20th.

19,782. Solution for use in Lead Accumulator Cells. P. Rabbidge. September 1st. (September 2nd, 1912.)

19,838. Machines for Sealing Supporting Wires into the Beads of the Glass Rods of Metal Filament Electric Incandescent Lamps. September 2nd. J. Kremenezky (Firm of). (April 16th, 1913.)

21,143. Voltmeter. J. Stephenson. September 18th. (Convention date not granted.)

23,553. Apparatus for Exhibiting Pictures, Advertisements and the like. W. J. Mellersh-Jackson (Elektro-Reklame Ges). October 17th. (Addition to 5,029/13).

25,046. Electrical Regulating Devices. A. G. Bloxam (Robert Bosch, Firm of) November 3rd.

26,684. Insulated Electric Conductors. Western Electric Co. (Woodward, acting for Western Electric Co.). November 20th.

27,988. Arrangements for Starting and Regulating Direct Current Electric Motors. F. Cumot. December 5th. (Divided application on 7,983/13, April 4th. Addition to 8,108/12.)

29,418. Electrolytic Furnaces for the Production of Light Metals. G B. Ellis (Sodium Process Co.). December 20th.

29,448. Electrical Relays. Kemp and Lauritzen (Firm of). December 20th. February 27th, 1913.)

1914.

91. Means for Intermittently Establishing an Electric Circuit for Indicating or Recording the Level of Liquids and for other Purposes J. B Hotham and M. J. Wilson. January 1st.

970. Switches for Electric Hand Lamps and the like. G. F. Hitzelberger and New British Ever Ready Co. Jan. 13th.

3,992. Portable Electric Battery Lamps. B. Pordes. February 16th.

5,535. Wireless Telegraphy. G. Leimbach. March 4th. (March 4th, 1913.)

6,074. Electric Starting and Ignition Systems for Internal-combustion Engines C F Kettering & W. A. Chryst. March 10th. (November 20th, 1912. Divided application on 7,545/13, March 31st.)

7,788 Device for obtaining Rontgen-ray Exposures. G. Bucky. March 27th (April 7th, 1913. Addition to 2,815/14.)

THE
ELECTRICAL REVIEW.

VOL. LXXIV. JUNE 12, 1914. No. 1,907.

ELECTRICAL REVIEW.

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1914 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London. E.C.

A QUESTION OF STATUS.

IF the Dublin Section of the I.E.E. has not yet been dubbed the Fighting Section, we give it now the accolade. It did yeoman service for the profession when the new Articles were under discussion, and may fairly claim to have helped forward the healthy democratic movement more during that stressful period than any other Section has done in recent times. Now the bugle has sounded the advance once more against the seeming apathy of the central body, and the Dublin Section is thundering in the charge with steady ranks.

We print elsewhere an abstract of the proceedings at a meeting of the Fighting Section, at which the matter discussed was of the first importance to the profession as a whole. It was concerned with no epoch-making discovery, for, as one speaker said, it is 20 years old. It was, in fact, the time-worn, if not time-honoured, subject of professional status.

What intensity of feeling there is amongst the general body of members may be gauged by observing the common-place, insignificant little match which lighted the train to the powder barrel; nothing more, in fact, than a municipal job. The Dublin speakers emphasised the fact that the meeting was not called to criticise the jobbers, and we will follow their polite example for what we take to be the same reasons, (*a*) that criticism would be impious, (*b*) that the resulting hell-broth of ink and mud and vituperation would obscure the real issue as hopelessly as the path of a frightened squid is veiled by its own dark emissions.

It is necessary, nevertheless, for the proper understanding of the sudden and determined action of the Fighting Section, to state that the Electricity Supply Committee drew the attention of the Dublin City Council to the procedure which governs the training and improvement of the junior engineers on the staff of its Electricity Department. It is an excellent procedure, or programme, and as such we give it in brief, and commend it to less forward Councils:—

1. Candidates for apprenticeship must have passed through certain electrical courses, and are subjected to an examination by the city electrical engineer as to their general fitness for the profession.

2. The selected candidates are indentured for two years.

3. The Corporation, although not binding itself to do so, finds employment in junior positions for such apprentices as have shown the necessary ability.

4. Subject always to the young engineer showing reasonable progress, his course up the ladder of promotion was as follows until 1913:—

First period.—Switchboard attendant in the main distributing station at £65, rising in two years to £78.

Second period.—Switchboard attendant at the generating station at £78, rising in two years to £104.

Third period.—Shift engineer at the main distributing station at £104, rising in two years to £130.

Fourth period, and the last for junior engineers.—Shift engineer at the generating station at £130, rising in two years to £156.

In 1913 the Committee revised the salaries and increased the maxima for the various periods to £104, £130, £156 and £200, and at the same time it took a notable step towards the most praiseworthy end of improving the professional status of its junior engineers:—

5. It made an order expressing the opinion that members of the staff desirous of promotion should pass the examination for Associate Membership of the I.E.E., and it proposed to take this into consideration in future cases of promotion, and when applications for increments were submitted.

We doubt if the Council of the Institution, or even the Dublin Local Section, could have drafted a more satisfactory prospectus for the junior engineers of our supply systems. Hardly had the ink dried on the minute book in London in which, presumably, a record was made of the decision to institute examination as a test for Associate Membership, than the Dublin Electricity Committee seized the opportunity to advance its admirable work for the uplifting of the professional electrical engineer. The members of that Committee did, in fact, forestall and anticipate the desire of the Fighting Section which the latter expressed in restrained, dignified and reasoned language at the meeting which inspired this article.

We are deeply grateful to the Dublin Electricity Committee for its enlightened efforts, intended primarily, of course, for the improvement of the public service which it directs, but having a reflex effect which may and should be felt over a much wider area.

Not less grateful may we be to it for appointing, or, more strictly speaking, recommending the appointment of a man to the responsible position of assistant and deputy to the engineer in charge of consumers' connections, who does not appear to have complied with any one of the requirements which are set out above under five headings. He was, in fact, appointed in 1912 as a permanent wireman at the standard wage of 36s. per week, and the Committee made the present appointment (at a salary of £156, rising in five years to £200) in the face of a totally adverse report from the city electrical engineer, and over the heads—so it was stated at the meeting of the Local Section—of 17 junior engineers.

This was the incident that brought the Fighting Section into line for another gallant charge, and that is why the Dublin Electricity Committee deserves our thanks.

It is high time that the Council should bestir itself to get something more effective and certain for the members of a profession, which ought to be honoured, than sporadic local recognition which can be rendered useless whenever—let us say—the Lord Mayor's cook goes to take tea with an aspiring wireman's mother-in-law.

Mr. Tomlinson, hon. secretary to the Fighting Section, and it seems, in this case as in the other, the man behind the gun, quoted from the Electrical Review of January 15th, 1909, a pungent satire entitled: "The Status of the Electrical Engineer," by "Tito," in which the deadly grievance and disability under which our profession suffers were laid bare. "Tito" did not merely scarify our wounds: he suggested healing them, and the remedy is as fresh and good now as it was five years ago, when he compounded it; part of it, indeed, has been applied.

He desired to see established at once a matriculation examination for Students I.E.E., and a graduation examination for A.M.I.E.E., and he urged electrical engineers to obtain an Act in conjunction with the Civil Engineers, the Mechanical Engineers, and the Architects, which would protect the properly accredited and registered members of these societies from, as an example, the jobbing propensities of municipal bodies.

"Tito" wanted no more, in fact, than the doctors, lawyers, dentists and other professional men have obtained, either because the public or they themselves became sufficiently alive to their own interests to make things unpleasant until they got what they wanted.

The immediate outcome of the Dublin meeting was the following resolution:—

"That this appointment (by the Dublin Corporation) is a direct attack upon the profession, and that the Committee be instructed to communicate with the Council of the Institution of Electrical Engineers, urging upon them the necessity of promoting immediately such legislation as shall protect the trained professional engineer in the exercise of his profession, as the trained professional man in other professions is protected."

The Society of Architects was formed for an identical purpose, and is working still to that end. A circular letter of June, 1913, issued by that Society contains arguments for the registration under an Act of Parliament of all architects, the whole of which can be used with equal cogency in our own case, and we suggest that valuable mutual assistance might be given by the two Societies in any application to Parliament.

The following extract from the letter puts the case for action concisely:—

> The first effect of an Architects' Registration Act would be to give an immediate and definite impulse to architectural education and training, by setting up a compulsory standard of qualification. The chief weakness of the present voluntary system of architectural examinations is that they are not obligatory (except under certain conditions for admittance to membership of architectural bodies). At present such examinations are not in any case essential as a preliminary to the practice of architecture or to the claiming of the title of architect.
>
> The ultimate result of such an Act of Parliament would be that the unqualified practitioner would be gradually eliminated by effluxion of time without inflicting injustice or hardship on anyone, and without creating a monopoly, while the public would have a guarantee that in employing any architect they would secure the services of a person possessed of at least the minimum qualifications required for the proper performance of his very onerous duties.

The action of the Council will be awaited with interest.

Rubber. Considering the amount of rubber coming forward for sale lately, when fully 2,000 tons went under the hammer inside of 10 days, the market must really be considered to have given a very good account of itself. Certainly the sales held just prior to the Whitsun holidays passed off without any fresh feature, but it is at least satisfactory to be able to record that there was no further weakness in prices compared with those ruling at the close of the former series. Consumption is going on very well, and indeed in some branches it is stated that there is a certain amount of difficulty being experienced in turning out manufactured products at a sufficiently rapid rate. At all events, there has been talk of a scarcity of tennis balls, the same authority which has unearthed this item of news adding that but for the cold weather which was recently experienced and which hindered playing, while at the same time allowing makers to pick up their arrears, the lack of balls might have kept courts idle indefinitely. It is, however, probable that the early arrival of the summer weather, regardless of the calendar, and the increasing popularity of the game itself, are the prime factors in this particular respect. Be this as it may, the demand for rubber at the auctions has proved quite regular, even though the interest shown by America was indifferent. Good judges are now inclined to consider that the price has fallen to a point sufficiently low to be regarded as pretty safe, but enlarged speculative interest in the article is hardly likely to develop yet awhile, or, at all events, until the general trade and financial positions have cleared up a good deal. One thing which is still militating against the market, is the abstention of interest on the part of United States consumers whose purchases in the London market have become of less and less importance, though a few weeks ago a very fair business was reported as having been done across the Atlantic.

The standardisation of rubber continues to excite a good deal of interest, and complaints are made that it is practically impossible for plantation managers to attain any definite standard of quality owing to the innate variability of the latex produced on different plantations, but it is too late now to kick against the pricks. Standardisation has to be faced sooner or later, and the proposals put forward by the Rubber Growers' Association form a step in the right direction. It is not to be expected that the matter can be put into complete shape at once, but the drift of affairs is at the same time unmistakeable. It is probably impossible to evolve a scheme which would please everyone, but a start has been made, and progress is certain, even though it may be slower than its originators may like. *Festina lente* is, nevertheless, not a bad maxim. A sign of the lessened haste to put rubber on the market, and thus free the sales from immature produce, is seen in the spreading of the practice of allowing an increased interval of time between the tappings, and the reduction in the number of cuts made. Reformation in both of these respects, while having as a first effect a reduction in the output of the trees, would ultimately result in the crop reaching the normal, with a large reduction in the labour costs of the plantation adopting the plan, which, it may be remarked, is finding advocates and supporters.

According to official returns, the exports of plantation rubber from the Federated Malay States for the month of May amounted to 2,069 tons, compared with 1,225 tons in the corresponding month last year, and 2,151 tons in April last.

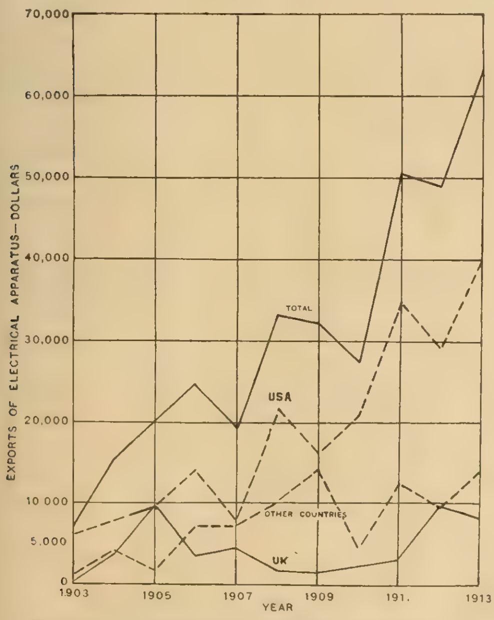
	1912.	1913.	1914.
January	1,218	2,131	2,542 tons
February... ...	1,212	1,757	2,364 ,,
March	1,379	1,737	2,418 ,,
April	1,020	1,626	2,151 ,,
May	1,007	1,225	2,069 ,,
Total, 5 months...	5,836	8,476	11,544

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

The Department of Trade and Commerce has recently published its reports for the fiscal year ended March 31st, 1913, and from the figures given the accompanying curves have been prepared.

The term "Electric Apparatus" which appears on these curves includes carbons, electric light, and carbon points of all kinds, N.O.P.; carbons over 6 in. in circumference; electric apparatus, N.O.P., insulators of all kinds, &c., electric and galvanic batteries, telephone and telegraph instruments; electric motors, generators, dynamos and sockets; fuse heads of metal, foil, or cardboard, for use in the manufacture of fuses; incandescent lamp bulbs and glass tubing for use in the manufacture of incandescent lamps, and mantle stocking for gas lighting.

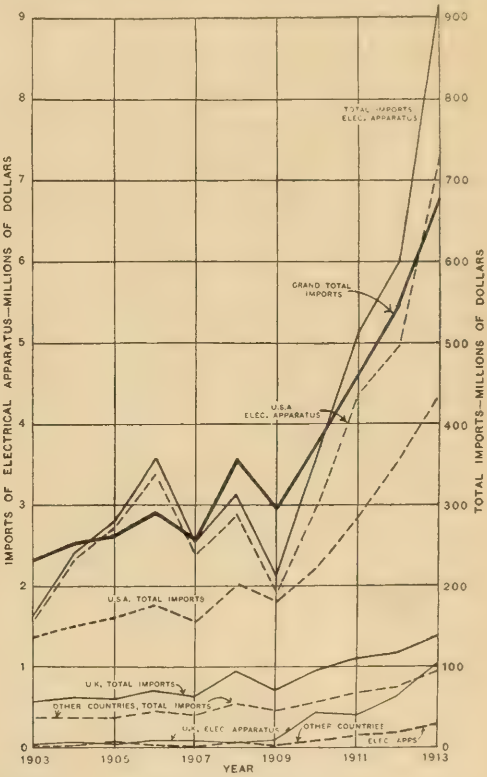


Exports of Electrical Apparatus from Canada.
Based on 1913 Report of the Department of Trade and Commerce, Ottawa.

It is rather curious to note that the curves of "Exports from Canada," are of the same general character as those of "Imports into Canada;" in fact, on the respective scales to which they happen to have been drawn, they almost coincide if laid one over the other, though the actual monetary values for "Electric Apparatus" are vastly different. The curves of "Imports into Canada" will be the more interesting to manufacturing firms at home, especially, of course, those showing imports of "Electric Apparatus," the curves of "Total Imports" having only been given for the sake of comparison. The similarity in the general trend of the curves for these two items is, however, as noteworthy in this case as in the one cited above.

Referring now specially to the curves of "Imports into Canada," and dealing only with those for "Electric Apparatus," it will be seen that, as has already been pointed out in these notes in discussing similar curves in other years, the U.S.A. is still very far in advance of Great Britain.

Considering the disabilities under which British firms labour here, the showing is not at all a bad one, but it will be a great pity if these firms do not during the next few years do something towards securing a greater share of a business which, as is plainly shown by the curves, is increasing at a very rapid rate—it has doubled within the last $3\frac{1}{2}$ years, and while the imports from Great Britain have increased during the same period by some 25 per cent., those from the U.S.A. have increased by about 95 per cent.



Imports of "Electrical Apparatus" into Canada, and "Total Imports."

It is very possible that the United States will always secure the lion's share of the electrical trade of this country, owing to her geographical position, and to the fact that American standards have been already adopted here to such an extent that it is unlikely that they will ever be altered, but in referring to "disabilities" above, the writer had in mind several difficulties which might, if attacked in the right manner, be removed, or at least minimised considerably. This matter will be touched upon in the next "Notes." In the meantime, it is hoped that the curves now presented will furnish food for thought.

D

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Institution and the Electrical Industry.

The article in your issue of June 5th on the "Fate of the Industrial Committee," and the general attitude of the Council which has thus come to light, voices a most widespread dissatisfaction.

I notice that you mention the Council's action of a few years ago under the title of the "broader policy." I think the Council's present action might very well be described as the "old woman policy," since they are evidently fully determined to do nothing—but to be "academic," *i.e.*, "sit and talk." It is quite obvious that the Council's idea of the work of the Institution is that it should be a kind of Grandmotherly Debating Society. No-one would object to a society for such harmless diversions if it did not usurp a position which should be occupied by a properly operative body, and if it did not spend the huge number of subscriptions which are at its disposal in such futilities. It is surely quite time that the members of the Institution asserted themselves, and made sure that the Institution which they supported was being run in their interests, and not for the vanity and advertisement of the few. So far as numbers are concerned, the members of the Institution are —with but a few exceptions—dependent for their livelihood on the commercial success of the electrical industry. It is not a matter of academic interest, but one of bread and butter.

The despised "commercial side" have got to furnish their incomes, and even the money to pay their subscriptions. Now this being so, are not the present attitude of the Council and the present operations of the Institution a ridiculous spectacle ?—and if anything is more ridiculous it is any talk of the Council about keeping up the "dignity of the Institution." Why, even two-thirds of the Council themselves are dependent for their own living upon selling, in some form or other, electricity to the public—ashamed though they may pretend to be in Council of having to do with such vulgarities as buying and selling. However, it may be supposed that the business instincts of this latter section are still to the top (but take an oblique direction) by their recognising that it pays them—so far as their personal position at the Institution is concerned—to take sides for the moment with the top dog. In short, the original "Society of Telegraphic Engineers and Electricians" has developed into a "National Institution of Electrical Engineers," but is still under the old *régime* which it has long ago outgrown.

It is for the members now to see that some drastic alterations in constitution and policy take place. They want to see something for their subscriptions beyond the privilege of listening to a few papers which they could just as easily read in the technical Press, and they also want to see that the magnificent premises which are their property are put to far more extensive use. The only people who can do this are those who are frankly interested in the commercial development of the electrical industry, *i.e.*, those who are really in earnest in increasing the amount of business in electricity done in England. It is the commercial side who hold the purse-strings, and who can make possible more and better paid positions for the technical men.

Commercial.

London, *June 8th*, 1914.

Comparative Economics of Tramways and Railless Electric Traction.

The correspondent in your issue of the 5th inst., signing himself "The Critic," implies that the basis of comparison in my I.C.E. paper was of a railless car seated for 28 passengers with an L.C.C. car carrying 78 passengers. He is doubly wrong. In the first place, my estimates of capital cost, weight, current consumption and other working expenses cover the operation of a railless car to carry 56 passengers.

In the second place, in my comparisons I have altogether neglected the L.C.C. cars, as "The Critic" might easily have seen from the diagrams.

The L.C.C. tramways occupy a unique position in tramway statistics both as to capacity and capital expenditure. The latter figure is about £87,000 per mile of route. My assumption of tramway cost for purpose of generalisation is only £28,000 for the case of densest traffic considered.

Although "The Critic's" traffic studies of the L.C.C. cars at Westminster and Blackfriars Bridges are no doubt interesting, I am not concerned with any project for railless electric traction installations in those places, and must, therefore, be content to note his data.

"The Critic" refers to a statement made before a Committee of the House of Lords in regard to road maintenance at Rotherham which he accepts as proof of fact, and from which he draws deductions. This is nothing more than expert evidence. No such sum has been paid, or adjudicated to be paid. The matter is *sub judice*, and it is not usual among professional men to build up a case upon *ex parte* evidence. Expert evidence of this kind is "merry and bright." "The Critic," in his first letter, swallows the statement of one surveyor of road damage of 2d. per mile. In his second letter, with increased avidity he swallows that of another surveyor of 4d. per mile. I can assist him with another piece of "expert evidence." It was sworn to by a member of the Institution of Municipal and County Engineers before a Committee of the House of Commons, and was to the effect that the damage of the motor-'bus was 10d. per mile. We are getting on !

"The Critic" states his opinion that in any case where traffic calls for a headway of 20 minutes or less, a tramway is to be preferred to railless traction or petrol-'buses. Every one is entitled to his opinion, on however slender ground he may choose to base it. The fact remains, however, that the petrol-'bus competes favourably with the tramway where the traffic is very much more dense than the limit set by "The Critic." I do not know of any case where the tramway has ousted the petrol-'bus, however dense the traffic may be.

I quite agree with "The Critic" that for workmen's cars the fare should be less than 1d. per mile, but I do not see why the general public should be carried for less. When the Parliamentary fare on railways was fixed, a penny had much greater purchasing power than it has now. Corporations may be indirectly benefited by developing suburban rateable areas, at the expense of an unremunerative tramway fare. It is, however, often not the result of a progressive, sound, economic policy, but of compulsion from competition.

In my previous reply, I put to "The Critic" the case of York tramways, which he has not answered, although he professes to do so. He stated in his first communication that the proportion of earning capacity of the railless car to the tramcar should be taken as 1 to 1·6. I applied this to the case, and asked him whether he would stand by his assumption.

He now admits that the earning capacity might be the same, but states that the railless car could not be worked at the working expenses, nor could it be bought for the price assumed in my paper. He thus shifts his ground for one upon which he is equally insecure.

The working expenses of a car carrying 40 passengers do not differ materially from those of one carrying 28. The double-decked car is much shorter, and weighs no more than the single-decked car. The cost is also about the same. It is worked by the same staff. It should also be borne in mind that *ceteris paribus* the price of cars decreases as the production increases. The tramcar is made in very large quantities, and to standardised patterns.

I think that anonymous writers might refrain from inferences regarding the personal knowledge and experience of those who are not afraid to give their names.

"The Critic" volunteers the description of his long experience of Parliamentary Committees and the Board of Trade, also as giving responsible advice in a great many cases. It might interest his numerous clients to see the arguments which he urges with a force equal, if not superior, to his knowledge of the question at issue, supported by his name. I suggest, however, that if any of these numerous clients are considering the alternative of a tramway or a railless line "where traffic calls for a headway of 20 minutes or less," they might as an alternative to "The Critic's" advice, consult one of the municipal engineers who has both tramways and railless lines under his responsible management, both as to working expenses and cost of construction. It would be still open to these to avail themselves of "The Critic's" valuable services for inviting tenders.

T. Graham Gribble.

London, E.C., *June 8th*, 1914.

"Wireless Telegraphy and Telephony."

We have to thank you for the long and careful review which appears in the June 5th issue of your valuable paper.

We are not surprised that the reviewer should repeatedly point out that 5s. is much too high a price to ask for such a comparatively small book. He has, however, been misinformed. The price of the volume is 2s., not 5s., and this, we think, removes what would undoubtedly have been a serious objection to the volume.

May we ask you to have the kindness to remove in your next issue the mistaken impression thus given to your readers?

Seeley, Service & Co., Ltd.

[We regret the error, the source of which we have not been able to trace. The reviewer was not responsible for it.—Eds. Elec. Rev.]

Arc Lamps and Electric Cranes.

Can anyone inform me where I can obtain statistics of the annual cost of upkeep of 10-ampere flame arc lamps (not magazine), and also similar information regarding the cost of 30-cwt. electric jib cranes?

H. T.

BLEACHING BY OZONE.

On Thursday last week, by the courtesy of Messrs. Ozonair, Ltd., we were enabled to inspect a bleaching plant which they have recently constructed to the order of the Eparchial Candle Works of St. Petersburg; the plant will be used for bleaching the beeswax of which the candles used by the Russian Orthodox Church are made, and has been designed for an output of one ton of wax per day of 10 hours.

The treatment of oils, fats and waxes with ozone, whether directed towards the bleaching, deodorising, oxidising or refining of the material, or to several of these purposes simultaneously, depends for its action mainly upon the powerful oxidising properties of ozone, and the methods and plant adopted are almost identical in all these cases, the process consisting in forcing ozonised air through the substance under treatment. The plant therefore consists of apparatus for generating ozone and conducting it into the material, which is contained in vats provided, if necessary, with heating coils. The accompanying illustration shows diagrammatically such an installation, and corresponds closely with the one which we saw in operation at a soap works in Brentford.

The plant consists essentially of an electrically-driven blower, an air cooler, a battery of ozone generators, and the vessel in which the material is treated. The blower has a capacity of 100-300 cb. ft. of air per minute, according to the speed at which it is driven, and the resistance of the column of material in the treating vessel. The blower is water-cooled in order to render its efficiency higher, and to take away as much as possible of the heat of compression. The power taken by the blower is about 3 kw.

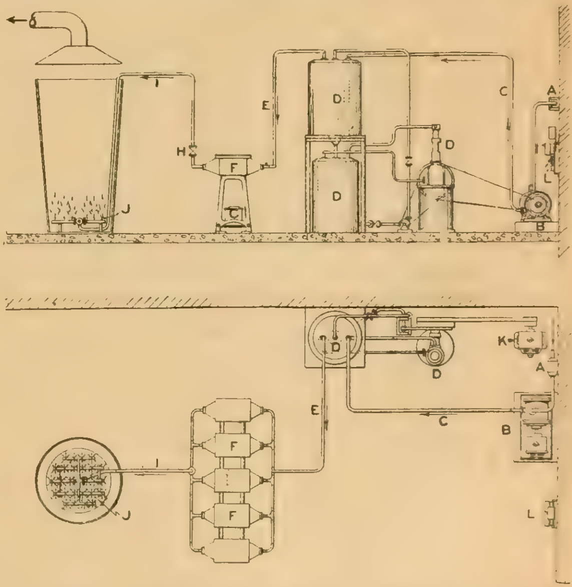
The air after leaving the blower passes into a preliminary cooler, the object of which is to assist the refrigerating plant by further cooling of the air by means of cold water. This cooler consists of a galvanised steel tank in which cold water circulates through a series of gilled pipes. The resulting temperature of the air is about the same as the temperature of the air before it enters the blower.

The air now passes into the cooler of the CO_2 refrigerating apparatus; this is worked on the direct expansion system, and the power taken is approximately 3 kw. The temperature of the air issuing from the refrigerating apparatus is about 0° C. The object of this cooling of the air is, first, to dry the air by deposition, and, secondly, to keep the electrodes of the ozonisers cool, and thus increase their efficiency.

The air now enters the bank of ozonisers through pipes arranged to give an equal volume of air to each generator. The ozonisers are constructed on the well-known Ozonair system. The electrodes consist of flat sheets of wire gauze, made of a special alloy and separated by a dielectric of specially-prepared micanite. Each ozoniser has an electrode surface of 40 sq. ft. The high-pressure current is supplied by three transformers, each supplying current to three ozonisers coupled up in parallel. The secondary voltage varies from about 7,000 to 9,000 volts, and is capable of regulation by means of the primary winding of the transformer. The amount of power consumed by each ozoniser varies from about 300 to 600 watts, according to the secondary voltage. The power factor is low, but, as the ozone generators take a leading current, this is a very desirable feature from the point of view of the supply authorities. The switchboard is arranged so that the power consumed by each ozoniser can be measured and complete regulation and control obtained. The ozonised air passes into a series of pipes which lead it through the melted material at the bottom of the treatment vessel. The total amount of power taken by the complete plant amounts to (approximately) 10 kw., so that to bleach 1 ton of beeswax takes approximately 100 kw.-hours. The same plant can be used for bleaching various other materials, such as palm oil, tallow, &c., and the amount of energy taken per ton of these materials varies also. For instance, for bleaching palm oil, the energy required is much less than for bleaching beeswax, and amounts approximately to 50 kw.-hours per ton.

Comparing the relative advantages of this method of bleaching beeswax with the chemical method ordinarily adopted, it will be seen that the cost is relatively very small, and shows a great advantage in favour of the Ozonair system. The chemical method at present used for bleaching wax is what is known as the bichromate method, and consists in heating the beeswax for several hours in contact with bichromate of potash and sulphuric acid, the quantities used being for each ton of beeswax, 5 cwt. of sulphuric acid and 1½ cwt. of bichromate of potash. The cost of these chemicals alone amounts to about £3 15s., as compared with the cost of 100 kw.-hours, or, say, an average of about 5s. in this country. To this sum of 5s. must be added the interest on capital cost, depreciation and maintenance of the ozone bleaching plant; but even with this addition, the total cost represents a very great advantage in favour of bleaching by ozone.

In the chemical method of bleaching, there is a considerable loss of material due to the chemical action and what is technically known as "charring." This loss in the case of ozone is practically negligible. Again, the wax bleached by ozone attains a degree of hardness or brittleness much superior to that resulting from the chemical method of bleaching, and this is a great advantage when the beeswax is used for candle making. Another advantage is that the wax bleached by ozone remains pure and uncontaminated, whereas very special means are needed in order to free the wax from the mixture of chemicals when that method is used.



A, Air cleaner; B, Electrically-driven blower; C, Air-delivery pipe; D, Air cooling machine: K, Electric motor; E, Cold-air delivery pipe; F, Ozone generators; G, Transformer; H, Valve; I, Ozone pipe; J, Ozone injectors; L, Switchboard.

Lay-out of Ozone Bleaching Plant.

By taking samples of the wax at intervals, the progress of the operation is easily watched, and during our visit the charge of beeswax—received in a nut-brown condition—made marked progress towards the attainment of the desired standard, the last sample taken being of a creamy whiteness. The plant has, in fact, exceeded the anticipations of its makers, and the duration of the process may be materially shortened, with corresponding economy of energy. The cost of the treatment, therefore, will be even less than is indicated above.

LEGAL.

Postmaster-General *v.* Staffordshire County Council.

At Stafford County Court on 5th inst. an application was made to his Honour Judge Ruegg on behalf of the Postmaster-General with respect to the refusal of the Staffordshire County Council to allow overhead telegraph poles and wires to be erected over a distance of about a mile on Lichfield Road, at Weeping Cross, in the direction of Stafford. According to the report in the *Birmingham Daily Post* the Post Office had made application to the County Council for permission to erect the poles and wires, but the County Council refused to grant permission on the ground that the district in question was a residential one and the erection of poles and wires would destroy the amenities of the neighbourhood. The question which was raised by the County Council was that the wires should be put underground.

It was explained that the proposed telegraph wires would form part of the long-distance trunk line from London to Ireland, and that the cost of underground wires was much more than that of overhead, and they were not so efficient.

His Honour inspected the district, and on the Court resuming he gave judgment in favour of the Postmaster-General.

Alleged Bogus Wireless Telegraph College.

Alfred Henry Mayne (31), electrical engineer, a defendant in the Sheffield wireless telegraphy case, failed to appear at the Sheffield Quarter Sessions on the 22nd ult., to answer charges against him. He had been allowed bail, and it was stated that he had gone abroad. His co-defendant, Thos. Jones (58), electrical engineer, was in Court. It was alleged that defendants kept a bogus wireless telegraphy college, and they were charged with conspiring by false pretences to obtain 10 guineas from Robert Loxley, fitter, 274, School Road, Sheffield, and 10 guineas from John Comins, miner, Doe Lea, Chesterfield.

Mr. Waddy, who appeared for Mayne, said he could not understand his client's absence. A letter dated April 1st from Rapallo, Italy, had been received from him that morning by his solicitor in Sheffield, and Mr. Waddy thought there was real reason for believing that the man did not know that the Sessions were being held at this time, and that letters sent to him by his solicitors had not reached him.

The case was adjourned until the next Sessions, Jones being allowed bail upon his own recognisances.

CENTRAL STATION PRODUCER GAS PLANT.

From an article by M. H. Parodi, in the *Génie Civil*, we learn that during 1913 the producer gas plant laid down at Tours in 1908 by the Cie. Chemin de fer d'Orleans generated 645 million cb. ft. of gas, 30 per cent. of which was used in various heating furnaces, and the remainder in producing 3,338,000 kw.-hours of electrical energy distributed to the company's works and yards. Since its opening the capacity of the plant has been more than doubled, and there are now at work 14 gas producers, each capable of supplying 20,400 cb. ft. per hour of gas worth 124-136 b.th.u. per cb. ft. Twelve producers are of the Taylor rotating grate type, and use anthracite coal; the remaining two are of the Riché type (with reducing column of incandescent coke), and burn wood refuse. The Taylor producers were designed to burn hard anthracite of 12,500-14,300 b.th.u. per lb. calorific value, containing at most 10 per cent. ash and 10 per cent. volatile matter, but they operate equally well on coal with more ash, so long as the latter does not form slag. Sifted "frasil" from loco. fire-boxes gives good results if mixed with 50 per cent. to 60 per cent. of hard coal. The calorific value of frasil is about 10,800 b.th.u. per lb., its ash content 15 per cent. to 20 per cent., and volatile matter 3 per cent. to 4 per cent. The coal-fed producers normally burn 10 lb per sq. ft. per hour, can be overloaded 50 to 70 per cent., and then supply 35,400 cb. ft. per hour per producer. Experience shows that not more than 20 per cent. of sawdust should be present in the wood refuse used in the Riché producers, otherwise there occurs loss of partially-burnt fuel during slicing. The calorific value of gas made from the wood refuse is about 146 b.th.u. per cb. ft. Through a gasholder of 17,700 cb. ft. capacity, gas is delivered at 2½ in. mercury pressure to the heating mains and the central station. The equipment of the latter comprises six 550-h.p. producer gas engines direct-coupled to d.c. generators. The four 1908 engines are two-cylinder, double-acting machines with cylinders 650 mm. diameter × 750 mm. stroke, speed 135 r.p.m., water-cooled pistons and piston-rod, l.t. ignition and control by variable mixture (compression constant at 170 lb.). Four-cylinder single-acting engines were installed in 1913, the cylinders being 560 × 700 mm., speed 190 r.p.m., pistons air-cooled, h.t. magneto ignition and control by variable compression (maximum 143 lb., the mixture being practically constant). Owing to risk of pre-ignition (particularly when using gas containing more than 17 per cent.—18 per cent. hydrogen) the maximum output of the 1908 engines is limited to 400 kw. The 1913 engines are much more elastic and will easily supply 10 per cent. overload (410 kw.) when operating on gas varying in calorific value from 100 to 160 b.th.u. per cb. ft. No interruption in supply has been experienced during the five years the works have been in service, and no serious repair or replacement has yet been necessary. An 80-kw. reversible booster and 800-a.h. storage battery secure satisfactory operation in parallel and maintain the supply pressure constant within ± 3 per cent. Skilled manipulation is required to keep the calorific value of the gas between 135 and 170 b.th.u. per cb. ft., despite wide variations in output; on the uniformity of gas consumption depends satisfactory performance.

During the past four years the fuel used per kw.-hour utilised has averaged from 1·80 to 2·01 lb. These figures assume 3 lb. of wood to produce as much gas as 1 lb. of coal, and assume that the gas engines consume 124 cb. ft. of gas per kw.-hour. The overall efficiency is about 12·7 per cent. (maximum = 14 per cent. in 1912), that of the producers averaging 68·7 per cent. The fuel consumption per effective kw.-hour is considerably (10 per cent.—30 per cent.) lower than that in large turbo-stations using 8,000 to 15,000-kw. turbo-generators, notwithstanding the lower load factor (25·4 per cent., as compared with 35 per cent. to 45 per cent. in the turbo-stations), and much smaller units in the present case. The overall thermal efficiency of the Interborough Rapid Transit station using 7,000 to 8,000-kw. reciprocating engines and exhaust turbines is 11·1 to 11·3 per cent., as compared with 12·7 to 14 per cent. using 400 to 500-kw. producer gas units. The cost of gas per 1,000 cb. ft. is estimated to be 2·75d. and of producing 1 kw.-hour (effective) to be 0·53d., made up as follows:—Fuel, 0·2; producers (wages, maintenance and waste, &c.), 0·14; gas engines—wages, 0·08; maintenance and repairs, 0·10; lubrication, &c., 0·01; total, 0·53d. per unit. Allowing for capital charges on £40 per kw., the total costs per kw.-hour and per 1,000 cb. ft. of gas are 0·8d. and 3·4d. respectively.

BUSINESS NOTES.

Consular Notes.—CHINA.—The Austrian Consul at Shanghai reports that a new Chinese electrical works, under British management, was erected during 1913 in the suburb of Nantao, near Shanghai; Chinese electrical works were also planned for Canton, Huchou (Chekiang), Tungchou (Kiangsu), &c. A new purely Chinese electric tramway undertaking was opened in August, 1913. The capital amounts to $20,000. The motors were supplied by the Siemens Electrical Co., the rails came from Germany, the cars and other installations were produced by Chinese firms, and the *personnel* also is Chinese. A similar Chinese undertaking was started at Peking at the end of 1913, with a capital of $3,000,000. The length of the line is intended to be 27 miles.

Later in his report the Consul gives the following figures of imports of electrical apparatus into Shanghai:—

	1911. Haikwan taels.	1912. Haikwan taels.
From Germany	601,847	547,255
" Great Britain	369,620	429,199
" Japan...	243,521	249,387
" United States	100,171	95,282
" Belgium	64,220	67,453
" Austria	7,791	26,236
" Other countries	296,527	264,476
Total	1,683,697	1,680,288

Most of the firms who are engaged in this business with China have their own electrotechnical branches in the country, under the control of capable engineers. The German Siemens-Schuckert Werke have their own house in Shanghai (Siemens China Electrical Co.), which carries on an extensive business in the erection of electric lighting and power plant and in other directions. The following were the imports of telegraph material in the same years:—

	1911. Haikwan taels.	1912. Haikwan taels.
From Germany	62,998	102,519
" Great Britain	133,093	82,957
" Japan...	97,007	62,657
" Austria	7,198	6,731
" Other countries	57,684	79,695
Total	357,980	334,559

CONGO.—The British Consul reports that since the date of his last annual report further progress with wireless telegraphy installation has been made, but atmospheric conditions in the district are unfavourable the air being highly charged with electricity. A new station is in process of construction at Kinshasa. Continued progress in the construction of telephone and telegraph lines is being made. Communication by telegraph is now established between Kasongo on the Kongolo Railway and Baraka on Lake Tanganjika.

RUSSIA.—The Austrian Consul at St. Petersburg reports that the past year was particularly favourable for the Russian electrotechnical industry, which was especially assisted by the large orders given in consequence of the execution of the naval programme for the fitting up of vessels, the harbour works at Reval, the equipment of the State shipyards, &c. Moreover, the extension of several metallurgical and machine construction works and the establishment of new enterprises of this character brought important orders to the industry. Further, considerable activity was displayed in the erection of municipal lighting works in several provincial towns, as well as the erection of commercial and industrial plants. The three large undertakings in Russia are daughter companies of similarly named German works, the Allgemeine Elektrizitäts Gesellschaft, Siemens & Halske and Schuckert and Co., which all three control the Russischen Kabelwerke. At the end of 1913 negotiations towards amalgamation took place between the St. Petersburg works of Siemens & Halske and Schuckert & Co., whereby both should amalgamate as the Russische Siemens Schuckert Werke for high-tension plant, whilst Siemens should remain separate for low-tension plant. All the works, named together with the smaller works, "Volta," of Reval, Duflon and Konstantinovitch, of St. Petersburg, and others, showed satisfactory financial results, and are said to have been well supplied with orders at the beginning of the year. Increases of capital were effected in the case of the Allgemeine Elektrizitäts Gesellschaft, the Russian Wireless Telegraphy Co., and the St. Petersburg Lighting Co. of 1886.

ITALY.—The American Consul at Florence reports that following the example set by landowners in the Department of Emilia, some experiments have recently been made near Florence in ploughing by electricity. The advantages claimed for this system of power ploughing are :—(1) The small cost of equipment as compared with other mechanical systems of ploughing ; (2) the lower cost of maintenance ; (3) the need of a smaller number of labourers ; (4) the fact that during stoppages from any cause the current may be cut off from the motors, thereby stopping at once the expense for power ; (5) the availability of the surplus power from the motors and transformers for use in other work. The stationary apparatus drawing energy from some commercial electric line consists of transformers, motors from 25 to 50 H.P., motor-driven capstan, and hauling cable. The running apparatus is made up on a leading truck and wheeled ploughs. It is stated that 89 acres can be ploughed without shifting the stationary plant. At Gazzo Veronese the following estimates of the cost per acre of ploughing were made :—Ploughing with animals, 22s. to 24s. ; steam power, 18s. ; electric power, 12s. 6d. The ploughing was done to a depth of 35 to 40 cm. (13·78 to 15·75 in.), and the foregoing cost of electric ploughing is figured on the basis of 200 days' work per year with electric power at the rate of 1½d. per KW.-hour. In the same district for 100 days' work in the year with the price of electric power at 2d. per KW.-hour the comparative costs per acre of steam and electric ploughing were :—Steam ploughing, 21s. ; electric ploughing, 14s. Other plants in the same district are said to have reduced the cost of electric ploughing to 10s. per acre.

Near Piacenza on a 2-acre tract the expense for ploughing to a depth of 45 to 50 centimetres (17·72 to 19·68 in.) with electric power was 16s. 8d. per acre. The ploughing was somewhat deeper, the cost of electric current was 2½d. per KW.-hour, and the land was cut by a highway running through it.

Calculations made at Reggio Emilia on 741 acres ploughed by electric power gave the following results :—

Capital invested :			
8 kilometres of line, 10,000 volts	£600	0	0
2 sets of motors and transformers, 50 H.P. each ...	415	0	0
2 capstans, platform ploughs, &c.	710	0	0
Total	£1,725	0	0
Operating expenses :			
13 per cent. of amount invested in line	£78	0	0
15 per cent. of amount invested in motors, &c. ...	62	0	0
20 per cent. of amount invested in ploughs, &c ...	142	0	0
Cost of current, 118,656 H.P.-hours	400	0	0
Labour for operation of motors and transformers, 2 men, 100 days	41	5	0
Labour for capstans and ploughs, 4 men, 200 days	133	0	0
Oil and lubricants for the motors	8	6	8
Oil and lubricants for the capstan and cable ...	6	5	0
Labour insurance	4	3	4
Superintendence	25	0	0
Total	£900	0	0

Electricity consumed for 741 acres, KW.-hours	30,000
Loss in transmission and transforming, 10 per cent., KW.-hours	3,000
Loss in energy by motors running without load... ...	2,100
Total (equal to 47,736 H.P.-hours) KW.-hours ...	35,100
Energy generated at cost of $1,920, H.P.-hours	118,656
Used in ploughing, H.P.-hours	47,736
Balance, H.P.-hours	70,920

The balance of 70,920 H.P.-hours is available for use in other agricultural work, pumping water, running a mill, thrashing, &c. For other systems (those using a moving engine) of ploughing a similar parcel of land figured on the same basis the costs as calculated are : Ploughing with steam power, £908 ; gas engine, £910 ; oil burning engine, £893. The cost of fuel in this district is approximately as follows :—Coal, per metric ton, 50s. ; wood, per quintal (220 lb.), 3s. 4d. ; gasoline, per 5-gallon tin, 7s. 6d. ; kerosene, per quintal, 29s. 2d.

Catalogues and Lists.—FORTUNA MACHINE CO., LTD., Deacon Street, Leicester.—Illustrated descriptive circular relating to their new "Fortuna" power hack saw with patent Universal vice, driven either by belt or by electric motor.

MR. P. W. RANDS, Caxton House, Westminster, London, S.W.—Publications giving prices and particulars of electric fans, also of various electrical plant and apparatus in stock.

MESSRS. FALK, STADELMANN & CO., LTD., 83-87, Farringdon Road, London, E.C.—Supplementary price list (No. 385) giving illustrated particulars and prices of "Antarctic" electric motor fans for table and wall service, also porthole type, and special ship and railway carriage types. Leaflet 189 gives prices, &c., of "Farringdon" H.V. flat tumber switches.

MESSRS. ADNIL ELECTRIC CO., LTD., Adnil Building, Artillery Lane, London, E.C.—Eight-page illustrated price list of their semi-indirect lighting fittings.

THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD.—109-111, New Oxford Street, London, W.C.—Illustrated list I.F.4 contains particulars and prices of the "Indra" electric lighting fittings suitable for either one-watt or half-watt lamps. One of the pictures shows a night view of a large modern office building, where the Indra system of illumination is employed, some 250 fittings being installed.

THE WALSALL ELECTRICAL CO., LTD., 57, Bridge Street, Walsall.—Supplementary catalogue giving clearly printed prices and illustrations of a number of their manufactures, including the Walsall minimum cut-out and the Walsall 1914 auto cut-in and cut-out. A further leaflet gives net prices of meters. During May the firm turned out over 5,000 meters, about one-fifth of the total turnover of last year. Prices have been considerably reduced owing to great strides made in the meter department.

MESSRS. DONOVAN & CO., 47, Cornwall Street, Birmingham.—New price list of electric desk and wall fans, Flicker knife switches, ironclad switchgear for mills and collieries, and cast-iron water-tight lighting fittings.

THE LENNOX FOUNDRY CO., LTD., Tantiron Foundry, Glenville Grove, New Cross, S.E.—Fifty-six-page catalogue of "Tantiron" specialities. The non-corrosive qualities and physical properties of "Tantiron" are shown in tabulated form, and plant and fittings made of this acid-resisting alloy, such as cocks, valves, blowers, ejectors, pipes, connections, pumps, &c., are well illustrated.

MESSRS. SANDYCROFT, LTD., Sandycroft, near Chester.—Catalogue of over 160 pages. The first few pages are occupied by specification and other matter describing their Cascade induction motors, excellent half-tone pictures appearing of complete motors and their parts. The remainder of the book consists of very fully detailed tables of prices, weights, &c., of three-phase single-speed Cascade motors (type H.V.1 without slip-rings) and accessories.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich.—Pamphlet A550 (52 pages), dealing with their quenched spark system of wireless telegraphy for ships. The system is now installed on more than 100 British vessels. The pamphlet contains an extract of all the important recommendations regarding wireless telegraphy by the recent Committee for Safety of Life at Sea.

MESSRS. J. & G. ODHAMS, 206 and 207, Upper Thames Street, London, E.C.—Abridged illustrated price list (20 pages) of electrical goods, including bells and bell accessories, magneto machines, ampholders, switches, conduits, fittings, lamps and cooking apparatus.

MESSRS. GEO. M'CARTNEY & CO., Burnside Works, Cumnock, N.B.—Leaflet describing the "Orb" combined switch and fuse panel (mining type).

MESSRS. CROMPTON & CO., LTD., Chelmsford.—Illustrated price list (536A) of searchlight projectors (commercial patterns). Dimensions and weights are given.

MESSRS. LESTER BETTS & CO., LTD., 9, London Street, E.C.—Bulletin No. 3 giving descriptions and prices of a variety of electrical manufactures.

MR. ROBT. H. LASCH, Carburton Street, Portland Road, London, W.—Illustrated price list of the "Excelsior" portable vice and stand for conduit work.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. 52, No. 235. June 1st. London : E. and F. N. Spon, Ltd. Price 3s. 6d.—This issue contains papers on "Alternating Electromotive Forces in Parallel," by A. E. Clayton ; and "Static Transformers for the Simultaneous Changing of Frequency and Pressure of Alternating Currents," by A. M. Taylor.

"Electric Furnaces for Iron and Steel." By D. A. Lyon and R. M. Keeney. Washington : Government Printing Office.

"Picture Play Photography." By H. M. Lomas. London : Ganes, Ltd. Price 5s.

"Konstruktion und Prüfung der Elektrizitätszähler." By A. Königswerther. Leipzig : Dr. Max Gänecke. Price M. 16.

"Les Courants Vagabonds, L'Electrolyse et les Perturbations causées par l'Induction et les Courants Pulsatoires." By A. Payot and A. T. d'Altoff. Pâris : Dunod & Pinat. Price 1 fr. 25.

We have received from Mr. H. P. Wiggins a reprint of a paper read before the Optical Society, in which an interesting account of the mining, preparation and uses of mica is given. We note that owing to the peculiarities of the mineral, the cut mica that reaches the market is only $\frac{1}{30}$th to $\frac{1}{100}$th part of the mica mined, and not more than $\frac{1}{5000}$th of the rock excavated in mining.

For Sale.—The Corporation of Londonderry has for disposal, by tender, 192 double-carbon and 12 single-carbon arc lamps and accessories. Particulars are given in our advertisement pages.

Bankruptcy Proceedings.—Leonard James Aron, 7, Harpur Street, Bloomsbury, electrical engineer.—Under a receiving order made in this case, the first meeting of creditors was held on June 3rd at the London Bankruptcy Court. The receiving order was made on the petition of Capt. Clarence Wiener, who tendered a proof of debt for £653. Mr. W. G. Williams, Official Receiver, reported that it appeared from the debtor's statements that in 1897 he became connected with a business carried on by his uncle, which was in the following year converted into the Aron Electricity Meter, Ltd. In 1901 he entered into the employment of Vickers, Son & Maxim, and subsequently into that of the General Electric Co., Ltd., of Birmingham. In 1908 he re-joined Aron Electricity Meter, Ltd., who subsequently financed him to some extent in getting out certain electric clock patents. The debtor was also financed by a Mr. C. E. Harrison, an electric clock-case maker, and in August, 1911, he entered into partnership with that gentleman to combine the two businesses. They traded as the British Electric Time Co. until the partnership was dissolved in November, 1911. During the next few months the debtor traded alone, but in March, 1912, he met the petitioning creditor, and in the following month the "X.L. Electric Co." was formed, with registered offices at Waldorf House, Aldwych, W.C., and a nominal capital of £20,000. Capt. Wiener was to act as managing director, and the debtor as director and advisory engineer. The debtor, in consideration for the transfer of his interests to the company, was to receive 10,000 shares, of which Capt. Wiener was to have 5,000. The other 10,000 shares were offered for subscription, but only a small proportion were taken up by the public. Disputes arose between Capt. Wiener and the debtor in December, 1912, culminating in the present bankruptcy proceedings. No accounts had been lodged, but the debtor roughly estimated his liabilities at £2,500, and had no assets of substantial value. He attributed his insolvency to the creation of debenture bonds by Capt. Wiener over "X.L. Electric Co." in October, 1912. In the absence of a quorum the case was left with the Official Receiver to be wound up in bankruptcy.

Private Arrangement.—G. Braulik, electrical engineer, 8, Lambeth Hill, Queen Victoria Street, London, E.C.—A largely attended meeting of the creditors of the above was held on Tuesday, at the Cannon Street Hotel, E.C., when a statement of affairs was presented showing the position as at April 24th last. The statement disclosed ranking liabilities of £11,914, of which £7,551 was due to trade creditors, and £4,363 to Mrs. Braulik. The assets were estimated to realise £11,766, from which had to be deducted £232 for preferential claims, leaving net assets of £11,534, or a deficiency of £380. The assets were as follows :—Cash at bank, £17 ; cash in hand, £18 ; book debts, £3,656 ; fixtures, fittings and furniture, £75 ; and stock, valued on the basis of a going concern, at £8,000. Mr. Houston, of Messrs. Corfield & Cripwell, accountants, of Finsbury Pavement, E.C., said it would be remembered that a conference of the creditors was held on April 30th. According to the statement of affairs then submitted, which showed the position as December 31st last, the liabilities amounted to £15,183, and the assets were valued at £21,604. The assets, however, then consisted of book debts, £8,930 ; lease of premises, £375 ; investments, £1,000 ; while the stock was then valued at £11,105. At the conference of the creditors it was decided to accept a composition of 10s. in the £. It had been stated that Mrs. Braulik was a secured creditor for £2,500, and also an unsecured creditor for £1,800. If an assignment was agreed to, however, Mrs. Braulik would withdraw her claim until the creditors had received 10s. in the £. A very large number of the creditors had already agreed to the offer. Mr. Houston said that the present statement showed that the estate was practically solvent, but they had to consider what would happen if bankruptcy took place. At a forced realisation the stock would not realise anything like the amount set down upon it. The debtor had refused to sign the deed of assignment when it was presented to him for signature, as another firm in London were said to have issued a circular saying that they were the agents for a firm in Germany for which the debtor had always acted. If that agency had been taken away from the debtor, he would have lost a very large slice of his business, and would not have been able to trade with very great success. The firm in question were communicated with, and a reply had been received from them stating that the debtor was still their agent, and that the agency to the other firm did not exist. In answer to questions, it was stated that the debtor's offer of 10s. in the £ still held good ; and, further, Mrs. Braulik would withdraw her claim until the creditors had received the amount of the composition. Owing to a threatening creditor a deed of assignment had already been executed, with Mr. G. E. Corfield as trustee. After a lengthy discussion, the creditors decided that the offer made should be accepted, and they also confirmed the deed already executed. A committee of the principal creditors was also elected.

Trade Announcement.—The works and offices of Messrs. J. H. Tucker & Co., of Birmingham, will be closed all day on Saturday, 20th inst., the occasion being the annual works' trip to Blackpool.

Liquidations.—Colne and Trawden Light Railways Co.—A meeting of creditors will be held on June 12th at 16, Great George Street, S.W.

Ludw. Loewe & Co., Ltd.—A meeting is to be held in Berlin on July 13th, to hear an account of the winding-up. Mr. G. W. P. Goodchild, liquidator.

Lamp Manufacture.—Poland.—The Zircon Co. is the name of a new undertaking which has lately been formed in Warsaw, with a capital of £63,250, to carry on the manufacture of lamps and other electrical appliances.

LIGHTING and POWER NOTES.

Bath.—The Corporation and the Diesel Engine Co. have arrived at a settlement in regard to the Diesel engine plant supplied by the latter, under which the Corporation pays £1,575 in discharge of all its liabilities under the contract and retains the engine. The original contract price was £5,451, but various deductions were made in view of the engine not fulfilling its guarantees. The engineer is now authorised to spend £50 with a view to improving the efficiency of the engine.

Bexley.—L.G.B. Inquiry.—An inquiry was held last week into the application of the U.D.C. for a loan of £8,000 for electricity purposes, including £2,500 for mains, services and transformers, and £5,500 for extensions, to plant, the latter being the alternative to taking a bulk supply from Woolwich. The application was supported by the Traders' Association.

Blackburn.—Street Lighting.—The T.C. has authorised the preparation of a scheme for automatic street lighting.

Castlerahan (Co. Cavan).—Prov. Order. — The L.G.B. has granted the application of the R.D.C. for powers for lighting the town of Virginia with electricity.

Chester.—Hydro-Electric Results.—Mr. Britton, the city electrical engineer, informs us that the hydro-electric works have been in operation 23 weeks up to March 25th last. During this period 736,310 units were generated, 15·5 per cent. being used for excitation, sewage pumping, works lighting, distribution, &c., leaving 639,427 units supplied to consumers. Running and maintenance cost, rents, rates and establishment charges amounted to £299, or ·112d. per unit ; capital charges were £554, or ·208d. per unit ; the total cost of energy supplied from the plant being ·32d. per unit sold.

Christchurch.—Workhouse Lighting.—The B. of G. has received L.G.B. sanction to a loan of £680, for the purpose of lighting the workhouse, infirmary, nurses' home and cottage homes with electricity.

Cleckheaton.—Proposed Extensions. — The Electricity Committee has decided to install a mixed-pressure turbine, driving a 400-kw. d.c. generator, in conjunction with the surface condenser, and to extend the engine room. The Committee recommended the installation of two Babcock & Wilcox water-tube boilers behind the destructors—doing away with the two small Lancashire boilers—the new boilers to be so arranged that they could be used solely for destructor purposes or as coal-fired boilers. The Committee also suggested the construction of a 600,000-gallon reservoir to supply the works, and the installation of a water filter and a grease separator. The suggestions were approved by the T.C.

Colchester.—Year's Working.—The revenue of the electricity department for the past year was £17,809, and the gross profit £7,671, and after meeting financial charges, £5,737, and writing off £1,273 on prepayment installations, meters and arc lamps, a balance of £661 remained, as against £591 in the previous year. The units sold amounted to 1,623,526, an increase of 68,000. For the first time since the institution of prepayment installations the receipts from them have exceeded the total expenditure, which includes £748 written off suspense account ; 72,488 units were supplied on this basis, and the surplus was £11.

Continental Notes.—Norway.—The Shenkjär Mill and Electrical Works have recently purchased the water rights of three waterfalls in the neighbourhood of the town of the same name, which will be capable of producing 3,000 e.h.p.

The municipal authorities of Kristiansand have decided to purchase the existing electrical works and the water-rights of a number of waterfalls in the River Nidelven for £163,000, supplementing a purchase of several other falls, which was made in 1912. When regulated, the river will be able to supply up to 75,000 e.h.p., delivered at the town. The cost of harnessing the falls and of the erection of electrical plant and cables, &c., is estimated at £1,111,000. Kristiansand will have a larger amount of power at its disposal than any other Norwegian town.

Austria.—The Austrian Union for Chemical and Metallurgical Products, of Aussig, and Messrs. Kolben & Co., of Prague, are interested in a scheme for the utilisation of the water-power of the River Elbe, between Aussig and Lobositz, in the generation of electricity.

Spain.—The Sociedad Electricas Reunidas de Zaragoza proposes to erect a new electricity generating station of 4,000 h.p. in the town of Saragossa.

Clevedon (Somerset).—Prov. Order.—The Clevedon and Portishead Electric Supply Co. has intimated its willingness to waive the agreement with the Council respecting the lighting of the district on the understanding that the Council will not press for a revocation of the prov. order until November 1st next ; the Council has accepted the offer.

Dewsbury.—Proposed Extensions.—The Electricity and Tramways Committee is negotiating with the Gas and Water Committee for the purchase of property adjoining the Bradford Road electricity works, in order to extend the plant to supply the proposed Mitchell Laithes sewage works.

Dover.—The T.C. has entered into an agreement whereby the War Office will take a minimum supply of 30,000 units per annum at 3¼d. per unit, and beyond that at 3d. per unit; current for power is to cost 2¼d. per unit.

Dundee.—Year's Working.—The revenue of the Corporation electricity department for the past year showed an increase of £5,408 over the previous year, equal to 20 per cent. The net profit was £5,150. The reduction of the charge for heating from 1⅛d. per unit for the first 100 units, and ⅞d. per unit after, to ¾d. per unit, has been recommended. This applies also to the guaranteed lighting consumers.

Durham.—Overhead Wires.—The County of Durham E.P.D. Co. has applied to the B. of T. for permission to use overhead wires in the borough for the supply of electricity to the Corporation Sewage Works, at a pressure of 480 volts.

Edinburgh.—Street Lighting.—The E.L. Committee has agreed to recommend the reduction of the cost per arc lamp for street lighting from £9 to £7 10s. per lamp.

Farnworth.—Proposed Loan.—In regard to the application of the U.D.C. for loans of £1,900 for transformers, and £1,000 for mains, the L.G.B. has asked what need the Council had for the extra plant, and also for a detailed statement of the sums required. The Board expressed its willingness to entertain the application in regard to cables, and the loan for this purpose has been increased to £1,500, for three years.

Frodsham.—Sewage Pumping.—The Water Committee has been recommended to install electricity in place of gas for pumping purposes, at a capital outlay of £155 for motors, &c., with £128 a year for current, against £195 for gas. A Committee has been formed to report on the matter.

Grays.—Year's Working.—The output of the U.D.C.'s electricity department for the past year was 256,447 units, an increase of 46,725 on the previous year. The gross profit was £1,977 and the net profit £287. Owing to the increased load it is expected that new plant will have to be installed next year.

Hastings.—Year's Working.—The income of the Corporation electricity department for the past year amounted to £25,338, an increase of £3,011 on the previous year. The expenditure was £12,468, an increase of £1,799. The net profit was £1,297, an increase of £740. The energy sold amounted to 1,284,501 units, the consumers numbering 1,706.

Hereford.—Proposed Loan.—The T.C. has applied to the L.G.B. for sanction to a loan of £1,030, for electricity purposes.

Horwich.—Proposed E.L.—The South Lancashire Tramways Co. having stated that it has no powers to supply electricity in the district, the U.D.C. has decided to allow the Bolton T.C. to submit terms.

Huddersfield.—Proposed Bulk Supply.—The Electricity Committee has agreed to receive a deputation from the Golcar U.D.C. relative to the latter's inquiries as to a supply of electricity in bulk.

Hythe.—Electricity and Water Mains.—In presenting an estimate of £900 for the substitution of cast-iron for steel water-mains, the borough surveyor stated that the steel mains had only been laid four years, and there was no doubt that the leakages, 39 in number, were caused by electrical action. The Waterworks Committee proposes to engage an electrical engineer to report on the matter; the town clerk thought that the responsibility for the damage rested with the Electricity Co.

Hull.—Asylum Lighting.—The T.C. has sanctioned the introduction of electric lighting at the Willerby Asylum.

India.—Messrs. Burn & Co., Ltd., of Calcutta, have been granted a concession for the utilisation of the rivers in Sikkim, for the generation of electricity.—*Indian and Eastern Engineer.*

Leigh.—Year's Working.—The total income for the past year of the electricity department amounted to £10,690; the gross profit to £5,026; and the surplus, after meeting all charges, was £1,154. The units sold were 1,325,492, an increase of 239,195 for the year, during which generation and distribution charges fell from 1·059d. to 1·024d. per unit, and total charges from 1·82d. to 1·72d. per unit, despite an increase in cost of fuel.

Lincoln.—Year's Working.—The gross profit on the Corporation electricity department for the past year was £6,792, an increase of £177 compared with the previous year. The net profit was £2,715, of which £1,500 has been placed to the relief of rates, and £1,040 to the depreciation account. The energy sold, 2,105,000 units, represents a small decrease compared with the previous year, which is accompanied by a slight increase in working costs.

Lisnaskea.—L.G.B. Inquiry.—Dr. J. F. M'Carthy held an inquiry last week into the application of the R.D.C. for powers to light the streets of the town with electricity. The proposed area includes Lisoniel, Castlebalfour, Drumbane, Killygullen and Barnhill.

Little Hulton.—Proposed Street Lighting.—The D C. has asked the Earl of Ellesmere to quote a sum for lighting Wharton Lane by electricity from the Wharton Hall colliery plant.

London.—Poplar.—Annual Report.—Mr. J. Horace Bowden, the borough electrical engineer, in his annual report on the electricity undertaking, shows a net profit for the last year of £8,010. The working costs were 0·55d. per unit sold, which constitutes a record for the metropolitan area. The average price obtained was 0·97d. per unit, and if the supply to Stepney is deducted, the figure for energy sold in the Poplar area is 1·11d. The output of 17 million units is the largest figure yet published in connection with a metropolitan municipal undertaking.

Luton.—Workhouse Lighting.—The B. of G. has decided not to install a separate E.L. installation at the workhouse, as the running cost would be more than the Board at present pays for the supply of current.

Lytham.—Proposed Loan.—The L.G.B. has informed the Council that it is unable to deal further with the Council's application for sanction to a loan for E.L. purposes until the St. Anne's U.D.C. has obtained powers to give the proposed supply to Lytham.

Maybole.—Proposed E.L.—The T.C. has granted the application of Messrs. Purvis, of Edinburgh, to send a representative to Maybole to discuss the question of a supply of electricity for the town.

Morley.—Year's Working.—During the past year the units sold by the Corporation electricity department numbered 214,337, against 180,086 in the previous year. The revenue was £3,739, against £3,476, and the expenditure £2,229, against £2,152.

Newbiggin.—Overhead Wires.—The Newcastle-on-Tyne E.S. Co. has asked the consent of the B. of T. to the erection of a 20,000-volt overhead electric line, from North Seaton to Newbiggin Colliery sub-station.

Newport (Mon.).—Proposed Free Wiring.—The Electricity Committee has instructed the borough electrical engineer and the general manager to consider the question of undertaking free wiring in workmen's houses.

New Zealand.—The municipal authorities of Oamaru have decided to expend £30,000 on an electricity undertaking for the town.

The Napier B.C. has decided to obtain a loan of £7,200 for the completion of the E L. and tramway extensions now in hand, and £7,700 for further extensions to the present systems.—*Tenders.*

Norwood Green (Yorks.).—Street Lighting.—The Halifax R.D.C. has approved of the resolution of the P.C. to obtain terms for electric street lighting, including erection of lamps, from the Yorkshire E.P. Co. and Halifax Corporation.

Pinner.—E.L. Scheme.—The Colne Valley E.S. Co. has informed the Hendon R.D.C. that it is about to lay cables in the Pinner area, and that the supply should be available by next November.

Plymouth.—Supply to Tramways.—The Mayor and chairman of the Finance Committee, to whom the matter was referred, have decided that the charge shall be 1¾d. per unit up to 250,000 units per annum, and 1½d. per unit above that amount, as from April 1st, 1914, for a supply of electricity to the Tramways Committee.

Radcliffe.—Overhead Wires.—The U.D.C. has applied to the B. of T. for consent to use overhead wires in the district.

Skelton and Brotton.—E.L. Scheme.—The U.D.C. has received B. of T. sanction to the use of overhead wires for the proposed E.L. scheme, provided all the regulations are complied with. The Council decided that the work should be completed within four months from the commencement, also to ask the Gas Co. to light the streets until electricity is available, and to advertise for tenders for the plant.

South Africa.—The Wellington (Cape Province) E.L. installation, which cost £10,000, was inaugurated on May 17th by Mr. Malan, Minister of Mines and Education.

One of the few isolated plants in use in Johannesburg, which supplied the Standard Building and Standard Theatre, failed last month, and the theatre was closed in consequence. Our correspondent considers that as a result such plants will be discarded in the future.

Stalybridge.—Proposed Bulk Supply.—The chairman of the Generating Station Committee of the Joint Board and the engineer have been requested to draft terms upon which the Board would supply electricity in bulk to the Saddleworth U.D.C.

Stockport.—Proposed E.L. Extension.—The borough electrical engineer has been instructed to canvass the residents at Reddish with a view to ascertaining the number of possible consumers of electricity, and to prepare an estimate of the cost of providing a supply.

St. Helens.—Year's Working.—The sales of energy of the Corporation electricity department for the past year amounted to 5,036,412 units, an increase of 146,000 units over the previous year. The revenue was £28,557, an increase of £1,192, and working expenses amounted to £14,534, an increase of £1,190, of which £783 represented the increased cost of fuel. The total cost of production was ·57d. per unit, an increase of ·02d. The net profit, which has been carried to the reserve fund, was £1,099, compared with £1,629.

Swindon.—Proposed Loan.—The T.C. has approved of a proposal to raise a loan of £7,000 for the development of the electricity undertaking. It is estimated that the cost of providing a supply to the Imperial Tobacco Co.'s new factory will be £4,820.

Tasmania.—In a report on the proposals for the extension of the Launceston electricity works, Mr. R. J. Strike, the city electrical engineer, suggests the installation of a battery and booster of three times the capacity of the present one, and, when required, a 300-kw. motor-generator. He recommends that the capacity of the station be increased by water-power from the South Esk, and that two units (one spare) of 2,500 e.h.p., and, later, others of 5,000 e.h.p. each, be installed. The ultimate maximum load is estimated at from 18,000 to 22,000 e.h.p., and immediate action in the matter is urged.—*Tenders.*

Thirsk.—Street Lighting.—The P.C. has decided to invite tenders from the local gas and E L. companies for street lighting in the parish.

Torpoint.—Proposed E.L.—Mr. J. A. Pearce, of Devonport, has informed the U.D.C. that certain developments having arisen, the proposed Electricity Co. will now be formed without delay, and the Council has decided to consider the question at a special meeting.

Truro.—Proposed New Generating Station.—The T.C. has applied to the B. of T. for permission to erect an electricity generating station in Newham Road.

Tunbridge Wells.—Annual Report.—The report of Mr. R. N. Torpy, the borough electrical engineer, upon the operation of the electricity undertaking for the past year, states that the net profit has increased from £1,111 to £2,235. The number of units sold has increased by 168,000, with a reduction in total costs of £115. The gross profit has increased from 7·72 per cent. to 8·9 per cent. on the average capital expended, although reductions in price amounting to nearly £600 were made last year. The actual revenue increased by £1,153, compared with the preceding year. The increase in 30-watt lamps connected was 16,373, of which 11.884 represent power and heating.

Loan Sanction.—The T.C. has received L.G.B. consent to a loan of £3,100 for electricity purposes, including mains, £2,500; services, £200; transformers, £200; and sub-station pillars, £200.

In accordance with the suggestion of the L.G.B., the Council has decided to apply for a prov. order to supply electricity within a radius of three miles from Holy Trinity Church, in the areas of the Ticehurst, Tonbridge and Sevenoaks R.D.Cs.

U.S.A.—In a recent issue of the *Electrical World*, it was pointed out that the total output of the New York Edison Co. for electric vehicle charging is in the neighbourhood of 7,000,000 kw.-hours a year.

Walthamstow.—Proposed Loan.—The U.D.C. has applied to the L.G.B. for sanction to the borrowing of £2,055, for an electricity main to supply the Billet Road district with a view to meeting the requirements of factories, &c.

Warrington.—Prov. Order.—The Electricity Committee has decided to apply for a prov. order to supply electricity to Stockton Heath, Latchford Without, Thelwall, Grappenhall, Lower Walton, Higher Walton and Appleton. The T.C. is seeking the consent of the Lancashire E.P. Co. to supply electricity in Penketh and Great Sankey.

Wimbledon.—Loan Sanction, &c.—Messrs. James Carter & Co. have agreed to take a supply of electricity from the B.C. at 1d. per unit for three years, with a minimum consumption of 100,000 units per annum.

The B.C. has received L.G.B. sanction to the borrowing of £8,087 for additional plant at the electricity works.

Wolverhampton.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the T.C. of £28,000 and £2,500, for extensions at Commercial Road electricity generating station.

Worcester.—Proposed Loan.—The Electricity Committee has recommended the T.C. to apply to the L.G.B. for a loan of £5,250, including mains, £4,000; transformers, £750; and sub-station equipment, £500; and also for £1,973, for expenditure incurred by the increased demand for current.

Worthing.—Half-Watt Lamps.—The T.C. has decided to replace the 28 850-c.p. arc lamps on the Marine Parade with independently-connected 1,000-c.p. half-watt lamps, at an estimated cost of £120. This, it is estimated, will result in an annual saving of £32 14s., while the illumination will be increased by 17 per cent. The chairman of the Highways Committee remarked that half-watt lamps would, no doubt, be gradually extended into the other streets of the town.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Year's Working.—The returns of the Corporation tramways department for the past year show that the passengers carried numbered 20,966,394, and the car-mileage amounted to 1,832,587 miles. The total revenue was £85,264, an increase of £5,113. A proposal has been made for the Corporation to take over or manage the Suburban Co.'s tramway system.

Bournemouth.—The T.C. has decided to apply to the B. of T. for permission to double the tramway track on Richmond Hill, and to obtain a loan to cover the cost. The general manager has been instructed to prepare specifications and obtain tenders for the work.

Bradford.—The Tramways Committee has decided, after consideration of the report of the general manager on fares and stages, that the present time is not opportune for further reducing fares. but that the general manager be asked to prepare a more definite scheme for increasing the length of stages.

The Committee has decided to support the application of the Bingley U.D.C. to the B. of T. for additional borrowing powers in connection with the Bingley tramways. The Committee has also approved an estimate of £15,848 by the city engineer for the continuation of the tramway from Ann Street to Micklethwaite Lane.

The Committee has decided to proceed with the extension of the tramway depôt and workshops, at an estimated cost of £54,000.

Burnley.—Year's Working.—The past year's working of the Corporation tramways resulted in total receipts amounting to £88,316; the working expenses amounted to £62,948; and of the balance, interest and sinking fund charges absorbed £14,667; rent of lines, £1,941; income-tax, £1,072; and the borough fund, £7,687. The passengers carried numbered 17,669,000. The general manager, Mr. Mozley, refers to the increased expenditure, which exceeded the increased revenue by over £5,000, but much of this was due to special circumstances.

Canada.—The Elbow River Power and Development Co. is to commence this autumn the building of an electric railway to connect Calgary with Springbank and Jumping Pond. The line is to be about 40 miles long, and will be known as the Elbow Suburban Railway.—*Canadian Engineer.*

Colchester.—Year's Working.—The revenue of the Corporation tramways for the past year amounted to £10,966, and the working expenses to £8,812, the debit balance, after meeting financial charges, being £2,333, as compared with a deficit of £1,964 in the previous year. The car-miles run, 324,622, were a slight increase on 1912-13; the tickets issued were 1¾ millions, including 381,000 return tickets.

Continental Notes.—Sweden.—A large electric locomotive is being erected at Kiiruna for the purpose of undergoing practical tests. The engine is equipped with two electric motors, which have a total rating of 1,700 h.p.

Italy.—The Turin-Cirié-Lanzo Railway has decided to convert its existing line, and also the Lanzo-Cirié branch now under construction, to electric traction. The work is to be carried out by Messrs. Siemens-Schuckert, and the system adopted is continuous current at 1,500 volts. Current will be supplied by the Societȧ Elettricita Alta Italia. The line has an extent of 45 km.

The Societȧ Brioschi, of Milan, has presented its scheme for the construction of an electric railway from Borgo San Donnino to Salsomaggiore. It forms the first section of a main line from Borgo San Donnino to Borgo Taro, for which the society is now maturing its plans. The present line is to be 9½ km. long. The locomotives will have two 100-h.p. d.c. motors, and a transformer station will be installed to convert the a.c. at 120,000 volts, which will be utilised.

Doncaster.—Proposed Extensions.—The T.C. is to consider the proposed construction of a tramway from Sunny Bar to High Street.

New Zealand.—The Wanganui B.C. has decided to extend its overhead electric tramway system, at a cost of £21,000. —*Tenders.*

South Africa. — The overhead equipment for the Germiston railless traction scheme is now completed, and two 500-kw. Peebles motor-converters have been installed and tested. Some delay is expected in connection with the cars. The Germiston scheme is the second one to be adopted in South Africa, the first one being at Boksburg, a neighbouring town.

St. Helens.—Railless Traction.—The Parliamentary Committee has instructed the Tramways Sub-Committee to inquire as to the running of railless trolley cars and motor-'buses.

The Tramways Co. has requested the T.C. to extend the lease of tramways for a further period of 21 years.

Wolverhampton. — Year's Working. — The annual accounts of the Corporation tramways department for the past year show that the total receipts amounted to £56,444, and the gross profit to £24,078, which has been disposed of as follows:—Interest, £6 854; repayment of loans, £5,285; renewals fund, £3,716; additions and improvements fund, £2,848; and rate relief, £5,554. The reserve and renewals fund now stands at £54,864. Receipts per car-mile were 11·333d., and the working costs increased from 6·272d. in the previous year to 6·651d., due largely to the assessment of the undertaking being increased from £2,500 to £5,294. During the year 1,195,326 car-miles were run, and the passengers numbered 12,616.881.

York.—Year's Working.—The working of the Corporation tramways department for the year ended March 31st last resulted in a net surplus of £2,523; the passengers carried numbered 5,946,143, against 5,008,398 in the previous year.

TELEGRAPH and TELEPHONE NOTES.

Guadaloupe.—The Colonial Government authorities have voted a sum of £8,320 for the establishment of a wireless telegraph station.

Wireless in the Pacific.—The Japanese Department of Communications has opened negotiations for the transmission of wireless messages through the Marconi wireless station in Honolulu, and plans have been prepared for the erection of a wireless station near Choshi, at a cost of about 400,000 yen.

Wireless Rescue.—In the disastrous collision which resulted in the loss of the *Empress of Ireland*, wireless telegraphy again rendered priceless assistance. The distress signal was immediately issued by the chief operator, Mr. R. Ferguson, and gained the attention of the station at Father Point, resulting in the instant dispatch of two steamships to the rescue, although only eight minutes elapsed between the collision and the stoppage of the dynamos by the inrushing water.

Wireless Research.—The report of the Committee on Wireless Telegraph Research, presided over by Lord Parker, was issued on Monday last. It recommends the appointment of a National Committee for Telegraphic Research, for the purpose of promoting the progress of scientific telegraphy and telephony, with the aid of a National Research Laboratory and a special scientific staff. The laboratory should be established at Teddington, in co-operation with the National Physical Laboratory, and the staff would carry on investigations, the results of which would be available for all departments of the public service.

The Committee, it is stated, should consist of 12 members, namely, two representing the Admiralty, two the Post Office, one the War Office, two appointed directly by the Treasury (not departmental officials), three appointed by the Treasury on the nomination of the Royal Society, one on the nomination of the Institution of Electrical Engineers, and the Director of the National Physical Laboratory, with a secretary of technical training and experience. The annual expenditure required is estimated at £4,800, of which £2,255 would be for the laboratory staff and £1,100 for honoraria to the National Committee. The cost of a mast and aerial, with buildings, and a laboratory covering 4,000 sq. ft., with equipment, is put at £7,300. For work to be commenced without delay, the Committee should have at disposal at least £4,000.

The Committee reports that valuable work is being done by the engineering department of the Post Office, but is hampered by lack of funds, and is necessarily directed primarily to the requirements of the service rather than to scientific progress in general. The same applies to the research work of the Admiralty and the War Office. Both the United States and Germany make liberal provision for experimental research in wireless telegraphy.

No member of the Committee will advise commercial firms on matters connected with the work of the Committee, except with the consent of the latter.

Wireless Telephony.—Reports from Paris state that further progress has been made by the French naval officers, Commander Colin and Lieut. Jeance, who have been carrying on experiments in wireless telephony for the past five years. Conversations have been very successfully and efficiently carried on over a distance of 150 miles.

It is understood that the inventors have succeeded in developing a transmitter which can be depended upon to maintain constancy of pitch, enabling accurate tuning to be effected. The apparatus is made by the Compagnie Générale de Radiotélégraphie.

Portsmouth.—On June 1st the transfer of the Corporation's telephone system to the Post Office took place. The purchase price was £35,000, and there were about 2,600 subscribers connected.

CONTRACTS OPEN and CLOSED.

OPEN.

Atherton.—June 24th. E.H.T. cable switchboard and transformers for the Electricity Department. Mr. C. T. Astbury, Resident Engineer.

Australia.—SYDNEY.—July 20th. Box compound, meters, maximum-demand indicators, arc lamp carbons, and straight-stem insulators, for the Council. Specifications for each section 10s. 6d., from City Electrical Engineer, Town Hall.

July 20th. H.T. insulators and feeder cables. Specifications (10s. 6d.) from the City Electrical Engineer, Town Hall.—*Australian Mining Standard.*

July 20th. Municipal Council. 33,000-volt insulators (Contract No. 278); two coal conveyors, motors, &c. (Contract No. 307). Copies of particulars can be seen at the Board of Trade Commercial Intelligence Department in London.

July 8th. N.S.W. Railways and Tramways Department. One battery booster set to Specification No. 453. Specification (2s. 6d.) from the Electrical Engineer's Office, 61, Hunter Street, Sydney.

HOBART.—July 20th. Telegraph and telephone material, for Postmaster-General. See "Official Notices" to-day.

PERTH.—August 5th. Copper wire and binders, for Postmaster-General. See "Official Notices" to-day.

August 5th. Telephone instruments and parts. Telegraph accumulators and power board, Kalgoorlie, for Postmaster-General. See "Official Notices" to-day.

August 12th. Cable, lead-covered and various, for Postmaster General. See "Official Notices" to-day.

August 19th. Electric lamps and fittings, for Postmaster-General. See "Official Notices" to-day.

MELBOURNE.—July 28th. Testing apparatus for the P.M.G. See "Official Notices" to-day.

July 6th. Rotary converters and frequency changers, for Melbourne Suburban Railways. See "Official Notices" June 5th.

July 6th. Electrically-operated car-shed cranes for Melbourne Suburban Railways. See "Official Notices" to-day.

August 26th. Eight 50-ton, one 30-ton, and three 10-ton electric overhead travelling cranes for Victorian State Railways. Specification, &c., from Messrs. John Coates & Co., Ltd., 115, Victoria Street, S.W.

August 12th. Insulators, for Postmaster-General. See "Official Notices" to-day.

Austria.—June 30th. The Austrian State Railway authorities in Innsbruck are inviting tenders for an electric lighting installation at the West Railway Station in the town of Innsbruck.

Aylesbury.—July 6th. U.D.C. Lighting and power. Switchboard with connections, battery of accumulators, underground mains, including house services, conversion of existing lamp standards, &c. See "Official Notices" to-day.

Beckenham.—June 22nd. U.D.C. Evaporative condenser (500-KW. set). See "Official Notices" to-day.

Belgium.—July 18th. The municipal authorities of Nalinnes are inviting tenders for the concession for the supply of electrical energy for public and private lighting and power purposes in the town.

Bolton.—July 19th. Corporation. Converting plant, sub-station E.H.T. and H.T. switchgear. See "Official Notices" to-day.

Dartford.—June 15th. U.D.C. One 500-KW. high-pressure steam turbine, generator, condenser, &c. See "Official Notices" May 22nd.

June 17th. Installation of telephones and domestic bells, &c., at Orchard Hospital, for Metropolitan Asylums Board. See "Official Notices" June 5th.

Doncaster.—June 22nd. Light railway extensions for Corporation Tramway Department. Specification, &c. (10s., not returnable) from the Borough Engineer, 3, Priory Place.

Dublin.—June 25th. Corporation. Feed pump, tanks, pipework, &c. See "Official Notices" June 5th.

Eccles.—June 22nd. 5,000 tons of slack for the Electricity Department. Borough Electrical Engineer, Electricity Works, Cawdor Street, Patricroft.

Exeter.—June 15th. Steam coal. Washed beans or peas, about 2,500 tons for six months, or about 4,800 tons for 12 months, for the Corporation Electricity Works. Mr. H. Lloyd Parry, Town Clerk.

France.—VIENNE.—June 24th. Supply of underground electric cables and wire, 500 plumbago crucibles, and 5,500 kilograms of minium and litharge. Particulars from the Manufacture d'Armes de Châtelherault.

Harrogate.—June 22nd. Corporation. Economiser, 288 pipes, for Electricity Department. See "Official Notices" May 29th.

Hereford.—E.L. installation, Holy Trinity Church; Rev. D. H. G. Sargent, Vicar.

Huddersfield.—22nd June. Electric light installation at Crosland Moor Institution. Mr. T. W. Armitage, Clerk to the Guardians, Union Offices, Ramsden Street.

Hull.—The City Council decided on the 4th inst. that the contract for the supply of electrical fittings in the new Guildhall be submitted to open competition.

Hungary.—FACSAD.—June 20th. Erection of a power station and distribution network for public and private lighting. Particulars of the Vozstehung der Gemeinde, Facsad, Komitat Szöreny, Hungary.

Leeds.—June 17th. Installation of electric lighting, bells and telephones at Grange Hospital. Apply to Architects' Section of the Education Department.

June 29th. Corporation. Air-cooled transformers. See "Official Notices" May 22nd.

London.—L.C.C.—June 23rd. 50, 100 or 150 complete trailer-cars, and equipment of 200 existing electric motor-cars with couplers and traction gear for drawing trailer-cars. See "Official Notices" May 29th.

June 30th. 150 sets plough collector gear. See "Official Notices" to-day.

Battersea.—June 24th. B.C. Coal telpherage plant. See "Official Notices" May 29th.

St. Pancras.—June 25th. B.C. Large water-tube boilers. See "Official Notices" June 5th.

H.M. Office of Works.—June 30th. Wiring public offices extension, Westminster, S.W. See "Official Notices" to-day.

Manchester.—June 26th. Corporation. Potential and current transformers, c.c. and a.c. motors, electricity meters, c.c. motor-starting switches and three-phase star-delta switches. See "Official Notices" to-day.

Morecambe.—June 25th. Corporation. 2,500 tons of coal or slack, for the Electricity Supply Department. See "Official Notices" May 29th.

New Zealand. — Wellington. — July 27th. New Plymouth B.C. (2) Overhead wiring and permanent way (5 route miles). (3) Sub-station equipment (converting plant, battery, booster, switchboard, &c.). (4) Rolling stock (six complete cars) for electric tramways. Specifications from Mr. F. Black, Consulting Engineer, Wellington, or B. of T. Offices, London. Deposit (2) £4 4s.; (3) £2 2s.; (4) £2 2s.—*N. Z. Shipping and Commerce.*

Auckland.—August 6th. Three 750-kw. d.c. mixed-pressure turbo-generators; one 1,500-kw. three-phase turbo-generator, including auxiliary plant and sub-station equipment. See "Official Notices" May 22nd.

Panama.—Particulars of material required by the Government of Panama for the construction of a telegraph and telephone system can be obtained at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

Rhondda.—June 18th. U.D.C. Installation, 330 points, 360 lights, at Fever Hospital, Ystrad-Rhondda. See "Official Notices" to-day.

Salford.—June 15th. 24 car bodies, also trucks, motors, controllers, &c., for same. General Manager, Corporation Tramways, 32, Blackfriars Street.

Skelton and Brotton.—July 2nd. U.D.C. Overhead lines, underground cables, transformers, sub-station equipment, public lighting fittings. See "Official Notices" to-day.

South Africa.—Tramway material, estimated to cost £85,000, is shortly to be ordered by the Germiston (Transvaal) T.C. Particulars from the Town Clerk.—*B. and S. A. Export Gazette.*

Stalybridge.—June 27th. 12 months' supply of stores for the Joint Tramways and Electricity Board. Specifications and form of tender obtainable from Mr. R. Blackmore, Engineer-in-Chief, Generating Station, Stalybridge.

Stockton-on-Tees.—June 12th. Corporation. Supply of e.h.t. lead-covered paper cables. See "Official Notices" June 5th.

Stretford.— June 15th. Lighting battery, booster, switchboard, &c. Specifications (£1 1s.), from Mr. R. Rowland, Resident Engineer, Electricity Works, Chester Road.

Swansea.—June 25th. Corporation. Main generating station and sub-station. Extra h.t. and l.t. switchgear. See "Official Notices" June 5th.

Walthamstow.—June 12th. U.D.C. e.h.t. cable and stoneware conduits. See "Official Notices" June 5th

Warrington.—July 3rd. Electric equipment, &c., for transporter bridge over the River Mersey, for Jos. Crosfield & Sons, Ltd. Drawings, &c. (£2 2s.) from Mr. W. H. Hunter, M.I.C.E., 42, Spring Gardens, Manchester.

CLOSED.

Australia.—Department of Home Affairs :—

E.L. installation at Postal Stores, £241.—Hayes & Eggers, Ltd.
Sydney Tramways Department.—Four d.c. motor-generators, Spec. No. 446. —Shaw Wireless, Ltd.—*Australian Mining Standard.*
P.M.G.'s Department.—4,000 Vedopri link insulators, £305.—Laing, Wharton, Ltd.—*Tenders.*

Sydney.—The Electricity Committee has recommended the City Council to accept the following tenders :—

Bare copper cable, £5,217.—Standard Cable Manufacturing Co.
Battery for Phillip Street sub-station, £32,948.—Tudor Accumulator Co., Ltd.
Machinery for charging same, £10,581.—W. Guthridge, Ltd.
Switchgear, £7,415.—Australian G.E. Co.
Submarine cables, £2,389; underground cables, £3,408.—Noyes Bros.
Underground cables, £11,178.—Siemens Bros. Dynamo Works, Ltd.

The British Insulated and Helsby Cables, Ltd., has contracted to supply the Victorian Railway Commissioners with insulated lead-covered and armoured feeder cables in connection with the electrification of the suburban railways, the tender price being £259,121. The total amount of the electrification contracts let by the Commissioners is now £2,270,298.—*Tenders.*

Aberdeen.—The Electricity Committee recommends the acceptance of tenders for coal supplies from the following :—Aberdeen Coal Co., Messrs. George Elsmie & Sons, James Gordon, Charles Christie & Co., and the Carden Coal Co.

Bacup.—The T.C. has accepted the tender of Messrs. W. T. Glover & Co., Ltd., for supplying and laying cables in Newchurch Road.

Batley.—The Electricity Committee has arranged with the British Westinghouse Co., Ltd., for the supply and erection of a switchboard and gear required at the works.

Bedford.—The Borough Education Committee has appointed Mr. R. H. Crawley to carry out electrical work for the six months ended December 31st next.

Belgium.—As the result of the recent call for tenders, the Société d'Electricité de Seraing has secured the concession for the electric lighting of the little town of Rocour (Province of Liége).

Seven concerns—six German and one Belgian—submitted tenders last week to the Belgian Post and Telegraph authorities for the supply and laying of a quantity of telephone cables and cable heads in the Brussels district. The lowest offer was that of the Société A.E.G.-Union Electrique, of Brussels, which quoted £20,875.

Bradford.—The Electricity Committee has accepted the following offers :—

Mr. R. Gillam to purchase three steam dynamos now at the Valley Road Electricity Works, for £662.
Messrs. J. Blakeborough & Sons to supply five valves required at the Valley Road Electricity Works, for £147.
Messrs. Whipp & Bourne to supply two switchboards (distribution panels) required in connection with the new induced-draught fan motors at the Valley Road Works, for £109.
Clay Cross Co., Ltd., for the supply of about 24 tons of main circulating water piping required at the Valley Road Works, for £237.
Messrs. S. Parsons & Co. to supply six piled steel piers, &c., for Valley Road Works, for £130.

Dartford. — The U.D.C. has accepted the tender of Messrs. C. Isler & Co., Ltd., for fixing a 20-in. diameter artesian bored tube well for the E.L. works, at £411.

Darwen.—The Peel-Conner Telephone Works has secured a contract for telephone exchange equipment.

Derby.—The following tenders have been accepted :—

Motor alternator, £1,594.—General Electric Co., Ltd.
Telephone exchange equipment.—Western Electric Co., Ltd.

Folkestone.—The T.C. has accepted the tender of the Electric Street Lighting Apparatus Co., for six standards for electric lamps for the East Cliff, at £3 16s. each.

Hull.—At the meeting of the City Council on June 4th, Mr. Exley moved that tenders should be asked for from selected firms to supply the electrical fittings in the new Guildhall. This was seconded by Mr. Evans. It had been recommended by the Property Committee that the contract entered into with Mr. Wm. Smith, 1, Balcombe Street, London, on the advice of Mr. Cooper, the architect, be confirmed, and Sir Alfred Gelder, M.P., said that Mr. Cooper was a very capable and artistic man, on whose advice the Council might rely. Alderman Crook said that it was a rule that work over £50 should be tendered for, and the amount involved in this case was £1,084. Mr. Exley's amendment was defeated, and then Mr. Easton moved a further amendment that tenders be advertised for acceptance of the specifications of the architect. This was carried.

The City Council has accepted the following tenders :—

Brush Electrical Engineering Co., Ltd.—Twenty car bodies, at £481 each.
M. & G. Truck Engineering Co., Ltd. Twenty trucks, at £49 17s. 6d. each.
Siemens Bros. Dynamo Works, Ltd.—Twenty pairs of motors for ordinary series parallel, at £181 per pair.
Twenty pairs of controllers (latest type), at £43 per pair.

Liverpool.—The Liverpool Overhead Railway Co. has placed an order with Messrs. E. Bennis & Co., Ltd., for two Bennis stokers and self-cleaning compressed-air furnaces for an 8 ft. diameter Lancashire boiler.

London.—An order from the G.P.O. (South), Knightrider Street (per the Howden Boiler Co.), for three Bennis chain grates, each 11 ft. 6 in. long by 3 ft. wide, has been received by Messrs. E. Bennis & Co., Ltd.

Messrs. Napier, Kimber, Ltd., Bayswater, have received the contract for electric bellhanging for H.M. Office of Works.

Messrs. Dick, Kerr & Co., Ltd., have received the contract for electric motor wagons, for the G.P.O. experimental railway, Woolwich.

Luton.—The B. of G. has accepted the tender of Messrs. Edmundson's for fixing telephonic instruments on the workhouse premises.

Malvern.—The U.D.C. has accepted the following tenders in connection with extensions at the electricity works :—

Engine.—Messrs. Belliss & Morcom.
Alternator, exciter, &c.—British Westinghouse Co., Ltd.

Manchester.—The tender of the Premier Accumulator Co. has been accepted for a storage battery at the head post office.

New Zealand.—The Christchurch City Council has accepted the tender of the British Electric Transformer Co. for transformers, at £3,635, and of Messrs. Turnbull & Jones for insulators, £250, and rubber mats, £86.—*Tenders.*

Northampton.—The tender of the Brush Electrical Engineering Co., Ltd., is recommended for acceptance, at £177, for the erection of a girder platform to carry the new turbo-generator.

Plymouth.—The Corporation Electricity Committee has accepted the tender of Cory Bros. for 9,000 tons of coal, at 16s. 7½d. per ton. The previous contract was 18s. 10½d., with a recent extension at 16s. 9d.

Rochdale.—The tender of Messrs. John Nicholl & Son for a liftway for an electric book lift in the borough treasurer's department has been accepted. Eleven tenders for the supply of an electric book lift have been referred to a sub-Committee.

Salford.—The tenders of Messrs. L. E. Wilson & Co. have been accepted by the Finance Committee, at £70 10s., for the supply and erection of intercommunication telephones in the Police Department in the Town Hall, and at £24 for maintenance, repairs and renewals for a period of ten years. The Electricity Committee has accepted the tender of William Gornall, at £2,513, for the erection of a transformer sub-station and machine foundations in Robert Hall Street.

Sevenoaks.—The contract for the lighting of the Parish Church "St. Nicholas" has been secured by Messrs. S. Young and Son, of Sevenoaks.

Sheffield.—The following tenders are recommended to the City Council for acceptance :—

Ruston, Proctor & Co., Ltd. (with the General Electric Co., Ltd., as sub-contractors).—Electric generating plant, driven by suction gas producers and gas engines.
Brown, Bayley's Steel Works, Ltd.—500 steel tramcar tires, 24s. each.
Abbott & Bannister, Ltd.—Erection of transformer sub station, £651.

Tunbridge Wells.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a 300-KW. steam alternator and condensing plant, at £3,181.

Warrington.—The Electricity and Tramways Committee recommends the acceptance of the following tenders :—

Johnson & Phillips, Ltd.—Transformers.
Electric Construction Co., Ltd.—D.C. motors.
British Thomson-Houston Co., Ltd.—A.C motors.
Swan, Ratcliffe & Co., Ltd.—Boiler setting, £177.
Johnson & Phillips, Ltd.—Cables, £696.
Walter Scott, Ltd.—100 tons steel tramway rails, £7 10s. per ton.

York.—The Tramway Committee has accepted the tender of the Brush Electrical Engineering Co., Ltd, for supplying eight of the tramway cars with coupling bars at each end, and for the provision of attachments for coupling the light and bell signals for communicating between the motor-car and trailer, and making the necessary alterations to the cars, at £27 10s. per car.

The Electricity Committee has accepted the tender of the General Cable Manufacturing Co., London, for high and low-tension cables required by the Electricity Department, at the sum of £6,358 plus £50 for two ducts instead of one. The tender was the lowest received.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued :—

Friday, June 12th.—"D" Company. Infantry drill, 7 to 8.30 p.m. Technical instruction, 8 15 to 10 p.m. Miniature range instruction, 8.15 to 10 p.m.

Saturday, June 13th.—All Companies. Annual course of musketry at Purfleet rifle ranges. Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

Monday, June 15th.—"A" Company. Infantry drill, 7 to 8 p.m. Technical instruction, 8.15 to 10 p.m.

Tuesday, June 16th.—"B" Company. Infantry drill, 7 to 8 p.m. Technical instruction, 8.15 to 10 p.m.

Wednesday, June 17th.—All Companies. Rating examinations, 7 to 9.30 p.m.

Thursday, June 18th.—"C" Company. Infantry drill, 7 to 8.30 p.m. Technical instruction, 8 45 to 10 p.m.

Friday, June 19th.—"D" Company. Infantry drill, 7.30 to 8.30 p.m. Technical instruction, 8.45 to 10 p.m.

Saturday, June 20th.—All Companies. Annual course of musketry at Purfleet rifle ranges. Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, June 12th. At 8 p.m. At Imperial College of Science, South Kensington, S.W. Papers on "A Magnetograph for Measuring Variations in the Horizontal Intensity of the Earth's Magnetic Field," by Mr. F. E. Smith ; "The Atomic Weight of Copper by Electrolysis," by Mr. A. G. Shrimpton ; "An Improvement in the Einthoven String Galvanometer," by Mr. W. H. Apthorpe.

North of England Institute of Mining and Mechanical Engineers.—Saturday, June 13th. At 2 p.m. At Wood Memorial Hall, Newcastle-on-Tyne. General meeting.

Municipal Electrical Association.—June 15th to 20th. At Birmingham. Annual Convention.

National Physical Laboratory.—Friday, June 19th. At 3.30 p.m. Annual inspection.

Physical Society of London (Fellows only).—Saturday, June 20th. (Morning.) Visit Cambridge Scientific Instrument Co.'s Works. (Afternoon.) Visit to Cavendish Laboratory.

Salford Technical and Engineering Association.—Saturday, June 20th. Visit, Broadheath.

NOTES.

The Institution and the Industry.—The following letter reached us too late for our "Correspondence" columns :—

"Whilst deploring the dissolution of the Industrial Committee, and entirely agreeing with you that our Institution has a wider destiny than that of 'a Technical Debating Society,' I feel that it is unjust to lay the entire blame on the shoulders of the Council so long as the members at large take so little apparent interest in the matter. Apart from the Council and the representatives of the Press, I doubt if there were in all 10 members present at the recent annual meeting, and seeing that this question figured so prominently in the report, the Council might well assume from this that the majority of the members were in agreement with them.

"That such an assumption would actually be correct I very much doubt, but, at the same time, the *laissez-faire* attitude against which you inveigh is not to be found at the Council table alone. There has been a great deal of grumbling, but almost the only serious attempt to find a solution for an admitted difficulty is contained in the article by Mr. Wordingham. published in your issue of May 22nd.

"Mr. Mordey, I think, fairly expressed the views of the opponents of commercialism when he said at the annual meeting that he 'thought that the influence, dignity and usefulness of the Institution would be best maintained and increased by following the example that they had always had before them of giving their attention to the scientific and engineering foundations of the electrical engineering industry rather than by attempting in any way to make it a trade association.' While I do not think that anyone would suggest adopting the latter course, the 'example' which Mr. Mordey has before him is presumably that of the Institution of Civil Engineers. But that Institution occupies an absolutely unique position. It is to me almost as difficult to imagine a second Institution of Civil Engineers as a second Royal Society ; in fact, in their different spheres the two would seem to be the embodiment of much the same idea, and I should be the first to deplore any tendency to commercialism in either.

"When we turn, however, to the relationship of our own Institution to the industry (I notice that Mr. Mordey speaks of the 'profession'), the case for allotting a place to commerce as well as to engineering strikes me as an extremely strong one.

"Even taking the opposite view, however, it will, in my opinion, be found increasingly difficult to maintain the interest in technical debates which has been possible in the past. In the early days a good paper on any electrical engineering subject was of interest to probably 80 per cent. of the members ; now, thanks to specialisation, a similar paper is of vital interest to, perhaps, 10 per cent., and of some interest to another 10 per cent., while the remaining 80 per cent. do not give it a thought.

"On the other hand, there is one subject which (such is human nature) is of interest not to 80 per cent., but to 99·99 per cent. of the membership ; and that is how to make money out of electricity, or, more euphemistically, how to 'strengthen and encourage the electrical industry.'

"Mr. Wordingham, I think, is really in agreement with this point of view, but seems somewhat loath to strike out a new line to meet the altered conditions. His suggestion is that each 'properly constituted Association' (such as the B.E.A.M.A.) should be represented on the Council of the Institution. This might, or might not, be a satisfactory method of constituting the Council (there are grave objections to it), but so long as the Institution, as a whole, is to be debarred from taking any part in commercial matters, does it actually carry us much further ?

"Another course which suggests itself is that the Institution might have a commercial section as well as an engineering section, possibly each with its own committee responsible to one Council. However, the schemes, good, bad and indifferent, which can be suggested are innumerable, and cannot be discussed at all adequately in a letter.

"If it were once clearly demonstrated that the members, or, at any rate, a majority of them, were dissatisfied with the present state of affairs, I feel quite sure that the Council would willingly appoint a committee to investigate and report upon the whole subject. The future of the Institution rests, it seems to me, with the members themselves quite as much as with the Council.

"Kenelm Edgcumbe.

"London, *June 9th*, 1914."

The Kinematograph Exhibition.—We learn that circular letters have been issued in connection with this exhibition, from which an impression might be gained that we were exhibiting thereat. As this has led electrical manufacturers to ask us whether a stand there would be a good business proposition, we wish to state that we are not exhibiting, nor have we authorised the name of the Electrical Review to be used in connection with the undertaking. While we, of course, wish the exhibition every possible success, we desire it to be understood that our interest in the matter is limited to a promise to, as on the occasion of the last kinematograph exhibition, deal editorially and on their merits, with whatever electrical features may form part of the display.

Strike.—The men in the electrical department of the Glengarnock Iron and Steel Works, Kilbirnie, came out on strike demanding an increase of ½d. per hour. The strikers are supported by the Electrical Workers' Union.

Engineering Societies in Manchester.—A brochure recently issued gives particulars of the steps that have been taken towards the foundation of a joint establishment in Manchester as a communal home for the members of the various engineering and technological societies in the district. The first representative conference was held on May 1st in the rooms of the Manchester Geological and Mining Society, when 12 such bodies were represented, and Sir Thomas H. Holland was elected chairman. In the course of a speech on the origin and objects of the conference, the chairman remarked that in London it had been possible to establish metropolitan institutions in which the special requirements of mechanical, electrical, mining, sanitary and marine engineering had completely overshadowed the interests that were common to all varieties of engineers. Although "civil engineering" once covered everything that was not military, it was gradually becoming narrowed in meaning with the shrinking of the residue, from which there was taken intermittently one special extract after another.

Every engineer would admit that it was mainly through the Institution of Civil Engineers that a definite, high and universally recognised professional standard, both in competence and etiquette, had been successfully established. But excessive zeal in orthodoxy, like unnecessary ballast in a ship, might result in the sacrifice of speed for safety, and had the "Civils" been less rigid in some respects, they might have retained as colonial dependents those specialists who had now formed distinct institutions in separate homes.

The burden of divided interests so brought about was more especially felt by provincial members, many of whom had now to be members of two or more of the London special institutions, as well as of the Civil Engineers, without being able easily to obtain the advantages of attending meetings or of consulting the libraries. Provincial members thus paid for little more than the hall-mark of membership.

If by local co-operation they gave the younger engineer what the London institutions now failed to provide for their provincial members, the whole profession would benefit, and with it the central institutions would grow in wealth and power. They did not want amalgamation, but co-operation, and primarily for mere economy in the necessary "general charges" of rent and management. At the same time, community of lodgings would naturally grow into a recognition of community of interests, increasing mutual respect with personal knowledge, and thereby increasing business connections.

The most direct advantage, and one which could be obtained in no other way, was the formation of an efficient reference library. No public library and no university library could possibly take the place of that formed by the process of exchange between societies. The advantages in this respect to be gained by cooperation completely outweighed all other considerations, and were to him the chief public value of the present enterprise.

Some of the more imaginative supporters of the movement contemplated a grand engineering building, but any scheme of the kind, even if financially possible and free from risk, would take years to accomplish.

Resolutions were passed, appointing a provisional organising committee to draw up proposals for the consideration of the societies represented at the meeting, and naming as convener Mr. W. T. Anderson, 27, Queen's Avenue, Old Trafford, Manchester.

Recent Electricity Costs.—Some of the earliest of the annual accounts of municipal electrical undertakings which have reached us this year contain ample evidence of the downward trend of "costs of production" under modern conditions, with plant which cannot be regarded as large nowadays. Thus, the Coventry returns for 1913-14 show, on an output of 16½ million units sold, with a 20·4 per cent. load factor, works and distribution charges amounting to ·289d. per unit, and total works costs of ·346d. per unit sold (or just over ·3d. per unit generated). Interest and sinking fund charges add ·307d. per unit to this figure (*i.e.*, total ·653d. per unit). Both turbines and engines are in use, and the coal per unit sold was a trifle over 3 lb. Coal cost 11s. a ton, and a certain amount of power was derived from a refuse destructor, which is not usually a help to low costs. The maximum load was 9,240 KW.

Turning to the Stepney electricity accounts, generating costs are to some extent obscured by the supplementary units purchased under agreement from Poplar. In this case 17,469,572 units were generated, presumably the greater proportion at the Council's new riverside turbine station; in addition, 2,665,000 units were purchased. The report gives the cost per unit generated, inclusive of bulk supply, as:—Works and administrative costs, ·461d. per unit; interest, sinking fund, &c., ·361d.; total, ·822d. per unit. The total cost per unit sold was just over 1d. The maximum generated load was, roughly, 7,000 KW., and in this case also a destructor plant rendered minor assistance.

The Leeds electricity accounts show an output sold of over 31 million units, and working expenses amounting to ·42d. per unit, which, added to interest and sinking fund charges, give a total of ·95d. per unit sold. These figures were no doubt adversely affected by the municipal strike which took place during the year. The maximum load on the plant was 13,880 KW., and both engine and turbine plant are installed.

The Accrington accounts, also to hand, are interesting, because the bulk of the output sold, which totalled 5,856,000 units, is generated by gas engine units working in conjunction with a by-product recovery plant; steam plant is also used, and destructors are credited with ·023d. per unit for heat supplied. The maximum supply demanded was 2,876 KW. The returns show generating costs amounting to ·542d. per unit, distribution costs, management, &c., bringing this up to ·737d. per unit; capital charges amounted to ·370d. per unit, a total of 1·107d. per unit sold, but allowing for sale of by-products, this figure is reduced to 1·03d. per unit. Coal cost, roughly, 13s. per ton.

Petroleum, Gas and Electrical Accidents in Germany.—According to an official report which has lately been issued, 169 accidents occurred last year in Germany in connection with petroleum, the majority being the result of the explosion and overturning of lamps. The accidents caused the deaths of 57 persons, slight injuries to 9, and serious injuries to 51 others. Gas was responsible for no less than 413 accidents, resulting in the death of 134 persons, serious injury to 335 people, and slight injuries to 76. As regards electricity: there were 251 accidents during the year, in which 147 persons, including 74 employed at central stations, were killed, 71 badly injured, and 10 slightly so. As regards the cause of the electrical accidents, the majority, 126, were due to coming into contact with wires, 38 were caused by short-circuits, 14 occurred during repairs to conductors, 14 by climbing electrical masts, 6 were due to the falling of overhead conductors, 23 were ascribed to imprudence, while in 3 cases the cause was unknown. No less than 122 of the electrical accidents occurred in the open air, 3 in houses, 51 in works, 37 in central stations, 5 in public buildings, 4 in hotels and restaurants, 8 in theatres and exhibitions, 1 at a railway station, and 20 in mines. In addition to the foregoing 15 persons committed suicide with petroleum, 464 with gas, and 5 with electricity.

Water Power in Norway.—Prof. Olaf Heggstad recently lectured at the Technical College, Trondhjem, on the history of Norwegian water-power, and its future. He stated that the rights of the Rjukanfos, which by next year will be able to produce more than 250,000 H.P., were sold in 1890 for £55 10s., a transaction which the vendors considered to be very good business. Up to the present there have not been any reliable figures as to the actual amount of power available in Norway, and a Commission has been appointed to inquire into the question. In the meantime it has been ascertained that there are, at all events, six million horse-power which can easily be harnessed; but there are also a number of rivers in the western and northern parts of the country which have not been taken into account, and it should not be far out to put the actual figures at anything between eight and ten million horse-power, after the regulation of the rivers has been completed. At the present time there are 700,000 H.P. harnessed, of which 500,000 H.P. are conceded to foreigners. It is easy to see of what immense value the development of such enormous resources of power will be to the country. In a few years' time the amount will have reached one million horse-power, which alone represents a revenue of two million pounds a year. But this is only the direct value, and if the indirect value of the energy as employed for industrial purposes be taken into consideration, the social-economical value will, at the lowest, be five times as much or ten million pounds a year.

The Del Monte Process of Coal Distillation.—We recently had the opportunity of inspecting the Del Monte plant for the distillation of oils from coal, shale, peat, sludge, &c., which is now being operated on a commercial scale by Messrs. Oil and Carbon Products, Ltd.

The Del Monte retort is extraordinarily compact as compared with the standard Scottish shale oil plant; it consists essentially of an inclined steel tube 18 ft. long and 14 in. diameter, into the lower end of which fuel is fed through a hopper and conveyed up the tube by a revolving cast-iron worm, being finally discharged as coke at the upper end. The feed and discharge valves are arranged for simultaneous operation. The retort is enclosed in a brickwork chamber and heated at the sides by gas flames to a moderate temperature—which can be adjusted at various points—reaching about 450° C. at the point where full distillation takes place. The feature of the process is the collection of the distilled oil vapour, and this is effected by forcing a current of gas in at the discharging end of the worm—incidentally cooling the coke—the gas as it passes along the retort carrying with it the oil vapours at the moment of formation into the cool neighbourhood of the entering material, where they are condensed, the oil being subsequently removed at intervals. The lighter fractions, which will not liquify in this way, are carried off in the gas to a scrubber, and recovered in the usual way, the gas subsequently being used for retort heating, &c.

A single unit retort deals with 10 tons of bituminous coal, or 5 tons of hard cannel or shale a day, the yield of oil (which on treatment yields a high percentage of motor spirit, and all the usual petroleum products), varying from 25 to 130 gallons a ton. In view of the attention which is being directed to the gasification of fuel, and recovery of by-products in connection with bulk electricity generating schemes, the above process may interest electrical engineers. The coke secured from the Del Monte process is quite suitable for gas production, and the subsequent ammonia recovery treatment.

It is stated that a ton of cannel coal, costing 7s., used in this process, has given some 68,000 cb. ft. of gas (some of which is used for retort heating), 58½ gallons of crude oil, and 54½ lb. of sulphate of ammonia.

Conference in Germany.—The Verband der Elektrotechnischen Installationsfirmen in Deutschland (Union of Electrotechnical Installation Firms in Germany) commenced its 12th annual meeting in Dortmund, yesterday.

Electricity and a Floating Oil Factory. — An interesting article in an American contemporary (*International Marine Engineering*) described the ss. *Mil's*, of Philadelphia, which serves the purpose of a floating fertiliser and oil factory. In connection with the catching of the fish and the conversion of them into valuable products electricity is extensively used. The purpose of the vessel is to catch menhaden fish, which are met with in large schools, and in connection with the main factory ship a number of small scouting vessels are used, which, on finding a school, signal to the main vessel by means of wireless telegraphy. The fish look like herring, but are not edible, the chief product being the menhaden oil, which is used in the tanning of leather and in the mixing of paints. In addition to this, the fish scrap from which the oil has been extracted, is sold as a fertiliser.

All the machinery involved in the manufacture of the fertiliser is driven by electricity, and a powerful arc lighting and searchlight plant is on board, so that the work of catching and treating the fish goes on interruptedly day and night. The external appearance of the vessel is somewhat peculiar. There are apparently a considerable number of masts projecting from the storage bins, these being really funnels through which electric blowers force the impure air from the inside storage tanks. The vessel carries a complement of 160 men divided into two shifts, one for day and the other for night work, and has to keep enough supplies on board to feed this crew for two weeks or a month at a time, and also a storage of 10,000 barrels of food fish. Every day the vessel converts the menhaden which are caught into 800 barrels of oil and 20 tons of fertiliser. When a school of the fish is found, nets are slung over the side of the vessel and hauled in by electric hoists until the bins are full. Screw conveyors, driven by motors, carry the fish into smaller receiving tanks, and automatically feed them into the steam cookers, and in a few minutes the fish are reduced to small particles. Then the cooked fish is forced through a rotary press to extract the oil, which is conveyed to testing tanks. After it is here found to be sweet and pure, it is cooled, and is conducted into storage tanks of 20,000 barrels' capacity. The fish scrap, or fertiliser, from which all the oil has been extracted, is blown by an electric fan and dried as it is forced by the draught into other storage bins, where it is bagged as it arrives. This fish scrap is very inflammable, and the room in which it is stored is protected by an electric thermostat, and, in case of fire, the store is flooded at once.

In addition to the menhaden, a quantity of fish good for food, such as haddock, &c., is caught. These are sorted out and placed in cold storage, an electrically-driven ammonia cooling plant being used. When the storage tanks and bins are full the wireless plant is called into use to summon barges and tugs to remove the cargo to the nearest shipping point. In this way a large amount of time is saved, and the boat is always operated at its full capacity. This vessel is an interesting example of the various ways in which electricity is utilised in the service of mankind.

Foreign Trade in May.—The returns for the month of May contain the following figures of electrical and machinery imports and exports :—

Imports.	*May.*	*Inc. or dec. compared with* 1913.
Electrical goods ...	£126,857	Inc. £8,134
Machinery	£737,423	Inc. £87,061
Exports.		
Electrical goods ...	£386,828	Dec. £78,244
Machinery	£3,386,886	Inc. £130,910

For the five months of the year the electrical imports show an increase of £26,710, and the electrical exports an increase of £85,351.

Electric Vehicles at the I.M.E.A. Convention.—We are informed that 11 electric vehicles will be on view in front of the G.E.C. Works, at Witton, during Tuesday afternoon next. Particulars of these can be obtained at the Midland Institute, Birmingham, on Tuesday morning. The General Vehicle Co. (New York) will have on view a ½-ton parcel van, and a 2-ton heavy van, the former equipped with a flat-plate lead battery, and worm-gear drive, and the latter with an ironclad Exide battery and chain drive. The controllers, running switches, charging plug receptacles, lamp switches and fuses are enclosed in metal boxes, and the wiring is in conduit.

Institution and Lecture Notes.—PHYSICAL SOCIETY OF LONDON.—At the meeting held on May 22nd, "Experiments with an Incandescent Lamp" were described and exhibited by Mr. C. W. S. Crawley and Dr. S. W. J. Smith. The first of these experiments was due to Mr. Addenbrooke, who, using a 100-volt lamp filled with paraffin oil (after removing the tip) as a convenient high resistance in a 200-volt circuit, noticed that some of the many bubbles forming on the filament behaved in a curious way. Instead of rising at once to the surface from the point at which they formed, they ran down the legs of the filament, against gravity, and then escaped at the leading-in wires. Dr. Smith, led to repeat this experiment by Mr. Crawley, discovered another, more striking, phenomenon. Placing the 100-volt lamp in a 100-volt circuit in series with a variable resistance, it was found possible, by momentarily cutting out most of the resistance, to obtain a single bubble upon the wire. Instead of escaping at either terminal, as in Mr. Addenbrooke's experiment, it travels backwards and forwards between the two, "looping the loops" of the filament in a fascinating way during every journey. It was shown, from the experiments, that a rapid fall of temperature from the wire through the liquid, in the region through which the bubble moves, is an essential condition of the phenomenon, and also, from theoretical considerations, how this condition can be used to explain why the bubble moves in the manner described.

On Saturday, June 20th, the Society will visit the Cavendish Laboratory and the works of the Cambridge Scientific Instrument Co.

IRON AND STEEL INSTITUTE.—The autumn meeting of the Institute will be held in Paris on Thursday, Friday and Saturday, September 17th, 18th and 19th. On the conclusion of the meeting in Paris a visit will be made to Nancy. September 21st and 22nd will be devoted to visits to the principal iron mines and metallurgical works of French Lorrane.

ROENTGEN SOCIETY.—At the annual general meeting on Tuesday an interesting exhibition of apparatus was organised, showing recent progress; radiographs can now be taken through the thickest parts of the body with an exposure of 0·01 second. The electroscope, which has become so useful an instrument in connection with X-rays and radium, has left the laboratory stage, and new types suitable for general purposes were exhibited. Mr. F. H. Glew read a paper on charging lithium salts with radium emanation, the effect of this operation being that the lithium salts then gave out a radiation similar to X-rays; the colour of the salt was changed from pink to blue, but as the activity of the radiation diminished the normal colour gradually returned.

ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTIONS.—At the Conference which was held at Liverpool last week, the burning question of examinations was discussed, and the system of external examinations was roundly condemned. Fortunately a strong movement is in progress to free technical education from this incubus, and credit was given to the Board of Education for taking the initiative in this direction.

Half-Watt Lamps of Low Candle-Powers.—This subject is attracting attention in electrical circles in Germany, where contradictory opinions appear to prevail in regard to the present possibility of manufacturing such lamps of low candle-powers. At the annual meeting of the Bergmann Electricity Works Co., on May 19th, it was mentioned that the glow lamp department was developing favourably, and the company was obtaining the same satisfactory results with the half-watt lamp as the other companies. It was added that there were no half-watt lamps of less than 200 C.P., and that the experiments made to produce them had not yet been brought to a conclusion. It was, however, possible that the construction of lamps for lower powers would be achieved in the near future, but in the meantime announcements otherwise made were declared to be based upon a misunderstanding. This statement by the Bergmann Co. forms a striking contrast to that which was made earlier in May by Herr Emil Rathenau, of the A.E.G., and which was reproduced in this journal on May 22nd. As will be seen on reference to that issue, the director is reported to have asserted that the company had already succeeded in manufacturing half-watt lamps for powers reaching down to as low as 25 C.P. It is improbable that a statement of this kind would have been made without some foundation in fact, and the only conclusion to be drawn from the contradictory views in question is that the experiments conducted by the A.E.G. have been carried to a more advanced stage than those undertaken by the Bergmann Co. The position of affairs is all the more interesting when it is borne in mind that both companies, as well as the Siemens & Halske Co., or the Siemens-Schuckert Works and the German Incandescent Gas Light (Auer) Co., utilise the same United States patents, the Bergmann Co. working under a licence.

Fatalities.—Our Cape correspondent writes :—"In connection with the recent death of a native at the Wharf, East London, apparently from electric shock, serious developments have taken place. As the result of an inquiry, it has transpired that the natives were accustomed to wash their feet in a pool near where some iron rails were lying. Two youths had on previous occasions connected these rails to the lighting supply, and several natives had received shocks. On this occasion, however, the ground near the rails being wet after recent rains, the native received so severe a shock that he died."

According to the *Daily News*, on the 4th inst. a man named Kirkham, engaged at the new London Colliery, Kimberley, Notts., "became entangled in the cogs of the electric driver, and was cut to pieces before the motor could be stopped."

Appointments Vacant. — Applications are being invited for the Chair of Physics at Birmingham University (£750 per annum), rendered vacant by the death of Dr. J. H. Poynting, F.R.S.; a professor of chemistry (£600 per annum) is wanted for the Heriot-Watt College, Edinburgh.

Chief lecturer and head of Electrical Engineering Department of Royal Technical Institute, Salford (£225); assistant engineer (£150), for Kilmarnock Corporation; shift engineer, age 25 (£175), for Manchester Corporation. Particulars are given in our advertisement pages to-day.

Inquiry.—Makers of cane glass hub-making machines for electric lamp making are asked for.

Operating under Difficulties in Mexico.—The civil war now going on in Mexico has made it necessary for all large industrial companies to adopt means to safeguard their property. Armed guards are therefore established to resist, not the attacks of the contending forces, but the incursions of marauding bandits, who take advantage of the chaotic conditions at present existing in Mexico and commit depredations on private property. The electric lighting companies, among others, have found it necessary to adopt defensive means, and an insight into the conditions existing is afforded in the case of the Mexican Light and Power Co., which operates the largest hydro-electric station in Mexico at Necaxa, about 125 miles from the city of Mexico. The plant has an effective head of about 1,400 ft., and develops over 50,000 KW., which is transmitted to the city of Mexico at 88,000 volts.

Trouble was at first encountered at night, because of miscreants within the station who sympathised with the rebels tripping out the exciter circuit-breakers and tampering with important switches. Cement dust was sprinkled on the concrete floor for the purpose of discovering whether the culprits wore shoes, the sandals of the peon, or were bare-footed. Doors were also locked in order to protect certain apparatus. By this means a Mexican oil and rebel sympathiser was apprehended. A powerful 30-in. projector, fed with direct current from a motor-generator set, is used at night to sweep the surrounding country in search of rebels and bandits. One night the generator of the motor-generator set used for the searchlamp was discovered wrecked, and dirt was found in the bearings. This was done by some sympathiser in order to hide the movement of a number of Zapatistas six miles off. By prompt work and not very elaborate repairing, the projector was placed in service again that night, and an electrician was placed in charge of it. Part of the operating force was also sent out on guard duty in anticipation of an attack, which fortunately did not take place. Everyone in the power house is armed with a Mauser rifle furnished by the company.

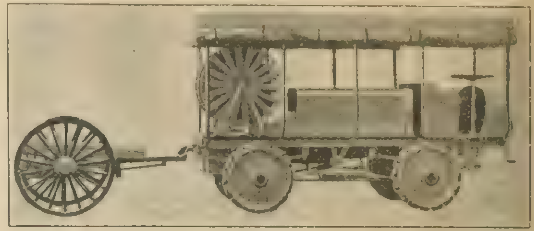
Not long after the above incident a man was shot, and it was determined to run a line down to the likeliest place of trouble and light up the trail by means of four 60-watt tungsten lamps, controlled by a switch at the sentry box overlooking the trail. An enamelled wash-pan was placed behind the lamps to serve as a reflector and keep in darkness the background where the armed operators were stationed. Another of these home-made bull's-eye lanterns was placed on a different trail, and when seven or eight weeks later there was a little fuss in the locality these lanterns became very useful. Two prisoners were taken alive, and a third was shot. Station operators were able to track him by blood marks to where he left the trail in the dark and evidently plunged headlong to his death in the canyon below, for two days later buzzards flocked to the spot.

Of course, it is necessary to protect the power station, although it is situated in a rather inaccessible canyon, since the city of Mexico depends upon it for transmitted energy for public and private lighting and for railway purposes. From five to 85 soldiers are quartered at the station at various times. Some of these are good men, some scoundrels, and others absolutely worthless. There are also a Hotchkiss rapid-fire field gun and three Colt machine guns available at the station in case of attack. Strange as it may seem, the transmission lines are not tampered with very much. The rebels at first climbed the steels towers and cut the lines with machetes, but inasmuch as this resulted in a 88,000-volt arc and a dead rebel, and was not very helpful to the cause, these pranks were short-lived. The rebels then began shooting at insulators. One night all four lines were shot down almost simultaneously, as well as the telephone lines strung on the transmission towers. However, there was a telephone line on wooden poles some distance from the transmission line but parallel to it which was fortunately overlooked, and over this communication was had with Mexico City. This trouble occurred during a New Year's celebration and left the theatres, streets and dance halls in darkness, also tying up the railways until a small steam plant in Mexico City could be started. No rioting occurred in the city, and the President himself telephoned to the plant at Necaxa to ascertain whether or not it had been taken by rebels. Next morning soldiers were started from the plant and also from Mexico City, travelling toward each other. This was the only time on which all four lines went down at once, and the lines since then have been constantly patrolled, so that trouble from this source has been almost entirely eliminated.

Needless to state, because of the presence of rebels or bandits in the vicinity the station operators do not stray far from the station. Two men were out on an inspection trip recently on a hand-car on the little narrow-gauge railroad, 25 miles long, by which the station is reached, and on the way back were met at a turn in the road by six bandits. One had a rifle, but the others were armed only with machetes. The car was going down grade, and although ordered to stop the two men, both armed, continued on. One or two shots were fired, and a peon said later that one of the bandits had been killed. Bandits, when captured by the Government troops, are in most cases executed by a firing squad of five men in charge of an officer. The usual and official custom is to have all five soldiers shoot with ball cartridges, then the officer stabs the victim with a sabre or shoots him with a revolver to make certain of his death.

There are no wagon roads in the vicinity of the generating station, so that no wheel vehicles are to be found anywhere about the plant. The site is almost impregnable. All transportation except that by the private narrow-gauge road owned by the company is by human beings or animals. Indians carry enormous loads on their backs, supported by a band passing over the forehead, and Mexicans are expert in loading pack mules.—*Electrical World.*

An American Searchlight Wagon.—The Couple Gear Freight Wheel Co., of Grand Rapids, Mich., U.S.A., has recently completed a special petrol-electric motor-wagon to the order of the U.S. Naval authorities for use in connection with the haulage and operation of powerful electric searchlights. The engine, instead of being located at the front of the chassis, as usual, is fixed under a bonnet behind the driver's seat; it is of the four-cylinder type—the bore and stroke being $5\frac{3}{4}$ in. × 6 in.—and is coupled direct to a 13-KW. dynamo. For driving purposes, each of the four road wheels is provided with an electric motor built up with the wheel itself. Each of the hubs is also provided with a capstan head, so that the vehicle can, by means of a cable, pull itself out of any difficult places in the road over which it may be travelling. At the rear of the wagon are two reels on which are wound lengths of flexible cable used to conduct the current from the wagon to the searchlights, or other electric appliances which may be in use at a distance. A two-wheeled trailer used for the transportation of the searchlight apparatus is towed at the rear of the wagon, which is capable of attaining a speed of 15 miles per hour.



PETROL-ELECTRIC SEARCHLIGHT WAGON.

The Electrified Defences of Matamoras, Mexico.—During one of the attacks made by the Mexican Constitutionalists upon the Federal forces in the city of Matamoras, Mexico (which is just opposite Brownsville, Tex.), the defending Federal troops entrenched themselves behind a barricade of barbed wire, and then, as an afterthought, their commander hit upon the pleasant scheme of connecting this barbed wire to the lines of the Matamoras electric plant, so that a deadly shock would be given persons making contact with it. During a fierce assault on the Federal works six or seven Constitutionalist soldiers were electrocuted by the wire before the deadly nature of the barricade became known. Withdrawing his infantry for the time being, the rebel general then directed his field guns upon the electric plant, with the result of quickly shutting it down. Returning to the assault, the now innocuous barbed-wire entanglement proved only a slight obstacle to the final capture of the city by the Constitutionalist forces.—*Electrical World.*

International Congress.—The sixth International Congress of Mining, Metallurgy, Engineering and Economic Geology will be held in London on July 12th to 17th, 1915. Ordinary members pay a fee of £1, which entitles them to attend the meetings and receive the proceedings of one of 14 sections. Particulars can be obtained from the Secretary, International Congress, 28, Victoria Street, S.W.

Educational Notes.—CITY AND GUILDS TECHNICAL COLLEGE, Leonard Street, Finsbury, E.C.—Entrance examination on September 22nd. Particulars are given in our advertisement pages.

MUNICIPAL SCHOOL OF TECHNOLOGY, Manchester.—Matriculation and entrance examinations will be held in July and September. The 1914-15 session will open on October 6th; particulars will be found in our advertisement pages.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Subject to the usual sanction, the salary of MR. T. HALL, engineer of the Burton-on-Trent electricity undertaking, is to be increased from £275 to £350 per annum, and by a further £50 in 1915. The Council is recommended to make the following increases in the salaries of the undermentioned charge engineers:—MR. MELBOURNE, from £160 to £200 per annum (this figure to be the maximum), by increases of £20 now and two further increases of £10 per annum; MR. MELLOR, from £2 8s. to a maximum of £2 10s. per week;

MR. KNIGHT, from £2 to a maximum of £2 10s. per week, in three advances; MR. WAKEFIELD, from £1 18s. to £2 10s. per week, in four advances.

MESSRS. T. HOLLINS and G. SOWERSBY, assistant to mains superintendent, and junior shift engineer, respectively, at the Watford electricity works, have resigned their appointments.

The Wimbledon E.L. Committee recommends an increase of salary to MR. W. J. OSWALD, one of the engineers-in-charge at the works, from £156 to £182 per annum.

Bexhill-on-Sea T.C. by eight votes to six has declined to allow MR. A. C. TICEHURST, the electrical engineer, to act as consulting engineer to the Battle B. of G. who recently had the E.L. installed at the Workhouse, at a fee of £6 6s. per annum.

The Darwen Corporation has increased the salary of MR. PERCY TAYLOR, assistant electrical engineer, from £91 to £104 per annum.

MR. FRANK H. WHYSALL, resident engineer in the Manchester Corporation electricity department, has been appointed borough electrical engineer to the Greenock Corporation in succession to MR. JAMES A. ROBERTSON, now at Salford. Mr. Whysall was formerly in the service of the Sheffield municipality, and has been resident engineer at Manchester for 12 years. The eight candidates on the short leet were interviewed by the Council on Friday, with the above result. Mr. J. Allan, of West Ham, was in the short leet.

The marriage took place at Winchmore Hill Congregational Church, London, N., on Saturday, of MR. SYDNEY JAMES VINCE, district sales engineer at Enfield for the electricity supply company, and formerly of the electricity staffs at Ipswich and Marylebone, and Miss Dorothy Gertrude Potter, second daughter of Mr. Charles W. Potter, of Ipswich.

The Barnstaple E.L. Committee recommends the T.C. to increase the salary of MR. J. W. HADFIELD, engineer, of the Municipal Electric Light Works.

The Crewe T.C. has increased the salary of the engineer at the electricity works (MR. T. KEENLYSIDE), from £150 to £165 per annum.

Tramway Officials.—The Hull T.C., on June 4th, adopted a recommendation by the Tramways Committee to increase the salary of the traffic manager, MR. M'COMBE, from £500 to £600, £50 this year, and £25 in each of the following two years.

MR. J. W. THORPE, works foreman of the Halifax tramways, has been appointed works superintendent of the Oldham Corporation tramways, at a salary of £156 per annum.

General.—We understand that MR. A. MACFARLANE, who was for the last five years responsible for the fittings department of Siemens Bros. Dynamo Works, Ltd., Dalston, has resigned his position.

MR. GEORGE LEDGER, of Blackheath, who is approaching the age of 79, has just completed his fiftieth year of service with the Telegraph Construction and Maintenance Co., Ltd., at Enderby's Wharf, East Greenwich.

MR. JOHN EWART TREANON, B.Sc., electrical engineer for the La Junta Consolidated Gold Mining Co., Telluride, Colorado, U.S.A., was married on June 3rd, at the Wesley Church, Lancaster, to Miss Ada Till. A characteristic telegram was received from the mine:—"Best wishes for the man from Colorado who went to Collar Ada!"

MR. W. B. DUCKWORTH, a young electrician on the ill-fated *Empress of Ireland*, who is reported amongst the saved, hails from Morecambe. He is only 27 years of age, and was formerly on the *Lusitania*.

MR. J. F. C. SNELL was on Monday last elected a member of the Royal Institution.

The salary of MR. HOLME, the telephone manager at Hull, has been increased from £325 to £500 a year, as with the purchase of the National Telephone Co.'s plant in the Hull area, the business has increased fourfold.

The Cambridge Philosophical Society has elected MADAME CURIE, PROF. H. A. LORENTZ, PROF. M. PLANCH and PROF. P. ZEEMAN honorary members of the Society.

According to a notice in the *Times*, MR. ALFRED WILLIAM BEUTTELL was married on 5th inst. at Christ Church, Streatham, to Miss Ida Augusta Locke.

The Council of the Royal Society of Arts, with the approval of the President, H.R.H. the Duke of Connaught, have awarded the Albert Medal for the current year to CHEVALIER GUGLIELMO MARCONI, D.Sc., LL.D., "for his services in the development and practical application of wireless telegraphy." The Medal was instituted in 1862 as a memorial of the Prince Consort, and is awarded annually for distinguished merit in promoting arts, manufactures or commerce.

Obituary.—MR. W. SCOTT.—A Scottish correspondent writes with reference to the recent loss of the *Empress of Ireland*:—"Despite news earlier in the week announcing the safety of Mr. Walter Scott, electrical engineer, Montrose, an official statement from the Canadian Pacific Railway Co. to his relatives has brought the information that he was among the lost. Deceased, who had decided to make a surprise visit to his mother, was 26 years of age. He served his apprenticeship as an electrical engineer with Mr. J. L. Warden and the North of Scotland Electric Light and Power Co., Ltd., Montrose, and was subsequently in the Fairfield Shipbuilding Yard, Glasgow."

MR. PERCY FAIRMAN.—Mr. P. Fairman, electrical engineer, engaged at Quex Park, Birchington, was drowned whilst bathing in the sea at Hythe on Whit Sunday.

HERR JOHANN WEISS.—The death is announced from Bad Nauheim, at the age of 66 years, of Herr Johann Weiss. The deceased was the founder in 1880 of the Electritechnischewerke Johann Weiss, of Landshut, Bavaria, which were among the first in Germany to take up the manufacture of dynamos and arc lamps in that country.

THE LATE A. BRUCE ANDERSON.—At an extraordinary meeting of the Council of the British Electrical and Allied Manufacturers' Association, held at 36, Kingsway on Monday last, the following resolution was passed, after which the meeting adjourned till the 25th inst.:—"Resolved that the Council of this Association, in meeting assembled this 8th day of June, 1914, deplore the untimely death of their late Chairman, A. Bruce Anderson, who perished at the sinking of the *Empress of Ireland* in the St. Lawrence River on the 29th of May, and desire to place on record not only the loss of the chief executive officer of the Association, through whose efforts mainly it has reached its present position, but also the loss of a personal friend; and that a copy of this resolution be sent to Mrs. Anderson, with an expression of their deepest sympathy for her in her sad bereavement."

NEW COMPANIES REGISTERED.

Brough Electric Lighting Co., Ltd. (136,099).—This company was registered on May 28th, with a capital of £1,500 in £1 shares, to carry on at Brough, Westmorland, the business of an electric lighting company. The subscribers (with one share each) are:—W. Coates, Brough, Westmorland, draper; F. F. Yare, Brough, Westmorland, tailor; I. Bainbridge, Brow, Westmorland, physician and surgeon; C. E. Kilvington, Brough, Westmorland, gentleman; T. Taylor, Brough, Westmorland, tailor; G. Small, Brough, Westmorland, saddler; T. Bell, Brough, Westmorland, grocer. Minimum cash subscription, £1,200. The first directors are W. Coates, F. F. Yare, I. Bainbridge, C. E. Kilvington, J. Reynoldson, G. W. Bailey and J. B. Walton; qualification, 10 shares. Registered office, Helbeck Mill, Brough, Westmorland.

G.M. Wireless Patents Syndicate, Ltd. (136,040).—This company was registered on May 26th, with a capital of £3,000 in £1 shares, to acquire and turn to account any invention relating to wireless telephony or telegraphy, or the transmitting, recording and reproduction of telephone and telegraph messages, &c. The subscribers (with one share each) are:—H. G. Matthews, Morton Hotel, Russell Square, W., inventor; Lieut.-Col. J. B. Butler, The Grove, Stoke Bishop, Bristol. Private company. The number of directors is not to be less than two or more than six; the subscribers are to appoint the first; qualification, 20 shares. Registered office, 2, Coleman Street, E.C.

A. B. Vibro and Domestic Electrics, Ltd. (136,149).—This company was registered on May 30th, with a capital of £6,000 in 5,940 7 per cent. cumulative participating preference shares of £1 each and 2,400 founders' shares of 6d. each, to carry on the business of manufacturers of, and dealers in, electrical and other vibrators and all kinds of switches, rheostats, resistances and instruments ancillary thereto, to undertake the establishment of institutes for the treatment of persons, to carry on the business of chemists and druggists, &c., and to adopt an agreement with W. R. Ansell. The subscribers (with one share each) are:—P. Manton-Myatt, 21, Dorville Road, Ravenscourt Park, W., musician; H. R. Holmes, 32, Southcroft Road, Tooting, S.W., shipping clerk; J. A. Ellis, 27, Broad Street, Ratcliffe, E., shipping clerk; T. Brain, 14, Bourne Place, Duke's Avenue, Chiswick, W.; L. M. Shepherd, Fir Cottage, Bounds Green, N., shipping clerk; W. R. Ansell, 3, Chapel Court, Borough High Street, S.E., merchant; A. Quaife, 18, Millard Road, Stoke Newington, N., secretary. Minimum cash subscription, seven shares. The number of directors is not to be less than three or more than five. W. R. Ansell is one of the first. Registered office, 58, High Street, New Oxford Street, W.

British Willard Battery Co., Ltd. (136,098).—This company was registered on May 28th, with a capital of £10,000 in £1 shares (3,000 "A" and 7,000 "B"), to carry on the business of sellers, manufacturers, assemblers, fitters, adjusters and repairers of electric accumulators and storage batteries, and articles connected with, or relating to, electric cables, connections, jars, electrolyte, fittings and accessories, and to adopt an agreement with the Willard Battery Co., of Cleveland, U.S.A. The subscribers (with one share each) are:—J. F. Rowlate, 38, Bedford Row, W.C., solicitor; T. A. Kirkham, 38, Bedford Row, W.C., solicitor. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification, one share; remuneration (except managing director), £600 per annum. Registered office, 37, Bedford Row, W.C.

Hammersmith Welding, Engineering and Electrical Co., Ltd. (136,136).—This company was registered on May 29th, with a capital of £250 in £1 shares, to take over the business of T. H. R. Heard and R. C. Heard, trading as the Hammersmith Welding Co., and to carry on the business of welders of metals, mechanical, electrical, and general engineers, founders, smiths, braziers, machinists, plumbers, electricians, workers in electricity, &c. The subscribers (with one share each) are:—A. H. Hunter, 78, Elsham Road, Kensington, W., engineer; T. H. R. Heard, 3, Station Road, Shepherd's Bush, W., engineer. Private company. The number of directors is to be two; the first are A. H. Hunter and T. H. R. Heard (both permanent); qualification, £50. Solicitor, L. Boyes, 2, Pancras Lane, E.C.

Molybdenum and Tungsten Traders, Ltd. (136,143).—This company was registered on May 29th, with a capital of £1,000 in £1 shares, to carry on the business of refiners, smelters, assayers, metallurgists, and contractors, dealers in molybdenum, tungsten and other mines, &c., and to adopt an agreement with C. Vautin. The subscribers (with one share each) are:—P. B. Smyth, The Clock House, Wanstead, accountant; A. E. Tester, 142, Shaftesbury Avenue, Norbury, S.W., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification (except first directors), £100; remuneration as fixed by the company. Registered office, 638, Salisbury House, London Wall, E.C.

Stolz Electrophone Co. (1914), Ltd. (136,274).—This company was registered on June 6th, with a capital of £5,000 in 4,995 ordinary shares of £1 each, and 100 founders' shares of 1s. each, to carry on the business of manufacturers of and dealers in electrophones, devices and instruments to improve hearing and aiding the deaf to hear, aural instruments, &c., and to adopt an agreement with the Stolz Electrophone Co. (1913), Ltd., in liquidation. The subscribers (with one share each) are:—F. M. Billson, 17, Morley Road, Lewisham, S.E., clerk; G. J. Humphreys, 26, Roding Road, Clapton Park, N.E., clerk. Private company. The number of directors is not to be less than two or more than five; the first are S. M. Hyman, A. Hyman and J. Goldstein; qualification, 100 ordinary shares. Registered office, 8, St. Martin's Place, Trafalgar Square, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rugby Lamp Co., Ltd.—A memorandum of satisfaction in full on March 5th, 1914, of mortgage, dated November 30th, 1908, securing certain sums up to £1,500, has been filed.

Spagnoletti, Ltd.—Mortgage deb. dated April 28th, 1914, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Park Royal Engineering Works, Ltd., 34-36, Gresham Street, E.C.

City of Oxford Electric Tramways, Ltd.—Mortgage dated May 11th, as collateral security to £46,000 debs., secured by trust deed dated February 20th, 1914, charged on certain land and premises in Leopold Street and Green Street, Oxford. Holders: Union Commercial Investment Co., Ltd., Dashwood House, 9, New Broad Street, E.C.

Lamplough & Son, Ltd.—Mortgage, created by the Receiver and dated May 14th, 1914, to secure £1,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: L. R. Rose, Summerfield, Cedar Road, Sutton, Surrey.

Apparatus and Accessories, Ltd.—Particulars of £1,000 debentures, created April 21th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, included uncalled capital. No trustees.

W. S. Laycock, Ltd. (68,203)—Capital, £150,000 in £1 shares (50,000 pref). Return dated February 24th (filed April 11th), 1914. All shares taken up. £50,007 paid on 7 ord. and 50,000 pref. £99,993 credited as paid on 99,993 ord. Mortgages and charges: £25,000.

Imperial Light, Ltd.—A memorandum of satisfaction to the extent of £2,400 on May 4th, 1914, of debs. created by resolution of November 7th, 1910, securing £5,000, has been filed.

I.T.E. Electric Co. (1907), Ltd. (95,222).—Capital, £1,000 in £1 shares return dated March 20th (filed March 2nd, 1914); 107 shares taken up; £107 paid. Mortgages and charges: £2,400.

Lancashire Dynamo and Motor Co., Ltd.—Capital, £150,000 in £1 shares (50,000 pref.); return dated April 21st, 1914 (filed May 25th, 1914); 48,250 pref. and 97,700 ord. shares taken up; £145,950 paid. Mortgages and charges: £75,000.

Rushmore Lamps, Ltd.—Debenture dated May 27th, 1914, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: T. Estall, D. J. H. Cunnick and F. Eley, 15, Bishopsgate, E.C.

Auto-electric Transmission, Ltd.—A memorandum of satisfaction in full on May 6th, of debenture dated March 13th, 1914, securing £250, has been filed.

Ramsgate and District Electric Supply Co., Ltd.—Particulars of £20,000 debenture stock created February 10th, 1913, and secured by trust deed dated May 15th, 1914, filed pursuant to Sec. 96 3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Underground Electric Railways Co. of London, Ltd.—Trust deed dated May 20th, 1914, to secure £700,000 4½ per cent. Three Year Secured Notes, charged on £463,000 4 per cent. deb. stock in London Electric Railway and £412,000 4 per cent. perpetual stock in City and South London Railway Co. Holders: Union of London and Smiths Bank, Ltd., 2, Princes Street, E.C.

Percy G. Green & Co., Ltd.—Particulars are of £1,500 debs., created May 26th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Tucuman Tramways, Light and Power Co., Ltd.—Trust deed, dated May 20th, 1914, to secure £400,000 5 per cent. deb. stock, charged on 7,800 ord. shares of $100 gold each, fully paid in the Campania Hidro-Electrica de Tucuman, all the issued shares of $100 m/n each fully paid in Campania Electrica del Norte & Co.'s other assets. Trustees: City Safe Deposit and Agency Co., Ltd., 13 and 15, Throgmorten Avenue, E.C., and M. W. Mattinson, K.C., 1, Garden Court, Temple, E.C.

CITY NOTES.

German Atlantic Telegraph Co.

The report for 1913 of the Deutsch-Atlantische Telegraphen Gesellschaft, of Cologne, states that the traffic on the Atlantic cables again experienced an increase, although the growth in the number of words was attributed to the traffic at reduced rates, whereas a slight decrease took place in the fully-paid messages. The business on the Vigo cable also developed satisfactorily. The money transmission department was constantly expanding, and in addition to Luxemberg and Switzerland, Holland had now joined the service, and the connection of other countries was held in prospect. During the year a deep-sea interruption occurred in No. 2 Atlantic cable, the removal of which was much delayed by unfavourable weather. On the other hand, No. 1 Atlantic cable and the Vigo cable were not subject to any interruption in the year. The introduction of the Heurtley high-speed telegraph system was completed, the results having already been satisfactory, and they would probably be still better with further experience.

Alluding to wireless telegraphy, the report remarks that the principal activity of the system still consisted in the transmission of telegrams between ships and the coast and between vessels themselves, and that it had frequently become a feeder for cable messages. As the Governments of almost all cable-owning nations had established further submarine cables in the past year, and the cable companies in open competition had also laid large sections of new cables recently, it followed that wireless telegraphy was not destined to supersede cables in the transmission of telegrams.

The gross receipts from cable traffic and interest on investments amounted to £296,000 in 1913, as contrasted with £288,000 in the preceding year. After meeting general expenses and taxes, &c., the sum of £30,000 has been placed to the cable redemption fund, as in 1912, and £7,100 to the account of depreciation, as against £7,300 in the previous year. Including the balance forward, the net profits total £173,000, as compared with £166,000, and a dividend of 7½ per cent. has been declared on the ordinary share capital of £1,200,000, being the same rate as in each of the three preceding years.

Aluminium Corporation, Ltd.

The directors' report for the 12 months ending December 31st, 1913, states that there is an increase in the gross profit, but an abnormally low rainfall during the year 1913 prevented a further increase being shown. The carbon works have now been completed at Dolgarrog, and are giving very satisfactory results. A contract has been placed for the construction of a dam and tunnel to bring the Dulyn Water into the Eigiau Lake. The maintenance of the machinery and plant in a high state of efficiency out of revenue has been continued, and no provision for depreciation has been included in the accounts. The value of the freehold land, water power, &c., appears at the same figure as last year, plus the additions during the year, and in view of the removal of the carbon factory from Wallsend, the directors have pleasure in stating that the figure they stand at in the books has been more than justified by an independent valuation. £1,295 preliminary expenses have been written off. After considerable negotiation arrangements have been made to define the exact value of the present participating shares by giving them the same rights and privileges as 40,000 preference shares, and an extraordinary general meeting has been convened, and will be held immediately after the close of the annual meeting on June 17th, for the purpose of passing the necessary formal resolution should the proposal be approved.

Peel-Conner Telephone Works, Ltd.—The directors report that for the year ended March 31st, 1914, the profit and loss account shows a net profit of £27,104. Out of this there has been placed to reserve for depreciation £5,000, and to general reserve £4,000, leaving £18,104 plus £3,555 brought forward. The balance available for dividend is £21,659. Interim dividends were paid on November 1st, 1913, as follows:—On the preference shares, £2,500; on the ordinary shares, £4,000. The directors recommend that dividends be now paid as follows:—Preference shares (balance) £2,500, 1s. per share on ordinary shares £4,000, and 1s. per share on ordinary shares (bonus) £4,000, leaving to be carried forward £4,659. The factory has been more fully employed during the past year, although not to its maximum capacity. This has resulted in an increased profit which enables the directors to recommend the payment of a bonus of 1s. per share on the ordinary shares in addition to the usual dividend of 2s. per share.

New British Ever-Ready Co., Ltd.—According to the *Financial Times*, the directors recommend a dividend of 1½ per cent. on the preference shares, making 8½ per cent. per annum for the 15 months to March 31st, 1914, and 8½ per cent. on the ordinary shares for the same period, placing £2,500 to general reserve, writing £3,686 off preliminary expenses, &c., £1,330 for depreciation and carrying forward £859.

The Bachelet Levitated Railway.—At a meeting of the directors, on Wednesday, it was decided not to proceed to allotment, and instructions were given to return the amounts received from applicants. The reason given for this decision is "the extremely disappointing result of the recent public issue." The publicity given in the columns of the daily Press to our criticisms of the project presumably contributed to this result, which, in the public interest, cannot be regarded as unsatisfactory.

Electric and General Investment Co., Ltd.—The directors announce further dividend for year to May 31st, making on the ordinary shares 10 per cent.; on deferred shares a dividend of 6d. per share is to be paid.

Constantinople Telephone Co.—At the annual general meeting held at the offices in Constantinople on June 4th, Mr. George Franklin presiding, the directors' report (see Elec. Rev., p. 832) was unanimously adopted.

Globe Telegraph and Trust Co., Ltd.—The directors have declared a final dividend of 6s. per share on the ordinary shares, making 6 per cent. for the year, carrying forward £25,700.

Manila Electric Railroad and Lighting Corporation.—The directors announce a quarterly dividend of 1¾ per cent. for the quarter ending June 30th on the common capital stock.

Brazilian Traction, Light and Power Co., Ltd.—The directors announce a dividend of 1½ per cent. for the quarter ended June 30th on the 6 per cent. cumulative preference shares.

International Light and Power Co., Ltd.—The directors announce a final dividend of 1½ per cent. on the preference shares for the quarter ending June 30th.

Provincial Tramways Co., Ltd.—An interim dividend of 8d. per share, less tax, upon the ordinary shares is announced.

Western Telegraph Co., Ltd.—Third quarterly interim dividend, 3s. per share, free of income-tax, for the year ending June 30th, 1914 (being at the rate of 6 per cent. per annum).

(*Continued on page* 1000.)

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

THE BIRMINGHAM CONVENTION.

On Monday evening next the nineteenth Annual Convention of the I.M.E.A. will be opened by an informal reception and smoking concert to be held, by the invitation of the Birmingham Entertainments Committee, at the Grand Hotel, which will be the headquarters of the Council.

The proceedings, which will extend over the entire week, will be presided over by Mr. R. A. Chattock, city electrical engineer of Birmingham, who will deliver his presidential address on Tuesday morning after the official welcome by the Lord Mayor. On this and the following pages we give photographs of many of those who are either officially or in other capacities connected with the organisation this year. We also give information regarding some of the electricity works and manufactories that will be visited by the members during the Convention.

Mr. H. Richardson
(Vice-President).

Mr. R. A. Chattock,
President.

Mr. A. C. Cramb
(Vice-President).

Mr. G. Wilkinson
(Past-President).

Mr. W. W. Lackie
(Past-President).

Alderman G. Pearson
(Hon. Solicitor).

Mr. C. McArthur Butler
(Secretary).

Mr. H. Faraday Proctor
(Hon. Sec. and Past-Pres.).

Mr. J. E. Edgcome
(Hon. Treas. and Past-Pres.).

Photographs:

R. A. Chattock	*Lafayette*
H. Richardson	*Valentine & Co.*
G. Wilkinson	*Rosemont*
G. Pearson	*Abel Lewis & Son*

Photographs:

W. W. Lackie	*[illegible]*
A. C. Cramb	*Bender & Lewis*
J. E. Edgcome ..	*G. F. Jones & Son*
C. McA. Butler	*Corbett*

Mr. R. A. Chattock (*President*).—Mr. Chattock has been city electrical engineer at Birmingham for the past 11 years. Previously he was for three years chief electrical engineer at Bradford. He was born 49 years ago. His education at University College School, London, was followed by some years' training gained in marine and mechanical engineering works at Blackwall. His electricity supply service has been continuous since 1889, when he began a period of some years spent with the Metropolitan Electric Supply Co. at their several stations. Subsequently Mr. Chattock, for a brief period, held office as chief electrical engineer at Hampstead, and, after five years as superintendent engineer at the Bankside works of the City of London Electric Lighting Co., he accepted the Bradford post mentioned above. As leader of one of the foremost electricity supply systems in the United Kingdom, which is progressing by leaps and bounds, and is in the midst of important extension operations at the present time, he should make an excellent president of the M.E.A.

Mr. H. Richardson (*Vice-President*).—Mr. Richardson was educated at the City of London School. He served his mechanical apprenticeship with Messrs. Frank Ashwell & Co., of London and Leicester, and subsequently entered upon his electrical training with Messrs. Siemens Brothers & Co., and afterwards joined the National Electric Supply Co., at Preston, previous to taking up an appointment as assistant electrical engineer during the construction of the Newcastle-on-Tyne tramways. He left Newcastle to take up the position of chief electrical engineer to the city of Dundee. The Dundee electrical undertaking has undergone great change and development and, as a result, considerable improvement in economy and management has been attained. A new high-tension three-phase generating station was erected on the banks of the Tay, with sub-stations, and the whole of the designs and specification for this enterprise were prepared by Mr. Richardson. He is a Fellow of the Royal Society of Edinburgh, a Member of the Institution of Electrical Engineers, and a Member of the Institution of Mechanical Engineers. Mr. Richardson is a keen Territorial, and is in command of the City of Dundee Royal Engineers.

Mr. A. C. Cramb (*Vice-President*) who has been, for the past 10 years, chief engineer and manager of the Croydon electricity undertaking, was from 1902 to 1904 chief assistant in connection with the same system. Prior to that he had had a varied experience in connection with electricity supply work in Huddersfield and in several London stations, including Hampstead and Islington. He was born just forty years ago, and received his engineering training with a Newcastle firm and at the Erith works of Messrs. Easton, Anderson & Goolden.

Mr. W. W. Lackie (*Past-President*).—Mr. Lackie was born at Montrose in 1869, and was a student under Lord Kelvin at Glasgow University. He was with Messrs. Mavor & Coulson for four years, during which time public electricity supply in Glasgow was developed, until the undertaking was taken over by the Corporation; Mr. Lackie then transferred his services to the Corporation. For four years he acted as mains superintendent, and was appointed chief assistant engineer in 1898, when Mr. Chamen took office as chief engineer. In 1904 Mr. Lackie succeeded Mr. Chamen as "chief." During the past 10 years the capital expenditure of the undertaking has increased by over a million sterling, and now stands at £2,300,000. The revenue has increased from £186,000 to £345,000. The output has gone up from 21,000,000 to 77,000,000 units, and the number of consumers from 9,000 to 27,000. A large new generating station is now in course of construction, which will have an ultimate capacity of 140,000 KW. Last year, before approving of the plans of the new generating station, the Glasgow Corporation sent Mr. Lackie to America to see the switch-houses at Niagara and the power houses at Chicago and New York. Mr. Lackie was president of I.M.E.A. in 1909-10. He is a past chairman of the Scottish Local Section of I.E.E. and of the Scientific Society of the Royal Technical College, Vice-Chairman of the Institute of Engineers' Shipbuilders, and he is at present Chairman of the Glasgow University Engineering Society. Mr. Lackie is M.I.C.E., M.I.E.E., M.I.Mech.E.

Mr. John Christie (*Past-President*), is, of course, the popular borough electrical engineer at Brighton, where he took up the position of resident engineer and manager in 1900, becoming chief engineer and manager five years later when Mr. Arthur Wright resigned his post in the management of the undertaking. Mr. Christie is 46 years of age. He was one of Prof. Jamieson's day engineering students at Glasgow. Marine engineering service was followed by a period as assistant engineer with Messrs. Crompton, at Chelmsford, then a year with the St. Pancras electricity undertaking at its birth, and after experience gained in the testing department of Messrs. Siemens Bros. & Co., at Woolwich, he re-entered municipal electricity supply service in 1893, finding his way to Glasgow, Londonderry, and again to Glasgow until he came right south where at Brighton, as our readers know, he is engaged at present devoting himself with considerable enterprise to the cultivation of a cooking and heating load. He was president of the M.E.A. in 1911.

Mr. George Wilkinson (*Past-President*).—Mr. Wilkinson, who presided over the Harrogate Convention in 1912 is the engineer-in-chief of the Harrogate Corporation electricity undertaking. In addition, he is also responsible for designing the electricity works which are now in course of construction for the Ilkley Urban District Council. In his capacity as a consulting engineer he, further, has the works in hand for the Knaresborough Urban District Council.

Alderman George Pearson (*Hon. Solicitor to the M.E.A.*) is, we should say, one of the busiest men in Bristol. He was elected without opposition to represent Clifton Ward on the Bristol Town Council in the year 1888. He was chairman of the Boundaries Committee from 1889, when the work commenced, to 1897, when it was brought to a successful issue by the passing of the Bill through Parliament, and he became chairman of the Committee for bringing the Act into operation. He is now serving his 21st year as chairman of the Electrical Committee, and his legal knowledge and experience gained as a partner in the firm of G. Pearson & Usher, solicitors, has always been freely at the disposal of the M.E.A. He is also a member of many other committees concerned with public interests, as well as being chairman of the Joint District Board of Masters and Men for the Coalfields of Bristol under the Minimum Wage Act of 1912. The fact that in the midst of his multifarious other activities, Alderman Pearson is able to devote time and interest to the affairs of the M.E.A. says much for his appreciation of the importance of electrical affairs to the community. Alderman Pearson has been laid up for some weeks of late, but members of the M.E.A. will hope that he will be sufficiently recovered to attend the Convention at Birmingham.

Mr. J. E. Edgcome (*Hon. Treasurer and Past-President*).—Mr. Edgcome was born in the year 1865 and educated in London and Paris. After his engineering training he was with Messrs. R. E. Crompton & Co., Ltd., at Kensington Court power station, in 1887-8; with the Kensington and Knightsbridge Co., Ltd., in 1889-90; the Notting Hill Co., Ltd., from 1890 to 1893; and was appointed borough electrical engineer and advising engineer to the Drainage Committee of the Corporation of Kingston-upon-Thames in 1893. He is a member of the Institutions of Mechanical and Electrical Engineers, was on the Executive Committee of the Olympia Electrical Exhibition, 1907. An original member of the I.M.E.A., he has twice served as President, in 1906 and 1913, as Vice-President twice, as Hon. Secretary, and he is at present Hon. Treasurer. Mr. Edgcome is a Member of the Standing Committee on Wiring Rules of the I.E.E., and is President of the Diesel Engine Users' Association.

Mr. H. Faraday Proctor (*Hon. Secretary and Past-President*).—At the time of his appointment as chairman of the Western Local Section of the I.E.E., we published a brief account of the career of Mr. Faraday Proctor (ELECTRICAL REVIEW, November 7th, 1913). For more than 21 years he has been connected with municipal work. He was one of the founders of the I.M.E.A. some 18 years ago, and was president in 1898-9. He has occupied a seat on the Council continuously since that date. He is city electrical engineer of Bristol, and is 47 years of age.

Mr. C. McArthur Butler (*Secretary*), has been Secretary of the I.M.E.A. since 1899, and, as its executive officer, has been responsible for organising the annual Conventions held in Glasgow (two), London (three), Sunderland, Derby, Edinburgh, Sheffield, Nottingham, Manchester, Brighton, Harrogate, and the forthcoming one in Birmingham. He is a Fellow of the Chartered Institute of Secretaries, an Associate of the Institution of Electrical Engineers, and a member of several other professional bodies.

Mr. Frank Ayton (*Member of Council*).—Mr. Ayton served as a pupil for three years at the Woolwich works of Messrs. Siemens Bros., entering these works in 1889, and he was subsequently taken on the staff. He served on the deck engineering staff of the two expeditions connected with the laying of the 1894 Atlantic cable for the Commercial Cable Co., and the 1896 expedition connected with the laying of the cable up the River Amazon. He was employed as an assistant in connection with the inauguration of electric supply at Derby in 1893-4. During the latter part of his time at Woolwich works he was engaged in estimating for, and designing, central station schemes and tramways. In 1896 he was placed in charge of the railway and tramway work of the firm at their London office. While in this position he supervised the contract for the electrical equipment of the Waterloo and City Railway, the earlier stages of the equipment of the experimental section for electrical working on the Underground Railway between Earl's Court and Kensington High Street, together with the contract for the electrification of the Hull tramways, &c. In 1898 he left Messrs. Siemens to join the staff of Sir Alexander Kennedy. When Sir Alexander was appointed consulting engineer to the Ipswich Corporation, Mr. Ayton prepared the designs and specifications, and later on was appointed resident engineer to supervise the carrying out of the whole work. Before its completion he was appointed by the Corporation as the chief engineer and manager of the new electric supply and tramways departments, which position he continues to hold. Mr. Ayton is 40 years of age.

Alderman Bruce (*Member of Council*).—Alderman Bruce has been chairman of the Sunderland Corporation Electricity Committee from the commencement of the undertaking. He is a Sunderland man through and through. He was born there 72 years ago, educated there at the New Academy, became a Town Councillor in 1879, and an Alderman in 1896. He filled the office of Mayor in 1897 and 1898. In addition to his active interest in the electricity department, Alderman Bruce is also a Magistrate of the borough.

Mr. W. Wyld (*Member of Council*).—Mr. Wyld, of Hampstead, after serving a full mechanical apprenticeship entered the Blackpool Corporation electricity works. Subsequently he held the position of chief assistant to Salford Corporation electricity works, and was appointed chief electrical engineer to the Patent Shaft and Axletree Co., Ltd., of Wednesbury, where he designed and erected one of the earliest three-phase power station and works equipments in this country. Upon completing this work he was appointed electrical engineer to the Corporation of Doncaster, and whilst there was responsible for the electrical equipment of the tramway system, being subsequently appointed tramways manager. Later on Mr. Wyld was appointed general manager to the Birkenhead tramways, and after holding this appointment for three years, he was offered and accepted in addition the office of borough electrical engineer. After nine years at Birkenhead, he was last year appointed chief electrical engineer and manager at Hampstead, which position he now holds.

Mr. Thomas Roles (*Member of Council*). Mr. Roles was born at Brighton in 1875, and, after receiving general and technical education there, he entered the service of Messrs. Crompton & Co. in September, 1892. There he was employed on work in connection with the plant of the Hove Electric Lighting Co., Ltd., and, on commencement of supply, he was transferred to the staff of that company. Between 1895 and 1897 he was assistant electrical engineer at Aberdeen, leaving to take up a position as draughtsman in the Leicester Corporation electricity department, and was soon promoted to the position of mains engineer. From 1900 to 1901 he held office as generating engineer at the Poplar Borough Council electricity works, and left there to become chief assistant electrical engineer to the Bradford Corporation. To the position of city electrical engineer and manager, which he now holds, he succeeded early in 1907. At Bradford he has greatly developed the extra-H.T. three-phase system of generation and transmission. Mr. Roles has at present in hand extensions involving an outlay of nearly £100,000. The total capital expenditure on the Bradford electricity undertaking now exceeds £925,000, of which over £400,000 has been expended during Mr. Roles's period. He has paid considerable attention to the development of the business side of the undertaking, including the extension of the motor, arc lamp and accessories hiring department, opening of showroom, &c. He has instituted a specially low scale of charges for power supply with the result that a number of weaving sheds and spinning mills are now solely dependent on the Corporation electricity supply for their power. The total number of units sold during the year ended March 31st last exceeded 28,000,000, as compared with 14,500,000 units in 1907. For domestic purposes a ·5d. tariff has been in operation since July, 1910, with great success. Mr. Roles was one of the founders of "The Point Fives" Association, and he has been unanimously elected chairman of the Yorkshire Local Section of the I.E.E. He is at present engaged, in conjunction with the B.E.A.M.A., in promoting an Electrical Exhibition to be held in Bradford in October next.

Mr. F. Ayton.

Mr. W. Wyld.

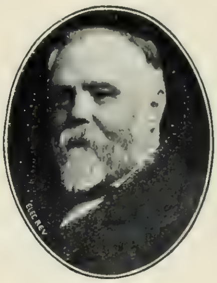
Mr. S. L. Pearce.

Mr. A. H. Seabrook.

Ald. Sinclair.

Councillor Smith.

Councillor Gibson.



Councillor W. Bruce.

Bailie James Willock.

*Mr. W. A. Vignoles.

*Mr. J. H. Bowden.

*Mr. S. E. Fedden.

Mr. S. J. Watson.

Photographs: W. Wyld, *Foulds & Hibberd*; S. L. Pearce, *Guttenberg*; W. A. Vignoles, *Sherlock*; S. E. Fedden, *Kingham*; Councillor Smith, *Bentley*; Ald. Sinclair, *Chapman*; Councillor Gibson, *Treble*; Councillor Bruce, *Elliott & Fry*.

* Authors of Papers.

Councillor A. G. Ellaway (*Member of Council*), was born in 1864. He early entered his father's business of brass-founder, which he took over at his father's death in 1887, and still carries on under the name of Henry H. Ellaway, at Essor Works, Birmingham. He was brought up in a political atmosphere. His father was a councillor and alderman before him, and Mr. Ellaway has taken part in public affairs since he was 18 years of age. He has served on the City Council since 1898, and in 1899 he took a seat on the original Electric Supply Committee when the Corporation acquired the undertaking from the company. He now holds, and has done since 1904, the position of chairman of the Electricity Committee. He was appointed on the first Tramway Committee in 1900, and is now its only original member. He is also a representative of the City Council on the Council of the Birmingham University.

Mr. S. J. Watson (*Member of Council*).—Mr. Watson is the chief engineer and manager of the Bury Corporation electricity undertaking. He is a member of the Institution of Electrical Engineers.

Mr. S. L. Pearce (*Past-President and Member of Council*).—After completing his practical training and the theoretical studies at the Finsbury Technical College, Mr. Pearce held positions with the Metropolitan Electric Supply Co, London, the British Thomson-Houston Co., Ltd., London, and the Central London Railway. He was appointed deputy chief electrical engineer in Manchester in 1901, and in 1904 succeeded Mr. Metzger as "chief." He has been responsible for all new work in connection with the Manchester undertaking, and during his period as "chief" the K.W.D. of the system has risen from 17,290 to 49,897, and the output has advanced from 28,966,000 to 117,929,000 units per annum. Mr. Pearce is now engaged on the design of the new Barton power station, the ultimate capacity of which is expected to reach not less than 120,000 KW. He held the position of Chairman of the Manchester Local Section of the I.E.E. in 1905/6, was President of the I.M.E.A. in 1908/9, and President of the Institution of Civil Engineers (Manchester Association of Students) in 1913-14. He has served three terms on the Council of the I.E E., and has also taken considerable interest in the proceedings of the Manchester Association of Engineers, serving on the Council of that body. He has taken an active interest in the formation of the Manchester Engineers' Club, and has served on the Committee since its inception. He is now a member of the Organising Committee which is endeavouring to formulate proposals for bringing together all the scientific and technological institutions in Manchester. Mr. Pearce has recently given evidence before the Board of Trade Committee on the use of Bitumen Cables, and before the Special Electricity Committee of the London County Council on London's Electricity Supply.

Mr. A. Hugh Seabrook (*Member of Council*).—Mr. Seabrook has for the past five years been general manager of the St. Marylebone electricity undertaking, during which time the output has nearly doubled, advancing from 9,000,000 to 17,000,000 units per annum. The maximum number of consumers has increased by 50 per cent., and the maximum load by 50 per cent., while the financial result has been changed from a deficit to a surplus. Mr. Seabrook is, perhaps, best known by reason of the close attention that he has given to the management and development of electric supply undertakings. At Marylebone the principal business is in domestic supplies—especially heating and cooking. During the past three years the connections to mains for heating and cooking have increased from 2,700 to 8,600 KW. During his three and a half years as general manager of the West Ham electricity undertaking, which position he held prior to taking up his present post, Mr. Seabrook was able to show figures of development and financial results three or four times better than during the five years in Marylebone. The restrictions in development were far less in West Ham than in Marylebone. Mr. Seabrook has always held that if we could not fix tariffs so as to make the cost of the service competitive with that of similar services by other agencies, neither a great amount of business nor financial success could result. On this ground he has always endeavoured to get tariffs fixed, not necessarily low, but on a competitive basis.

Mr. S. E. Fedden, city electrical engineer of Sheffield, is to contribute to this year's meeting (on Wednesday at Coventry) a paper on "The Design and Operation of Modern Boiler House Plant." Mr. Fedden is a past-president of the Association, and is 47 years of age. Prior to taking up his appointment at Sheffield in 1900, he had had a lengthy and varied experience in railway, electric supply, tramways and other branches of engineering in this country, Canada and the United States; Edinburgh, Greenock and Broughty Ferry electricity departments were the scenes of his labours on the way to his important office at Sheffield. The extent of his operations in the latter city, both technically and commercially, are already well known to readers of the ELECTRICAL REVIEW. Some ten years ago the Sheffield Corporation sent him to Canada and the United States, as the result of which he prepared a voluminous and instructive report on electrical practice, which we published in our pages at the time.

Councillor James Willock (*Member of Council*) has been a member of the Glasgow Town Council for 20 years, during the whole of which period he has been a member of the Electricity Committee. As chairman of that Committee he saw the capital grow from £150,000 to about £2,000,000. His retiral from the chairmanship after eight years was the result of the operation of a standing order of the Corporation that no member should hold a convenership for more than three years. Councillor Willock has always taken a keen interest in the M.E.A., and he has been present at practically every annual Convention of the Association. For many years he has been a member of Council. He has taken an active part in the various movements which have had for their object the popularisation and the more extended use of electrical apparatus. Councillor Willock has served for three years as a magistrate of the city of Glasgow, and now holds the honorary position of Master of Works. His business is that of a coal merchant.

Councillor Richard Gibson (*Member of Council*) is chairman and managing director of the Messrs. Baker & Crockett, Ltd., hardware merchants and brassfounders, of Wolverhampton. He is 72 years of age, and was initiated into masonry in 1864. He is interested in many public movements in Wolverhampton, and as a member of the Corporation he has devoted himself to the work of various Committees. He is chairman of the Wolverhampton Electricity Committee.

Mr. W. A. Vignoles, who will read a paper on "The Commercial Development of Electric Supply in Towns of Moderate Size," at Birmingham on Tuesday, is chief electrical engineer to Grimsby Corporation. He was born in London in 1874, and educated in France and at Finsbury Technical College. He was entered as an apprentice with W. T. Goolden & Co., who were then specialising in mining and electrical coal-cutting work. For another company he was in charge of the cutting plant at various collieries in Durham for about 12 months. Subsequently he became head draughtsman with Messrs. Crompton & Co., going later to Sir Alexander B. W. Kennedy, F.R.S., with whom he was for some time in his London office, afterwards acting as his resident engineer during the construction of the Grimsby Corporation electricity works. In 1901, when the Grimsby works commenced to supply, he became borough electrical engineer, and he holds this position still. He has designed and carried out all extensions of plant since 1902. Mr. Vignoles made a number of experiments some years ago in connection with fuel economy. In 1906 he read a paper at the I.M.E.A. on the same subject. He has devoted a great deal of attention to the commercial development of electricity undertakings and to publicity work. Mr. Vignoles is a brother of Mr. E. B. Vignoles, of Evershed & Vignoles, Ltd.

Mr. J. Horace Bowden, who will regale members at Stratford-upon-Avon on Thursday with his views on "Standardisation of Tariffs," is still, as we say, "on the right side of 40." He is the borough electrical engineer and manager at Poplar, where the undertaking has made excellent progress during the 9½ years that it has been under his care. For 17 years he has been continuously in responsible control of electric light and power systems in London, his experience before going to Poplar having been with the South Metropolitan E.L. & P. Co., Ltd., and Brompton and Kensington Electric Supply Co., Ltd. In respect of capital expenditure, Mr. Bowden claims a record in the Metropolitan area—£33 per KW. installed. His output for 1912-13 was just over 12 million units, and the estimate for 1913-14 was in the neighbourhood of 17 millions. He claims to have introduced the ·5d. system of charging, and since the initiation of that system at Poplar the demand has increased enormously, the present rate of increase being 3 million units per annum, compared with 1 million in previous years. Mr. Bowden has been president of the Associated Municipal Electrical Engineers (Greater London), was first chairman of the Point Fives, and was organiser of the conference considering the linking up of the various London undertakings.

Lieut.-Col. Alex. Sinclair, V.D. (*Member of Council.*)—Alderman Sinclair, of Swansea, is perhaps one of the most familiar figures at M.E.A. gatherings. He has attended the annual Conventions every year since in 1902 he became chairman of the Swansea Electric Lighting and Tramways Committee. As a member of that Committee he took an active part in the inception and carrying out of the electricity undertaking. He has been a member of the I.M.E.A. Council since 1903. Col. Sinclair was born in Aberdeen, Scotland, in 1861. After being some time abroad he, for five years, studied electrical and general engineering. In the early eighties he took part in the lighting, electrically, of several houses in London and neighbourhood, among these being that of the late Sir George Newnes, under Messrs. Goolden & Trotter. In 1883 he joined Messrs. Siemens Bros., as assistant electrician, taking part in the manufacture of the Mackay-Bennett Atlantic cable, and assisting in its laying by the cable ship *Faraday*. In 1885 he was appointed electrical engineer and manager of the works to Messrs. Vivian & Sons, copper manufacturers, Swansea, which position he still holds. He is a member of the Institution of Electrical Engineers, and an Associate Member of the Civils. For 27 years he has been an ardent member of the Volunteer and Territorial Forces. He recently retired with the rank of Lieut.-Colonel from the sixth battalion of the Welsh Regiment.

Councillor J. P. Smith (*Member of Council*) received his training as an engineer with Messrs. Storey Bros., of Lancaster. He was elected a member of the Barrow Corporation in 1891, and as an alderman in 1903. He has twice filled the office of Mayor—1901-2 and 1911-12—and has been chairman of the Electricity Committee from its commencement. He is an Associate of the Institution of Electrical Engineers.

Mr. C. Furness, city electrical engineer and manager at Blackpool, is also a member of the I.M.E.A. Council.

I.M.E.A. Visit to Birmingham.—As a modern switchgear works will doubtless be of interest to many, Messrs. J. H. Tucker & Co. extend to municipal engineers and other interested visitors to Birmingham a cordial invitation to visit their works on any day of the Convention week, except the Saturday (when they are closed for the works' annual outing), and see the making of "Tucker switches." The works are easily accessible by train or tramcar, and can be reached in about 20 minutes from the centre of the city. To facilitate matters for visitors, the company have arranged for the display in the principal hotels, &c., in Birmingham, of a wall sheet, giving the routes and times of trains to "Tuckers' Works." A notification by 'phone or otherwise of intending visits will be appreciated.

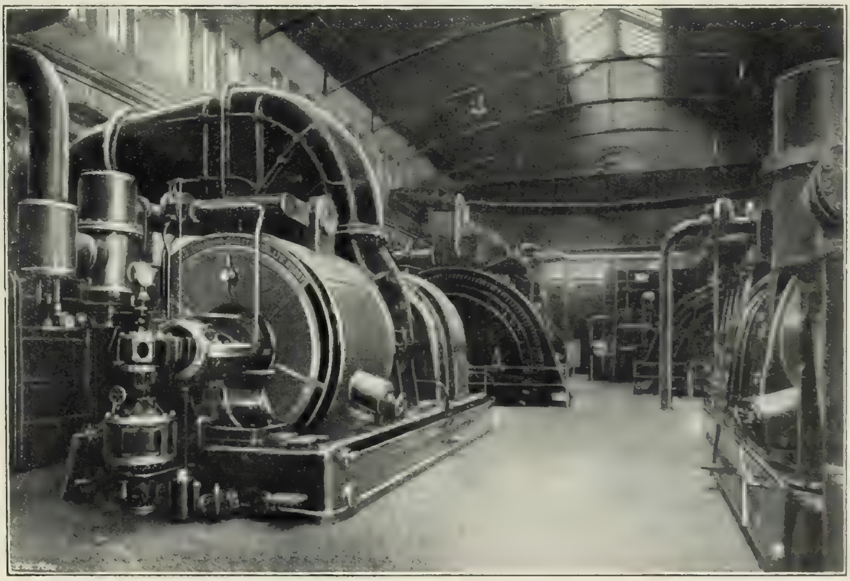
THE COVENTRY ELECTRICITY WORKS.

The Corporation Electricity Works, which form the subject of a visit on Wednesday next, were started in 1895, with a single-phase 87-cycle rope-driven plant. All this plant has, of course, been scrapped, and it is worth noting that the original engine room, at one time filled by plant having a total capacity of 750 kw., now accommodates some 11,000 kw. of plant.

The Coventry Electricity Works, from the Canal.

In 1902 the conversion of the supply from single-phase to a two-phase 50-cycle system was commenced, McLaren marine-type triple-expansion engines with self-contained condensing gear being installed for driving 2,000-volt alternators of the fly-wheel type at moderate speeds.

Altogether four 600-kw. and two 800-k.v.a. generating sets of this type were installed, with generators by the British Schuckert Co., Siemens, and British Westinghouse Co., and these are still in use, although naturally the later and larger plant installed carries the bulk of the load.



Interior of the Engine Room, showing B.T.H. Turbine Units and Reciprocating Plant.

In 1910 the first of three B. T. H. horizontal Curtis turbo-alternators was installed. These machines are all similar, each having an output of 2,750 k.v.a., two-phase, at 2,100 volts, with a ·8 power factor, when running at 1,500 r.p.m. Worthington condensers and pumps are provided, the arrangement of the plant being somewhat novel, as, on account of the water-bearing strata being only some 6 ft. or 7 ft. below the engine-room floor level, the condensers were placed beside the turbines and coupled to the latter by overhead exhaust pipes. The air and circulating pumps are electrically driven, and the circulating water, obtained from the adjoining canal, is cooled by means of four Worthington steel cooling towers which have been installed some distance from the station, on the canal bank. The four towers deal with 250,000 gallons of water per hour.

The switchgear has recently been remodelled by the British Westinghouse Co., and is of the remote-controlled mechanically operated type, with the control panels on galleries situated over the switch cubicles.

The switchgear is of the double-pole automatic oil-break type, no switching being effected on the neutral conductors, which are permanently earthed. The feeder overload relays are fitted with definite and adjustable time-limit elements. The machine relays are of the instantaneous reverse-current type. The last extension of the switchboard, which now occupies two galleries at right-angles, enabled the older board to be converted into a feeder board in two sections supplied through group switches from the extension board, to which the turbo-generators have been connected. The auxiliary circuits on these boards are supplied from a small 100-volt battery.

The Boiler House, Coventry.

The boiler house contains eight Babcock and four Lancashire boilers, fitted with chain-grate and sprinkler stokers respectively—all of the Bennis type, and the same firm also supplied the coal-handling plant.

Local water-borne coal is used, delivered from canal barge to conveyor, automatically weighed, and mechanically transported to the various bunkers and boiler hoppers.

The Components Shop. The Power House.

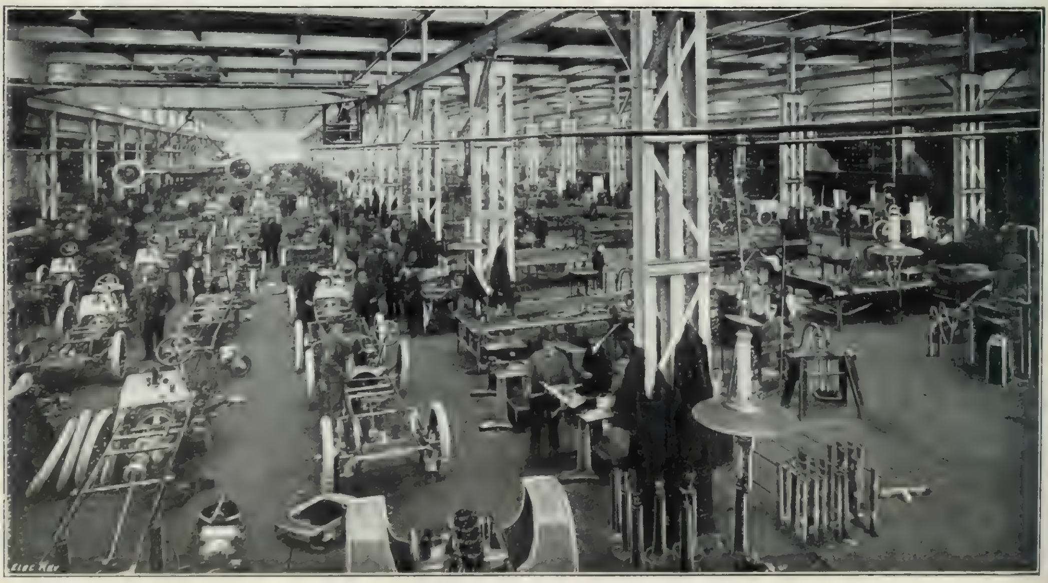
The Daimler Works, Coventry.

As our readers are aware, Coventry is a flourishing centre of the motor-car and cycle industries, and of the 16½ million units sold last year, nearly 15 millions were supplied at power rates.

Large power consumers obtain their supplies from sub-stations erected on their own premises, and the equipment has to be purchased by the consumer before he becomes entitled to bulk-supply rates.

The general distribution in the town is effected through static sub-stations equipped with either 50-kw. single-phase or 100-kw. two-phase transformers, usually at 200 volts.

During the last five years the load factor of the supply has gradually fallen from 25 to 20 per cent., due, we understand, to the increased lighting load, particularly in the large works, which are unlimited in this respect on power rates. Considerable development is also taking place in domestic lighting, which, at the present price of 3½d. per unit, appeals to the smaller consumers.

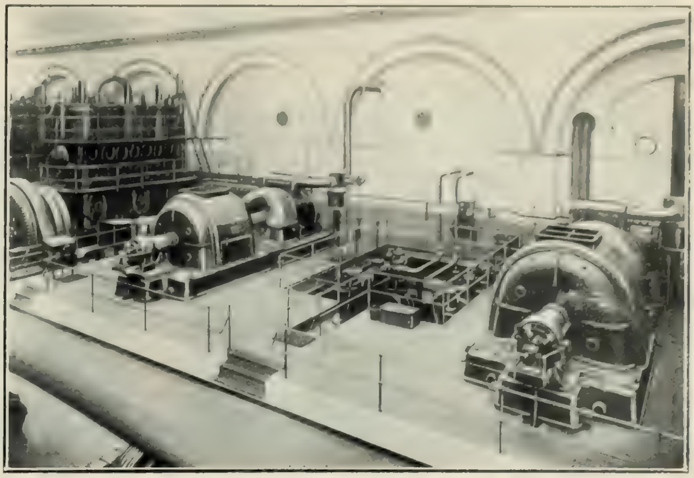


The Erecting Shop, Daimler Works, Coventry.

In concluding this brief reference to the Coventry undertaking, it should be mentioned that the "all in" generation, distribution and management cost of ·346d. per unit sold constitutes a record certainly for municipal stations, on which Mr. Tough, the borough electrical engineer, is to be congratulated. The financial charges, at ·307d. per unit sold are also on the low side, thanks to the wisdom of the Coventry Corporation in past years, in utilising the surpluses of the undertaking in its development and thus relieving the capital account. It appears that altogether considerably over £50,000 has been utilised in this way since 1907.

THE DAIMLER CO., LTD.

This well-known firm of motor-car manufacturers have very extensive works in Coventry, containing some 16 acres of floor space and employing close upon 4,000 men. The chief departments consist of the foundry, machine and fitting shops, erecting, coach building, and the testing and delivery departments. A laboratory for chemical and physical testing, and a department for the mechanical



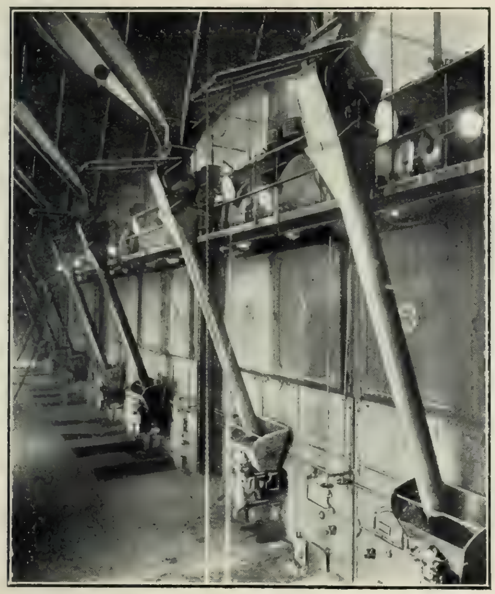
5,000-KW. Turbo-Alternators, Summer Lane Station, Birmingham (see p. 999).

testing of all the materials employed are features of the works.

The tool shop alone employs some 200 men.

Electrical power is used exclusively throughout the works, the group drive being generally adopted, although some 40 or 50 machine tools are individually motor-driven.

At the Coventry works, power is supplied from the company's Diesel engine plant of 1,100 B.H.P., and a two-phase bulk supply is also taken from the Corporation, being fed to an 18-panel change-over feeder board in the power house. This branch of the company's works practically adjoins the Corporation electricity works; the more recent works at Radford, a short distance away, are supplied entirely from the Corporation mains, upwards of 5 million units per annum being taken by the combined works. Lack of space precludes our referring at length to the manufacturing processes employed, but some idea of the magnitude of the company's business can be gathered from our view in the erecting shop, which is 1,000 ft. long and 160 ft. wide.



New Boiler Plant, Birmingham (see p. 999).

A repair department is carried on as a separate organisation, with its own machine tools, &c.

We are indebted to the Daimler Co. for the views here given.

THE GENERAL ELECTRIC CO., LTD.

It is probable that very few of those visiting the Convention will need any introduction to the General Electric Co., whose manufacturing headquarters at Witton will be visited during the week.

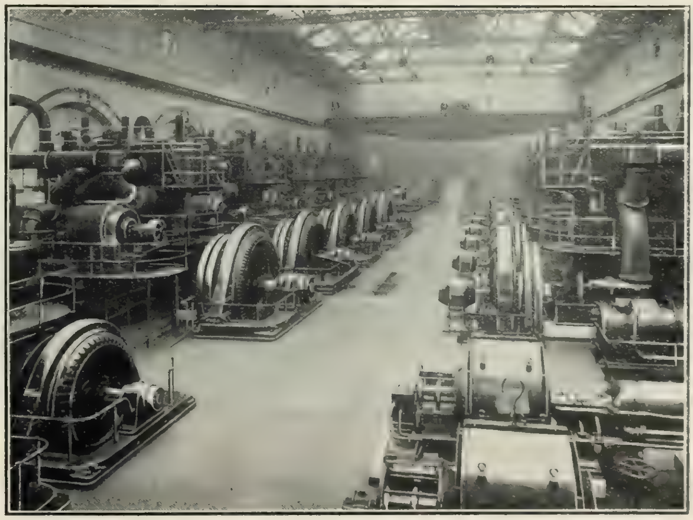
The Witton establishment embraces the engineering shops devoted to the production of large and small electrical plant of all descriptions; departments for switchgear, fans, &c.; a carbon works and conduit works; a power house, with 1,250 KW. of plant for driving the machinery in the works and an adjoining test house. A foundry provides the greater part of the castings used in the works, and the central stores, a three-storey building 350 ft. long, which accommodates stocks of the products of the various factories and facilitates their rapid dispatch to the company's numerous branches, is quite a feature of G.E.C. organisation.

The company are large manufacturers of electric light fittings and heating and cooking apparatus, this branch of the business, however, being carried on at another works in Birmingham. There are also associated factories in Manchester for the production of meters, circuit-breakers, telephonic and telegraphic apparatus, in London for lamps and accessories, and in Southampton for the manufacture of cable, the extent of the firm's business operations being indicated to some extent by its employing some 10,000 people.

Extensive alterations are being made at the Witton Works; a new bay to the engineering shop is projected, while other buildings, including a new test-house, mica shops, &c., are in course of construction.

The meter works will shortly be moved from Salford to a large building to be erected between the present engineering shops and the central stores.

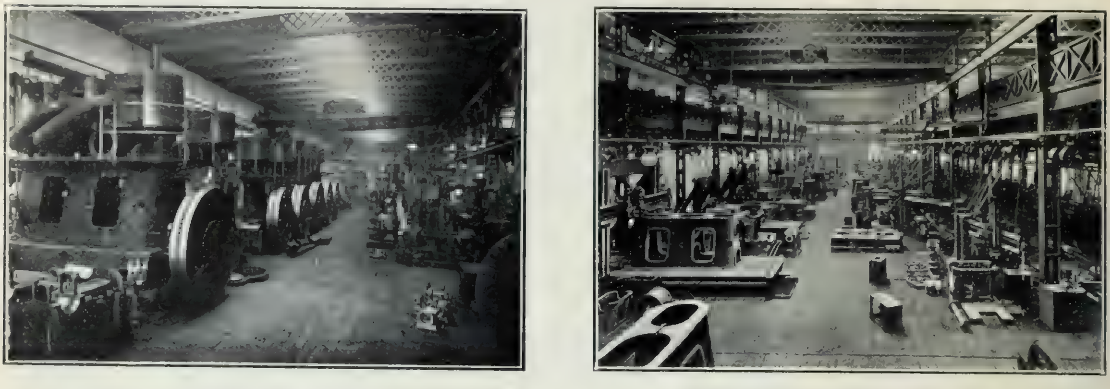
The carbon factory is a particularly interesting branch of the company's business, which, as is well known, was estab-



General View, Summer Lane Station, showing Engine Sets equipped with Exhaust Turbines on the left (see p. 999).

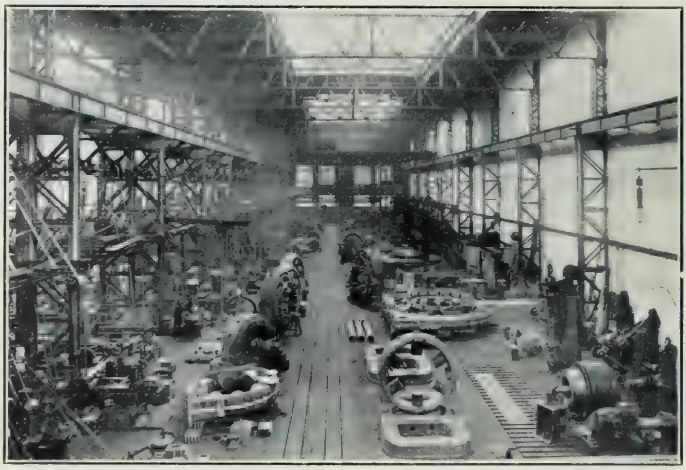
lished in the face of great difficulties, and is, in point of fact, the only arc lamp carbon works in the United Kingdom.

In addition to arc lamp carbons, special machinery has been installed for making battery carbon plates for Leclanché and dry batteries, and a chemical laboratory is provided here for obvious reasons. No reference to the Witton Works would be complete without some mention of the well-equipped club-house, known as the Magnet Club, where dinners and teas are served, and billiards and other recreations are provided. The social side has at all times been cultivated by the company, and facing the works are very large playing fields for cricket, football, &c.



Erecting Shop. Machine Shop.

Typical Views in Messrs. Belliss & Morcom's Works.



Large Engineering Shop, General Electric Co.

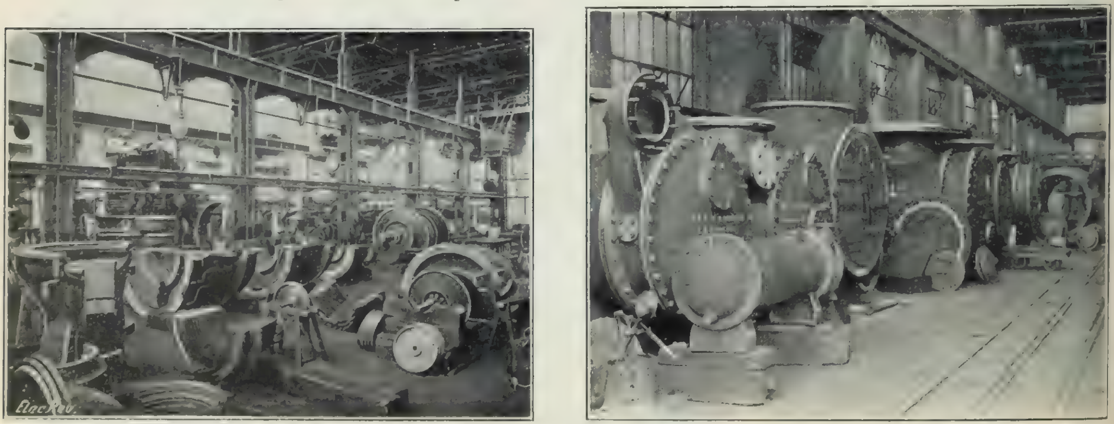
It is difficult to realise that these varied G.E.C. industries and the surrounding property have sprung into existence in the short space of 14 years, occupying land which prior to that time was given up to the rural occupation of cattle grazing. Through the courtesy of the company we are able to illustrate the large engineering shop at Witton Works, detailed descriptions of which have appeared from time to time in our pages.

MESSRS. BELLISS & MORCOM, LTD.

The well-known firm of Belliss & Morcom, whose works are to be visited next week, have for many years been intimately connected with central station work, through the popularity of the Belliss high-speed engine.

This type, no doubt, owes its successful development to the early experience of the firm in the construction of machinery for torpedo boats and destroyers, a branch of business now given up.

The firm builds extensively both high and low-pressure air-compressing plant, and auxiliary machinery for central stations and naval vessels, but greater interest attaches to the more recently added branches of the business, in the making of steam turbines, paraffin and crude oil engines.



Turbine Department. Condenser Bay.

Typical Views in Messrs. Willans & Robinson's Works.

It is some 10 years since the firm took up the question of turbine building for electrical work, and the progressive improvements introduced during this period have enabled them to put on the market a turbine which is at least as satisfactory as any other machine of the kind. The Belliss turbine is of the impulse type, and it has been the endeavour to give it as good a name for reliability as the Belliss engine.

The firm's older works at Ledsham Street have been reorganised, and are employed in the manufacture of small machinery. The larger engines and turbines, which form the greater part of the firm's output, are constructed at works in Icknield Square. The latter contains capacious well-lighted shops, in which the whole of the machinery is electrically driven, and to which a compressed air service is provided by electrical compressors.

The works power station, containing the company's standard engines coupled to dynamos of 700 KW., is equipped with a view to most efficient operation; the power house has been extended and adapted for testing turbines up to the maximum capacity of the boilers, a large condensing plant has been installed for the same purpose, and special resistance tanks are provided for taking generator loads, where such machines are tested with the turbines.

Two special water brakes are in use, the larger one being capable of absorbing 3,000 H.P.

It may be interesting to note that a portable turbine is used for balancing turbine rotors at full speed in the open; all such rotors are balanced both statically and dynamically up to full speed before being inserted in their casings.

Messrs. Belliss do not generally advocate the use of high-pressure turbines for under 1,500 KW. in preference to their engines, but they build exhaust steam turbines down do 200 KW. An experimental turbine of this class used in conjunction with their shop engines has led to a saving of some 1,000 tons of coal per annum, although only of 200 KW. size. The various departments are arranged for the systematic progress of the work, and the erecting shop is served with six large travelling cranes with which engines up to 1,250 H.P. can be lifted bodily. Very complete testing equipment is provided for engine sizes of from 75 to 1,500 H.P., with steam pressures up to 250 lb. per sq. in., the steam being supplied by five water-tube boilers. The electrical equipment provides for pressures up to 10,000 volts, and the test-house provides berths for 12 engines at the same time, and the use of different steam pressures.

THE SUMMER LANE STATION, BIRMINGHAM.

The Birmingham electric supply undertaking has a special interest for those attending the Municipal Electrical Convention, if only because its able chief engineer and manager, Mr. R. A. Chattock, is the honoured President of the Association this year.

It is, moreover, recognised that the extraordinarily rapid growth of electricity supply in Birmingham during recent years has introduced administrative and technical problems of an exceptional kind, and that, due to Mr. Chattock's skilful management, the undertaking is successfully coping with a situation which appears to be unique in this country.

In 1907 under 11 million units were sold; during the last year of working nearly 74 million units were sold. The year 1913 marked a jump from 40 to 63 million units sold, though this was due in part to the taking over of the supplies in areas recently added to the city.

The principal generating station in the city is at Summer Lane; its original equipment was described in our columns, and this has been extended from time to time until the buildings now accommodate some 36,500 KW. of generating plant.

One of our views (p. 997) shows the general appearance of the engine room, a well-known feature of which is the 12 large Belliss engines, half of which drive 1,500-KW. alternators, and are coupled to Belliss-Westinghouse exhaust-steam turbine sets mounted over the condensers—an arrangement which has nearly doubled the output of these units—while the other six are direct-current generating sets each of 1,500-KW. rated output. The latest addition to this station, however, is two 5,000-KW. B.T.H. turbo-alternators, our illustration showing the arrangement of this plant, and giving some idea of its size in comparison with the adjoining engine sets.

The turbines are of the Curtis six-stage type, and work in conjunction with Worthington condensing plant.

The generators are designed to take an overload of 25 per cent. for two hours, and to give an output of 7,500 K.V.A. at ·66 power factor. The exciters are direct-coupled, and the air-pumps steam driven by compound engines working in conjunction with an exhaust heater, through which the condensate passes to the hot-well tank.

The addition of the above plant rendered further boiler power necessary, and a separate boiler house was erected at the back of the original one, and on the same level as the basement of the latter.

This building, which we also illustrate, accommodates seven Babcock & Wilcox boilers, each with a rated evaporation of 24,000 lb. Underfeed stokers are fitted, working in conjunction with two steam-driven fans.

The conveyors to the older boiler house have been adapted to supply the bunkers which have been provided in the new building.

A prominent feature of the Summer Lane plant is the group of 12 steel Worthington cooling towers, now being supplemented by a Davenport wooden tower, which have been installed to cool the condensing water, in view of the limitations of the canal in this respect.

In order to keep pace with the demand, which is increasing at the rate of 5,000 KW. per annum, and pending the erection of the new station at Nechells, it has been decided to install a 5,000-KW. turbo-alternator with boiler plant, &c., at the Aston generating station.

The rapid extension of the supply has necessitated the provision of numerous sub-stations; 17 of these supply the public networks, and over 23,000 KW. of rotary converters are installed for this purpose. In addition, private consumers' sub-stations number over a hundred. In conclusion, we may add that some 48,000 KW. of feeders and trunk mains are connected to the Summer Lane station.

MESSRS. WILLANS & ROBINSON.

The firm of Willans & Robinson—of Willans engine fame—removed from Thames Ditton to Rugby in 1897 when the present Victoria Works were started up.

During the years that have intervened, various extensions have been carried out and the scope of the firm's business has also completely changed, the leading products now consisting of steam turbines, Diesel oil engines, condensing plants and high-lift turbine pumps for collieries, waterworks, &c.

The works now give employment to from 1,000 to 1,100 men. They are driven by a Willans three-cylinder enclosed Diesel engine coupled to a 330-KW. Peebles generator, the introduction of which has, we understand, materially improved the firm's generating costs, which stand at ·6d. per unit with oil at 80s. per ton and a full maintenance and depreciation allowance.

Through the courtesy of Messrs. Willans & Robinson we are able to reproduce some views in their works. One of these shows the turbine blading shop, with parts of the 3,000-KW. turbines for the Perth (W.A.) Government station in the foreground.

A rotor for a 7,500-KW. turbine for Leeds is also shown, and it may be of interest to mention that a 3,000-KW. turbine is under construction for Canadian purchasers, which is designed to run at 3,600 R.P.M.

As the standard Canadian frequency is 60 cycles, Messrs. Willans have prepared a special series of patterns for 3,600 R.P.M. turbines to meet that country's requirements.

It may be of interest to mention that the foundry is one of the largest in the Midlands, and a large number of castings are produced for outside engineering works, in addition to meeting the requirements of the works.

Another view illustrates a series of surface condensers in the erecting shop. We need only add, in conclusion, that the works are well worth the visit proposed on Wednesday afternoon next.

CITY NOTES.

(*Continued from page 990.*)

Brazilian Traction, Light and Power Co., Ltd.

According to the financial papers, the report has been issued covering the period from the incorporation in July, 1912, to December 31st, 1913. The consolidation of the interests of the Rio de Janeiro Tramway, Light and Power Co., Ltd., the Sao Paulo Tramway, Light and Power Co., Ltd., and the Sao Paulo Electric Co., Ltd., which was undertaken in July, 1912, has been successfully carried out, and at December 31st, 1913, practically the entire share capitals of these three companies had been acquired by this company. The total share capital of the company issued at December 31st, 1913, was $114,177,200. The results of the company's operations since its incorporation have proved very satisfactory, as is shown from the following revenue statement;—Revenue from 18 months' operation (July 1st, 1912, to December 31st, 1913); revenue from securities owned, and under contracts with subsidiary companies, $11,266,138; interest on advances to subsidiary companies, $256,698; total, $11,522,836; less head office, general and legal expenses, interest, discount and exchange, $324,343; surplus available for dividends, $11,198,493; dividends Nos. 1, 2 and 3 on 6 per cent. preferred shares, at 1½ per cent. each, $450,000; dividends Nos. 1, 2, 3, 4 and 5, on common shares at 1½ per cent. each, $7,735,495; surplus carried to profit and loss, $3,012,997. At the conclusion of the year 1913 this company, after payment of a regular dividend at the rate of 6 per cent. per annum on its ordinary shares, carried forward a credit balance on profit and loss account of $3.012,997, apart from the credit balances of the general reserve funds and profit and loss accounts of the subsidiary companies. The combined reserves and surpluses of this company and its subsidiaries at the present time reach the total of $15,028,144, which have been expended on the development of the enterprises of the subsidiary companies. Large expenditures have been made in the development of the properties of the subsidiary companies during the last few years, so that they are in an excellent position to supply the demands of the public, which are bound to largely increase, and the result of the present year's operation should show a material increase in net income over the past year. The shareholders' attention is called to the satisfactory returns of the first few months in justification of this forecast. The combined net earnings from the operation of the businesses of the subsidiary companies for the year 1913 show an increase of $1,709,437 over the corresponding period for 1912. The meeting will be held at Toronto on July 3rd.

Bath Electric Tramways, Ltd.

Sir James Sivewright presided on June 4th at Winchester House, E.C., over the adjourned annual meeting for the consideration of the proposals of the directors circulated to the shareholders on February 19th.

The Chairman said they would recollect that on the occasion of the annual meeting he told them that the loan to the bank, which had been outstanding for a great many years and which they were gradually paying off out of revenue, had been practically called up. At the same time they saw the opportunity of using a certain amount of money in the lucrative business of motor cars, and so they submitted a scheme to the shareholders which was discussed and afterwards deferred to the meeting called that day. At the time the suspension of the preference dividend was proposed as a possible necessity, but he stated that the scheme had been framed on extremely drastic and conservative lines, and although he would not commit himself to a promise, yet he said he thought there was a very great possibility of the preference dividend not having to be suspended. He said that this would depend to a great extent on the weather, because the weather was the ruling factor in the case of tramways. Well, the weather had been very propitious and their business had gone on in a most satisfactory fashion, and he was in the happy position of being able to announce that, owing to the revenue having been much in excess of what he had anticipated, and owing to the action of the bank, the preference dividend would not be suspended. Seeing the way they had tackled the question, the bank had expressed their willingness to take a considerably less annual payment than they at first demanded. Now, therefore, they were in the position that they were in before, and they could pay their debenture interest and preference dividend and lay a substantial amount by. The scheme for the present, at all events, was dropped. A committee of shareholders was appointed to confer with the board, and some of them had been to Bath, and he asked them to report their views.

Dr. Moody said that Mr. Roe and himself visited Bath and were accompanied by a personal friend, who was an electrical tramways expert. They visited the power house and enquired into a number of the company's subsidiary interests, and they formed a very unfavourable opinion of the company's undertaking. They met the board in London and they agreed to ask Messrs. Balfour, Beattie & Co., well-known tramway experts, to report on the system. These gentlemen had reported quite confirming the unfavourable view the committee held concerning the management of the company. He and Mr. Roe considered that the control had been most inefficient, and that the energies of the company were being frittered away in running a foundry. A meeting of the board and the committee was arranged to take place the previous day, when the committee would have had a suggestion to make as to the financing of the company. They wished to make sure, however, that the Board would endeavour to follow the suggestions made in the report of Messrs. Balfour, Beattie & Co. In a preliminary interview with the Chairman, however, they obtained from him a most remarkable statement. They heard that the board was so dissatisfied with the unfavourable report of Messrs. Balfour, Beattie that, without consulting the committee, they had asked another expert, Mr. Hamilton, of Leeds, to make a report. He ventured to think that such a procedure on the part of the board was most unwarranted. His belief was that the Board improperly sent Messrs. Balfour, Beattie's report to the manager at Bath, and the manager then suggested the calling in of some other expert, so that the management might be white-washed. That was a way of conducting business that his colleagues on the committee and himself were not accustomed to, and on that account they refused to consider the matter further with the board. They had had a most extraordinary statement from the Chairman that day. Two months ago a scheme was put before them which fundamentally affected the preference shareholders, who were asked to forego their dividend for a number of years. Now the Chairman came and told them that the position was changed, and that the preference shareholders would receive their dividend in future. It seemed to him that the sooner the board ceased to control their affairs the better. The committee had come to the conclusion that this was a concern in which the board were to a large extent managed by the staff at Bath. They had heard a great deal about the motor 'buses and the torpedo cars, but Messrs. Balfour & Beattie said they had not produced any profit, and, personally, he believed they were making a heavy loss on them. Messrs. Balfour & Beattie showed that the Bath undertaking was very much over-staffed and that they could make many economies.

Mr. Roe, who accompanied Dr. Moody to Bath, endorsed the remarks made by the last speaker, and spoke at some length on the past accounts of the company. He suggested that money had been frittered away in motor 'buses, a foundry, a tea shop and side-shows, which took up much of the manager's time which could have been better devoted to the tramway undertaking. He contended that the appointment of Mr. Hamilton to make a report was nothing less than scandalous, and hoped the shareholders would show their condemnation of such action by giving their proxies to men deserving of confidence.

Mr. Topham, who moved the appointment of the committee at the last meeting, said they all ought to have the engineers' reports in their hands to see what they were. He agreed with Dr. Moody in regard to the "right-about face" turn of the board, but, on the other hand, surely Dr. Moody did not mean to infer that the report of Mr. Hamilton was not worth anything at all. He did not see how they could judge by the verbal statements of the committee but they must have the reports and think for themselves.

After a further lengthy discussion, to which the Chairman replied, the Chairman said that there was nothing before the meeting, but the reports of the experts would be sent to the shareholders.

The meeting then ended.

Madras Electric Supply Corporation, Ltd.

The annual meeting was held at 1, Queen Victoria Street, E.C., on June 3rd, Mr. James Gray (the Chairman) presiding.

The Chairman, in proposing the adoption of the report (Elec. Rev., p. 959), said that since the last meeting Mr. Walrond and Sir W. J. Cunningham had resigned their seats on the board. He (Mr. Gray) was elected to fill the vacancy caused by Mr. Walrond's resignation and his colleagues had done him the honour of appointing him Chairman. He had been a director of the Madras Tramway Co. since its incorporation, and he hoped that his knowledge of that undertaking would be of service in carrying on the administration of the Electric Supply Corporation. Important changes had also taken place in Madras, and the arrangements foreshadowed by the Chairman at the last general meeting had been carried out and the joint management of the two companies was inaugurated on the 31st December last. The directors regretted that the results for the year were unsatisfactory. The revenue accounts showed a debit balance of £5,309, and after adding debenture interest, less interest receivable and dividend on the tramway shares, there was a total loss of £10,526. In view of the report for 1912 and the Chairman's speech at the last general meeting, they were doubtless prepared for unsatisfactory results, but so great a loss could hardly have been expected. The troubles with the old plant, however, were even greater than was anticipated, and it was with the utmost difficulty that it was kept running at all. That was reflected in the item "Generation of electricity," the total costs whereof amounted to £34,511 as compared with £19,182 last year, an increase of 80 per cent., although the number of units sold increased only 27 per cent. The cost of generating per B.T. unit sold was 1.819d., which was made up as follows: Fuel 1.196d., oil .168d., wages and salaries .240d., repairs .215d. When he told them that the cost of generating with modern plant of similar capacity would be considerably less than half of that they would appreciate why the results for the past year were so unfavourable. In view of the inefficiency of the old plant and the precarious position in which they would be placed if any further failure occurred, they had been constantly urging for the completion of the new plant. In addition, however, to delays incidental to a large contract of that kind, the contractors had been handicapped by difficulty in procuring supplies of local material, the starting of the first set having been postponed for many weeks waiting for fire-bricks for the boilers. In addition, erection had been retarded on account of illness among the European staff of the contractors. He could assure them, however, that the matter was receiving the closest attention of the management and everything possible was being done to expedite completion of the new plant. In order that the shareholders might have the latest information the consulting engineers cabled to Madras the previous day to enquire as to the rate of progress. They had that morning received a cablegram that a preliminary run of the first boiler and the first turbine would take place on the 6th inst. The second and third turbine would be completed on the 13th inst., and fire-bricks for the second and third boilers had been promised for the 24th inst., and if those promises were fulfilled those boilers would be ready for steaming on 11th July. The consulting engineers thought the preliminary tests should be completed by the end of July, when the whole of the new plant would be in beneficial use. The cost of distribution was less than last year, the maintenance and repairs to mains having been reduced. Management expenses did not show any reduction, the change not having been inaugurated until the end of the year. The credit side of the revenue account was more satisfactory, for although no serious efforts could be made to procure new consumers, the revenue increased 21 per cent. Their representatives in Madras had no doubt that as soon as energetic steps could be taken there would be a large development in the demand for electrical energy. Negotiations were proceeding with the Corporation of Madras for more street lighting, but having regard to the very high price of fuel the directors considered that the rate of 2½ annas provided by the licence was in some cases insufficient, and they had applied to have that question referred to arbitration as provided by the Indian Electricity Acts. Further, in their opinion, the present flat rate to private consumers for light and power was too low, and in conjunction with the consulting engineers, Messrs. Merz and McLellan, they were considering what could be done to increase the rate, but they were not yet in a position to formulate a definite proposal, the conditions in Madras being somewhat exceptional. There was so much scope however for the reduction of costs that whether they decided to increase the rates for lighting or not they were satisfied that the present results could be greatly improved. Unfortunately they would only get the full benefit of the new plant for four or five months this year, but he was glad to say that under the new management the cost of generating with the old plant had been reduced and therefore they looked forward to presenting accounts for 1914 of a much more satisfactory character. The tramway business continued to develop satisfactorily. The traffic receipts in 1913 amounted to 644,201 rupees, being an increase of 7.71 per cent. on 1912, and down to the end of May this year there was an increase of 8.1 per cent. on the corresponding period of 1913. At the end of 1913 there was available for distribution, including the amount brought forward and after adding debenture interest and providing £7,000 for depreciation and renewals, the sum of £12,552. A dividend of 6 per cent. was paid on the preference shares and 5 per cent. on the ordinary shares, and the sum of £3,320 was carried forward. For 1912 a dividend of 4 per cent. was paid on the ordinary shares and £5,000 only was transferred to depreciation and renewals. The relaying of the permanent way with 90lb. rails and the renewal of the rolling stock would be completed this year, and the transfer from revenue to depreciation and renewals fund at the end of 1914 would, they expected, be considerably reduced. They had expended during the year £41,977 on capital, of which £31,229 was on new buildings and machinery. To enable them to complete the new installation it would be necessary to provide a further amount of capital on account of which they had issued since the accounts were closed £4,000 of 6 per cent. debentures, increasing the amount issued to £192,675, leaving £7,325 unissued and available when required. He regretted that he had not been able to submit a more encouraging statement, but they were confident that the company was now on the point of turning the corner and better times were in store for them. One thing he could say and that was that the directors and staff would spare no effort to put the undertaking at the earliest possible moment on a basis which would reflect credit upon themselves and what was of greater importance would provide shareholders with a return upon the capital which they had invested.

Mr. J. G. B. Stone seconded the motion.

In reply to questions the Chairman said that he was not at present able to say what the loss would be of replacing the old plant. Until the new plant was running, they were still doubtful as to what proportion of the old plant would be able to be beneficially used. Undoubtedly if the company were commencing now they would put in the plant that was now being installed, but at the time they put in the old plant he did not think that any firm of engineers would have recommended the present type of plant. At that time they had not sufficient knowledge of turbine plant.

The report was then adopted.

Birmingham District Power and Traction Co., Ltd.

The directors report that the total revenue for 1913 from all sources was £126,116 compared with £115,[illegible] for 1912. The expenses amounted to £61,158 compared with £[illegible]. After providing for all sums chargeable to revenue, including repairs, maintenance, sums payable to local authorities, and placing £1,000 to the renewals fund there remains £[illegible]259 plus £109 brought forward, making a total of £[illegible]. From this has to be deducted interest on loans £[illegible], interest on debenture stock £17,880, leaving a balance of £[illegible]. Deducting debenture sinking fund £5,128 and dividend for the year on the 5½ per cent. cumulative preference shares £11,558 there remains £14,512. The directors recommend a dividend on the preferred ordinary shares at the rate of 5½ per cent. for the year £12,250, putting to reserve £2,000 and carrying forward £262.

The gross receipts from the tramways were £55,686 compared with £53,640 in 1912. The gross receipts from the lighting and power department amounted to £36,117, an increase of £6,942 compared with the previous year. The dividends received from investments produced £30,849, compared with £30,180 in 1912.

Expenditure on the capital account of the tramway undertaking was incurred during the year to the extent of £18,134, principally in the purchase of motor omnibuses for hire to the Birmingham and Midland Motor Omnibus Co., Ltd. Practically the entire capital of the latter company is owned by this company. A sum of £172,876, representing the book value of the Smethwick Electric Supply Undertaking, has been received from the Shropshire, Worcestershire and Staffordshire Electric Power Co. on the transfer in November last to that company of the Smethwick Electric Lighting Order, 1898, with the power stations, mains, etc., forming part of the undertaking. The amount so received has been credited to capital account and the deposit with the company of £212,091 10s. 8d. which appeared in the previous balance sheet has been repaid.

During the year the balance of £44,890 of the 4½ per cent. debenture stock of the company was issued to provide funds for the extension of the Smethwick power station pending the sale of the electric supply undertaking to the Shropshire Power Co., to finance the Birmingham and Midland Motor Omnibus Co., Ltd., and for other purposes. The total amount of debenture stock now outstanding is £418,528. In accordance with the trust deed, a sum equal to one per cent. of the debenture stock issued, together with an amount representing interest on the stock previously redeemed, was paid to the debenture trustees in July last and was applied by them in the purchase and cancellation of £6,055 stock.

The company holds 161,566 ordinary shares of £1 each in the Electrical and Industrial Investment Co., Ltd. A proposal has been made by that company to convert the ordinary shares of £1 each in that company into 7 per cent. preferred ordinary shares of 10s. each and deferred ordinary shares of 10s. each, in equal proportions, to which the company has acceded.

Increases have taken place in the traffic receipts of all the associated companies principally as a result of the continued good trade in the various districts served by the companies and the prevalence of exceptionally fine weather during last summer, and in all cases these companies have put larger sums to reserve.

The increase in the expenses is due to the higher cost of material and the increase in the rates of wages paid to the employees.

The electric lighting and power supply business having been sold to the Shropshire, Worcestershire and Staffordshire Electric Power Co., that company will in future supply the electricity required for working the company's tramways.

	1912.	1913.
Miles open :—		
Route miles	10.32	10.32
Single line	4.66	4.66
Double line	5.66	5.66
Passengers carried	12,159,739	12,582,829
Average rec. per passenger	.991	.991
Average exp. per passenger (apart from rent of line, etc.)	.531	.631
Proportion of expenses to receipts	53 p.c.	63 p.c.

The annual meeting was held on June 3rd at the Electrical Federation Offices, Kingsway, Mr. C. S. B. Hilton presiding.

In proposing the adoption of the report, the Chairman said the business again showed expansion in both branches, and although it had not been possible to recommend an increased dividend they had no reason to be dissatisfied with the position or with the outlook for the future. The receipts from the tramways showed an increase of £2,000, of which £400 was contributed by the parcels department, while running expense had increased by £1,300, of which £760 was accounted for by increases in wages and salaries. Repairs and maintenance had increased by £1,100, mostly caused by additional expenditure on rolling stock. Sundry receipts showed a considerable increase, which arose chiefly from the sum of £913 paid by the Birmingham and Midland Motor Omnibus Co. for hire of omnibuses. The number of passengers carried during the year increased by 420,000, but the expense per passenger and the ratio of expenses to receipts also showed substantial increases. The track, rolling stock and overhead equipment had been maintained in first-class condition during the past year, and negotiations were now proceeding with the Smethwick Corporation for certain improvements in the track which, if carried out, would permit of services being carried out on the main line and on the Bearwood Road line which it was hoped would result in increased traffic. On the electric supply side they had again the satisfaction of reporting steady progress; 10,150,473 units were sold during the year compared with 7,745,887 in 1912. The receipts increased by £6,941 and the profits amounted to £12,847 against £11,114 in the previous year. The higher cost of fuel, which maintained throughout the year caused a considerable increase in the generating expenses, and in the earlier months of the year under review they were still feeling the effects of the coal strike. That was the last time to which he would have to refer directly to the working results of the electricity supply side of the undertaking, as the whole of that undertaking had been sold to the Shropshire, Worcestershire and Staffordshire Electric Power Co., and in future they would only have an indirect interest in the working of that company through their holding in it. He referred last year to the labour question. They had again this year to meet further demands for increases in wages and salaries, and as far as they were justified he hoped they had met them in a generous spirit. They were not in any exceptional position in that matter. The demand for increased wages existed among the whole working population of the country. The expenses of living had increased and employers of labour during times of prosperity recognised, he thought, all fair demands willingly. That was right, but the cost to the company was not light and would give rise to considerable anxiety when the tide of prosperity turned. The question of economy was therefore always before the directors. Turning to the investments, the interest received on investments in the associated companies amounted to £30,849 compared with £30,180 in the preceding year, an increase of £359. The South Staffordshire Tramways (Lessee) Co. again failed to pay a dividend on its preference shares, but placed £3,500 more to reserve. They received an increased dividend on the ordinary shares in the Dudley Co.—4 per cent. against 2 per cent.—and they received an increased amount in dividend on the preference shares in the Investment Co., the dividend being for twelve months instead of for seven months as in the previous year. On the increase of their holding of debenture stock in the South Staffordshire Tramway (Lessee) Co., on which they received only six months' interest in the previous year, they had received a full year's interest this year, so that in spite of the fact that the equivalent of the dividend received in past years from their holding in the old City of Birmingham Tramways Co., Ltd. had not been received this year from the holding now representing that investment, there was room for congratulation that the dividend received from the associated companies still showed an improvement. He mentioned last year that they had every reason to hope for a substantial dividend from their holding in the Investment Co. for the year ending December 31st, 1913. That hope had not been realised, but he thought a reference to the report and accounts of that company would convince them that their investment was a good one, and that the conservative policy of the directors was entirely in their interests in the present financial conditions prevailing. Turning to the capital account, they would remember that there was an item of £212,091, a loan from the Shropshire and Worcestershire Co. That had been entirely liquidated during the year, and while the capital account had been increased on account of the tramway undertaking by £180,000, chiefly in the purchase of motor omnibuses, and on the lighting side by £6,523, it had been credited with £172,895, the result of the sale of the electric light undertaking of the Shropshire Power Co. Advances had been made to the Power Co. since the close of the year pending the completion of arrangements for the issue of the further capital on its own behalf to provide for the purchase of the electrical supply undertaking in Dudley and for additional plant now in course of delivery at the Smethwick power station. When the Bill now before Parliament to authorise the Shropshire Co. to issue preference shares had received the Royal assent, the company would become one of the biggest supply companies in the country. The area in which the Shropshire Power Co. operated was capable of large future development, and it would be necessary from time to time during the next few years to incur considerable expenditure for that purpose. During the year the Corporation of Birmingham decided that they must have all the means of transport inside the city in their own hands, and an agreement had been concluded with the Corporation by which they bought the garage of the omnibus company and 30 of the omnibuses of the Birmingham and Midland Motor Omnibus Co. He was glad to say that their relations with the Corporation continued to be very friendly, and as a result the agreement provided that the company's omnibuses, which would in future operate in the outside districts around Birmingham, might nevertheless run through into the centre of the city, but without plying for hire in the city and at a minimum fare. That was a satisfactory arrangement for the company, having regard to the fact that they had no longer any interests inside Birmingham. The outside business showed signs of expansion and good increases in receipts had taken place. The omnibus company had on order 40 additional 'buses to replace those sold to the Corporation. With regard to the reports of the associated companies, he could only add that the conservative policy of the directors of the Electrical and Industrial Investment Co. was fully appreciated by that board, having regard to the troublesome financial times through which they had been passing and the end of which was not even yet in sight. The result of the division of the ordinary shares of that company into half preferred ordinary and half deferred ordinary secured at least the equivalent of a 3 per cent. dividend in future on their original holding of £161,566 ordinary shares. The report of the Dudley and Stourbridge Co. showed a marked improvement on that of previous years. The South Staffordshire Tramways (Lessee) Co. appeared to have definitely turned the corner and to have put its bad days behind. The Wolverhampton and District Co. had also had a prosperous year and was able to increase its reserve fund and to pay the same dividend as in 1912. The Birmingham & Midland Motor Omnibus Co.'s receipts had increased by over £20,000, and that company was also able to show a fairly satisfactory result. To summarise the position, the total receipts showed an expansion of £10,718, while the expenses had increased by £8,568, giving a net improvement of £2,150, whilst the surplus at their disposal amounted to £58,258 against £55,108. As a result of the transactions of the year they had £63,000 in reserve funds, in addition to which the subsidiary companies had their own seperate reserve and renewal funds, the total amount of which on 31st December last was £87,829. They were therefore able to maintain the dividend on the ordinary shares at 3½ per cent., to place £4,000 to renewals fund, compared with £5,000, and to place to reserve £2,000 against £3,000.

Mr. J. A. Lycett seconded the motion, which was adopted without discussion.

Singapore Electric Tramways, Ltd.

Sir Frank. A. Swettenham (chairman) presided on Tuesday at 19, St. Swithins Lane, E.C., over the annual meeting.

The Chairman, in moving the adoption of the report, said the capital now stood at £100,000, effect having been given in the accounts to the reduction of the shares from £1 to 5s., which was sanctioned by the court in February of last year. To meet these new conditions £3,825, the debit balance of the profit and loss account at December 31st, 1912, had to be written off, and the amount at which the tramway undertaking stood in the books of the company had been reduced by £296,175. Last year he referred to the progressive state of the company's business, and the year 1913 showed a marked improvement over 1912, the profit being £9,385, and they now for the first time had a balance on the right side. They had given earnest consideration to the question as to the commencement of the payment of a dividend. The board were as anxious as the shareholders that the time should be as early as possible, but they considered it prudent this year to recommend that the balance of profit should be carried forward, although they did not think it would be too optimistic to say that by next year they would be in a position to recommend the payment of a dividend which they hoped would be the forerunner of an annual distribution of profits. A strong reason for deferring the question of a dividend was that the board for long had under consideration the recommendation of their manager to construct a parallel line of tramways in the most densely inhabited part of Singapore, and that would cost a large sum. The project had much to recommend it, but depended at present on certain questions in regard to two bridges which had to be widened, and the apportionment of the cost of this work was still the cause of correspondence with the Singapore Municipality. As time went on extensive repairs were needed, and for all these reasons the board considered that it was well to strengthen the financial position of the company and carry forward the profits of 1913. They had already shipped several items of the new power plant, and they hoped to get the 350 kw. Diesel engines shipped in the course of a week or two. This new plant would cost about £16,000 f.o.b., so that with the freight and erection the total capital expenditure would be in the neighbourhood of £20,000. The revenue showed an increase as compared with the previous year of £9,360, or approximately 15 per cent. The gross receipts from the sale of current for lighting and power were almost 10 per cent. down as compared with 1912, but this decrease was wholly accounted for by the revised scale of rates charged to the Municipal Commissioners of Singapore, which came into force on January 1st, 1913. Year after year, the revenue from this source had shown a high percentage of increase and had become an important part of their business, and clearly therefore it was their duty to go into the matter very closely and to offer the best terms they could to the Municipal Commissioners in order to secure a continuance of trading with them. They were confident that the demands would increase and fully justify the course they had taken. As was pointed out in March last year, the supply contract was to be extended for a period of 10 years from the date that electrical current was supplied to the Tanglin district. They were not yet able to say when the first supply for this district would be required, but until it was they had the satisfaction of knowing that they had the minimum of 10 years' trading with the municipality before them. The expenditure for the year had increased somewhat in one or two branches, particularly in fuel, which was nearly £1,200 in excess of 1912. This was attributable almost wholly to the increase of 373,000 units of energy, and coal also had been slightly dearer. The traffic expenses showed an increase of about £600, or about 4½ per cent. more than the previous year. Maintenance and repairs were £2,600 higher, the principal item being an increase of £2,000 in the work on the permanent way. This was an expenditure which could not be avoided, and which must not be neglected. In Singapore a great deal of their track was very little above sea level, the road being constructed on what was practically a mud subsoil, and it was therefore very necessary that any defects in the permanent way through sinkage or other cause should be promptly repaired. The expenditure on the track, however, meant an avoidance of what might become a heavy expense for rolling stock maintenance. They had written off to depreciation on track, rolling stock, etc., £13,269. It was shown by the statement of averages published with the accounts that they carried over 16 million passengers during last year, or an increase of nearly 2,200,000, and it was very satisfactory to note that they were more than maintaining this year the volume of traffic. The receipts for the current year to Saturday last were 9,671 dollars in excess of the corresponding period of last year. Notwithstanding the increased traffic, the car mileage was reduced by 34,677 miles as compared with a reduction for the previous year of 29,698 miles. The passengers carried per car mile had gone up from 6.71 to 7.9. The receipts per car mile for last year were 8.69d., as against 7.44d. in 1912. The expenses per car mile were 4.42d., or an increase of 0.3d. per mile. The expenses of the tramway undertaking represented 50.9 per cent. of the receipts, while the total Singapore expenses were only 49.53 per cent. of the total Singapore revenue. In 1912 these figures were 57.25 per cent. and 52.66 per cent. respectively. In conclusion the chairman said the board had great pleasure in expressing their satisfaction at the manner in which the work of the company had been conducted in Singapore by their manager and his staff.

Mr. E. Davis seconded the motion.

Mr. Shaw contended that the board were using the profits of the company to purchase debentures, and that seeing how long the shareholders had been without a dividend they ought to have one.

Mr. Waldron asked from whom the debentures were bought, and if the company had purchased any from members of the board or from companies with which members of the board were associated.

The Chairman said the board had only one interest—it was that of the shareholders—and seeing that the debentures were bought at a considerable discount and they were saving interest, he thought it was a good way of using their money.

Mr. E. Davis (a director) said the debentures had been purchased slightly below the market rate. In one case they bought a number from a company with which some of them were connected. The new construction they had in view would cost £45,000, and they would be able to borrow money for the purpose on the security of the debentures they had in hand.

The Chairman said they anticipated that the work they contemplated would pay them well. He had said they hoped next year to pay a dividend, and personally he would be greatly against the payment of a dividend unless they saw their way to continuing it.

The motion was carried and the retiring directors re-elected.

Bombay Electric Supply and Tramways Co., Ltd.

The directors report that for the year ended 31st December, 1913, the total revenue from all sources, including the amount represented by sale of current to the tramways, amounted to £276,468, an increase of £19,768, or 7.70 per cent. over the previous year. The total expenditure was £130,896, an increase of £2,878, or 2.24 per cent. The net profit aggregated £145,573, showing an increase of £16,891, or 13.12 per cent. After deducting interest on the debenture debt amounting to £36,132, placing £23,500 to depreciation account, £6,668 to sinking fund, and deducting £8,000 for the redemption of the second debentures of equivalent par value drawn for repayment on the 1st July last, there remains £71,273 plus £5,072 brought forward.

The directors recommend payment of the dividend on the 6 per cent. cumulative preference shares £22,497, and that accrued to 31st December, 1913, £13,498; a dividend on the ordinary shares at the rate of 6 per cent. per annum, free from English income tax, £36,000, leaving £4,350 to be carried forward.

The gross receipts from the tramways amounted to £170,672, compared with £163,662. The working expenses were £81,123, against £78,842. The balance of receipts over expenses in respect of the year's working is £89,549, compared with £84,820 for the previous year.

The progressive expansion of the company's traffic reflects the building activity in many districts of the city, and the recent opening of the new and extensive Alexandra Docks is evidence of the always increasing trade of the port. In addition to the extensive programme of the Bombay Improvement Trust, a special committee appointed by Government has recently sat to consider and report on further measures for the development of the city, with special reference to the question of greater facilities for urban transportation. It is anticipated that further extensions of the tramway system will be advocated and facilitated. To meet the present demands of the traffic ten more two-car trains are to be added to the rolling stock. Three of these are already in service, and the remaining seven are now under construction in the company's workshops.

	Year ended 31st Dec., 1912.	Year ended 31st Dec., 1913.
Miles opened—		
Route miles ...	20.38	20.38
Passengers carried ...	38,612,891	40,692,022
Proportion of expenses to receipts ...	49 p.c.	48 p.c.
Cars in stock—		
(A) Running singly ...	150	150
(B) Coupled as two-car trains ...	60	60

The gross revenue from electric supply for the year, including the amount represented by the sale of current to the tramways, aggregated £105,466 compared with £91,414 for the preceding year. The working expenses were £46,284 against £45,683. The receipts, exclusive of the revenue represented by the current supplied for the tramways, amounted to £77,569 compared with £61,163 for 1912. The balance of £59,182 compares with £45,731 for 1912.

Year ended.	Consumers.	Equiv. 30-watt lamps.	Units sold.			Revenue.	Expenses.	Balance.
			Lighting and power.	Tramways.	Total.	£	£	£
1911	2,091	241,897	3,356,184	4,581,614	7,937,798	76,530	48,264	28,266
1912	3,112	300,250	4,364,977	4,792,167	9,157,144	91,418	45,683	45,730
1913	4,468	356,591	5,792,308	5,160,302	10,952,610	105,466	46,284	59,182

The progress of the supply branch continues satisfactory. All the extensions made to the company's mains last year are producing profitable results, and further extensions are being laid this year. The generating costs at the Kussara power house have again recorded a satisfactory declension. The new 2,000 KW. turbine set was brought into service in April of this year, and promises to prove the most economical generator yet installed. Several important contracts for the supply of power are under negotiation. At the request of the Municipal Corporation the company has arranged to make a demonstration of the most up-to-date methods of electric street lighting in certain streets of the city.

The capital expenditure during the year has aggregated £58,315, and has been applied to the extension of the company's mains, the consequent provision of additional sub-stations, the completion of the equipment of the Kussara power house, and the provision of additional rolling-stock as above-mentioned.

United Electric Tramways of Montevideo, Ltd.

In their report for the year ended 31st March, 1914, the directors state that the results of the operation of the tramway system for the year to 31st October, 1913 (the fiscal year of the Uruguayan Co.), are shown as under:—

	1912-13.	Increase.
Gross receipts ...	$1,755,572	$127,936
Operating expenses ...	1,045,941	111,089
Net receipts ...	$709,631	$16,847
At Exchange of $4.7 to the £ ...	£150,985	£3,584
Passengers carried ...	44,622,690	3,886,488
Car miles run ...	7,461,194	382,019
Percentage of operating exp. to gross receipts ...	59.58	2.14

Traffics were affected by the interruption of many of the company's important services owing to the repaving works which were in progress during practically the whole year. The paving of important streets in the city is still proceeding, and it is expected this work will continue during the greater portion of the current year, when the paving contracts entered into by the Municipality of Montevideo should be completed. The increase in the ratio of working expenses is chiefly due to the fact that the gross receipts have not risen proportionately to the increase in wages and cost of general repairs and renewals. The construction of the two sub-stations has been practically completed, and the erection of the plant is being proceeded with. It is expected that these sub-stations will be ready for operation in time for the heavy traffic during the next summer season. The new car-shed, and also the extension to the existing central car-shed, have been completed and are now in service. These extensions necessitated the provision of further capital, and £84,502 debenture stock, 10,000 preference shares and 19,800 ordinary shares were issued. The amount received from La Sociedad Comercial de Montevideo in respect of dividend and interest was £147,214. The profit and loss account for the year, after providing for administration expenses, and charging £46,930 for debenture interest, shows a credit balance of £91,282 plus £14,020 brought forward, making a total to be dealt with of £105,302. The following amounts have been set aside:—For redemption of debenture stock, £3,161; for redemption of the preference and ordinary share capital, £2,500; for renewals and contingencies, £30,000. After paying the preference dividend of 6 per cent. and an ordinary dividend of 7 per cent. for the year, there remains to be carried forward £12,641.

Reference is made to the death of Mr. Frame Thomson, who had been a director of the company from the commencement, and had rendered it valuable service. Mr. George Balfour, who has a wide knowledge of tramway engineering and administration, was elected a director of the company on 31st October, 1913.

In view of the overspent position of its capital account, and of the further capital expenditure which it will be necessary for the company to undertake in course of the next three years upon the creation of additional revenue-earning assets in the shape of extensions to its mains, anticipated extensions to the tramway lines, and the provision of the new Kingsway depot and workshops, the necessity of increasing the company's capital will shortly arise. The directors are giving the question of the form which this issue should take their careful consideration and their conclusions regarding it, should a further issue of shares seem advisable, will in due course be submitted for approval. £3,843 of the company's 4½ per cent. debenture stock was purchased and cancelled last year for the purpose of the sinking fund, reducing the amount outstanding on 31st December to £583,730. Mr. A. T. Cooper on resigning his position as managing engineer of the company at Bombay, has been elected a director.

New General Traction Co., Ltd.

Baron Emile B. d'Erlanger presided on Monday at 8 Crosby Square, E.C., over the annual meeting.

In moving the adoption of the report (Elec. Rev., p. 957), the Chairman said that it was impossible to make a comparison between the accounts of this year and last, because in view of the reconstruction of the company last year, the accounts were for a broken period. This was the first year, taken as a whole, under which the company had operated since the capital was reduced, and there had only been one class of shares. The report was so simple and clear that he would only be wasting their time to repeat the figures one by one. He wanted to draw their attention to the fact that the company was now simply a trust company holding certain securities in various enterprises, such as the Darby, Media and Chester Street Railway Co., and Norwich Tramways Co., and the Douglas Southern Electric Tramways. From their American enterprise they derived a fixed income on the bonds, and 5 per cent. guaranteed interest on the shares. From the Norwich Co. they received a dividend which naturally fluctuated with the results attained in the year. From the tramways company last year they received 3 per cent. He was glad to say this company seemed now to have passed over what might be called the children's diseases stage, and had attained a stable earning capacity, and he trusted they would find improved results as time went on. They held a large interest in the Douglas Electric Tramways as compared with the total capital of that company, and that also showed a fluctuation according to the seasons because it was a holiday traffic, and they had to reckon on the weather which prevailed during the summer holidays as to whether their receipts were better or worse. They had a very good income last year, and they trusted they would get an equally good one this year. He thought they might say, so far as the New General Traction Co. was concerned, it was established on an absolute sound and permanent basis, and that they might look forward to a somewhat increased receipt from some of their subsidiary companies, and, therefore, somewhat increased dividend themselves in the future. He thought they could look upon a dividend of 4 per cent. as permanently established. The Norwich Tramways were an improving company, and in accord with the Municipality of Norwich the company had applied for certain powers for extensions which would involve a capital outlay of some £30,000. The Bill had passed the House of Commons, and was now before the House of Lords. He had had the privilege of being connected with the company for a great many years, and had acted as its chairman since the death of Captain Paley. He took the finances of the company in hand at a time when it was faced with a great many difficulties, and, thanks to the insistent labours of Mr. Hopkins and the patience and ability of his colleagues, the company had attained a position which he considered as permanent, and from which he considered possible risks of any retrogression were effaced. It was possible he might not have the honour of presiding over any meeting in the future, for, as was well known in the City, his occupations were very numerous, and his time limited, and if he did not leave companies which were absolutely on an assured footing, he would never be able to curtail his responsibilities at all. Therefore it was very probable that before the end of the year he should ask his colleagues to be good enough to relieve him of the work which the company entailed. If he did leave, it would be with extreme regret, for one could not sever one's association with the company one had been connected with for over 18 years without a wrench.

The Hon. A. G. Brand seconded the motion, and said the shareholders would regret to hear of the chairman's possible retirement. In the past, whenever they had had difficulties with regard to finance, the chairman had been their bulwark and had pulled them through in a manner which had been to the credit of himself and the company.

The motion was carried.

Mr. Parker, in proposing a vote of thanks to the board, hoped the chairman would still retain his position in the company, as now it was in an assured position the work could not be difficult. He also expressed the hope that the company would be able to declare an interim dividend.

The Chairman, in reply, said he thought they would soon reach a time when an interim dividend could be paid.

British Electric Traction Co., Ltd.

The directors' report for the year ended March 31st, 1914, states that the Associated Companies have in the past year continued to make satisfactory progress in regard to tramway traffic, the sale of electricity for light and power purposes, motor-omnibus services, and in other respects. The receipts have been favourably affected by the continuance of trade prosperity and by the more seasonable weather during the summer of 1913. The total traffic receipts on the services which were in operation both last year and the preceding year, show an increase of £145,744. The receipts from the supply of electricity amounted to £428,518, and show an increase of £75,516, as compared with 1912. Working expenses, however, increased owing to a general rise in wages and the increased cost of materials. The Northern Ontario Light and Power Co. continues to show improved results. Progress has been made with the construction of the lighting and tramway system at Pelotas by the Rio Grandense Light and Power Syndicate, and also with the development of the Maritime Coal, Railway and Power Co.'s business. The company has acquired an interest in the Oesterreichische Motor-Omnibus Gesellschaft, which is working motor-omnibuses in Vienna.

The gross profit of the company for the year amounts to £225,754, as compared with £210,880 for 1912-13. After deducting management expenses and other charges, including the expenditure during the year on negotiations in regard to new business, there remains a balance of £204,973 plus £12,493 brought forward. After deducting debenture stock interest amounting to £91,384, there remains a balance of £126,083. The revenue account has been debited with £6,486, being the amount reserved against or written off various assets, and the directors have, in addition, placed £50,000 to reserve for depreciation, and they recommend the payment of the dividend for the year upon the 6 per cent. cumulative preference stock, and a dividend of 3½ per cent. upon the 7 per cent. non-cumulative preference stock, together amounting to £52,467, carrying forward £17,130. During the year the directors purchased in the market, and cancelled, £1,000 5 per cent. perpetual debenture stock, and £2,600 4½ per cent. second debenture stock of the company. The outstanding debenture stocks have been reduced by these amounts, and the difference of £784 between the nominal value and the purchase price has been added to reserve. The item investments and undertakings, after deducting the reserve for depreciation, stands at £4,672,458, and consists of shares and debentures in associated tramway, electricity supply, manufacturing and other companies, Government, municipal and sundry securities, and undertakings. The revenue from the investments and undertakings amounted to £209,045, as compared with £193,305 in the previous year. The yield for the past year on £4,672,458 was 4·47 per cent., as compared with 4·11 per cent. for the preceding year on £4,696,052.

The reserve against depreciation of investments has been increased by £19,686 profit on sale of sundry investments, by £784 in respect of debenture stocks purchased and cancelled; and also by £50,000 transferred out of the profits of the past year. The reserve has been debited with £20,005, being the deficiency in book value on realisation of the Cavehill and Brighton undertakings, and the loss on sale of other investments. The balance at credit of this account is now £602,923, which amount is shown in the balance-sheet as a deduction from the amount at which the investments and undertakings stand in the books. There are additional reserves against specific assets of £69,102, and a balance carried forward amounting to £17,130. The amount of profit placed to reserve or unappropriated by the associated companies in respect of the year 1913 was £314,860. The corresponding figure for the previous year was £275,883. "As the stockholders are aware, the board has for some time had under consideration the question of dealing with the depreciation in the value of the company's assets, and a memorandum with regard to proposals for reduction of capital is in course of preparation for issue to the stockholders."

The annual meeting will be held at the Holborn Restaurant on June 18th.

French and Belgian Companies.

The *Compagnie Française Thomson-Houston* reports gross profits of £261,000 on manufacturing in 1913 as compared with £216,000 in the preceding year, and including the yield from investments the total profits amount to £328,000 as against £295,000 in 1912. After meeting interest charges on loans and defraying other items, the net profits are returned at £173,000 as contrasted with £172,000 in the previous year. It is proposed to pay a dividend of £1 8s. per share on the ordinary capital of £2,400,000, being the same as in 1912.

The report of the *Société Anonyme Westinghouse, of Paris*, records an increase in the value of the turnover in 1913, and states that the department at Freinville worked favourably, whilst that at Havre improved. The gross surplus amounts to £67,000, of which £8,000 has been devoted to the extinction of the deficit brought forward from 1912, £40,000 has been applied to depreciation, and the balance is absorbed by an allocation to the reserve fund and the amount carried forward. It is, therefore, not possible for the company, which was reorganised in 1911, to pay any dividend. The report mentions that the Italian Westinghouse Co. had received an order for electric locomotives of the value of £600,000, and that as further capital was needed, the three principal shareholders in the Italian company had advanced £112,000 to that company.

The *Société Générale Belge d'Entreprises Electriques, of Brussels*, which is an investment company, reports gross profits amounting to £110,000 for 1913 as compared with £88,000 in the previous year. The deduction of interest on loans, general expenses and depreciation leaves net profits of £79,000 as against £62,000 in 1912. It is proposed to distribute £2 2s. per share (10½ per cent.) on the ordinary shares as contrasted with £2 in 1912, and 13s. 9d. per share on the founder shares as against 10s. 5d. per share in the preceding year, the ordinary share capital which participates being £600,000 as compared with £500,000 in 1912.

The *A.E.G.-Union Electrique*, reporting on the year 1913, states that business was abundant in the first half of the period, if the term of the general strike was left out of consideration, but in the second half the financial and critical situation caused the colliery owners and iron and steel works to reduce their purchases to a minimum. Nevertheless, the company was able to obtain satisfactory results owing to the diversity and extent of its sphere of activity. The city of Liége took over the local electricity supply system last July, when the company secured an important order for extensions of the station. After allocating £3,000 to depreciation, the accounts exhibit net profits of £15,800, or approximately the same as in 1912, and the directors recommend the payment of a dividend of 13s. 7d. per share on the ordinary shares and 9s. per share on the founder shares.

German Electrical Companies.

The *Elektrotechnische Fabrik Rheydt Max Schorch & Co., of Rheydt*, report that the company was well employed in 1913, particularly for the textile industry, and a large portion of the production was exported. The gross profits amounted to £17,000, as against £14,000, and after providing for depreciation, the net profits permit of the distribution of 8 per cent., as in the previous year.

The *Elektrizitäts Lieferungs Gesellschaft, of Berlin*, which owns 21 supply stations and works several others under agreements, reports an increase in the connections from 35,758 KW. in 1912 to 42,176 KW. last year. As gross profits the accounts show the sum of £310,000, as compared with £271,000 in 1912, and the net profits were £213,000, as against £181,000. The directors recommend a dividend of 12 per cent. on the ordinary share capital of £1,500,000, being the same rate as in 1912.

The *Deutsche Kabelwerke, A.G., of Berlin* report gross profits, of £89,000 for 1913, as contrasted with £75,000 in the previous year. After defraying general expenses, taxes and interest charges, and apportioning £12,700 to depreciation, as against £12,100 in 1912, the accounts exhibit net profits of £34,000, as compared with £31,000, the dividend being 8 per cent., as in the preceding 12 months. The turnover largely increased last year, and this was also the case with the Union Cable Co. The activity of the Kabelwerke in the present year has hitherto been satisfactory.

The directors of the *Sachsenwerk, Licht und Kraft A.G., of Dresden*, which took over the former Kummer works a few years ago, report that a considerable increase in the volume of business occurred in 1913. The company acquired the Medlitz overland station, and also an interest in the Dresden Light and Power Supply Co. After placing £10,000 to depreciation, as compared with £8,700 in 1912, the accounts indicate net profits of £45,000, as contrasted with £30,000 in the preceding year. It is intended to distribute 7 per cent. on share capital of £212,500, this rate comparing with 6 per cent. in 1912.

The *Land und Seekabel Werke, of Cologne-Nippes*, experienced a favourable development in 1913, during which all departments were fully employed. The accounts show, after apportioning £15,000 to depreciation as in 1912, net profits of £38,000, as against £35,000, and a dividend of 11 per cent. has been declared, this contrasting with 10 per cent. in 1912 on a share capital of £262,500. Since the opening of the present year the orders received have been satisfactory, although they are slightly less than in the early part of 1913.

The *Gesellschaft fur Elektrische Unternehmungen, of Berlin*, which is financially interested in many supply works and tramways, states that the rate of progress in the supply of energy in 1913 slackened as compared with preceding years in consequence of certain industries being prejudicially affected by the general decline in trade. After providing for interest payments on the loans amounting to £2,049,000, the accounts show net profits of £318,000 for 1913, as contrasted with £279,000 in 1912. A dividend of 10 per cent. is proposed on the share capital of £2,500,000, and 5 per cent. on £500,000, as against 10 per cent. on the former sum in 1912.

The *Akkumulatoren Fabrik, of Berlin and Hagen*, which completed orders for £1,102,000 in 1913, as against £1,016,000 in 1912, states that the total results were prejudiced by the high prices for lead and the increased cost of other materials, salaries, &c., but larger receipts were derived from investments. During the year the company acquired the shares in the German Edison Accumulator Co., and assumed a greater interest in the Hungarian and Russian Tudor Accumulator Companies. The net profits realised in 1913 amounted to £147,000, as contrasted with £125,000 in the previous year, and the directors recommended a dividend of 20 per cent. on share capital of £600,000, this comparing with 25 per cent. in 1912.

The report for 1913 of the *Bergmann Elektrizitäts Werke, of Berlin*, states that the volume of the turnover increased by 10 per cent. as contrasted with the previous year. The machinery department yielded satisfactory results, and the sales were considerably greater in the departments for apparatus, transformers, small and medium sized machines and electric tools. During the present year the company would begin the delivery of the electric locomotives ordered by the Prussian State Railways, and the company is also interested in the introduction of electric traction on the Berlin City and Circle railways. After setting aside £179,000 for depreciation, as compared with £193,000 in 1912, the accounts indicate net profits of £158,000, as against £119,000. It is proposed to pay a dividend of 5 per cent. on capital of £2,387,000, this contrasting with a similar rate on less capital in 1912 and 2½ per cent. on new capital.

The report of *Voigt & Haeffner A.G., of Frankfort-on-Main*, states that notwithstanding the unpropitiousness of circumstances in 1913 it was possible for the company to secure an increase in the turnover, especially in export markets. The gross profits amounted to £164,000 as compared with £141,000 in 1912, and after meeting general expenses the sum of £13,000 has been set aside for ordinary depreciation as against £14,000. Including the balance forward the net profits total £104,000 as contrasted with £76,000, and after allocating £33,000 to extra depreciation as against £25,000 the balance permits of the payment of a dividend of 12 per cent. on ordinary capital of £250,000, this comparing with 10 per cent. in the previous year. At the recent general meeting it was stated that the period of general declining prosperity had not manifested itself to a great extent as the sales in the first three months of the new financial year were higher than in the corresponding term of 1913. Nevertheless, a slower course of business caused prices to fall and a depression in prices was perceptible in all departments.

Torpoint Electric Light Co.—At a meeting held on Saturday it was reported that the required capital had been subscribed, and it was decided to proceed to allotment forthwith. A survey of the streets and the site was made, and the engineer (Mr. Purves) was instructed to place the orders for the plant, &c., tenders for which had been obtained. The site secured for the generating station is at Thanckes, where existing buildings will be converted for the purpose. Torpoint Urban Council has adjourned the question of public lighting to a special meeting.

Stock Exchange Notices.—A special settling day has been appointed as follows:—

Thursday June 18th.—Toronto Power Co., Ltd.—Prov. scrip fully paid for £523,655 4½ per cent. cons. gua. deb. stock.

And the following have been placed on the Official List:—

Calgary Power Co., Ltd.—Further issue of £146,700 5 per cent. 30-year first mortgage bonds of £100 each.

Calgary Power Co., Ltd.—Further issue of £9,700 5 per cent. 30-year first mortgage bonds of £100 each.

Continental.—France.—Among the new electrical companies recently formed in France, are the Société d'Electricité du Nord-Est Parisien, Paris (4, Rue Michel Ange), capital £40,000; La Société d'Electricité de Thorens, organised with a capital of £8,000 to establish a small central electric lighting station in the little town of Thorens (Upper Savoy); and La Compagnie des Tramways Electriques du Libournais, Bordeaux, capital £24,000.

Spain.—La Société Franco-Espagnole de l'Electricité is the name of a new company which has just been formed in Paris, with a capital of £500,000, the principal object of the concern being to provide the new capital required for the extension of the Barcelona Light and Power Co.

Havana Electric Railway, Light and Power Co.—The report states that the combined accounts for the year 1913 show as follows:—Gross earnings, $5,417,054; operating expenses (45·96 per cent.), $2,489,831; net earnings from operation (54·04 per cent.), $2,927,222; interest on deposits, rents, &c., $140,087, making together $3,067,309. Deducting fixed charges, taxes, &c., $1,219,206, there remains a surplus income for the year of $1,848,103, plus $856,809 (being excess in dividends received on stock of the Havana Electric Railway Co. during the year from its accrued surplus over its actual earnings for 1913), and surplus January 1st, 1913, $294,749; total, $2,999,662. This was disposed of as follows:—Dividends paid during the year. $1,686,204; profits transferred to sinking fund reserve, $92,412; profit and loss balance carried forward, $1,221,045. Steps for equipping and organising a new business department have been taken, and an appropriate site for a display room of gas and electrical appliances has been secured at the corner of Prado and San Miguel Streets. The work on the consolidated power plant is being satisfactorily carried on, and when completed, about August, 1914, will enable the abandonment as generating stations of the three steam plants now in operation. This plant will be comparable in capacity and completeness of equipment and organisation with the very large power stations of the world.—*Financier*.

Morocco.—La Société Marocaine de Distribution d'Eau, de Gaz, at d'Electricité is the name of a new company which has lately been formed in Paris (15, Rue Pasquier) with a capital of £80,000.

STOCKS AND SHARES.

Tuesday Evening.

By this time the shock to City circles caused by the suspensions of Messrs. Chaplin, Milne, Grenfell & Co., and of the Canadian Agency, Ltd., has lost the first keenness of its edge. On Saturday morning, when the Chaplin, Milne announcement was made, there was for a time renewed flatness, following upon profound depression in the two or three days previous. It is often the case in the Stock Exchange, however, that any announcement has an effect directly opposite from what might be expected—to explain which would require more space than is available in mere notes on the electrical markets.

The failures, it must suffice to say, were taken in the Stock Exchange as clearing the air to some extent. Bears had been busy pressing down prices, but as soon as bargain-hunters began to appear, the shorts allied themselves to the buyers, and sharp recoveries ensued. One of the best illustrations this week is District Ordinary, the price of which had bent to 20½ last Saturday, from which it sprang to 24 upon the pressure being relaxed, so that on the week the quotation is actually 1 higher. Tuesday's carry-over in the markets evidenced abundance of money for this purpose, and Consols led swift recoveries in most departments.

The Chaplin, Milne suspension scarcely influenced any of the markets with which these notes are concerned. The latter are naturally coloured by whatever sentiment happens to be uppermost in the Stock Exchange at the time, but with so many investment securities in our lists, the changes are bound to be comparatively slight, save in times of high excitement in either direction; and, in spite of all its troubles, the Stock Exchange has not been demoralised throughout its long period of gloom and melancholy.

When prices go a-soaring, men shut their eyes—and wilfully—to the probability of those prices ever coming down again. When everything is flat, financial opthalmania prevents public apprehension of the fact that matters will mend by-and-by. So in the one case people miss the chances of taking profits, while in the other they are tempted to wait too long, missing opportunities in this way which are presented to them for the acquisition of really cheap stock.

It is incontrovertible that the swing of the pendulum will drive up prices from their present levels, though as to the precise date of such happy happening no reasonable pen would care to make more than a guess. All that we know is, that at the present time, many stocks are very cheap; and while they may go cheaper still, the day will come, as sure as ever slump followed boom, that this depression will give place to prices of a substantially high nature. Merely to write in this vein, however, is to attract the taunt of breezy optimism that is always levelled when a note of cheerfulness is struck amidst prevailing despondency. All of which, maybe, the reader will deride as superfluous platitude, leaning to the safe side.

To proceed to particular markets, therefore, the most interesting point has already been mentioned—namely, the violence of the fluctuations in Districts. So narrow is the market in the stock that each seller of a small amount depressed the price inordinately. A financial paper took up the cudgels on behalf of the stock, and started the recovery, which, as already noticed, fully wiped out the earlier slump. Metropolitans went back to 38¼, and, recovering to 39½, show a loss of only ¾; the Surplus Lands stock, however, has fallen back 2 points to 60. Underground Electric Railways shares reacted after their previous rise, and the Income bonds went back to 89, though the losses have been since regained. The Board of Trade returns, showing clearly enough that the trade of the country is beginning to recede from its high-water mark, are not regarded in the Stock Exchange as an unmixed evil. One of the principal reasons why stocks and shares have gone down to such an extent of recent years is the fact that booming trade has absorbed so much capital that the effect has been to keep money dear, and to retain in trade circles large amounts of capital which would otherwise have been available for investment purposes. If less money is to be required in business circles, through falling off in trade, capital will gradually seek the Stock Exchange for profitable employment, and therefore the House is disposed to look indulgently upon decreases in exports and imports.

The British Electric Traction report is a somewhat colourless document, and has produced no price-changes in the company's securities. The most significant paragraph of the report is that in which it is declared that the board has for some time had under consideration the question of dealing with the depreciation in the value of the company's assets. A memorandum with regard to the proposals for the reduction of capital is stated to be in course of preparation for issue to stockholders, and this is accepted as a hint of the directors' determination to re-arrange the capital of the company on lines less clumsy than those at present laid down.

The Latin-Canadian group remains beneath the cross-currents that flow from Mexico and Brazil. Rumour has full scope for imagination and romance in the sittings of the Conference at Niagara. One day, peace is close at hand; on the next, the dove with the olive branch has timidly retreated. Prices are jerked up and down on these reports, and stockholders must have come to take little notice of the rapid fluctuations in the prices of their securities.

Mexico Tramways went back to 68, but rallied to 71, and the company's bonds of both classes are better. Mexican Light and Powers are virtually unaltered. Brazilian Tractions went ahead on the issue of a report that was generally considered satisfactory; at one time the price dipped to 78, but since then it has recovered to 81. The improvement in the Brazilian rate of exchange is another consideration which has helped the price of Brazilian Tractions materially, but still the quotation shows a small fall on the week. Rio Tramways bonds and Sao Paulos are all better. The Anglo-Argentine Tramways group has also hardened, and City of Buenos Ayres Trams Debenture went up again. In the Canadian group there are improvements in Canadian General Preference, Cochabamba bonds and Montreal Common shares, the only decline in this division being one of a point in Shawinigan Water. Of the Indian shares, Calcutta Supply Ordinary lost ⅛; the rest remain steady.

Electricity Supply shares are a trifle irregular. Values, on the whole, are well maintained, and the market has been little troubled by sales on behalf of those compelled to realise investments in order to clear other commitments. City Lights rose ¼, but Kensingtons are ⅛ easier, and so are London Electric Ordinary. Hove shares keep steady at 8¾, the idea being current that the Hove Corporation will before long acquire the undertaking.

Some link the recent strength of Cromptons with that of Hove Electric shares, but Crompton Ordinary have gone back a little, and are quoted about 4s. The demand for Westinghouse Preference continues unabated, and the price has made another advance to 36s. 3d. middle, the 6 per cent. Prior Liens hardening to 102½. Were it not for this, the Manufacturing list would present an uninteresting aspect. Dick, Kerr Preference retain their rise; and, taking the market as a whole, the tone is certainly firm.

Marconis dropped to 2¼⅛, and from the character of the selling it would appear as though some, at least, of it were forced. The bears took full advantage of the weakness, adding their sales to those of real holders. Monday's recovery, however, put a different complexion upon the market, and the price improved to 2¼⅜, which left a loss of 5s. on the week, while the Preference were $\frac{3}{16}$ lower. Canadians at 6s. 6d., and Americans at 13s. 6d. are a little less dull than they have been, which is about all that can be said for them. Rumour sports with the possibilities of the coming dividend announcement, expectation looking for the maintenance of the previous 20 per cent., which some regard as optimistic. New York Telephone bonds are better at 100¼. Telegraph stocks as a whole are inclined to sag, and there are small falls in Anglo-American Preferred and Eastern Telegraph Ordinary. West India and Panama continue weak and proprietors have not yet recovered from their disappointment at the probability that the expected advantages that were to accrue from the opening of the Panama Canal may not visit the company until a later date than was anticipated.

Raw rubber this week has been down to 2s. 3d., but the Mincing Lane auction sales were so far satisfactory that they had the effect of putting up the price nearly a penny per lb. Dealings in the share market continue to be more or less desultory, prices weakening and firming within narrow margins, careless of the various conflicts that are raging round the question of what is, and what is not, synthetic rubber.

MARKET QUOTATIONS

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, June 10th

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2⅞d.	..
a „ Sulphuric	per cwt.	6/6	.
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£21	5s. dec.
a Lead, Nitrate	„	£30 10	..
a „ White Sugar	„	£27 10	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8¼d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb	8½d.	..
a „ Perchlorate	„	8¾d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70/72 %) ..	„	£10	..
a „ Chlorate	per lb.	3⅜d.	..
a „ Crystals	per ton	£2 5	..
a Sodium Bichromate, casks ..	per lb.	6d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£86	..
b „ Wire, in ton lots (1 to 11 S.W.G.)	„	£167 6 8	..
b „ Sheet, in ton lots ..	„	£112	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7d.	⅛d dec.
c „ Tube (brazed)	„	9⅜d.	..
c „ „ (solid drawn) ..	„	7⅞d.	..
c „ Wire, basis	„	7⅛d.	⅛d dec.
c Copper Tubes (brazed)	„	9¼d.	..
c „ „ (solid drawn) ..	„	9¾d.	..
g „ Bars (best selected) ..	per ton	£77	£1 dec.
g „ Sheet	„	£77	£1 dec.
g „ Rod	„	£77	£1 dec.
d „ (Electrolytic) Bars ..	„	£66 5	£1 dec.
d „ „ Sheets ..	„	£68 15	10s. dec.
d „ „ Rods ..	„	£71 5	10s. dec.
d „ „ H.C. Wire	per lb	8⅝d.	¼d. dec.
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
o German Silver Wire	„	1/10	..
h Gutta percha, fine	„	8/-	..
h India-rubber, Para fine	„	2/9¼	¼d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	51/3	2d. inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	.
g Lead, English Pig	„	£19 10 to £19 15	5s. inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7	..
e Mica (in original cases) small ..	per lb.	6d. to 3s	..
e „ „ „ medium	„	3/6 to 6/	..
e „ „ „ large ..	„	7/6 to 11/	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0½ to 1/4	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10¼d.	⅛d. dec.
r Steel, Magnet, in bars	per ton	£56	..
g Tin, Block (English)	„	£143 to £144	£7 10 dec.
o „ Wire, Nos. 1 to 16	per lb.	2/3	1d. dec.
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 2 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 9th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	14½ — 16½	..	..
Do. Do. Deferred ..	100	..	..	7 — 9	+ ½	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	88½ — 91½	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	3	3½	57 — 60	..	5 16 4
Do. 5 % Perp. Deb. ..	100	5	5	92½ — 94½	..	5 6 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 80	..	5 12 9
Central London Railway, Ord. ..	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1903	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref. ..	1	6	6†	21/32 — 23/32	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord. ..	1	..	..	3/16 — 9/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	9/16 — 11/16	..	7 5 8
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	75 — 80	..	5 12 5
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	56 — 60	..	6 13 4
Metropolitan Railway Consol. ..	100	1⅝	1⅝	38½ — 39¾	— ½	4 1 10
Do. Surplus Lands	100	2¾	2¾	59 — 61	—2	4 10 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	79 — 81	—1	4 6 4
Metropolitan District Ord. ..	100	Nil	..	23¾ — 24½	+1	Nil
Do. 6 % Deb.	100	6	6	138 —141	..	4 5 3
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 86	..	5 4 8
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 13 0
Potteries, Ord.	1	3½	3½	9/32 — 13/32 xd	..	8 12 10
Do. 5 % Pref.	1	5	5	17/32 — 21/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81¾ — 84¾	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	3⅛ — 3⅝	..	Nil
Do. "A"	1/-	..	..	7/16 — ½	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	115 —117	..	5 2 7
Do. 4½ % Bonds	100	4½	4½	100 —102	+ ½	4 8 2
Do. 6 % Income	100	6	6	89 — 90	..	6 13 4
Yorkshire (West Riding), Ord. ..	5	Nil	Nil	¼ — ½	..	Nil
Do. 6 % Pref.	5	3	4	4¼ — 4¾	— ⅛	4 4 8
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends 1912.	Dividends 1913.	Closing Quotations June 9th.	Rise + or Fall	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4¾ — 5	+ 1/16	5 10 0
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 9/16	+ 1/16	6 2 3
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	98½ —101½		4 8 6
Do. 5 % Deb.	100	5	5	94½ — 96½	+ ½	5 3 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 —106	.	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11¾	+ ¼	5 2 2
Do. 4½ % Deb.	100	4½	4½	95 — 97	+ ½	4 12 9
Do. 5 % 2nd Deb.	100	5	5	99 —101	..	4 19 0
Brazilian Traction, Light and Power	$100	6	6†	80 — 82	— ½	7 5 5
Brisbane Trams Invt., Ord. ..	5	8	8	6⅝ — 7⅛ xd	..	5 12 3
Do. 5 % Pref.	5	5	5	4¾ — 5¼ xd	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	98 —101	..	4 9 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	110 —114	..	7 0 4
Do. Pref. Ord.	100	6	6	103 —107	..	5 12 1
Do. 5 % Pref.	100	5	5	103 —106	..	4 14 2
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	97 —100	..	4 10 0
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	94½ — 96½	+1	4 8 1
Calcutta Trams, Ord.	5	7½	9½	6½ — 7	..	6 15 9
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5 3/16 — 5 7/16	..	4 11 11
Do. 4 % Deb.	100	4	4	93 — 98	+1	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90 — 94	..	5 6 8
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie El. Trams 5% A Deb.	100	5	5	84 — 89	..	5 12 4
Do. 6% B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord. ..	1	..	..	¼ — ½	..	..
Do. Pref.	1	4⅜d.	6	23/32 — 31/32	..	6 5 0
Lisbon Elec. Trams, Ord. ..	1	6	6	1 3/32 — 1 11/32	..	4 9 3
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	95 —100	..	5 0 0
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
" Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	78 — 81	..	6 3 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ —100½	..	4 19 6
Mexico Trams Com	$100	7	7	69 — 73	—2	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	79 — 83	+1	6 0 6
Do. 6 % Bonds	100	6	6	77 — 81	+1½	7 8 2
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	3⅞ — 4⅜	..	11 8 6
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	86½ — 89½	..	5 11 8
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	98½ —100½	+ ½	4 19 6
Do. 5 % Mort. Bonds	100	5	5	89 — 91	+1	5 10 1
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	95 — 99	+1	5 1 0
Singapore Trams, 5 % Deb. ..	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	92 — 95	— ½	5 5 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends 1912.	Dividends 1913.	Closing Quotations June 9th.	Rise + or Fall	Present Yield p.c.
Bournemouth & Poole, Ord. ..	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10⅜ — 10⅞	..	5 10 4
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 9
Brompton & Kensington, Ord. ..	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	89½ — 92½ xd	..	4 6 8
Charing Cross, West End & City	5	5	6	4⅞ — 5⅜	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. Do. 4 % Deb.	100	4	4	92½ — 94½	+ ½	4 5 1
Chelsea, Ord.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	97 —100	..	4 10 0
City of London, Ord.	10	9	10	16¼ — 17¼	+ ¼	5 16 0
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	..	4 9 0
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 7 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 —103	..	4 8 1
County of London, Ord.	10	6	7	11¾ — 12¼	..	5 14 3
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜	..	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	103 —106	..	4 5 3
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	..	..	5/16 — 9/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3½ — 4	..	7 10 0
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	—1	5 4 6
Folkestone	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9
Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7⅜ — 7⅞	— ⅛	5 14 3
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1¼ — 1⅝	— ⅛	5 10 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	92½ — 95½	..	4 3 9
Metropolitan	5	4½	4½	3¼ — 3¾	..	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford	5	7	7	5 13/16 — 6 5/16	..	5 11 0
St. James' and Pall Mall, Ord. ..	5	10	12	9½ — 10	..	6 0 0
Do. 7 % Pref	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2¾ — 3⅜	..	6 10 4
Do. 5 % First Mort. Deb. ..	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	Nil	..	5/16 — 9/16	..	
Do. 5 % Cum Pref.	5	3‡	4	2⅝ — 3	..	6 13 4
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord.	5	10	10	8¼ — 8¾	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4 15/16 — 5 1/16	..	4 6 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 9th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Adelaide, 6 % Pref.	5	6	6	5½ — 5⅝	..	5 11 7
Calcutta, Ord.	5	8½	9	7½ — 7¾	−1	5 14 6
Do. 5 % Pref.	5	5	5	5$\frac{1}{16}$ — 5$\frac{5}{16}$	..	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	5 8 0
Canadian Gen. El. Com.	$100	7	8	103 —108		7 6 6
Do. 7 % Pref.	$100	7	7	118 —123	+1	5 18 10
Cordoba Lt., Power and T., Ord.	1	5	..	$\frac{7}{16}$ — ⅝	..	7 12 0
Do. 5 % Deb.	100	5	5	87 — 90	..	5 11 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	84 — 89	+1	6 14 10
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ — 95½	..	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	$\frac{1}{32}$ — $\frac{3}{32}$	..	Nil
Do. 6 % Pref.	1	6	4	¼ — ½	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 —105	..	4 15 2
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	.
Melbourne, 5 % 1st Mort. Deb.	100	5	5	105 —108	..	4 12 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	61 — 66	..	7 11 6
Mexican Lt. & Power, Common	$100	4	4†	43 — 47	..	..
Do. 7 % Cum. Pref.	$100	7	7	71 — 75	..	9 6 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	72 — 77	−1	6 9 10
Do. 5 % 2nd Mort. Bonds	100	5	5	59 — 64 xd	..	7 13 3
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	51 — 55	..	..
Montreal, Lt., H. and Power	$100	9	10†	226 —231	+ 1	4 6 7
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	
River Plate, Ord.	Stock	10	10	235 —245 xd	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 —103	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5½	6	133 —137	..	4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	99½ —101½	..	4 8 8
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	98 —100 xd	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	85 — 87	..	5 15 0
Victoria Falls Power, Pref.	1	6	6	$\frac{23}{32}$ — $\frac{25}{32}$	..	7 13 4
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 – 105	..	5 14 3

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 9th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	$\frac{23}{32}$ — $\frac{27}{32}$	..	8 5 0
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	6 17 2
Babcock & Wilcox	1	16	16	2$\frac{15}{16}$ — 3$\frac{1}{16}$	..	5 4 7
Do. Pref.	1	6	6	1¼ — 1⅜	..	4 7 6
British Aluminium, Ord.	1	..	5	$\frac{15}{16}$ — 1$\frac{1}{16}$	..	4 14 1
Do. 6 % Cum. Pref.	1	6	6	$\frac{13}{16}$ — $\frac{15}{16}$	..	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	97 —100	..	5 0 0
Do. Deb. Stk.	100	5	5	90 — 95	.	5 5 3
B.I. & Helsby Cables	5	10	13	9⅜ — 9⅞	+ ¼	6 11 8
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	101 —104	..	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	2	Nil	5	1$\frac{11}{16}$ — 1$\frac{15}{16}$	+ $\frac{1}{32}$	5 3 1
Do. Deb.	100	4	4	73 — 75	..	5 6 8
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	50 — 55	..	8 3 8
Do. 4½ % Second Deb.	100	4½	4½	29 — 33	..	13 12 8
Callender's Cable	5	15	15	11⅜ — 12⅛	..	6 3 8
Do. Pref.	5	5	5	5 — 5¼	..	4 16 5
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	22½	2⅜ — 2⅝	..	8 11 5
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	⅜ — ⅝	..	..
Do. Pref.	1	6	6	¾ — ⅞	..	6 17 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	1	5	6	$\frac{9}{16}$ — $\frac{11}{16}$xd	..	8 14 6
Do. Pref.	1	7	7	1 — 1⅛	..	6 4 5
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10$\frac{5}{16}$ — 10$\frac{9}{16}$	..	5 13 9
Do. Deb.	100	4	4	87 — 91	..	4 8 0
Henley's, Ord.	5	15	20	14½ — 15½	..	6 9 0
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	99½ —101½ xd	..	4 8 8
India-Rubber, G. & T.	10	7½	7½	9¾ — 10¾	..	6 19 5
Do. Pref.	10	5	5	8¾ — 9¼	..	5 6 8
Telegraph Construction	12	20	20	36½ — 38½	..	6 4 7
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	63 — 67	..	5 19 8
Do. B 4 % Cum. Pref.	100	..	£4	40 — 44	..	9 1 10

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 9th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾ — 6¼	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 97	..	5 3 0
American Telep. & Teleg., Cap.	$100	8	8	123 —127	..	6 6 0
Do. Collat. Trust	$1000	4	4	91 — 94	..	4 5 0
Anglo-American Telegraph	Stock	3	3	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	108 —109	— ½	5 10 1
Do. Def.	Do.	30/-	30/-	23 — 23½	..	6 7 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	6†	7¼ — 7½	..	5 6 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	7[illegible] — 81	..	4 18 9
Cuba Telegraph	10	5	6†	8½ — 9½ xd	..	6 6 4
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7¼ — 7¾	..	6 0
Direct United States Cable	10	4	4	6⅜ - 6⅞	..	5 16 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	129 —132	— 1	5 6 8
Do. 3½ % Pref. Stock	Do.	3½	3½	77 — 79	..	4 8 9
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 3 4
Eastern Extension	10	7	7	12½ — 13	..	5 7 9
Do. 4 % Deb.	Stock	4	4	94½ — 96½	..	4 3 0
Globe Telegraph and Trust	10	6	6†	10⅞ — 11⅜	..	5 5 4
Do. 6 % Pref.	10	6	6	12⅜ - 12⅞	..	4 13 4
Great Northern Telegraph	10	20	20	31 — 33	..	6 1 1
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	5	5	81 — 84	..	5 19 1
Do. 4 % Cum. Pref.	$100	4	4	68 — 71	..	5 12 7
Marconi's Wireless Telegraph	1	20	20	2¾ 2⅞	— ¼	6 19 0
Do. 7 % Cum. Partic. Pref.	1	17	..	2$\frac{5}{16}$ — 2$\frac{7}{16}$	— $\frac{1}{16}$	6 19 0
Monte Video Telephone, Ord.	1	6	6	[illegible]	..	6 8 0
Do. 5 % Pref.	1	5	5	$\frac{23}{32}$ - $\frac{27}{32}$	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99¾ 100¼	+ ½	4 9 6
Oriental Telep. and Elec.	1	10	10	2$\frac{3}{16}$ - 2$\frac{5}{16}$	..	4 6 7
Do. 6 % Cum. Pref.	1	6	6	1$\frac{7}{32}$ - 1$\frac{9}{32}$	..	4 13 5
Do. 4 % Red. Deb.	Stock	4	4	87½ - 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	7	7¾ — 8¾	— ¼	8 0 0
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 18 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 - 100	..	4 10 0
United River Plate Telephone	5	8	6†	6¼ — 6¾	..	5 18 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 9 0
West Coast of America	2½	2½	N	⅞ — 1⅛	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	1½	1½ — 1¾	..	7 2 10
Do. 6 % Cum. 1st Pref.	10	6	6	9¼ — 9¾	..	6 3 1
Do. 6 % Cum. 2nd Pref	10	6	6	8½ — 9	..	6 13 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	10	7	7	13¼ — 13¾	..	5 1 11
Do. 4 % Debs.	Stock	4	4	95½ — 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	94 — 97	..	4 12 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Staff Dinner.—On Saturday last, at the Holborn Restaurant, the ELECTRICAL APPARATUS CO., LTD., held the first of what it is intended shall be a series of annual staff dinners. This festivity was preceded on Friday by the more serious business of the Convention, attended by the district office managers from Manchester, Birmingham, Glasgow and Cardiff, and by the sales staff attached to the head office. It is found desirable to hold these Conventions quarterly in order to keep the outside representatives in touch with the developments in manufacture. On Saturday the annual staff photograph was taken, and this shows an increase of 40 per cent. in the size of the staff, which now numbers 100. The programme which followed the dinner consisted entirely of amateur talent, which met with due appreciation; a topical song, written and sung by Mr. Elstone, of the testing department, was well received.

Child Culture.—At the recent conference of the Child Study Association, Sir J. Crichton Browne deprecated experiments on the effect of electricity on the growth of children, fearing that harmful results might manifest themselves in later years. It is known, however, that electrification produces excellent results in the case of chickens, whose growth is accelerated 35 per cent. by the treatment, while their vitality and health appear to derive distinct benefit from it.

Secret Wireless Telegraphy.—Captain A. N. Hovland, of the Norwegian Navy, whose keyboard transmitting and receiving apparatus was described in our issue of September 15th, 1911, has continued his experiments, and is reported to have developed a sensitive relay, depending upon the properties of the selenium cell, for use in connection with his system. By means of codes which are automatically deciphered by the receiving apparatus, the inventor claims to secure secrecy in transmission.

TRADE STATISTICS OF EGYPT, 1913.

THE following statement, showing the imports of electrical and similar goods into Egypt during the year 1913, is taken from the recently-issued trade statistics. The figures for 1912 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1912.	1913.	Inc. or dec.	
Steam engines, including boilers, &c.—	£E.	£E.		£E.
From Great Britain ..	97,000	127,000	+	30,000
,, Germany ..	15,000	7,000	–	8,000
,, Belgium ...	—	1,000	+	1,000
,, France	4,000	8,000	+	4,000
,, United States ...	1,000	1,000		—
,, Holland	2,000	5,000	+	3,000
,, Italy	8,000	11,000	+	3,000
,, Switzerland ..	5,000	2,000	–	3,000
,, Austria-Hungary	15,000	20,000	+	5,000
,, Other countries	3,000	—	–	3,000
Total ..	150,000	182,000	+	32,000
Electric machinery (including gas engines and petrol engines).—				
From Great Britain ...	78,000			
,, Germany ...	32,000			
,, Austria	9,000			
,, Belgium	3,000	Shown		
,, United States ...	7,000	separately		
,, France	6,000	below.		
,, Italy	12,000			
,, Switzerland ...	32,000			
,, Other countries	2,000			
Total ...	181,000			
Electric machines.—				
From Great Britain ...		15,000		—
,, Germany ...		8,000		—
,, Austria	Not	3,000		—
,, Belgium	shown	6,000		—
,, United States ...	separately,	3,000		—
,, France	see	27,000		—
,, Italy	above.	3,000		—
,, Switzerland ...		1,000		—
Total ...		66,000		—
Gas and Petrol Engines.—				
From Great Britain ...		62,000		—
,, Germany ...	Not	31,000		—
,, France	shown	1,000		—
,, Holland	separately,	1,000		—
,, Italy	see	22,000		—
,, Sweden	above.	1,000		—
,, Switzerland ...		28,000		—
Total ...		146,000		—
Other machinery (except agricultural).—				
From Great Britain ...	88,000	103,000	+	15,000
,, Germany ...	49,000	36,000	–	13,000
,, Austria	4,000	7,000	+	3,000
,, Belgium	4,000	4,000		—
,, United States ...	42,000	30,000	–	12,000
,, France	39,000	36,000	–	3,000
,, Italy	3,000	5,000	+	2,000
,, Switzerland ...	4,000	9,000	+	5,000
,, Turkey	2,000	1,000	–	1,000
,, Other countries	3,000	2,000	–	1,000
Total ...	238,000	233,000	–	5,000
Railway and tramway carriages.—				
From Great Britain ...	22,000	2,000	–	20,000
,, Austria	42,000	21,000	–	21,000
,, Belgium	28,000	20,000	–	8,000
,, Other countries	7,000	4,000	–	3,000
Total ...	99,000	47,000	–	52,000
Lamps of all kinds.—				
From Great Britain ...	7,000	6,000	–	1,000
,, Germany ...	20,000	21,000	+	1,000
,, Austria	32,000	29,000	–	3,000
,, Belgium	1,000	—	–	1,000
,, Frances	11,000	6,000	–	5,000
,, Italy	1,000	1,000		—
,, Sweden	6,000	7,000	+	1,000
,, Other countries	1,000	3,000	+	2,000
Total	79,000	73,000	–	6,000

	1912.	1913.	Inc. or dec.	
India-rubber and gutta-percha, raw or manufactured.—	£E.	£E.		£E.
From Great Britain	8,000	12,000	+	4,000
,, Germany	16,000	15,000	–	1,000
,, Austria ...	1,000	1,000		—
,, France	12,000	11,000		1,000
,, Italy .	3,000	10,000	+	7,000
,, Switzerland .	1,000	—	–	1,000
,, Belgium .	1,000	1,000		—
,, Other countries	1,000	2,000	+	1,000
Total ...	46,000	52,000	+	6,000
Electric, telegraphic and telephone apparatus.—				
From Great Britain .	57,000	46,000	–	11,000
,, Germany ...	20,000	25,000	+	5,000
,, Austria	26,000	15,000	–	11,000
,, Belgium ...	5,000	7,000	+	2,000
,, United States .	1,000	1,000		—
,, France ...	13,000	19,000	+	6,000
,, Italy	3,000	3,000		—
,, Sweden	5,000	18,000	+	13,000
,, Switzerland ...	3,000	4,000	+	1,000
,, Other countries		1,000	+	1,000
Total ...	133,000	139,000	+	6,000
Scientific instruments.—				
From Great Britain ...	17,000	20,000	+	3,000
,, Germany ...	16,000	21,000	+	5,000
,, Austria	1,000	1,000		—
,, United States ...	2,000	2,000		—
,, France	13,000	14,000	+	1,000
,, Italy	1,000	1,000		—
,, Switzerland ...	1,000	1,000		—
,, Other countries	2,000	2,000		—
Total ...	53,000	62,000	+	9,000
Rails.—				
From Great Britain ...	35,000	106,000	+	71,000
,, Germany ...	60,000	20,000	–	40,000
,, Belgium	21,000	59,000	+	38,000
,, France	—	—		—
Total ...	116,000	185,000	+	69,000
Copper, hammered, drawn or sheet.—				
From Great Britain ...	160,000	96,000	–	64,000
,, Germany ...	11,000	15,000	+	4,000
,, Belgium	2,000	1,000	–	1,000
,, France	11,000	1,000	–	10,000
,, Other countries	—	—		—
Total ...	184,000	113,000	–	71,000
Copper, manufactured.—				
From Great Britain ...	17,000	11,000	–	6,000
,, Germany ...	16,000	20,000	+	4,000
,, Belgium	1,000	3,000	+	2,000
,, France	18,000	17,000	–	1,000
,, Italy	7,000	6,000	–	1,000
,, Other countries	2,000	2,000		—
Total ...	61,000	59,000	–	2,000

£E = £1 0s. 6¼d.

LEGAL QUESTIONS AS TO ELECTRICAL FITTINGS.

[FROM A LEGAL CONTRIBUTOR.]

CHANGE of occupancy of a house hardly ever takes place without the occurrence of some question relating to electrical fittings. Either the outgoing or incoming tenant has some question to raise with regard to them, or else a question of greater or less moment arises with the landlord.

It is proposed in the present article to consider some of the points which arise from time to time.

Sec. 24 of the Electric Lighting Act, 1882, provides that any officer appointed by the undertakers, may at all reasonable times enter any premises to which electricity is, or has been, supplied by the undertakers, in order to inspect the electric lines, meters, accumulators, fittings, works, and apparatus for the supply of electricity belonging to the undertakers, and for the purpose of ascertaining the quantity of electricity consumed or supplied, or where the undertakers are authorised to take away or cut off the supply of electricity from any premises, for the purpose of removing any electric lines, accumulators, fittings, works, or apparatus belonging to the undertakers, repairing all damage caused by such entry, inspection, or removal. The powers conferred by this section must not, however, be arbitrarily exercised. Due notice of an intended visit should be given, for it was decided in *Brompton Electricity Supply Co. v. Shadforth* (Electrical Review, July 24th, 1903) that where a consumer refused to allow inspectors to come into her house unless she received previous notice of their visit, an injunction ought not to be granted to restrain her. Electric fittings are also protected from distress for rent. Thus by Sec. 25 of the Electric Lighting Act, 1882, where any electric lines, meters, accumulators, fittings, works, or apparatus belonging to the undertakers (*i.e.*, the local authority or company supplying electricity) are placed upon any premises for the purpose of supplying electricity, they shall be subject to protection. In the ordinary way they might be seized by the landlord whose rent was in arrear; but this section provides that they shall not be subject to distress, or to the landlord's remedy for rent of the premises where the same may be, nor be taken in execution under any process of a Court of law or equity, or any proceedings in bankruptcy against the person in whose possession the same may be. This affords considerable protection to the undertakers. Very often when a tenant does a "moonlight flit" the only articles of vertue left on the premises are the electrical fittings, which the landlord would be glad to sell in order to satisfy some part of his claim for rent outstanding.

But what are fittings within the meaning of this section? Wires, and pipes through which wires are carried, naturally come under this heading, but there are other things not so easy to classify. It was decided under Sec. 14 of the Gasworks Clauses Act, 1871, which is similar to the above, that a gas stove let for hire is a "fitting for the gas" within the meaning of the section, and is therefore not subject to distress for rent (*see Gas Light and Coke Co. v. Hardy*, 1886, 17 *Q.B.D.* 619). It would seem to follow from this that electric stoves, kettles, motors, fans and electric irons, if hired out by the supply authority to the consumer, would not be subject to distress by the landlord.

A nice question may sometimes arise as to whether electric fittings let on hire by the supply authority vest in the trustee in bankruptcy of the consumer. The law of bankruptcy provides that goods which are in the order and disposition of the bankrupt, with the consent of the true owner at the date of his bankruptcy, shall vest in the trustee for the benefit of his creditors. And this is right; for credit is naturally given to a man upon the strength of the goods which he has on his premises. But where it is well known that certain classes of goods are customarily lent on hire, the presumption that they belong to the bankrupt does not arise. For instance, the custom of hotel-keepers to hire furniture is so well known that such furniture does not vest in the trustees in bankruptcy of the hotel proprietor. It has long been the practice of gas companies to hire out gas stoves to consumers; and questions arise from time to time as to the power of local authorities supplying electricity to deal in fittings. It is common to find in the Acts of local authorities a special clause enabling them to sell, hire, let, but not to manufacture, lamps, meters, electric fittings, etc. The terms of such clauses vary somewhat. In the Nottingham Corporation Act, 1899, Sec. 4., the power conferred is to provide and let, etc., but not to manufacture "lamps, meters, electric lines, fittings, apparatus and things for lighting and motive purposes for which electric energy can or may be used, or otherwise necessary or proper for the distribution, consumption or use of electrical energy."

The Manchester Corporation (General Powers) Act, 1898, after the usual wide powers, contains these words: "Electrical motors and apparatus for the use of electricity for motive power and other purposes." The Halifax Corporation Act, 1898, is even wider in its terms. It authorizes the Corporation to "purchase, hire, sell, let on hire, or otherwise deal with dynamos, electric motors, accumulators, meters, plant, engines, conductors, machinery, apparatus and appliances for and in relation to the production, supply, distribution or utilisation of electricity, or required or used for or in connection with their electrical works and undertaking. . . ."

The case of the *Attorney-General v. The Mayor, etc., of Barnstaple* (Electrical Review, Vol. 52, p. 766) showed clearly that it is not competent for an electrical company supplying electric light to supply electric fittings without an express provision to that effect in the Act under which they work. It appeared that in 1900 the defendant Corporation obtained from the Board of Trade a provisional order. In the summer of 1902 they circularised the ratepayers, and gave out that they were prepared to supply electric fittings, and fit them up in private houses. Two ratepayers moved the Attorney-General to bring an action, and as a result of the litigation the Corporation consented to the following order: "The Corporation undertake not to do any further installations for customers, or to expend further moneys on private installations except in pursuance of obligations already entered into."

The question whether a tenant for life has power to lay down and charge out of capital for electric plant put in by him has been considered in many cases. In *re* Lord Leconfield's Settled Estates, which was heard by Mr. Justice Kekewich some years ago, a summons was taken out under the Settled Lands Acts by the tenant for life in possession of the certain settled estates in England, asking that the trust might be directed to apply certain capital moneys in their hands in recouping the applicant the following sums expended by him out of his own moneys:—(1) £4,891 19s. 7d. for the construction of a new drainage system for the principal mansion house; (2) £3,299 9s. 10d. for the erection of an engine house for the engines which supplied the principal mansion house with electric light. The Settled Lands Act, 1882, Sec. 25, provides that improvements authorized by the Act to be made with capital trust moneys are works for (Sub-Sec. [1]) drainage and (Sub-Sec. [2]) saw mills, scutch mills and other mills, waterwheels, engine houses and kilns, which will increase the value of the settled land for agricultural purposes, or as to woodland or otherwise. It was held, that assuming that the engine house would increase the value of the settled land, taking settled land to include the principal mansion house, yet it would not increase its value "for agricultural purposes or as woodland or otherwise" within the meaning of the Sub-Secs. 1 and 2, and that its expense could not therefore be allowed out of capital moneys; but it was held also that the cost of the new drainage system could be allowed, for it was not a case of a mere addition but a completely new system and a permanent improvement. This decision appears to be somewhat incomprehensible to the non-legal mind. The tenant for life was allowed to spend a considerable sum of money on the drains for the house, but was not permitted to put down an electric lighting plant.

Yet in the existing conditions of modern society it is almost a *sine qua non* that a country gentleman's house shall be properly lit. A glance at the date of the Settled Lands Act is sufficient to explain this anomaly. That measure was passed in the same year as the first Public Electric Lighting Act. At that time electricity was in its infancy, and the fact that it has long since come to stay, and that, as a source of light it is practically a common necessity, ought to afford justification for an amendment of the Settled Lands Act. A short section might easily be drafted which would give the Court power to decree that a tenant for life may spend part of his capital on electric lighting.

The point was again raised in the case of *re* Blagrave's Settled Estates (Electrical Review, Vol. 52, p. 383). Mr. Justice Joyce held (following Mr. Justice Buckley in *re* Clark, 1902, 2. Ch. 327) that this was not an improvement which could be paid for out of capital within the meaning of the Settled Lands Act (Sec. 25). When the case came before the Court of Appeal, this decision was upheld, but Lord Justice Cozens-Hardy threw out the interesting suggestion that it would be desirable to extend the Acts so as to allow provision to be made for supplying gas or electric lighting to a mansion house. This, however, was a matter for the Legislature, not for the Court to decide.

Under the heading "Electric Fittings" the questions affecting the validity and effect of the free wiring agreement appear to find a proper place. In the *London Electric Supply Corporation, Ltd., v. Priddis* (18 T.L.R. 64) an agreement made between the plaintiffs, the National Electric Free Wiring Co., Ltd., and the defendant on February 17th, 1898, contained (*inter alia*) the following clauses: "(2) The Wiring Co. will in a proper manner and in accordance with the regulations of the fire insurance companies, and free of cost to the consumer, furnish and fit up on the said premises the necessary wires and fittings for electric lighting, hereinafter called the installation." Clause 4 gave the consumer an option of purchase in a certain event. Clause 7 provided: "The consumer shall until purchase as aforesaid pay quarterly to the supply company for the use of the installation ¾d. per Board of Trade unit for every unit of electrical energy supplied to the said premises, and the minimum payment in any year shall be 1s. for each 8-c.p. lamp or its equivalent installed." Clause 8 provided for recovery in case of non-payment. The defendant used no electricity supplied by the plaintiffs from June to September, 1900. They sued in the County Court for the sum of £1 6s. 3d., being the minimum provided by Clause 7 supra. It was held, on appeal, that the installation had clearly been put in on the terms that the customer should have the right to purchase after five years, and that during those years he was liable to pay a minimum rent, whether he used the current or not. The case was sent back for a new trial.

Of all electric fittings to be found on the consumer's premises, the meter, which is usually hired out to him by the company, is likely to be productive of the greatest amount of trouble.

The register of a gas meter is *prima facie* evidence of the quantity consumed, and two justices are empowered to settle differences between the company and the consumer. (See 34 and 35 Vict. c. 41, Sec. 23.) In the case of the Gas Light and Coke Co. *v.* Cree, 1897, 61 J.P. 699, it was laid down that where the only evidence of the amount is afforded by the meter, the Court will be unwilling to go behind it. There is no reported case in which a complainant has challenged the accuracy of a meter by appealing to an independent authority.

In the case of electricity supply, the meter register is still more conclusive. If any difference arise between consumer and the undertakers as to whether any meter whereby the value of the supply is ascertained (whether belonging to the consumer or to the undertakers) is, or is not, in proper order for correctly registering the value, or as to whether the value has been correctly registered at the meter, that difference is to be determined upon the application of an electric inspector, or, where the local authority are the consumers, by an inspector appointed by the Board of Trade. The inspector has jurisdiction over the costs of the inquiry, and his finding is conclusive and binding on the parties. Subject to the inquiry the register of an electric meter is conclusive evidence of the value of the supply in the absence of fraud. (Electric Lighting [Clauses] Act, 1899, Sec. 57).

As to the finality of the decision of a Government Inspector it is worthy of note that in the case of the Wandsworth and Putney Gas Co. *v.* Rye (31 Sol. J. 633) the accuracy of a gas meter, sworn to be perfectly accurate by a Government inspector, was successfully disputed, not by the production of any expert evidence, but merely by the sworn testimony of the plaintiff and his servants, who deposed that less gas had been used in the quarter immediately preceding that for which the company sought to charge. The authority of this decision, which comes from an inferior court, is doubtful.

Should the methods of supply and charge be altered, undertakers are bound to defray the expense of providing new meters to their consumers (Electric Lighting [Clauses] Act, 1899, Sec. 58). It sometimes happens that a serious defect in a meter remains undiscovered over a long period of time. The consequence is that a consumer may be overcharged or—as more rarely happens—considerably undercharged for the amount of gas or other commodity consumed by him. In such circumstances there is authority for saying that in so far as any claim is not barred by the Statute of Limitations (which prevents a debt being recovered after a lapse of six years) the injured party is entitled to redress. In the case of the South Metropolitan Gas Co. *v.* The Mayor, etc. of Bermondsey (*The Times,* May 18th, 1901), an action was brought to recover the sum of £884, the price of gas supplied to the Commissioners of Baths and Washhouses in Rotherhithe (the predecessors of the defendants) from 1894 to 1900. Owing to the fact that the dial of the meter in use during that period was misleading, the amount of gas charged for was but one-tenth of the actual amount consumed. The mistake had existed since 1885, but the claim for arrears which had accrued prior to 1894 was barred by the Statute of Limitations. The defendants admitted the mistake, but sought to escape liability on the ground (*inter alia*) that they could not make or levy a retrospective rate for the purpose of discharging the debt, nor could they apply the moneys in their hands derived from current rates in payment thereof. This defence, however, did not prevail, and they were held liable for the arrears which were not barred by the Statute.

A meter belonging to the undertakers which is placed upon any premises not being in the possession of the undertakers for the purpose of supplying electricity, is not subject to distress for rent; that is to say, the consumer's landlord could not distrain upon it. The same rule applies to "electric lines, accumulators, and fittings." (Electric Lighting Act, 1882, Sec. 25.) "Fittings" as applied to the property of a gas company have been held to include a gas stove (Gas Light and Coke Co. *v.* Hardy, 17 Q.B.D. 619). An electric stove or an electric motor would probably come under the same heading, and would, therefore, be protected.

A Heating Studentship.—A "heating" studentship, tenable in the Faculty of Engineering of University College, London, of the value of £50 a year, together with £11 11s., being the amount of college fees, may be awarded by the Institution of Heating and Ventilating Engineers in July. The student will be required to devote his whole time to research work in heating and ventilating engineering. Further particulars can be obtained from the Secretary of University College, to whom application should be made on or before Saturday, June 20th.

MUNICIPAL ELECTRICAL UNDERTAKINGS: RECORDS FOR FUTURE USE.

By "INTERESTED."

"The past is a lesson, the present a fact, and the future is that which can be made." The future, however, cannot be judged by the past. Those who have benefited by this teaching are now putting their learning into practical use. In the past mistakes have been made; errors into which some have fallen have been rectified, and precautions have been taken to prevent their recurrence. This is fact—the present. Accepted rules have been drafted because of a lesson, but many of these regulations will need redrafting in the future. That future has yet to be made. What is in store for us none can foresee; but one important point always to be borne in mind is that all will be exactly as we make it.

To all appearance, the future before the electrical industry, particularly the electricity supply branch, now shines rich and bright; yet upon the foundation laid to-day—the present—will success depend. There is a vast field undeveloped and awaiting the attention of central-station engineers and managers. Take London only, or Greater London for preference: what a future! How many thousands of business people there are who have not made use of electricity to reduce manual labour! How many thousands of private houses to which the blessings of electricity are as yet unknown!

What of the future? The errors which have been made in the past will carefully be avoided, but it is too much to hope that no mistakes will again occur. It is well to have a care for to-morrow—and beyond.

These remarks have been amply illustrated by the central-station engineer who uses the method described below for registering exactly the whereabouts of his electricity meters. The past is recorded, the present stock of new and old instruments is shown, and likewise the number on circuit.

METER TESTS.

Date.	Meter No.	Type.	Amps.	Volts.	Full load.			Half-load.			Tenth-load.			Percentage errors.			Starting test.	Stop test.	Remarks.
					Rdg. at start.	Rdg. at finish.	Diff. in units.	Rdg. at start.	Rdg. at finish.	Diff. in units.	Rdg. at start.	Rdg. at finish.	Diff. in units.	Full load.	Half-load.	Tenth-load.			

No. 1.

METERS REMOVED. METERS FIXED.

Date.	Address.	Type.	Number.	Size.	Reading.	Removed by	Why removed	Date.	Address.	Type.	Number.	Size.	Reading.	Fixed by	Why fixed

No. 2.

RECORD OF CHECK METERS.

Name and address.	Date.	Size.	Type.	Check meter rdg.	Advance.	Size.	Type.	Old meter reading.	Advance.	% error.	Remarks.

No. 4.

METER SUMMARY.

Week ending ....

Type	No fixed during week.	No. removed dur'g wk.	No. delivered dur'g wk.	No. fixed.	No. in stock (good).	No. in stock (faulty)	No. sold.	Total No. purchased.

No. 3.

RECORD OF MOTORS.

Date.	Address.	H.P. of motor.	Maker's name.	Description of machinery driven.

No. 5.

Arc Lamp HIRE A/c.

CARD No. *1*

Supplied by *White & Co.*

No. of Articles received *Six*

Reference Nos. or Marks *10, 11, 12, 13, 14 and 15.*

Articles Sold or Transferred *One, 24/3/14.*

Date *22/2/12.*

Rate *£5*

Depreciation *33⅓* %

Total Cost *£30*

Value *£5*

Ref. Nos.	Issues.		Returns.		Issues.		Returns.		Date depr'c'n. completed.	Stock March, 1912.				Stock March, 1913.				Stock March, 1914.			
	Date.	Address.	Date	Engrs. sign.	Date.	Address.	Date.	Engrs. sign.		New.	Old.	Depreciated	Circuit.	New.	Old.	Depreciated	Circuit.	New.	Old.	Depreciated.	Circuit.
10 11 12	24 2 12	— — —	6/1/13	F.H.	8/4/14	—			24/2/15	3	—	—	3	3	3	—		3	3	—	—

Card No. 1a.

Arc Lamp HIRE ACCOUNT.

STOCK SUMMARY.

Apparatus card Nos.	Rate.	Stock at March 31st, 1912.				Stock at March 31st, 1913.				Stock at March 31st, 1914.				Stock at March 31st, 1915.			
		New.	Old.	Dep.	Circt.	New.	Old.	Dep.	Circt.	New.	Old.	Dep.	Circt.	New.	Old.	Dep.	Circt.
1	£5	3	-	—	3	3	3	—	--	3	3	—	—				
5	£5 10s.	1	—	—	2	—	—	—	3	—	—	—	3				

Card No. 2a.

Form No. 1 is for keeping a record of all tests carried out on both new and old meters.

No. 2 represents a day book for entering details of each instrument fixed on consumers' premises.

No. 3 is a weekly summary showing the exact stock in hand, the number of meters out on circuit, the number of old instruments sold, and the number purchased from the commencement of the undertaking.

No. 4 is a further test record showing results of tests taken by means of a check meter. No. 5 is a detailed record of all motors connected to the mains. This book is found very handy for reference, and provides much useful information when corresponding with prospective consumers.

The following idea, recently brought to my notice, is one for keeping touch with goods loaned out on hire. It has the advantage of simplicity, yet contains all the desired information and detail, and, once brought up to date, gives no trouble in operation. Card No. 1A is for the purpose of entering each article delivered under this heading. If practicable—and that depends upon the amount of work in question—deliveries of similar goods in batches may very well be found on one card. The printed matter thereon, as shown below, will describe the purpose.

Card No. 2A is a quarterly summary of the whole of the before-mentioned cards; here, again, the printed matter explains fully its purpose. Figures have been filled in purposely to illustrate a little more clearly the intended idea.

Cards are mentioned, and in the instance in mind cards are used; but a loose-leaf book—or, better, two loose-leaf books—could be used for this purpose quite as well as cards; or, again, one loose-leaf book, and cards for the summary.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Mine Shaft Signalling.

The **Adnil Electric Co., Ltd.**, of Adnil Building, Artillery Lane, E.C., has introduced a system of electrical signalling for mines, which has been specially designed to conform to the new mining regulations, and is a combination of its luminous and automatic systems, which have been installed in a large number of mines. Fig. 1 shows the "visual indicator," which consists of a dial mounted in a metal casing, the dial being arranged for 14 or more signals; a pointer is provided which denotes the winding signals, and a luminous indicator shows when men are being carried. The indicator, as illustrated, is mounted on a cast-iron pedestal which also carries the audible signalling instruments.

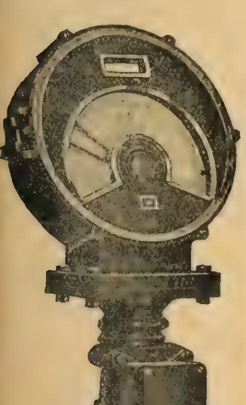


Fig. 1.—Adnil Mining Engine-Room Indicator.

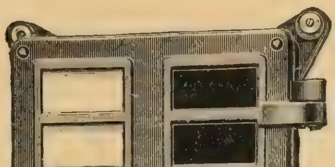


Fig. 2.—Adnil Level Indicator.

Fig. 2 shows a "level indicator"—a metal casing divided into a number of small compartments, with ground glass fronts, on which the names or numbers of the various levels are painted; these names are only visible when the lamp in the compartment behind one of them is caused to glow by a signal having been given. Other apparatus required to complete the engine-room equipment are a resetting contact, single-stroke bell, electric hooter and junction-box. Suitable modifications are made in the corresponding apparatus at bank and at the levels.

An electro-mechanical system is also made, with a special oil-immersed pull switch of heavy construction which is fixed at the bank and operated by a shaft signal rope, or can be used for haulage roads where insulated signalling wires are necessary. The engine room apparatus is the same as in the all-electric system, but at the bank a single-stroke bell is used, and mechanical bells are fitted at the levels.

A New Electric Horn.

A very cheap and compact electric horn for motor vehicles has recently been put on the market by the **General Electric Co., Ltd.**, of 67, Queen Victoria Street, E.C. The sounding mechanism consists of a substantial steel diaphragm, which is set vibrating by blows from a stud carried by the armature of a laminated electromagnet of special design. The mechanism, as in the case of earlier patterns of electric horn, is similar in principle to that of the common trembler bell, but embodies many novel points in design, while the construction is entirely different, being very much more substantial in every detail. Special insulating material and best quality metal is used throughout. The weight of the complete motor-car horn is as low as 2¾ lb. if fitted with the standard 10-in. projection, or only 2 lb. if fitted with the short projector, which is only 5¼ in. long. The finish is in black and nickel, or black only for fixing under the bonnet. The "Dean" horn is guaranteed for five years; it is watertight and dustproof, and the push switch supplied with it differs from the usual car push in that it is not a small button or plunger, but the upper cap effects contact over almost its entire surface, which is 1½ in. in diameter. A touch upon any portion suffices to close the circuit and sound the horn, which emits a rich, deep and penetrating sound.

The "Dean" motor-cycle horn weighs only 2 lb. and has a length of horn of 4¾ in. The internal and external arrangements are similar in all respects to those of the motor-car horn just described. The trumpet and case are of heavy sheet brass thoroughly plated. The handle-bar clip is of solid construction, and so is the lever push switch, which also is arranged to clamp the handle-bar tightly in such a way that it will not shake loose afterwards.

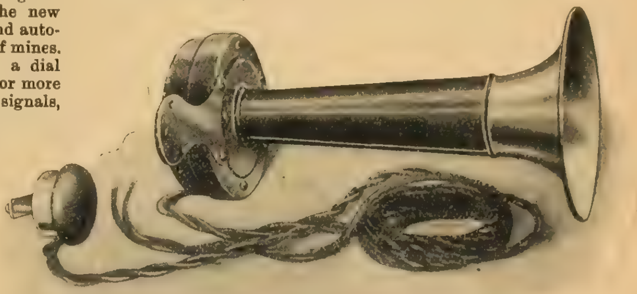


Fig. 3.—New G.E.C. Motor-Car Horn.

The pressure required to work these horns is from 5 to 10 volts, and may be obtained from dry batteries, which may be carried in special cases for attaching to suitable parts of the machine. All the requisite parts are supplied by the makers.

The "Phœnix" Accumulator.

Many attempts have been made to devise a satisfactory light portable accumulator, usually with qualified success; **Messrs. "Phœnix" Accumulators**, of 60, Wilson Street, Finsbury Square, E.C., are now introducing such a cell, which, they claim, is free from the drawbacks which have been previously met with, and can be depended upon to give good service with a life exceeding 300 charges and discharges. The construction of the cell is shown in the diagrammatic section, fig. 4, p. 1014; it consists of an outer ebonite container, within which is a perforated ebonite cylinder lined on the outside with a sheet of very porous material, and in the annular space is packed the negative active material, together with a light grid or electrode of antimonial lead. The positive consists of two concentric perforated ebonite cylinders, lined with porous material, and with the active material and a light grid packed between them; this is placed inside the cylindrical negative, and the electrolyte fills the two remaining spaces—the annular space between the two elements, and the cylindrical space inside the positive. Contact between the elements is impossible, because of the ebonite cylinders, and the granular active material cannot escape through the perforations, owing to the porous septa with which these are covered. Thus the cell is immune from short circuits and from the deposit of mud. The elements are held firmly in place, and the cover of the container is sealed in place.

It is claimed that the active material which represents 42 per cent. of the total weight of the cell, presents a very large surface of contact with the electrolyte, and makes good and permanent contact with the grids; that the elements are free from buckling, and that the cell has a high capacity—the output being 16·4 watt-hours per pound of total weight. Vibration and shocks do it no injury, and it can stand high rates of charge. The terminals are lead-cased, and the cells are made up in convenient sizes for use as ignition cells, for lighting motor-cars and omnibuses, and similar purposes. Messrs. Wentworth & Co., electrical engineers, of 26, Ivy Lane, E.C., inform us that they have had the Phœnix cells under test for six months, and are pleased with their behaviour; their ampere-hour efficiency is upwards of 85 per cent.

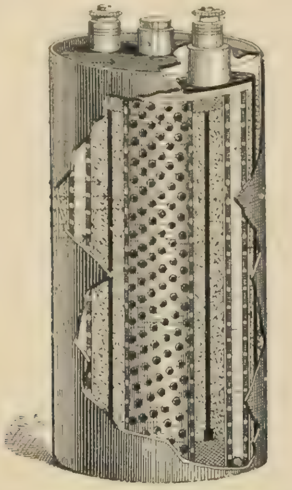


Fig. 4.—"Phœnix" Accumulator, Part Section.

The "Fialite" Moist-Heat Radiator.

The Altheat Co., Ltd., of 62, Oxford Street, W., have brought out a new type of radiator which appears to possess valuable qualities. The principle on which it is based is that a certain degree of humidity in the atmosphere is essential to our physical comfort; when air is heated, although no moisture is removed from it, its percentage humidity is nevertheless reduced, and the normal degree can only be restored by adding to its moisture content. This is effected in the "Fialite" radiator by the provision of a tank of water in the base of the apparatus, with wicks dipping into the water and extending upwards behind the lamps, as shown in fig. 5. The hot air rising carries with it a due proportion of added water vapour, and is deflected forwards into the room by the curved reflector above the lamps setting up an effective circulation of air. The makers state that the "moist heat" is far more efficient in producing an agreeable sensation of warmth than dry hot air, so that less power is required to heat a given space. The arrangement of the reflectors, which practically conceal the lamps, gives the appearance of a rich glow, as of a coal fire. Resistances can be used instead of lamps, if desired. The radiator is made in two models, one of which is shown in fig. 6, with four or six heating elements and two or three heats.

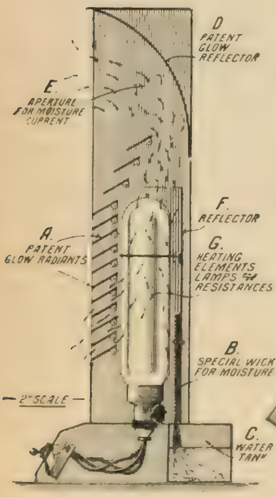

D
PATENT GLOW REFLECTOR
E.
APERTURE FOR MOISTURE CURRENT
F.
REFLECTOR
A.
PATENT GLOW RADIANTS
G.
HEATING ELEMENTS LAMPS OR RESISTANCES
B.
SPECIAL WICK FOR MOISTURE
— 2" SCALE —
C.
WATER TANK

Fig. 5.—Section of "Fialite" Radiator.

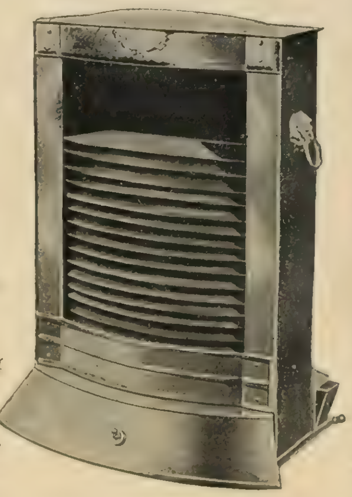


Fig. 6.—"Fialite" Radiator.

A PROFESSIONAL APPOINTMENT.

At a recent meeting of the Dublin Local Section of the Institution of Electrical Engineers the appointment of a wireman as staff engineer by the Corporation was discussed.

The Chairman said that at the outset he wished to make it clear that there was no intention of criticising the Dublin Corporation or the way they managed their important commercial undertaking. They were concerned simply with the broader issues affecting their profession, and the particular case which was before them was merely taken up as a foundation upon which to build something that would be of sufficient importance to attract the attention of the Council of the Institution of Electrical Engineers in London. The documents in connection with this case would speak for themselves. They would pass them on to London as they were, and with them would be sent such remarks as might be made at that meeting to strengthen the case.

Mr. T. Tomlinson, rising to propose a resolution for acceptance by the Institution, said that this subject had been agitated for years. The occasion had come when their Association must act if it ever hoped to see its members recognised as a profession. This kind of thing was occurring not merely in Dublin, it had occurred elsewhere, it was probably occurring in every place where the electrical industry was in the hands of the municipality, because they might be quite certain that in those places their profession would not be represented on the Municipal Council, while the unprofessional man would be largely represented. If they were left in the helpless position in which they now were, they would be gradually squeezed out. The high gods of the profession who ruled in their Council were ignorant of the conditions under which the Provincials were trying to eke out a living. Fortunately in their last fight the various local sections became united together, and they had now a power of putting their views before the Council in London which was not possessed by either the Civils or Mechanicals. After quoting an article on the status of the electrical engineer which was published in the Electrical Review in 1909, he concluded by pointing out that the author pleaded for two things as necessary:—(1) A standard of professional training; (2) Parliamentary protection. They had since got the first; they wanted the second, and that was the resolution before them.

Mr. Porte said he had great pleasure in seconding the resolution which their hon. secretary had just proposed. The foundation of this business, as Mr. Tomlinson had suggested, started in Report No. 86 of the Electric Lighting Committee of the Corporation, dated April 13th, 1913. That report was submitted to the Council on July 7th, 1913, and was passed. The last paragraph, which affected them most, said: "The Committee have also made an order expressing their opinion that members of the staff desirous of promotion should obtain Associate Membership of the Institution of Electrical Engineers by passing the necessary examination, and, with the approval of the Council, the Committee propose that in future cases of promotion, and when applications for annual increment come before them to take this question into consideration." As far as he was aware, the first case in which that new rule should have come into operation automatically was the case they were dealing with, and he had before him Report No. 56, of 1914, which embodied a letter from Mr. Ruddle (city electrical engineer) giving a list of 10 engineers who had applied for the appointment which was then under consideration. The report says: "Mr. Ruddle further stated that in order that the arrangement should be of full value to the department, assistance to Mr. Elward could only be given by a highly-trained electrical engineer of the class possessing the qualifications to act as assistant shift engineer at the generating station, as he would have to carry out the full duties in one district, while Mr. Elward was engaged in another." That was the report of the Committee, and then followed Mr. Ruddle's letter, and out of the 10 members of the staff who went forward, he named four. After giving their qualifications and length of service, he proceeded: "Having regard to the importance of the duties to be performed, he strongly recommended in the best interests of the Corporation that the appointment be made from one of the four engineers named." Then he reminded the Committee of their own recommendation which was adopted by Council in the previous year, and after that came this election [of the unqualified man, who was not one of the four engineers recommended]. The question was—Could not they, by bringing pressure to bear on the Institutions, he meant the whole of the Institutions—the Civils, the Mechanicals, and the Electricals—could not they enforce what they had been talking of for the last 20 years—Parliamentary recognition of the profession? The Civils had none, the Architects had none, the Mechanicals had none, they, themselves, had none; that was, to say, that of all the learned professions, the only one that had not a statutory standing was the one on whose work the whole fabric of modern civilisation was based. The engineer's work was an everlasting monument to him, and, therefore, if on nothing else but on the broad ground that an engineer's work remained as a monument to the man who put it up, they should be protected by law against the interference of non-professional men in every class of engineering work. The only other observation he would make in support of this resolution, which he seconded with great pleasure, was that if appointments of this class were to be made in the way in which this appointment had been made, it would take the backbone out of the staff for ever.

Mr. Pilditch supported the resolution, saying that it was clear that until some such protection was afforded by legislation the letters M.I.E.E. or A.M.I.E.E. were to all intents and purposes useless, for they carried no weight whatever.

Mr. Tatlow, also supporting the resolution, said that one way they should look at this matter was from the University man's point of view. The engineer who had spent several years in some University, and had spent a considerable sum of money in obtaining a degree in engineering, found that in the absence of something in the nature of Parliamentary support or recognition for his profession, the degree meant very little to him. He found that he did not acquire any great position by gaining the degree, whereas the doctor of medicine when he went through the same University course, or perhaps a couple of years longer with slightly more fees, on getting his degree found himself in a sound position, because he was recognised by the Legislature as a professional man, and he could always get work without any fear of being interfered with by people who did not know his business, but thought they did.

Mr. Cummins and Mr. Downey having followed on similar lines,

The Chairman, in closing the discussion, said that as they were all so unanimous about this resolution, and the discussion had been so practical and useful, he thought there was nothing for him to say further. He felt that if they could get the Council in London to take up the whole matter of getting legal protection for members of the Institution, they would have gone a long way, and have done a great deal of good. If they had had legal recognition, this particular case could not have arisen, but as it had arisen, he would only say, as an engineer responsible for a large concern, who had had to rely on the loyalty of a technical staff in critical times, he would consider it bad policy, to say the least of it, that anything should be done to give his staff just cause to consider they had been slighted or broken faith with in any way. The way to get legal recognition had been shown to them by other professions, which were now reaping the advantage of their perseverance and foresight.

The resolution given below was then carried unanimously:—

Report of the Committee of the Dublin Local Section of the Institution of Electrical Engineers to the annual general meeting, 1914, as to a recent appointment on the electrical engineering staff of the Dublin Corporation:—

At the Committee meeting held on 15th inst. a letter of protest, signed by 19 members of the electrical engineering staff of the Dublin Corporation, against a proposed appointment on the staff was brought before the Committee.

After very carefully considering this and other documents submitted, the Hon. Secretary was directed to address a letter of remonstrance to the City Council. (In the report the letter follows.)

The City Council met on the 18th, and confirmed the appointment by a small majority.

Your Committee again met on the 20th inst., further to consider the matter in view of this confirmation. The recommendation of your Committee is that this meeting should place on record its opinion:—"That this appointment is a direct attack upon the profession, and that the Committee be instructed to communicate with the Committees of the other Local Sections and with the Council of the Institution of Electrical Engineers, urging upon them the necessity of immediately promoting such legislation as shall protect the trained professional engineer in the exercise of his profession, as the trained professional man in other professions is protected."

Thomas Tomlinson, *Hon. Sec.*

The Water Power of the Rhine.—The question of the economic importance of the Rhine between Strassburg and Lake Constance was raised in a paper submitted by Dr. Sympher, of Berlin, at a conference held at Mannheim by the Baden Chambers of Commerce on May 7th. After discussing a scheme for improving the navigable way of the river at a cost of several millions sterling, and for the accommodation of ships of 1,000 tons, the author referred to a proposal for utilising the available water powers in connection with the suggested improvement works. The water powers capable of being usefully applied on the Upper Rhine between Strassburg and Constance, leaving out of consideration the falls of the Rhine at Schaffhausen, are estimated at about 500,000 KW., which is constant for the greater part, and variable for a small part, but is, nevertheless, available during most of the year. It is calculated that the 500,000 KW. would enable 3,000,000,000 KW.-hours to be produced yearly, or a total considerably in excess of the quantity which was sold by the electricity works in Germany to third parties in the year 1911. The use of water powers in the South of Germany and Switzerland has rendered it possible for energy to be disposed of at exceptionally low charges, and if the scheme proposed by the author were carried into effect, the promoters would have to reckon with considerably lower receipts than obtain in the more level districts of North Germany. Under these circumstances, the opinion of experts is that the annual income would not exceed £4 per KW. for constant supply, and about £2 for the variable supply. If it is assumed that 250,000 KW. would be constant and 250,000 KW. variable, the total annual income is computed at £1,500,000, of which £900,000 would devolve upon the section of the river below Basle, and £600,000 upon that above Basle. It is estimated that the £900,000 would suffice to pay the interest and redemption charges of the debt incurred, and the annual working and maintenance charges, in the execution of the river improvement works, together with the hydro-electric works and the requisite canals, between Strassburg and Basle. But the conditions on the section above Basle are considered to be less favourable in this direction.

NEW PATENTS APPLIED FOR. 1914.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

12,804. "Electrical egg-tester." F. [illegible] May 25th. (Complete).

12,814. "Slip-rings for dynamo-electric machines." Siemens-Schuckertwerke G.m.b.H. May 25th. (Convention date, May 31st, 1913, Germany). (Complete).

12,831. "Number indicator and advertising system for telephones [illegible] and other advertisements." H. L. [illegible] May 25th.

12,835. "Self-acting shunt or switch contrivance, especially for [illegible] with subterranean current." Stefan [illegible] May 25th.

12,844. "Electric switches." K. [illegible] and A. A. [illegible] May 25th. (Complete).

12,867. "Electric heating-apparatus." C. O. Bastian. May 25th.

12,870. "Mouthpieces for telephones and other [illegible]." H. J. Quilter. May 25th.

12,871. "Heating unit or resistance element for electric [illegible] apparatus." A. Slatter and G. Wilde. May 26th.

12,885. "Electrical signals in mines and collieries." [illegible] Ltd. May 26th.

12,906. "Lamp-locking and anti-vibration device for [illegible] lamp-holders of the bayonet-socket type." C. Wharram. May 26th.

12,910. "Method of generating electro-magnetic waves without [illegible] motion." Egmont C. Hoegerstaedt. May 26th.

12,912. "Telephone switching-apparatus." Western Electric Co., Ltd. May 26th. (Franklin Tuthill Woodward, Belgium).

12,913. "Impulse-producing mechanisms." J. A. Kropp. May 26th. (Convention date, July 29th, 1913, United States). (Complete).

12,926. "Mercury motor meters." W. Hamilton and Ferranti Ltd. May 26th.

12,934. "Effecting the automatic interruption of the current in electric conductors upon the occurrence therein of a short circuit or serious leakage." Felten & Guilleaume Carlswerk Akt. Ges. May 26th. (Convention date, May 26th, 1913, Germany). (Complete).

12,941. "Motor control systems." British Thomson-Houston Co., Ltd. May 26th. (General Electric Co., United States).

12,976. "Electrical Switches." H. W. Cox. May 27th.

12,979. "Electrical winding-mechanism suitable for winding-up clocks and the like mechanical devices." J. L. Greenberg. May 27th.

12,983. "Fool-proof safety lock for railway-carriage doors and other doors electrically controlled." J. W. Wollers, A. McCaw, and A. Wollers. May 27th. (Complete).

12,986. "Chains for supporting electroliers." E. J. Perry. May 27th.

12,018. "Telegraph receiver and keyboard telegraph transmitter." E. J. Kessels. May 27th. (Addition to 21,332/13). (Complete).

13,022. "Dynamo-electric machines particularly applicable for engine-starting systems." C. F. Kettering and W. A. Chryst. May 27th. (Convention date, July 14th, 1913, United States). (Complete).

13,044. "Electric accumulators." J. P. Haworth and Curt Wachs. May 27th. (Complete).

13,049. "Starting-up of electric motors." Siegmund Hans Eckmann. May 27th.

13,057. "Dynamo-electric machines particularly applicable for engine-starting systems." C. F. Kettering and W. A. Chryst. May 27th. (Addition to 13,022/14. Convention date, September 13th, 1913, United States). (Complete).

13,060. "Construction of electric switch." G. Markt. May 27th.

13,062. "Signalling systems particularly for use in mines." Sterling Telephone & Electric Co., Ltd. and F. G. Bell. May 27th. (Telephon Fabrik Akt. Ges. vorm. J. Berliner, Germany).

13,063. "Cooling electrical machinery." C. H. Lauth. May 27th.

13,076. "Manufacture of tungsten." British Thomson-Houston Co., Ltd. May 27th. (General Electric Co., United States).

13,078. "Selector which during the emission of a series of current impulses permits of adjusting a fresh series." H. G. Dietl. May 27th. (Complete).

13,086. "Apparatus for reproducing any number of pencils of light in succession or together by means of electrical action." A. M. Low. May 28th.

13,095. "Galvanic batteries." A. Thomas and J. Stott. May 28th.

13,136. "Electric polyphase commutator machines." Siemens-Schuckertwerke G.m.b.H. May 28th. (Convention date, June 21st, Germany). (Complete).

13,147. "Series-parallel control systems for electric motors." British Thomson-Houston Co., Ltd. May 28th. (General Electric Co., United States).

13,159. "Dynamo-electric machines." Compagnie de L'Industrie Electrique et Mecanique. May 28th. (Convention date, May 30th, 1913, Germany). (Complete).

13,173. "Automatic telephone exchange connexions." Betulander Automatic Telephone Co., Ltd., G. H. Bryant, and F. M. Ward. May 28th.

13,209. "Process for banding projectiles." S. O. Cowper-Coles. May 29th.

13,210. "Process for rendering iron and steel surfaces incorrodible." S. O. Cowper-Coles. May 29th.

13,213. "Tightening-devices for overhead electric conductors." Siemens Schuckertwerke B.m.b.H. May 29th. (Convention date, May 29th, 1913, Germany). (Complete).

13,231. "Systems of control for electric motors." British Thomson-Houston Co., Ltd. May 29th. (General Electric Co., United States).

13,232. "Liquid rheostats." British Thomson-Houston Co., Ltd. May 29th. (General Electric Co., United States).

13,247. "Vacuous tubes used as magnifiers and producers of continuous electrical oscillations." Marconi's Wireless Telegraph Co., Ltd., and H. J. Round. May 29th.

13,248. "Production of continuous electrical oscillations and the utilisation thereof for wireless telegraphy and telephony." Marconi's Wireless Telegraph Co., Ltd., and H. J. Round. May 29th.

13,281. "Telephone systems." T. Green. May 30th.

13,304. "Electric cooking apparatus." W. P. Perry. May 30th.

13,305. "Electric thermostat." W. P. Perry. May 30th.

13,310. "System of electric signals for main and tail haulages in mines and like places." G. B. Burrows. May 30th.

13,331. "Electric detonators and fuses." J. Leighton and W. W. [illegible] May 30th.

13,335. "Electric relays." Soc D'Electricite de Paris. May 30th. (Convention date, June 21st, 1913, France). (Complete).

13,338. "Plans or systems with pertinent apparatus for the complete equipment of an automatic selecting lock-out of intermediary stations and inter-connecting telephone system which combines an entire telephone plant." O. Asmussen. May 30th. (Complete).

13,348. "Electrically-heated vulcanizing apparatus." W. T. Henley's Telegraph Works Co., Ltd., and H. Savage. May 30th.

13,349. "Intercommunication telephones." F. Weingartner. May 30th.

13,359. "Electric clocks or timepieces operated and controlled by wireless waves." Eugene Victor Gratze. May 30th.

13,362. "Telephone exchanges." C. A. W. Hultzman. May 30th. (Convention date, June 2nd, 1913, Germany). (Complete).

EXPIRING PATENTS, TAKEN OUT IN 1900.

(*Continued from page 972.*)

7,777. "Wireless Telegraphy." Marconi, G., and Marconi's Wireless Telegraph Co. April 26th. Relates to improvements in the arrangements for wireless telegraphy described in Specifications No. 12,039, A.D. 1896, No. 12,326, A.D. 1898, and Nos. 6,982 and 25,186, A.D. 1899. The secondary of the induction coil is connected through one or more condensers to the primary of a transformer, the secondary of which is connected to earth or a capacity, and with an adjustable inductance connected to the aerial conductor. In the receiving apparatus the aerial conductor is connected through a similar inductance to the primary of an induction coil, with which a condenser is arranged in parallel. The secondary is divided by a condenser, and has its terminals connected to inductances. The inductances are connected through the coherer and a condenser in parallel. The local circuit, including impedances, is connected to the terminals of the condenser. Several forms of transformer and induction coil are described for use with the transmitter and receiver respectively. Several arrangements are described.

8,998. "Controlling Traffic on Railways." Smith, E. W. May 15th. Relates to staff-issuing apparatus of the Webb and Thompson type, such as is described in Specification No. 1,263, A.D. 1889. In the present invention the catch which locks the usual notched disc is itself normally locked by a lever, adapted to engage a pin on the catch. When a staff is raised it turns the lever and releases the pin, so that, if the electromagnet is energized by a current in the proper direction, the catch will be disengaged. If, however, the proper current does not pass, the catch is not raised, and the further movement of the lever by the staff again locks the catch.

9,331. "Electrolysis." Haas, M. May 21st. Relates to bleaching compounds, etc. A cell is placed within, but raised slightly from, an outer vessel containing the electrolyte up to a certain level. Within the cell are a number of double-poled electrodes insulated by plates, and also electrodes for conducting the current into and from the apparatus. The hydrogen developed during electrolysis causes the liquid to rise about the electrodes, and to overflow from the cell, fresh liquid entering the cell through the perforations in the bottom thereof.

10,580. "Electric Furnaces." Imray, O. (Morani, F.) June 9th. In a large furnace, the electric connections with the electrodes are made by water-cooled metal boxes, the movable electrodes are held by screw yokes, also water-cooled. When several adjacent electrodes are supplied with alternating currents by independent conductors, these are placed at right angles to one another, or in line, where they leave the group of electrodes, to avoid induction between them. The liquid product of the furnace is discharged through a slit formed by a water-cooled metal casing, upon a cooled metal plate.

10,637. "Electric Resistances." Mayes, A. H. June 11th. Pulverulent resistant material is contained between conducting-plates fixed in a non-conducting box, under non-conducting pressure plates. The box is made with grooves to receive the conducting plates, bottom holes to pass binding-screws thereon, and lugs to which a lid is secured.

11,340. "Electric Clocks." Fischer, M. June 22nd. Relates to electric clocks; synchronizing-apparatus and escapements. In operating a number of electrical clocks, a wheel train driven by weights or spring power, is released, say, once every minute, by the action of the escapement-wheel of a clock on a releasing lever. This lever is pivoted and carries stop-pins to engage pins on an arm operated by gearing. The pin is used when setting the hands of one of the clocks. The arm is carried by a spindle, also carrying a soft iron cylinder cut away opposite pole shoes screwed on to two iron plates attached by clips, etc., to a steel magnet. The cylinder is surrounded by a fixed wire coil in circuit with coils on the pole-shoes. The induced current passes round an electromagnet at each clock. This magnet attracts a spring-withdrawn armature pivoted and carrying a regulating and shifting spring engaging the teeth of the minute-wheel. An ordinary telephone inductor, coupled with the wheel train by cranks, the wheel train being released and arrested as before.

11,562. "Electric Lighting." Hewitt, P. C. June 26th. Relates to vacuum tubes. A tube for lighting contains vapour of mercury or lithium, or nitrogen or other gas at a pressure of a few millimetres of mercury. Selenium, phosphorus, sulphur, or red sulphide of mercury may be added to facilitate starting, which otherwise requires heating of the tube by a Bunsen burner or electrically. A high electric pressure must be used in either case at starting. Afterwards the gas vapour in the tube conducts a considerable current at ordinary supply pressures.

11,933. "Controlling Electric Motors." Lundell, R. July 2nd. In order to obtain a great variety of speeds and minimize sparking in series-parallel motors, the field magnets are energized by a small regulable motor-generator, or from some other source of variable electromotive force.

12,972. "Electric Distribution." Highfield, J. S. July 18th. In order to keep the pressure constant in systems in which storage batteries are employed, and also to raise the bus-bar pressure to charge the batteries, a booster is arranged between the batteries and the wires.

13,036. "Dynamo-electric Machines." Joel, H. F. July 19th. Relates to the construction of dynamos and motors in which the field magnet is provided with a single exciting-coil, and the frame or casing forms part of the magnetic circuit. The single coil which constitutes the field winding is specially shaped so as to pass alternately on one side and the other of successive field poles. It is claimed that this construction will diminish eddy currents and armature reaction, and prevent sparking at the brushes. Modifications are described. The Provisional Specification states that the sinuous winding described may be employed in the construction of armatures, especially those of alternating-current machines.

13,721. "Electric Motors, Controlling." British Thomson-Houston Co., (Perry, C. L.) July 31st. Relates to a motor-control system for electrically-driven vehicles, etc., in which the controller comprises a number of separately-operated contacts, with actuating-coils in connection with a master controller, the main object being to enable the several actuating-coils to be efficiently operated at full line potential.

13,975. "Electric Motors, Controlling." British Thomson-Houston Co. (Barry, C. E.). August 3rd. Relates to control systems in which the motor controllers are actuated from a master controller situated at a distance, for example, at one end of a train, and more particularly to those in which the contacts of each motor controller are actuated by a number of electromagnets connected with the master controller by a series of conductors running along the train. In order to reduce the number of train conductors, the coils of the electromagnets are connected across every pair of conductors, whereby as many contact devices may be actuated from any given number of conductors as there are combinations of such conductors taken two at a time. The windings of the electromagnets are so proportioned that the corresponding contacts will only be actuated when the full potential of the actuating-current is applied at their terminals.

14,368. "Rheostats and Switches." Kando, C. de. August 10th. In the liquid resistance apparatus described in Specification No. 16,960, A.D. 1899, controlled by air pressure admitted through valves, a short-circuiting switch was provided, closed against spring pressure by the increasing pressure of the air when the resistance has been reduced to a minimum. The valves are now modified to ensure that, on reducing the air pressure, the switch shall be opened before the resistance is increased.

15,748. "Electric Apparatus." Partridge, G. W. September 4th. Relates to means for rupturing the arc formed when a switch or cut-out is opened or a fuse melts. The arc is blown out by a jet of fluid or vapour liberated suddenly, as by opening a vessel containing compressed carbonic-acid gas, such as a Sparklet, or by firing an explosive mixture.

16,130. "Electric Switches." British Thomson-Houston Co. (Hewlett, E. M. and Emmet, W. le R. September 11th. Relates to switches for high-potential currents of large amperage, the fixed and movable contacts being immersed in an oil bath.

16,290. "Electric Distribution." Campbell, G. A. September 13th. Relates to the transmission of energy by varying currents, and to inductance coils for increasing the efficiency in telephone and like systems. Inductance coils having an air gap or break in the magnetic circuits to prevent dissipative losses are distributed along the line in series, several in each wave length.

16,293. "Electric Furnaces." Imray, J. (Soc. Electro-Metallurgique Française). September 13th. An arc furnace, for reducing ores, or decarburizing or dephosphorizing cast iron or other metals, consists of a crucible of refractory material, in an iron casing, placed below two or more carbon electrodes, from which independent arcs pass to the fused material, the object being to avoid introduction of carbon into the material, so that, for example, soft iron, chromium, or manganese may be obtained.

16,389. "Dynamo-electric Machines." Phillips, J. September 14th. Relates to apparatus for trimming or trueing the commutators of dynamo-electric machinery while in position. A shaft carrying an emery wheel is driven from a pulley on a spindle carrying at its opposite end a friction wheel bearing against the commutator. Means are described for traversing the emery wheel along the commutator.

(*To be continued.*)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

3,326. Electrical Printing Telegraphs. B. Soldatencow. February 8th. (Addition to 14,659/10).

3,655. Starting Systems for Engines or the like. C. F. Kettering. February 12th. (September 19th, 1912).

3,857. Trolleys for Electric Traction Systems. E. M. Munro and R.E.T. Construction Co. February 14th. (Cognate Application, 11,630/13).

10,920. Systems for Supplying from High Pressure Mains Continuous Current at a Lower Pressure. E. A. Graham and W. J. Rickets. May 8th.

10,988. Publicity Devices and the like. C. Lean. May 9th. (May 10th, 1912).

11,115. Means for Controlling Electric Circuits. H. Leitner. May 10th. (Addition to 16,174/12).

11,177. Telephone Exchange Systems. E. R. Corwin. May 13th.

11,191. Electric Annunciator for Electric Bells and the like. H. Myo. May 13th.

11,274. Regulating Electric Currents passed through the Human Body. E. E. Greville. May 14th.

11,370. Steel Manufacture. British Thomson-Houston Co. (General Electric Co.). May 15th.

11,371. Wireless Telegraph Transmitters. G. Marconi. May 15th.

11,453. Means for Detecting Continuous Electrical Oscillations. Marconi's Wireless Telegraph Co. and C. S. Franklin. May 16th.

11,506. Synchronous Dynamo-electric Machines. E. Rosenberg. May 17th. (Addition to 9,644/12)

11,561. Mariners' Compasses of the Projector Type. Kelvin & James White, Ltd., and M. B. Field. May 19th.

11,629. Trolleys for Electric Traction Systems. E. M. Munro & R.E.T. Construction Co. May 19th.

11,634. Process for the Electrolysis and Treatment of Sulphate Liquors. E. J. Hunt and W. T. Gidden. May 19th.

11,975. Production of Electrical Resistance Materials. Resisto-Electrical Manufacturing Co. and C. Ruzicka. May 22nd.

12,919. Electric Arc Lamps. A. H. Railing and A. E. Angold. June 4th.

13,135. Devices for Braking Electric Motors. J. Klinkenberg. June 6th.

13,988. Electrical Elements for Cooking. R. F. Venner. June 17th.

15,974. Sparking Plugs for Internal-combustion Engines. Electric Ignition Co. (1913), & A. Cox. July 11th.

16,565. Manufacture of Electrolytic Iron. Soc. Anon. "Le Fer." July 18th. (August 2nd, 1912).

17,164. Method of Localizing the Radiant Point of Electro-magnetic Waves and Apparatus therefor. R. Wanibuchi. July 26th.

17,809. Device for Securing Globes, Shades, Chimneys, or the like to Lamps. L. Severin. August 5th.

18,733. Electric Pocket-lamps. B. Lax. August 18th.

20,823. Self-starters for Internal Combustion Motors. K. Diehl. September 15th.

26,117. Production of a White Light Resembling Normal Day-light. P. Grosheintz. November 14th. (November 16th, 1912).

26,288. Telephonic Receivers. E. A. Graham. November 15th.

26,462. Electric Hot-plates and other Heating Appliances. W. A. S. Benson & Co. and W. J. Sims. November 18th.

26,602. Method of and Means for Use in Connecting an Automatic Telephone Sub-station System to an Automatic Central Station. H. C. Steidle. November 19th.

26,708. Watertight Telephonic, Telegraphic, and like Electrical Apparatus. E. A. Graham. November 20th.

27,618. Motor-vehicle and like Lamps. E. J. Lutwyche. December 1st.

28,286. Electrodes for Search-lights. Geb. Siemens & Co. December 8th. (December 7th, 1912).

28,535. Current Interrupting-devices for Electric Igniting Apparatus used in Internal-combustion Engines. P. Schroter and J. Kuster. December 10th. (December 11th, 1912).

28,630. Electrolytic Converter for the Transformation of Alternating Currents into Continuous Currents. A. Heinz. December 11th. (January 21st, 1913)

29,221. Receiver for Submarine Sound Signals. Signal Ges. December 18th. (December 18th, 1912. Addition to 2,185/13).

1914.

1,265. Electrical Control Systems for Motors Reproducing Predetermined Movements at a Distance. R. Girardelli. January 16th. (January 23rd, 1913).

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DIFFICULTIES IN CANADA: AN ORGANISATION NEEDED.

THE necessity that exists in some of our Colonies for strong representative British manufacturers' organisations to watch over British interests is emphasised in the "Notes" from our Canadian correspondent, published on another page to-day.

Experiences arise from time to time calling for protest or deputation to powers in authority, for British traders' interests, when left to themselves, are not always allowed to have fair play by large purchasing bodies. In such cases no single firm, nor a score of firms acting separately, can properly deal with the situation. Effective representations can only be made when they have the full force of an organisation behind them. In addition to being of service when particular matters call for attention, such organisations by their mere existence may have a moral effect, and act as a preventative of that unfair treatment that they are designed to overcome.

We commend the suggestion of our correspondent to the serious attention of our manufacturers who will know whether the conditions of the Canadian market can better be met by a branch of the B.E.A.M.A., or by a more comprehensive Association along the lines of the Association of British Manufacturers' Agents in Australia. The criticisms that are frequently received regarding the disabilities under which we labour in the Canadian market seem to us to fully justify the establishment of such an organisation as soon as possible. A number of our electrical firms have already spent a great deal of time and money in opening branches in Canada; it will be a thousand pities if such efforts lose any of their chances of success through lack of some combined endeavour to watch "events" as they arise, and to aim at securing the removal of grievances. That there are "events" and grievances seems to be pretty clear from information which reaches our ears from time to time.

For instance, several communications have come to hand lately regarding the placing of contracts by the Hydro-Electric Power Commission, whose operations extend throughout an area three and a half times as large as Great Britain. One writer says that this Commission called for tenders for ten thousand meters, and closed the list within five days after the manufacturers received notification. This was an unreasonably short time to allow for such important business. He states that the next move was to let out (accidentally) the prices which were bid on the ten thousand, and then tenders were called for fifteen thousand meters drawn over two years. A large number of these instruments, it is said, were for re-sale to various local municipalities. This system of doing business was very much resented, as also is the attempt to squeeze out of Ontario all but one manufacturer of meters for two years. The writer continues:—

> It is due to the European manufacturer that the various consumers should be able to buy meters at a reasonable price in Canada, but if business is to be conducted on the before-mentioned lines, it will not be long before the European interests withdraw. The result of this would be, from the customer's point of view, that they would again have to pay a high price which would result in huge profits for the companies then in the field. Could not the B.E.A.M.A. take this matter up and prove to those in power that such methods are not, in the long run, of very great advantage to them?

We understand that a contract for another class of manufactures for a long period has since been placed, and nobody knows which class may follow next, or where the practice will stop. It is undesirable that a powerful authority should in such a way close the door to European firms (who may already have shown their ability to give satisfactory service), not only by the placing of these particular contracts, but by setting an example which will probably carry a good deal of weight with municipal authorities all over the Dominion to the detriment of many firms. These municipalities will know that the hall-mark of the Commission has been given to a particular manufacture without being aware that the settling factor may only have been perhaps some trivial detail in shape or finish. Our sympathy is naturally with firms who have toiled steadily for several years to build up a business in an especially promising province, only to find, just as they had begun to feel their feet, that some influential concern, public or private, has arbitrarily taken away at one stroke practically all chance of business for at least two years.

We mention the foregoing as one of the many matters that might well be handled through a British organisation of some kind. Our Canadian correspondent mentions other questions which are of equal importance to all who are anxious that British manufacturers may operate in the market unhindered by prejudice and other unreasonable handicap.

THE UNDERWRITERS' CODE AND CANADIAN TRADE.

From time to time we have opened our pages to discussion on the Electrical Code of the Chicago Underwriters and its effect upon British trade in Canada. That Code has been viewed with suspicion by some of our firms, and regarded as an American barrier to various lines of British manufactures. Opinions of this character have sometimes been expressed by those who have visited the Dominion, but it is to be feared that occasionally they are given utterance to on no other authority than that of hearsay, no lengthened study either of the Code itself or of the market and its requirements having been made. It seems impossible that any firm can hope to be able to deal in an enlightened and successful way with this market without a thorough study of both the Code and the market.

British manufacturers have often been told that their failure to do better in Canada is due to their not adapting their manufactures to the requirements of the country. If they desire to do a good electrical business with Canada, the attitude of "take it or leave it" will have to be abandoned, for it is not to be supposed that we can alter the conditions which obtain there as the result of development operations that have extended over many years. It is unwise to excuse our own shortcomings by laying all the blame at the door of the Chicago Underwriters; a more profitable occupation would be to inquire into the origin and purpose of the Code and its development and application to conditions with the making of which it had nothing to do. British activities in the Canadian market are in many lines comparatively recent; the United States, with its enormous electrical industry and far-reaching connections, is just over the border-line; and when the Code has been revised, as it is with great care periodically, Americans and Canadians have naturally been taken into conference, framing the Underwriters' requirements in such a way to ensure a maximum of safety under the conditions prevailing in a territory new and in process of development, where American electrical engineering already in possession had not unnaturally made its impression. If British firms and British manufacturers complain that their interests are not studied in the Code, it is not that the Chicago Underwriters are anti-British or that they have any interests whatever in encouraging American designs, but because of the limited British electrical activity in the past and the resultant predominance of American electrical practice. If the electrical requirements of the people of Canada are such that American manufacturers in trying to meet them have less difficulty in meeting the requirements of the Code, it would seem to follow as the night the day that English manufacturers have either got to pursue a like course or be less successful than their manufacturing merits warrant. It is not suggested that this or any other set of rules has reached perfection—the fact that periodical revision takes place is proof of the recognition of that—and we learn that, far from having any feelings of hostility to the product of this country, the Underwriters are quite open to hear whatever suggestions or objections we have to offer. That is a perfectly reasonable position to take up. What so far may have been vague and general objections, may now be put down in black and white in definite terms, and suggestions which are not contrary to the safety requirements of the Underwriters, will, we are assured, receive every consideration.

Very naturally British firms objected to sending to Chicago to secure approval of manufactures intended for a British Colony, and when representations on the point were made, an endeavour was made to meet this legitimate objection by the appointment of inspecting engineers in this country who would, as the Underwriters' British representatives, examine, test, and approve suitable British manufactures on this side. Since that appointment was made complaints against the Code have been fewer than formerly, and, as a matter of fact, we believe that, speaking generally, the difficulty has been met, though the advantage taken of the London facilities has not been large. The objection that we could not get an increased turnover into Canada while we had to go to Chicago does not hold good to-day, and we look for larger business in consequence. It will hardly be possible to expect the Underwriters to place more extensive facilities at our disposal on this side until the turnover is large enough to justify their establishment and upkeep.

An important point that should not be lost sight of is the value of the Underwriters' Label. We are assured that nothing will be done to reduce the high standards imposed. The more stringent the test the higher has become the reputation of the Code and of articles approved thereunder. We believe that certain tests applied by the Underwriters' inspectors in electrical factories in this country have been a revelation to some of our own engineers, in respect to both their severity and their originality. When it is complained that isolated installations in certain parts of Canada have been accepted by the Underwriters in spite of defects, it has to be borne in mind that in a territory so wide, and with so much work being begun in pioneering and primitive fashion, the most efficient inspection is not always possible.

In view of the foregoing, and especially bearing in mind that the National Board of Underwriters, while it is a business organisation, and will do nothing to lower its high reputation as a judge of safety in respect to fire hazard, is prepared to receive whatever representations we may have to make from the British point of view, adopting suggestions wherever practicable, we think that the way is cleared for a better understanding of the Canadian trade position, and for a further well-planned effort on the part of our manufacturers to establish themselves strongly there.

Half-watt Lamps.

The question whether "half-watt" lamps of small candle-powers are on the market in Germany has been raised more than once in our columns of late; but we believe the contradictory statements that have been quoted arise out of nothing more than a lack of definition, resulting in misapprehension on one side or the other. It is well known that nitrogen-filled lamps can be made in very small candle-powers, with fairly high efficiencies, for low voltages, and they are, in fact, on the market in this country; the great question, however, is whether they can be made for pressures upwards of 200 volts, with candle-powers not exceeding 50 c.p., and at an efficiency of half a watt per candle. The answer, we believe, is in the negative.

It is true that the A.E.G. is advertising "half-watt lamps" of 50 to 200 candles, but the 50-candle lamp burns at 14 volts only, necessitating the use of reducing transformers on A.C. circuits, and preventing the adoption of the lamps in houses supplied from D.C. public mains. The efficiency and life of the smaller sizes are distinctly inferior to those of the larger ones. It is interesting to see history repeating itself in this way; it is but a few years since the boom of auto-transformers to enable tungsten lamps to be adopted took place here, and many of the installations then fitted with transformers still have them in use. Now the transformer is again required—but for a still lower voltage, necessitating the purchase of a new one; and this time the reduction of pressure is so great that, in spite of the increased efficiency of the lamps, the current required at the low voltage is far greater than before, and the existing wiring is likely to be much too light to carry it.

But the need has not yet arisen in this country, as a supply of the lamps in question is not available here, and, though increase in efficiency must unquestionably benefit the industry in the long run, it is not desirable that the improvement should take place too quickly. We think supply engineers have no need to worry at present; the half-watt lamp for domestic use is not yet in sight.

While "one-watt" and "half-watt" lamps are commonly spoken of, it should be borne in mind that these are only rough approximations to the truth, even when the "hefner" is in question (0·9 C.P.); the actual consumptions are nearer 1·2 and 0·6 watts per candle, in the horizontal plane.

The Copper Situation.

Really although the copper position is not so bad, there is not much apparent to encourage high hopes as to the chances of prices advancing materially in the near future. Taken altogether there has been quite a gratifying degree of steadiness in the market, but not sufficient to impart any real feeling of confidence to consumers whose attitude is still one of very modified enthusiasm, and whose purchases are strictly limited to the satisfaction of pressing needs. For some time now the trend of statistics has been against holders of copper, and the last American details afforded little encouragement to the bulls, though, rather strange to say, the publication of the returns was actually followed by an advance in prices. This was because the reduction in the month's output, compared with April, was heralded as being the forerunner of a move for the concerted diminution of production at the largest United States mines. In a way there is nothing amiss with the situation, and prices can hardly go much lower, but all the same there is no reason to look for much improvement yet awhile. There is, moreover, the possibility of a small further reduction in prices unless some definite turn for the better is to come to the rescue of the market, which can only, it would appear, be through an extension of buying by the consuming trades. It may be taken for granted that at current prices many mine-owners are inclined to check output rather than continue it on a heavy scale. It is only natural that there should be a disposition to husband ore reserves, pending a more favourable opportunity than that at present available for finding a market for copper. There is no doubt that the larger producers are not too much enamoured of the situation, for they have latterly again been shading the prices of refined metal, while it is doubtful if they have succeeded in clearing off any important quantity. The trade doing in the chief European centres has certainly not been much stimulated by the price reductions which have been put into effect, and although it is reported on somewhat vague authority that things are a little better in the United States, it is pretty certain that there has not been any development of demands upon a scale justifying anticipations of an early sharp upward movement in prices.

The tendency of stocks to accumulate is unmistakeable of late, the increase being apparent on both sides of the Atlantic, and it will require a very clear stimulus to trade to reverse the prevailing conditions. True, the increase in the stocks is not very large, but speculation is quick to note tendencies, and the persistent move in the direction of greater ease in this respect cannot be expected to pass unheeded. The total surplus stocks in Europe and America have gone up about 15,000 tons during the last three months, from 55,500 tons at the end of March, to 70,600 tons at the end of May, but the total at the latter date is only 5,000 tons in excess of the quantity held at the end of January, when cash copper stood at about £66 a ton. The increase since the beginning of the year is thus pretty well discounted in the reduction which has already taken place in the price. The world's visible supply, too, is practically the same as it was at the end of last year, when the price was about £65 a ton. The generally poor trade advices from all parts, and the very unfortunate position of things recently on the Stock Exchange have, no doubt, had something to do with the slackness, and with a revival of hope in share circles, there is no doubt that copper would undergo a moderate improvement. Possibly a move in this direction may be seen soon. Failing this, however, the market seems destined to slip back a little further for a time.

F.O.B.

The cruise of Mr. and Mrs. Hobhouse with their niece and other friends in His Majesty's telegraph ship *Monarch* to Scotland, at their country's expense, is not to be taken too seriously. It is one of those little incidents insignificant in themselves that might easily be passed over, were it not that they serve to give the public the measure of the men to whom the Empire entrusts its destinies. From time immemorial, so far as the present generation is concerned, cable ships have been famed for their hospitality and good cheer. So long as this hospitality is extended by private owners, it is, in general, beyond criticism, and in some noteworthy instances it has conferred untold benefit and happiness upon our countrymen and upon others doing service at remote and rarely visited foreign stations. His Majesty's ships, in like circumstances, are renowned throughout the world for similar hospitality, and it would be foolish in the extreme to advocate any lessening of this direct aid to a good understanding between the nations. The mischief begins when the hand of hospitality turns not outwards but inwards, and it is most nasty when those who condescend to this form of irregularity are those who control and who are paid to keep matters straight.

An article in the *Evening News* a few days ago contained what was described as an official statement regarding this cruise, from the private secretary of the Postmaster-General. In this account of the proceedings it is first of all denied that the cruise was in the nature of a pleasure trip. The defence is that the Postmaster-General was at work the whole time. It is admitted that the party landed several times to play golf and to fish, but it is contended that this did not interfere with the movements or the work of the *Monarch*. This is a very ingenious upholding of the virtue of Mr. Hobhouse, but the fact that he was at work is not in itself conclusive. It requires to be shown that he was engaged upon a task directly associated with cable-laying or repairing, and that his work in the *Monarch* could not have been carried out on shore. If cable work was proceeding the whole time, the occasion was scarcely one suitable for the presence on board of Mrs. Hobhouse and her niece. In brief, the exploit is not what in ordinary parlance could be called a clean potato. In his recent speech at the London Chamber of Commerce he said that his department were always watching with the hope of making any improvement they could. He declared also that while his department had a duty towards the public, the public had some duty towards the department. The *Monarch* incident may suggest, perhaps, just the kind of improvement for which the department has been watching. It certainly affords precisely the kind of example, defining departmental and public duty, required for the Postmaster-General's next speech.

Public Servants and the House of Commons.

In the course of the Post Office debate last week, a matter was raised which well deserves the attention of the public. The Member for Brentford, who supports the Opposition, said in relation to the redress of certain grievances from which Post Office servants are alleged to suffer, "the present system of putting pressure on Members of Parliament cannot go on." The Member for the Spen Valley Division, a supporter of the Government, was still more emphatic. He said: "This discussion is largely electioneering and vote-catching, and is brought about by pressure. I do not complain that Post Office employés should use their only remedy, but all parties should resolve to get rid of this lobbying and circularising. With the increasing number of Government officials in the country, it is a serious matter that numbers of electors should give their votes, not on national issues, but on the conditions and terms of their own employment."

The pronouncement was received with acclamation, and we are glad to note that the Government decided to free the members from political pressure by appointing a special tribunal outside the House to deal with the questions under discussion. The Member for the City of London suggested, in an aside, that all persons holding appointments under Government should be disfranchised. Such a proposal may not be within the bounds of practical politics, but we are persuaded that it represents the views of a large number of people.

We have never lost an opportunity of calling attention to the undesirability of allowing municipal servants to enjoy the municipal franchise, and the fact that servants of the Post Office are endeavouring to influence Parliamentary opinion for the purpose of securing better hours, or better wages, shows that they ought not to be allowed to vote. They have shown that their interests are in conflict with their public duties. Nor does it appear to us that the agitation for better terms to postal servants is very meritorious in itself.

If half the paid appointments in the gift of the Postmaster-General were declared vacant to-morrow, there would be scores of applicants for each individual job. Yet, by their weight of numbers, it seems that the servants of the Post Office can exercise a considerable degree of control in Parliament.

A Merchants' Association in Germany.

The Electrical Merchants' Association, of Frankfort-on-Main, which was formed in that city in 1910, has local or district branches in Berlin, Nuremburg, Hamburg, and in Saxony.

Its object is to secure the combination on an economic basis of all the merchants in Germany, either as representatives or as retailers. For this purpose the Association seeks the adoption of measures against the granting by local authorities of privileges to certain large firms in the form of monopolies in the supply of materials or in installation work; the securing of representation and voting power in the Committees of the Verband Deutscher Elektrotechniker; the conclusion of arrangements with manufacturers and combinations of manufacturers with respect to common conditions of contract; or eventually the adoption of joint action against manufacturers as well as installation contractors for the protection of any member of the Association who is not at fault in cases of dispute. In addition, the Association aims at the regulation of sale prices, the removal of excessive competition, the purchase of materials on joint account and the joint announcement of increases in sale prices. The Association has, so far, been able to enter into friendly relations with the Installation Contractors' Syndicate and the Buying Association of the Installation Contractors; the trade contest between individual members of the Association has been brought into a worthier course, and its neutral attitude is said to have caused the original mistrust of manufacturers to disappear.

The I.M.E.A.

The thoughtful address with which Mr. R. A. Chattock opened the proceedings at the Convention of the I.M.E.A., which is now in session, deserves the careful attention of all who are interested in the future of the electrical industry. Approaching some of the great questions which are pressing for solution with judicial caution and impartiality, Mr. Chattock summed up the situation and announced his considered opinion in each case with decision and finality. The first part of his address related mainly to the things that are; the second to what may be in the future.

Dealing first with the former, we note with interest a feature which stands out in several relations, although not explicitly emphasised by the President—it is the unfortunate, if not disastrous, result of deferring too far to the idiosyncracies of a small number of persons on either side of a controversy. That everyone has a right to hold and to express his own opinion, we willingly agree; but that he should endeavour to force his views upon his fellows, or that the latter should too readily submit to his persuasion, we do not believe—the will of the majority, tempered by due regard for the interests of all, ought necessarily to prevail.

As a case in point, we cite Mr. Chattock's comments on the failure of the M.E.A. to arrive at an agreement with the B.E.A.M.A. last year; the Council's recommendations were rejected owing, we believe, to the strong views held by a few of the members. The result was that the Model General Conditions of Contract of the I.E.E., issued a few months ago, have obtained general acceptance, and are likely to become firmly established, while the M.E.A. is apparently as far from agreeing with the B.E.A.M.A. as ever. In passing, we may compliment the Council of the Institution on this admirable example of effective action in a purely industrial matter, which might well be followed by similar work in other parts of that great field.

Again, Mr. Chattock deplores the failure to arrive at an agreement with the Electrical Contractors' Association, due to the irreconcilable views of a few extremists on either side, which has resulted in the resumption of the Parliamentary conflict.

As a third instance, we refer to the fate of the Industrial Committee of the I.E.E.; Mr. Chattock expresses no personal opinion on this matter, though it is easy to read between the lines of his address, but that the dissolution of the Committee was due to the strong views of a few influential members of the Council, we think, will not be disputed. It will be noted that Mr. Chattock advocates the formation of a Central Association to represent the industry in general, and, in fact, to discharge the functions for which the Industrial Committee was originally appointed, and he puts forward a definite proposition which may well afford a satisfactory solution to the problem.

Turning to the second part of the address, we think the President's objections to the joint management of gas and electricity supply undertakings will be endorsed by every member of the Association; unfortunately, he did not refer to the possibility of technical co-operation between the two industries, which raises entirely different questions for discussion. But by an easy transition he came to what we may call his "pet subject"—the centralisation and nationalisation of electricity supply throughout the country—on which his views agree in the main with those put forward by Dr. Ferranti three years ago. That the concentration of generating plant is the true path towards the attainment of the ideal of electricity supply at bed-rock prices is not open to question nowadays; but the mode by which that end shall be attained is not so readily decided. State ownership is notoriously inefficient and uneconomical; but the other alternatives mentioned by Mr. Chattock are recognised as feasible and advantageous, and the tendency of expert opinion is decidedly towards one of these. We are glad to note that Mr. Chattock reassures those engineers who might oppose this policy for their own safety; self-preservation is the first law of Nature, and we do not blame them for its exercise, but we are certain that they need have no fear.

Mr. Chattock's views so largely coincide with those which we have put forward in these columns that we may be excused if we express the pleasure and satisfaction that we have derived from the perusal of his address, and the hope that his views may commend the approval of all who read it.

THE MUNICIPAL ELECTRICAL CONVENTION.

BIRMINGHAM was in its brightest mood when the 19th annual Convention of the Municipal Electrical Association opened its proceedings in that city on Tuesday last. Upwards of 500 members and visitors are attending this year's meeting, which embraces a most strenuous round of visits, interspersed with debate and entertainment, the latter commencing with an informal reception and smoking concert on Monday evening.

The Lord Mayor (Lieut.-Col. Martineau) briefly and cordially welcomed the visitors at the Midland Institute on Tuesday, and subsequently Mr. R. A. Chattock, Birmingham's city electrical engineer and this year's President, delivered his inaugural address.

With the latter we deal at length elsewhere; it is sufficient to say that it covered a variety of matters of moment to electrical suppliers, and met with the cordial approval of the meeting, whose thanks were voiced by Ald. Bruce (Sunderland), and Mr. Harry Richardson (Dundee). Then followed Mr. Vignoles's paper on "The Commercial Development of Electrical Supply in Towns of Moderate Size," of which we give an abstract elsewhere, the discussion will be reported in a later issue.

Mr. Vignoles deals clearly but concisely with a very big subject—the paper, in fact, extends much beyond the usual limits, and will well repay the close perusal which some of the speakers in the discussion unluckily admitted they had not given to it, thereby incurring the wrath of a worthy alderman who takes such matters seriously.

The discussion showed the tendency which exists towards co-operative development of electricity supply and the need for some representative controlling force behind the movement.

At the conclusion of the morning's discussion, the visitors adjourned to luncheon at the Grand Hotel, at the invitation of the Birmingham Entertainments Committee.

The toast list was a brief one, but it cannot be passed over without some reference to the enjoyable speeches of Bailie Willock in proposing "The City of Birmingham," and of Alderman Bowater in replying to the toast.

The afternoon was given up to visits to the works of the General Electric Co. and Messrs. Belliss & Morcom, some reference to which appeared in our last issue.

It may be here mentioned that a representative party of members of the Press were, through the courtesy of the General Electric Co., enabled to make a complete tour of the company's works at Witton, and of the Ileene Works, on Monday, when every department of these works was thrown open to inspection.

During Tuesday afternoon a demonstration of electric vehicles was held at Witton. Wednesday's proceedings were held at Coventry, Thursday's at Stratford-upon-Avon and Warwick, and to-day the annual general meeting is taking place at Birmingham.

The Annual Dinner.

At the annual dinner, held on Tuesday evening, after the usual loyal toasts, **ALD. BRUCE** (Sunderland) proposed the toast of the "City of Birmingham," the **LORD MAYOR** (Lieut.-Col. Martineau) responding in suitable terms.

DR. S. Z. DE FERRANTI proposed the toast of the "Incorporated Municipal Electrical Association," emphasising the especial pleasure which it gave him to perform this duty. If he could give them any advice, it would be to keep the Society a "live" one, and that the members should exact from the Council due regard for their interests. He went on to refer to the disappointment of the Industrial Committee of the I.E.E., of which so many of them were members. Part of the work of their Association should be to educate the public to the use of electricity. A few years ago he had outlined his ideas as to the universal use of electricity, a matter which had been referred to by the President. They did not agree, perhaps, in the methods to be adopted but their ideals were similar. When it paid to employ electrical methods it would come about. He had previously given his opinion that it would not pay to carry out the idea until they could get at least 25 cent. of the energy out of the coal in the form of electricity.

The **PRESIDENT** (Mr. R. A. Chattock) in responding expressed appreciation of Dr. Ferranti's remarks. His experience of the Association was that every endeavour was made by the Council to further any desirable object. The Convention was only an interlude in the work of the Association, which continued throughout the year. He concluded by thanking them for their hearty reception of the toast.

MR. J. F. C. SNELL, in proposing the "Electric Supply Committee of Birmingham," referred in complimentary terms to the extraordinary growth of electricity supply in the city and the efforts being made to cope with it. He looked forward to a great expansion of the supply when the advantages of the Corporation's new power station were realised. It was necessary to look at the matter from its broader and more national aspects; the cheap supply would benefit the Birmingham manufacturers in their competition in the markets of the world. Councillor Ellaway (chairman of Birmingham Electricity Supply Committee) replied.

MR. H. RICHARDSON proposed "Our Guests," in felicitous terms, the Mayor of Stratford and Councillor Lee (Coventry) replying.

Presidential Address.

MR. R. A. CHATTOCK expressed his regret that the contentious clauses in the model general conditions had not yet been agreed between that Association and the British Electrical and Allied Manufacturers' Association. A set of model general conditions had been issued by the Institution of Electrical Engineers without the approval of their Association, and these Institution model conditions, which were at variance with their ideas in many respects, were now being put forward by manufacturers with the authority of the Institution behind them, and buyers were being obliged to accept them without much hope of negotiating alterations in them. He felt that a very different result, and one more favourable to them, would have been obtained if members of that Association had adopted the carefully-considered recommendations of the Council 12 months ago.

Negotiations were opened with the Electrical Contractors' Association to try and get them to withdraw their opposition to the Electric Lighting Bill, 1914, in order that the Bill might go through unopposed. It was ascertained that many of the contractors were in favour of withdrawing opposition, but eventually the opposition element in the Contractors' Association was successful, probably due to the action of those who were opposed to wiring being carried out by municipal supply authorities under any circumstances whatever.

He believed the contractors exaggerated the quantity of work that it would be possible for a municipality to undertake. They sought these powers not for the purpose of securing more trade, but to ensure good work, especially in the cheaper classes of installations. The expensive work in hotels and good-class business houses and residences, which was well paid for, was, as a rule, well done. Moreover, there was the wiring work for telephones and bells which the contractors must obtain, because the municipality had no power to do it, and did not seek such powers, with the result that a customer would probably prefer to place the whole order with one person instead of two. In addition, the contractor could calculate the profit on the whole combined order, and he could probably successfully compete in price with the municipality. With the cheaper work, the case was entirely different: the margin of profit was so small that the quality of the work often suffered, and the men who did it, as a rule, were not worth going for if trouble resulted. It was this jerry work that they wanted to eliminate.

The idiosyncrasies of a few engineers, and possibly also of a few contractors, should not be allowed to interfere with the well-considered policy of their Association in putting forward a scheme that all supply engineers, and, he believed, all broad-minded contractors, considered to be in the general interests of the industry. He sincerely hoped that a satisfactory agreement would be shortly arrived at. It was unthinkable that supply undertakings could do without electrical contractors.

Considerable progress had been made during the past few months in developing the adoption of the electric battery vehicle in this country. Demonstrations had been made in several towns, and working trials were being arranged for over extended periods. It was only by bringing and keeping these vehicles before the public that interest would be aroused in them, and for this purpose he considered that supply undertakings should be prepared themselves to bear some of the cost. Demonstration vehicles could quite well be used by municipalities for many of the operations that had to be carried out by them, and money spent in pioneering work of this kind would amply repay the supply undertaking. It also gave confidence to the public when they saw the vehicles in service, and it enabled first-hand figures as to cost of operation to be given to prospective users. In a large city many thousands of pounds of revenue would be obtained annually from the use of these vehicles when their adoption became general.

Up to the present, the expenses incurred by the Electric Vehicle Committee had been met out of the funds of the Association. The Committee estimated that during the coming 12 months their requirements in this respect would amount to about £200, and, with a view to meeting this expenditure, they were approaching the various municipal electric supply undertakings with a request that they should each contribute from one to three guineas towards this fund. They had also approached the manufacturing firms and others interested commercially in the movement, and had been met by a very liberal response.

Referring to the dissolution of the Industrial Committee of the Institution of Electrical Engineers, Mr. Chattock said that the report of the Council made it clear that the Industrial Committee felt that under their existing constitution and powers they were not in a position to perform useful work.

As a member of the now defunct Committee, he explained that they recognised that in all industrial concerns, differences of opinion must arise on matters of policy and detail, and the same thing applied to the operations of the various existing associations, which were bound to come into conflict with each other at times. Such points of disagreement were usually settled by meetings and discussions between the associations concerned. Occasionally, however (as in the case of the present disagreement between themselves and the Electrical Contractors' Association over the wiring clauses), disagreements arose which it appeared almost impossible to settle. The Industrial Committee felt that a case of this kind was one in which they should be in a position to assist, and, if necessary, offer to arbitrate, and, in view of their not being able to do this under their constitution, they felt that some body should be called into existence which would be capable of offering its services in such an eventuality.

He was of the opinion that all the associations connected with the electrical industry (and there were many of them) should form from their members a central association, which could arrange conferences to consider disagreements between individual associations, and, if necessary, arbitrate upon the same, and which could be called together by any individual association requiring support in its operations, whether political or industrial. It rested with the various associations themselves to form such a body, and if it were called into existence solely for this specific purpose, there was every reason to believe that it would be of inestimable advantage to all branches of the industry.

He thought that the many and varied interests represented on the Council of the Institution, which interests were largely individual and not really representative of the various associations, rendered it impossible for the Council to deal with disagreements between individual associations in the way that a body such as he had outlined could.

In an address given by Mr. J. J. Newbigging as president of the Manchester District Institution of Gas Engineers, at their annual meeting held in March last, Mr. Newbigging touched upon competition with electricity, and, coming as they did from the chief gas engineer to the Manchester Corporation, his remarks provided ample evidence that gas undertakings were beginning to fear the competition of electricity.

The real reason why electricity had been coming to the front so much faster than gas was undoubtedly the great reduction that had been made in the average price at which electricity was now sold to the consumer as compared with gas. In the year 1901 the average net price of gas in Birmingham was 26·68d. per thousand cb. ft. In the year 1914 this had dropped to 19·41d. per thousand cb. ft., a reduction to the consumer of 27·3 per cent.

In 1901 the average price received for electricity per unit was 4·37d. In 1914 this had dropped to 1·15d., a reduction of 73·6 per cent.

Mr. Newbigging suggested a combined control for municipal gas and electricity undertakings; he was glad to have this opportunity of joining issue with him at once.

He was of the opinion that the single control of gas and electricity undertakings would have exactly the opposite effect to that outlined by Mr. Newbigging. It would mean the total suppression of competition, and would create what he considered would be fatal to the interests of the consumer, namely, collusion. Instead of tending to foster keen rivalry between the two departments, it would effectually destroy that desire amongst the staff to improve upon previous records that was such an immense factor in the success of these public supply undertakings. Fair competition must always have a stimulating effect on industrial concerns, andto stifle this would be to deprive the ratepayer of the only real guarantee that he had for the most economical administration of both departments.

The charge that prices for current were sometimes cut down to an unjustifiable figure to secure business could not be substantiated.

The sale of gas was largely controlled by the amount the undertaking could obtain for its by-products. This amount was frequently greater than the gross profits earned during the year. The electricity department had no by-products to sell except the useful employment during the hours of small demand of the generating plant and underground distributing mains, which had been purchased to supply the maximum load demanded during the winter months, that was to say, cheap current with a high load factor, and low quotations for current of high load factor were perfectly justifiable under these conditions. They were not given with the sole object of securing business, but to reduce the average cost of giving the supply, to the benefit of the whole of the consumers.

He maintained that it would be impossible for one manager and one committee to work both departments in the interests of both classes of consumers. A man must become biased to a certain extent in favour of one or other of the branches of the supply, and it would be practically impossible for him to give an unbiased recommendation to his committee on a point involving, for instance, the development of some new area, as to whether this should be carried out by gas or electricity.

Consumers would resent being told that they could only have one or the other, and such a policy would undoubtedly have the effect of driving manufacturers and others away from the city, whilst it was more than likely that the Board of Trade would be inclined to admit outside competition from power companies if they found that the statutory obligations for giving a supply were not being properly carried out.

To his mind there was no evidence whatever that the existing methods of single control of both gas and electricity undertakings had been unsuccessful. There was a field for both of them, as was shown by the increased outputs of both that were recorded year by year, and until such evidence was available, single control should not be considered.

If centralisation ever came—and it would be greatly to the advantage of the users that it should—it was obvious that it would be quite impossible to arrange for single control of two industries, one of which was purely local and limited to comparatively small and isolated areas, whilst the other was national and capable of being applied over the whole of Great Britain as one concrete system of supply.

For some years past the question of bringing isolated electric supply undertakings under one central system of supply had been occupying the attention of electrical engineers, especially in London. In the provinces, too, the larger municipalities had been extending their boundaries, and incidentally taking over the electric supply undertakings belonging to the areas incorporated, with distinctly beneficial results to themselves and to the areas taken over. Parliament had also recognised the principle by agreeing to the formation of the various power supply companies which were operating in several counties.

All these were steps in the right direction, though they were as yet a long way off the goal—where it would be possible to obtain, all over the country and at one rock-bottom price, a supply of electrical energy for any purpose, such as power, heating, lighting (and this would ultimately be such a small percentage of the whole that the poor load factor could be safely ignored), domestic requirements, traction by rail, road, or tramway, &c.

The provision of cheap power and cheap transit for both goods and workmen was a most important consideration.

The larger municipalities in this country had pointed the way —now it remained for Parliament to tackle the question of nationalisation; whether by means of a Government department or a Public Board of Management, such as the Port of London Authority, or a private company, subject to limitations as to dividends and prices to be charged for current supplied, was yet to be seen.

Until some such scheme was brought into operation, it was useless to expect any marked reduction in the cost of producing and distributing electrical energy below that obtaining in the large power stations now operating in this country. It was only by tackling the problem boldly, by being prepared to supply current at prices much lower than were ruling at present, and recognising that for a few years there must necessarily be a deficit on the large initial expenditure incurred, that it would be possible to attract and develop the large volume of business that would be necessary to make such a scheme a financial success in the future.

Large bulk supply power stations should be installed in various parts of the country, having regard to the three following chief requirements:—

Proximity of an ample quantity of coal.

Proximity of an unlimited supply of water for condensing purposes.

Proximity of the various large centres of industry where the major portion of the energy was likely to be required.

As soon as these bulk supply stations were available and the distributing trunk cables installed, the majority of the small generating stations in the country should be at once shut down and utilised as sub-stations.

It would probably be concluded that when all these stations were shut down the engineers in charge of them would not be required; but it would be the worst possible form of so-called economy to dispense with the services of a single man at present employed in all these undertakings. The very object of the scheme was to increase enormously the business to be handled in all these centres by giving the supply at a much more attractive price. The men on the spot had the best knowledge obtainable for pushing the business and developing the distribution of the bulk supply that they would receive, and the chief engineers in charge would be especially valuable in this direction. The electrical engineers had to be managers of their businesses as well as engineers in charge, and the business control was every bit as important as the engineering control. The commercial side of the business was so dependent upon technical matters that it was necessary to have an engineer at the head. He did not see, therefore, that there need be any apprehension in the minds of the existing engineers in charge that they would not be required if such a scheme came into being.

The main distribution should be carried out wherever possible by means of overhead trunk mains, and provision should be made for reasonable wayleaves to be compulsorily granted. Without special powers regulating the granting of wayleaves, it was probable that the cost of obtaining them would very nearly kill the saving of overhead trunk lines compared with underground cables.

The cast-iron boundaries of existing municipalities and companies would entirely disappear, and development could go on freely and along lines most beneficial to the community in general.

There was no reason why the London scheme should not be developed as part of a large national scheme such as he had indicated.

He suggested that as this scheme was so vitally important to all industrial centres, in their own interests the large municipalities, which at present controlled the major portion of the bulk supplies in the provinces, should meet together and discuss the matter, and, if possible, formulate a satisfactory scheme which could then be brought jointly before Parliament, to be subsequently developed on proper commercial lines.

The justification for this method of procedure was the supply of electrical energy for all purposes, whether industrial, domestic, or public utility, at a price far below what was now being paid:—

(*a*) For the benefit of the community as a whole.

(*b*) For enabling our manufacturers to compete successfully with their rivals abroad, who were developing their resources on these very lines.

(*c*) For the abolition of smoke in our large cities, and the consequent general improvement in the health of the community.

(*d*) For the conservation of our coal supplies, which would be utilised on the most economical lines at present known to science, and

(*e*) For the upholding of our position as the leading country in the world of commerce, which position was being assailed more and more every year.

Some Notes on the Commercial Development of Electricity Supply in Moderate-sized Towns.

(*Abstract of paper by* W. A. Vignoles, *Chief Electrical Engineer, Grimsby.*)

To market the commodity it must be brought to the notice of the people who are likely to buy it, and this may be done in any of the following ways :—

(1) Showrooms, where electric fittings, heaters and cookers can be seen in use ; (2) periodical exhibitions or demonstrations serving the same purpose ; (3) advertising ; (4) personal canvassing.

Where, as in Grimsby, the undertaking has no special powers, and arrangements have to be made to sell through contractors, only a small proportion of the cost can be covered by the profit on sales, and the writer is convinced that under these circumstances the same results can be obtained in other ways at less expense. This view is based on experience in other towns ; for instance, the engineer in a town of about 100 000 inhabitants stated recently that his showroom cost him £600 per annum excluding canvassing staff ; in Grimsby excellent results have been obtained by advertising, with considerably less expenditure, as the following figures will show :—

Year.	1908-9.	1909-10.	1910-11.	1911-12.	1912-13.	1013-14.
Amount spent in advertising	£20	£48	£177	£335*	£268	£250
Increase in private consumers	102	106	203	168	230	315
Increase in revenue from supply to private consumers only	£38	£869	£1,242	£1,062	£1,864	£2,144

*This includes nearly £100 spent on demonstrations, exhibitions and showrooms.

All of the following advertising methods are used :—(1) Advertisements in local newspapers ; (2) enamelled iron plates on works using power ; (3) enamelled iron plates on the lamp-posts in the streets ; (4) posters in selected positions on Corporation property ; (5) personal facsimile letters ; (6) church and chapel magazines and bazaar catalogues ; (7) exhibitions and demonstrations ; (8) pamphlets and leaflets ; (9) issue of magazines—advertising electricity for works and for the home respectively ; (10) loaning apparatus for trial ; (11) canvassing ; (12) issue of a consumers' guide.

On a turnover of £20,000 to £24,000 the cost, which has averaged about £250 per annum, cannot be considered extravagant.

The writer suggests that the I.M.E.A. should appoint a Committee with full powers to confer with the Electricity Supply Publicity Committee or any other body, to endeavour to formulate some scheme by which a co-operative system of publicity could be put on foot for the benefit of electricity supply generally.

A difficulty in the way of a large combined municipal scheme of advertising, is that in a number of towns both electricity and gas are in the hands of the Corporation, but there does not appear to be any gas undertaking in the country that has seriously suffered from the competition of even the most energetic electricity supply authority.

Exhibitions and demonstrations are very useful in stimulating interest, and should be held from time to time, especially when any development comes along that it is desired to bring to the notice of the public ; but the cost is heavy, and they should not be held too frequently, otherwise the appeal is likely to lose its force.

Every undertaking of the size under consideration should employ an engineer as canvasser or representative, devoting the whole of his time to following up inquiries and canvassing. If systematic advertising is carried out it will be found that one man will be fully employed in following up inquiries.

With large power consumers the personal efforts of the manager will nearly always be necessary before the business is settled.

Arrangements should be made with the borough surveyor to supply the department with the names of persons who have submitted building plans for approval, and to give particulars of any new roads or estates that are being laid out ; and strenuous efforts should be made to induce the speculative and other builders to wire new houses.

The Grimsby E.L. Department offers free advice to all consumers, and for a small fee, 2½ per cent. on the value of the work with a minimum of 5s., undertakes the preparation of a specification of what is required, and superintends the carrying out of the work.

Alternatively, any consumer can obtain free of charge an outline scheme for the lighting of his premises.

These schemes and specifications are prepared under the manager's supervision by a special assistant (who may be called the consumer's engineer) well up in illumination problems, and are worked out on scientific lines.

When new devices or apparatus are placed on the market, the Department purchases a few examples and lets consumers have them on loan for trial.

Some years ago the Grimsby Electricity Committee met the local contractors, and after discussing the question of hiring with them, a friendly arrangement was come to by which the Department hires out :—(1) Motors and starting apparatus ; (2) arc lamps ; (3) cookers ; (4) heaters, and (5) provides installations and apparatus on hire-purchase.

All wiring work is done through a contractor, and no apparatus is hired out that is of less value than £3 10s.

In many cases the Department takes over the hire-purchase of apparatus or installations provided and arranged for by contractors. In these cases the profit is shared between the contractor and the Department.

It is of the greatest importance that consumers should be induced to adopt electricity for all purposes, and everything possible should be done to make it easy for them to do this by the hire, supply on hire-purchase, or loan for trial of all kinds of apparatus.

Installations on a rental basis can be given equally well by placing the actual work in the hands of a contractor, the Corporation merely doing the financing.

In such cases it is advisable to combine the charge for the hire of the wiring with the fixed charge of the rateable value system if electricity is supplied on this basis.

Sufficient has almost been said to show that it is possible to adopt a forward policy and to successfully develop the business of an undertaking without the help of a sales department.

If an undertaking is to progress satisfactorily there must be no hesitation on the part of the committee in spending the money required for extensions of mains to reach consumers. A guarantee should not be asked for unless there is a strong probability of the undertaking losing money by giving the supply and it is felt that it would be better to be without the consumer ; but in coming to a decision the possible developments in the next few years should be borne in mind.

In Grimsby a very large length of $\frac{7}{16}$ 3-core distributor has been laid and has given excellent results in providing for extensions in streets where there are numbers of small houses.

In Grimsby supply is being given to consumers at present whose annual bill only just reaches 30s., while with slot meters many consumers are paying less than this. With such a small revenue it is extremely difficult to meet all charges.

By standardisation and by adopting a system of looping services running one cable for each pair of houses, the average cost per service has been steadily reduced from £3 19s. 10d. in 1906-7 to £2 17s. in 1912-13.

Suitable methods and rates of charging must be adopted to induce consumers to generally adopt electricity for heating, and, in the writer's opinion, the most suitable method will be found to be the rateable value or Norwich system, with the running charge not above ½d. per unit.

With the smallest consumers, and in premises where the tenant is likely to change frequently, it is very desirable to use slot meters ; the revenue that has been obtained in Grimsby from these in the last few years has been as follows :—£383 (1914), £270 (1913), £201 (1912). The meters have been arranged for 5d. per unit, but when the meter is cleared 2d. in every 1s. is returned, so that the net cost is about 4d. per unit, instead of 3¾d., the usual flat rate.

In Grimsby, with a 1d. rate, and without any appreciable number of heaters being let on hire, the sales for heating and cooking have amounted to £206 (1912), £294 (1913), £324 (1914).

Cooking suffers at present under the disadvantage that the only suitable apparatus is too expensive for the small householder to buy, while it is difficult to get consumers to pay 15s. per quarter for cooking apparatus when they can hire a gas cooker for 3s. 6d.

If a number of undertakings were to combine together, and adopt a particular make of cooker, they should be able to buy on better terms.

The writer hesitates to recommend that the I.M.E.A. should appoint another Committee on this question, but a precedent is to be found in the establishment of the Committee on electrical vehicles, which appears to be doing work which could not possibly be done by any single undertaking.

The second part of the paper deals with financial management, in regard to which the only sound policy is to place the whole control of the undertaking under one supreme head, who should be absolutely responsible to the Committee for the success of the undertaking. Where accounts are kept by the borough treasurer, difficulties occur, because the staff is not in touch with the working of the undertaking.

Mr. Pearce's suggestion that a limit should be placed by Parliament on contributions to the rates, would strengthen the hands of Committees who are anxious to protect the assets of an undertaking.

The policy of devoting all profits to the undertaking is the soundest and best for the district.

The best way to raise capital is by borrowing on mortgage on the district rate, and the usual method of repaying a loan is by an annuity equated to give equal payments on each year's working.

Adequate provision must be made for depreciation by reduction of capital or in some other way ; allowance must be made for obsolescence, which complicates the question of the amount to be provided. A reserve fund may be called on for supplementing revenue, and a margin must be allowed over the calculated depreciation figure for this contingency.

In the Grimsby accounts the depreciation fund is represented by repayment of loans, revenue contributions to capital outlay, reserve fund and sinking fund.

Where loans are redeemed on the equated payment system, the amounts shown as actually repaid are not a true criterion of the provision made for depreciation. In Grimsby the loans actually repaid and accrued, as shown in the 1912-13 accounts, were £24,570, but the proportion of loans provided for (on which depreciation should be based) works out at £33,681.

In Grimsby the difficulty of finding working capital is got over by not investing the reserve fund, but leaving it in the ordinary banking account. If a bank overdraft were obtained, interest at 5 per cent. would have to be paid, while the reserve fund, if invested, would only earn about 3½ per cent.

The third part of the paper considers cost of supply. The writer is of opinion that electricity should not be sold on the basis of what it will fetch on the market, unless this will so reduce costs that ultimately a profit will be made, or will induce other business on which losses will be made up.

In any undertaking over a period of years the costs really follow a definite law as long as conditions remain the same. This law is that the total cost of generation per annum, not cost per unit, is equal to (*a*) a fixed sum plus (*b*) a small running cost per unit sold.

This is clearly shown by the diagram (fig. 1), which shows the amounts spent at Grimsby on generation during years when conditions were fairly uniform. No. 1 straight line lies fairly among the points; the formula for this is £2,450, plus ·341d. per unit.

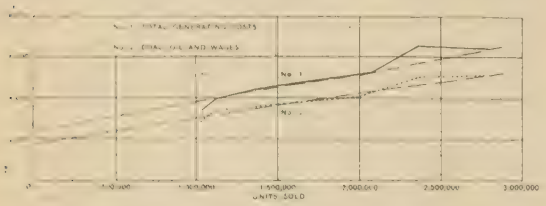


FIG. 1.

No. 2 line is drawn through points plotted for coal, oil and wages.

Fig. 2 shows coal, oil and wages, plotted for four towns; the curves agree, allowance being made for a probable lower cost of coal at Grimsby.

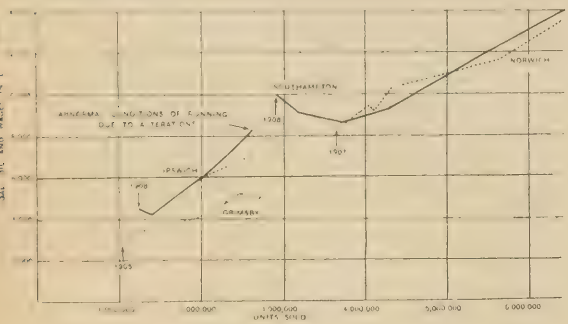


FIG. 2.

The only satisfactory way to allocate standing charges seems to be to take them in proportion to the maximum demand. All distribution costs are standing charges; the amount does not depend on units sold, but on the extent of mains laid and breakdowns in the year.

Management expenses do not depend on units sold (the author cites the case of Grimsby), but fig. 3 shows that management costs depend to some extent on the number of consumers; where conditions are uniform, the costs follow a Willans law, with a large initial expense and small increase with number of consumers.

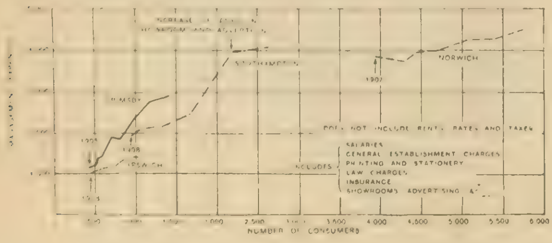


FIG. 3.

The greater part of management expenses are, therefore, fixed charges allocated to running the undertaking and developing it. Development expenses should be allocated in proportion to the profit made on each class of supply, and the same applies as regards rates and taxes.

Capital charges must be allotted according to the M.D. on the plant, but a difficulty arises in ascertaining how the M.D. of any individual consumer or class of consumer affects the total. The author shows the division of working costs, capital, &c., in the way described in the case of Grimsby, and applies the figures obtained to various classes of consumer.

In the case of bulk supply or cooking (where cost of service, standing charges, rates and taxes, and management would not be increased), the net extra cost at Grimsby would be £2·115 per KW. of increase in the peak on the basis of new plant, or £3 18s. if the average cost of present plant were included, with an extra ·31d. to ·36d. per unit sold. Comparing the present flat rate of 3⅝d. per unit in Grimsby and a R.V. system of 15 per cent. plus ½d. per unit, for houses assessed at £20, the latter rate brings in about £1 per annum more where lighting only is used; if such consumers adopt cooking, this is equivalent to paying £1 per annum and ½d. per unit for cooking.

Experience shows that the increase in the peak due to cooking (12½ per cent. connected demand) equals about ·3 KW. per consumer, the capital charges for which can be set against the £1 mentioned above.

Experience at Southampton shows that the effect of cooking on the peak is very small, and that it has resulted in improved load factors.

The Commercial Development of Electricity Supply.

AFTER reading carefully through the paper by Mr. Vignoles, of Grimsby, the first thought that came to the writer was that he had embodied enough material for considerably more papers than one; he has written on all phases of electricity supply where the term "business" can be applied even in an elastic manner, and he has discussed points and problems in a way that sometimes almost leaves business and borders on the purely engineering or technical.

The next thought that came to me was a sense of slight disappointment, engendered perhaps by this very diversity. I had rather hoped, after reading the first few pages, that Mr. Vignoles would keep on in the strain in which he began and go into further detail about the business-getting end of development. The art of getting new business and rendering every consumer a "satisfied customer," especially in the smaller undertakings, is not so thoroughly understood and appreciated that there would be any fear of the majority of Mr. Vignoles's audience being nauseated by a little more elaboration and description of his up-to-date methods and by more of his common-sense remarks on this important branch of commercial development.

It is presumed that the methods employed by Mr. Vignoles will apply in whole or in part to towns whose population is not so large as that of Grimsby, but which are equal in size electrically, unless of course such towns are electrically "saturated," and there are none such that I can think of at the moment.

It is not all of us who have been in the industry of electricity supply since the days when the one and only aim of the chief officer was to keep the supply going, and every problem that arose was a technical one, who so thoroughly realise, as does Mr. Vignoles, that all who are engaged in the supply of electricity have something to sell, just as the grocer or the draper, and it is refreshing to one who has constantly maintained that good engineering in a station without good business methods is of little worth, to find another engineer of the same mind who expresses the same sentiments so forcibly in this paper.

There are several points in the early part of this paper that can bear the light of further explanation; *e.g.*, after Mr. Vignoles has stated that Grimsby possesses no special powers, he makes the mouths of many of us water by describing his methods of getting customers—hiring-out of apparatus and the hire-purchase of installations being among the chief of these. Some of us who control the destinies of other undertakings of about the same size as Grimsby believe that these two things are almost vital to our prosperity, and yet, when such have been attempted, we have been peremptorily stopped by injunctions or other legal instruments, either through our competitors or through those who should be on our side.

Mr. Vignoles is in a very much better position at Grimsby than are a great many engineers; he seems to be able to do a great many things to promote business that other engineers would give a great deal to be able to do. In most towns that have no special powers, and particularly in the smaller towns where everyone seems to know every other person's business, engineers are rigidly kept from doing anything which is *ultra vires* of their powers, and these powers are simply their Provisional Order and the various Electric Lighting Acts; under these powers the poor engineer is bound down to the supply of electricity and the supply of electricity only. Any attempt on his part to do anything of the kind that Mr. Vignoles does at Grimsby with apparent impunity, or to do anything to obtain new business that is outside the strait and narrow way that is rigidly laid down for him, generally results in official complaints to the Council, in which our friends the enemy are usually well represented, threatening all sorts of pains and penalties.

I will now leave this part of the paper with the earnest hope that the matter so ably put together by Mr. Vignoles will stir up his hearers to a fuller realisation of the fact, for fact it is, that the obtaining of fuller powers for doing business is an absolute necessity, and that these powers are wanted at once. There surely must be a *via media* along which all parties might proceed together, particularly if all will remember that half a loaf is better than no bread. It will be a memorable achievement for the Convention of 1914 if this paper, and the discussion thereon, shall stir up such a wave of feeling among the unfortunate engineers who want to go ahead, and are so terribly handicapped, that they resolve to have done with so much talking and get on to real action, and not to rest until these powers are obtained.

Now that the Electric Vehicle Committee has paved the way for the work of other specialised Committees, I earnestly commend to the I.M.E.A. the suggestion of Mr. Vignoles that a special Publicity Committee be formed, and that its scope be on much the same lines as the admirably conducted British Commercial Gas Association.

Whatever be our opinion as to the merits of the commodity they sell, no one will deny after seeing the *Daily Mail*, *Punch*, or many other papers that it is at least well sold.

After leaving the actual business-getting of an electricity supply concern, Mr. Vignoles gives some good advice, which many Committees might read with advantage, as to the desirability of not being too conservative over mains extensions. There are, I think, few engineers who have not suffered, as did Mr. Vignoles, the indignity of having to lay mains past premises using a gas supply which had previously asked for a supply of electricity.

On the question of the half-watt lamp in small sizes, Mr. Vignoles forgets his early remarks. Surely, if we remember, it is light, heat, or power that the consumer buys, and not electricity; then it only means a suitable tariff for the undertaking to get its proper return from even small consumers. All of us are, I hope, looking for the time when electricity *per se* will not only be the cheapest means of artificial lighting, but also lamp renewals will be comparable with the cost of gas mantles. It is undoubtedly, in spite of isolated cases of successful application, the initial cost of lamps that prevents the late Sir William Preece's prophecy that electricity would become the poor man's light from being almost immediately realised.

The small consumer is, in my opinion, in most cases better tackled by a fixed weekly charge, either with or without a current limiter, than by means of slot-meters. My reasons for not agreeing with the author are that low-priced slot-meters cost a lot for upkeep, and the reliable ones are expensive; thus in any case the revenue from the consumer is "well watered" with meter charges.

Mr. Vignoles's remarks on charges are generally sound, but I wish, in view of the aim we are all working for, of universal electrification, that he had made a greater point of the mistake of charging low prices, such as $3\frac{3}{4}$d. or 4d. per unit, for such short-hour lighting supplies as the average office and the windows of high-class shops; to me it seems less defensible and a worse policy than charging what is considered by some people too low a rate for a cooking load.

With regard to charges in general, the local conditions have a great deal of influence; for example, a shop lighting load in East Ham is a much more profitable one than in, say, Cheltenham, and low charges for a power supply have no value in a town such as Eastbourne, while they are vital in a place like Maidstone. In framing a schedule of charges more attention should, I think, be devoted to the idea of a good load factor than to the actual obtaining of any class of customer whether profitable or not.

The pages on the financial side of the working of electricity undertakings evince a large amount of deep thought, and much that is written is of great value and should be brought home to all members of Committees; it is, however, outside the scope of this short article to say much on these points.

It is, as Mr. Vignoles has remarked, both interesting and instructive to work out the average cost per unit for each class of supply and compare it with the average price obtained for each class.

This can easily be done after the maximum demand on the station of each class of supply has been obtained, as the number of units sold for each class of supply is, of course, known. I have done this for a station having an output slightly smaller than Grimsby, where the total supply can be divided up as follows:—Shop and office lighting, private house lighting and the lighting of licensed premises, power supply, traction supply, street lighting supply and sewage pumping supply. Some of these demands can be accurately measured, and by taking the load curves of several days, such as Sunday, Wednesday, Saturday, as well as an ordinary week-day, and making equations with one or more unknowns, the demand of each class of supply can be got fairly accurately.

With the units sold known, it is then an easy matter to work it out on the same basis that Mr. Vignoles recommends, and which is the only method that is quite sound.

In conclusion, this paper is certain to bring forth a good discussion, and by stimulating interest in some of the most pressing needs of the smaller and pushing undertakings should do the industry, as a whole, a great deal of good.—E.E.H.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Review of "Electrical Meters."

Referring to the letter from Mr. G. C. Allingham which appeared in your issue of the 5th inst. in connection with the above subject, it may interest your readers to know that about 30 years ago the writer saw a small electrical "make and break" vibrator screwed on to the "cradle" which carried the fibre thread to which the fine glass tube, conveying ink from an ink well to the paper slip of a Thomson siphon recorder, was attached. Previously the ink had been spurted on to the paper by an electrical discharge provided by an "influence" machine, the circuit of which was completed through the ink in the glass siphon to the paper across the small space which separated the point of the siphon from the paper. This arrangement provided a frictionless conveyance of the ink to the paper, and was generally satisfactory, but gave trouble sometimes, especially in damp weather. By means of the vibrator, or "electric trembler," particles of ink were shaken out of the siphon on to the paper at a high rate of speed, the appearance at the point of the siphon being a fan-shaped blur. The glass siphon was kept always full by capillary attraction, after being once filled by suction.

This occurred at the Eastern Telegraph Co.'s Lands End Station, Porthcurno, and was found to provide a most satisfactory frictionless contact; it was afterwards universally adopted for all siphon-recording instruments, and, as far as the writer knows, is still in general use.

An arrangement of this kind is certainly needed for all delicate recording instruments, if accuracy is to be obtained.

Norman J. Hockley.

Manchester, *June 9th*, 1914.

Is Aluminium Diamagnetic?

In reply to your request on page 915 for information as to the magnetic properties of aluminium, may I refer you to Horda's paper in Science Reports of the University of Sendai, 1912, or to a shorter paper in the "Annalen der Physik," XXXII, page 1045 (1910). Aluminium appears to be paramagnetic, with a specific susceptibility of about $\cdot 6 \times 10^{-6}$.

Charles H. Lees.

Woodford Green, *June 5th*, 1914.

Comparative Economics of Tramways and Railless Electric Traction.

Mr. Gribble appears to abandon the claim made in his paper that the railless car of 28 to 36 seating capacity has equivalent earning power to the average tramcar, and by that admission the basis of his comparison fails, and the whole structure falls. It is not my intention to begin a discussion on the basis of a 56-seated car, which has not yet been ordered or built to comply with the weight limits and other regulations in force in this country, and which, therefore, is a purely hypothetical entity.

On the York case, my answer was intended to be complete, and still seems so. Trying again, it is that the trackless car of Mr. Gribble's paper run on the same services and fares, could only have earned about two-thirds of the revenue per car-mile actually earned by the tramcars; whilst trackless cars of equal seating capacity in all weathers would have earned as much as the tramcars per car-mile, but the total working expenses and capital charges would have been decidedly higher. The York tramway department now finds it necessary to procure trailers, showing what experience has taught it as to the need of high seating capacity per service unit.

Mr. Wakelam stated that petrol motor-'buses on Middlesex roads added 2d. per 'bus-mile; and Mr. Carpenter stated that the Rotherham railless cars, on the Rotherham route (West Riding roads), added 4d. per 'bus-mile to the cost of road maintenance. Evidence of facts within their official knowledge, which it was their official duty to observe and record, from professional men of high repute in responsible positions, and without personal interest in exaggeration, carries great weight, and can neither be discredited nor disproved. It is in an entirely different category to "expert evidence" of opinion and estimate. The facts are disagreeable, but they have to be faced.

It is not necessary to discuss Mr. Gribble's views on fares. The trend of experience is against him, and in his paper he tacitly assumed tramway conditions. It may, however, assist him to peruse the Glasgow tramway reports, for example, for the last few years, as the subject of fares and stage lengths has been studied experimentally and the results recorded with much care and acumen by Mr. Dalrymple. It is hardly accurate to say, as Mr. Gribble does, perhaps inadvertently, that tramway fares have been lowered by the compulsion of competition. The complaint of competing transport undertakers is just the reverse, viz., that tramway competition compels them to fix unremunerative fares.

The Critic.

A Motor Problem.

Will any reader kindly inform me the best method, H.P., and type of motor, for a 220-volt D.C. circuit, required to replace a 45-I.H.P. steam engine driving the stamp shop of an engineering smithy? The load is fluctuating, with at times a heavy overload that slows the engine down almost to a standstill, and causes the main belt to slip, but it quickly recovers normal speed when the load is released. There are seven stamps, varying from 3 to 6 cwt., with belts over a 3 ft. 6 in. diameter lifting pulley running at 150 R.P.M., also various other smithy tools.

Any practical information on this subject will be greatly appreciated.

Inquirer.

"A Tester" has not enclosed with his letter his name and address.

A Canadian Innovation.—We drew attention in a recent issue to the wiring regulations which it was proposed to enforce for all electrical work in Montreal. Matters are now being carried a step further, and efforts are being made on behalf of the workers to ensure that only those men possessing a certificate of efficiency, countersigned by the city officials, shall be eligible for employment as electrical wiremen in the city. The principle has much to recommend it at first sight, but the possible abuses of such a plan of action forbid our proposing it for general adoption. Should it be introduced in Montreal and the example followed in other parts of Canada, it will place a real difficulty in the way of immigrant wiremen getting their first job in Canada.

LEGAL.

Osram Lamp Works, Ltd., v. the British Union Lamp Works, Ltd.

On Friday, June 12th, the defendants in this action moved before Mr. Justice Sargant in the Chancery division to discharge an order made in Chambers requiring them to make certain experiments in the presence of the plaintiffs' expert witnesses.

Mr. Frost, who moved, said that the plaintiffs were suing for alleged infringement on two patents, one of 1904, and the other No. 3,622 of 1906, in both of which the presence of carbon in the filament was an element. The defendants denied that in their filament there was any carbon, and they had been required by order of the Court to carry out their process of manufacture in the presence of the plaintiffs' experts.

His Lordship asked whether the objection was to the order as a whole, or to any particular part of it.

Mr. Frost said that, in the first place, the defendants' submission was that the plaintiffs had not made out a *primâ facie* case for the order at all; and in the second, they were not now making the lamps complained of, and it was impossible now for them to get the material from which their filaments had been made. The first defence to the action was the invalidity of the patents sued upon. The statement of claim was in the usual form, alleging that the two patents had been infringed, and in the particulars the manufacture and sale of certain lamps in this country was specified. The defence admitted that in or about the month of April certain lamps were made in this country in accordance with a Berlin patent No. 7,092 of 1909 granted to Henrich Weber, from a compound supplied to the defendants by Henrich Weber from Berlin, and that those lamps were sold. The plaintiffs then wanted to know how those lamps were made. The defendants admitted that the filaments were manufactured from tungsten, but denied that there was any carbon in the compound. The lamps were then examined by Dr. Oberlander, who said he was satisfied that an organic fibre must have been used in the manufacture, and that the compound must have contained carbon. Now the plaintiffs, by their director, Mr. Peace, had sworn on three separate occasions that the lamps were manufactured in accordance with the German patent, and by that method no organic fibre was used. All that Dr. Oberlander had said in answer was that he knew of no other method except the plaintiffs' by which they could have been made. This affidavit, counsel submitted, was nothing more than a submission to the Court that these lamps were made in infringement of the plaintiffs' patent.

Mr. Justice Sargant said it was pretty obvious what the plaintiffs' case was. They say you have used an organic fibre or medium.

Mr. Frost: And I have positive evidence to the contrary.

His Lordship: Then they say your process could not have produced these lamps. You must have had some carbon, because this gentleman of great experience says your lamps could not have been produced without it. Is not the best way to test that to conduct the experiments as directed by the order?

Mr. Hunter Gray said Dr. Oberlander went further than that. He said there must have been organic fibre used.

Mr. Frost: And we say positively no.

His Lordship: We have a positive statement by the defendant that a thing was made in a certain way. Am I to take that as binding on the plaintiffs, and say that I won't have any experiments made to test it?

Mr. Frost would not suggest that, but he did submit that the Court would require something stronger than the mere suggestion of Dr. Oberlander.

His Lordship: If this defence is correct, is not the most perfectly satisfactory method of disposing of the action to carry on the manufacture in the presence of the plaintiffs?

Mr. Frost said that the difficulty was that the defendants did not now manufacture in this country. All their apparatus had been disconnected.

His Lordship said he understood that the plaintiffs were perfectly willing to put at defendants' disposal their manufactory and all their apparatus.

Mr. Frost said that was true so far as the apparatus was concerned, but they had to start by getting this material. The defendants had quarrelled with Henrich Weber and were unable to obtain a further supply from Berlin.

His Lordship said it was quite clear that they could not be ordered to carry out a process with material that they could not get.

Mr. Hunter Gray: We will get the material for them.

Mr. Frost suggested that that would not do. It would give rise to the question whether the material was the same.

His Lordship asked whether the stuff was squirted.

Mr. Frost said no. The squirting process was dying out altogether. His submission was that there was an infringement that had long ago ceased, and it was not right that the defendants should be asked to make these experiments. The position would be quite different if this were a going concern.

His Lordship: It really is the difficulty of carrying out the experiments.

Mr. Frost said that was so. The real position was, the defendant company had a right to manufacture in this country under Weber's patent 7,092 of 1909. They always used that process for the manufacture of a tungsten filament with a binding medium described in the patent, but which the defendants always got from the patentee. They could not now get that binding medium. It was a combination of sulphur and phosphorus, and contained no carbon.

Mr. Hunter Gray pointed out that the medium was well known and could easily be obtained. The defendants could buy the medium, or, if not, they could get the ingredients in any shop.

Mr. Justice Sargant: Then so can you, Mr. Gray.—And I will.

His **Lordship** did not see why the plaintiffs should not make the medium, and then the defendants could carry out the process.

Mr. Frost said the difficulty would be then in showing that it was the same as that which the defendants obtained from Berlin.

Mr. Gray: They say it was a binding medium made in accordance with the specification, and we will supply them with a binding material made in accordance with the specification.

His **Lordship** asked why the plaintiffs could not get some from Berlin.

Mr. Gray said that of course they would do so if they could; if not, they would make it in accordance with the specification. Their case was that the defendants must have used an organic binding medium.

His **Lordship**: That is to say that really the material supplied from Berlin was not material made in accordance with the patent.

Mr. Gray: Or that, consciously or unconsciously, something was introduced in the process of manufacture.

His **Lordship** said the point seemed to him to be whether he could order the defendants to do something entirely different from their ordinary process of manufacture. He could not order them to make experiments with something they could not get.

Mr. Gray: If they can't we will supply them.

His **Lordship** said he did not see how the defendants could object, but, of course, it would be left open to them to say that the material supplied by the plaintiff was not the same as the material supplied by Weber.

Mr. Frost suggested that that would not do. To make this material would naturally require a certain amount of skill and practice, and for the defendants or the plaintiffs to make it might result in the production of a different kind of material.

His **Lordship** said if Weber supplied the stuff still he could not see how the defendants could object to the order, and if it could not be got from him, then they must get the best they could. It would not be so satisfactory to the plaintiffs, but it would be the best thing that could be obtained.

Mr. Frost suggested that the order should go until the plaintiffs had established the validity of their patent.

His **Lordship** said he could not try the action piecemeal.

Mr. Frost submitted that the defendants used a particular material which they obtained for a particular period. They could not get it now, and the Court would not order them to carry out something they never did carry out, and which might be quite different to anything they had ever done.

His **Lordship** thought the order must stand, but as the defendants might not be able to get the original medium, it must be varied by adding a direction that it must not be construed as obliging the defendants to carry out the process with a medium obtained from Henrich Weber so far as they were unable to procure such medium, and in the event of their being unable to secure such medium, the process to be carried out with a medium to be prepared by the plaintiffs in accordance with the first part of Weber's specification, or at the option of the defendants by some independent person to be agreed upon between the parties. The costs of the motion were made costs in the action, and leave was given to the defendants to appeal.

BRITISH THOMSON-HOUSTON CO., LTD., *v.* THE UNITED ELECTRIC SUPPLY CORPORATION.

This action brought to restrain an alleged infringement came before Mr. Justice Sargant in the Chancery Division on Tuesday, June 16th, on a motion for judgment in default of appearance by the defendants.

Counsel for the plaintiffs, stated that the alleged infringement was in respect of letters patent for the manufacture of electric light filaments. They had been unable to serve the defendants with notice of the proceedings in the usual way, and an order for substituted service was obtained. Under that order all the necessary steps had been duly carried out, and all the necessary papers properly filed. The defendants did not now appear, and the plaintiffs asked for an order in the terms of minutes which had been drawn in the usual form of orders in patent actions.

His **Lordship** made the order as asked.

PARKER *v.* HEMMING.

In the King's Bench Division on Friday, June 12th, Mr. Thomas Hugh Parker, engineer and a member of the Institution of Electrical Engineers, who resides at Richmond, East Sheen, was awarded £200 damages against Mr. Henry Joseph Randolph Hemming, a retired solicitor and promoter of a company called "Hemming's Process, Ltd.," for false imprisonment and malicious prosecution. Mr. Parker let a part of his premises at Sheen to the company, agreeing to give a part of his time to adjusting the company's machinery. He was cleaning a lathe and drilling machine in his private room in January last, when Mr. Hemming called him a thief and gave him in charge for stealing the lathe and drilling machine. The magistrates dismissed the summons and ordered Mr. Hemming to pay the costs, stating that he had not brought the prosecution in good faith.

The jury found there was no ground for the allegation of theft, and that the defendant was actuated by malice, and judgment was entered for the plaintiff with costs.

UNDERGROUND ELECTRIC RAILWAY. STAMP DUTY ASSESSMENT APPEAL.

Mr. Justice Scrutton, in the King's Bench Division on Monday, gave judgment in a Revenue Appeal by the Underground Electric Railways Co. of London, Ltd., and Messrs. Glyn, Mills, Currie & Co., *v.* The Commissioners of Inland Revenue. The point upon which plaintiffs appealed was raised under the Stamp Act, 1891.

Mr. Roskill, K.C., and Mr. Austen Cartmell were for the appellant companies; and the Attorney-General (Sir John Simon, K.C.), and Mr. Finlay were for the Commissioners.

The appeal arose out of the proposal to amalgamate in the matter of control, the Central London Railway Co. with the other group of Tubes controlled by the Underground Electric Railways Co. of London.

His **Lordship**, in delivering his reserved judgment upon arguments heard a week previously, said that the question for the Court to determine, was the stamp duty payable on an indenture dated December 13th, 1912, and made between the railway company and the bankers (as trustees). The Central London Railway Co. had issued £3,000,000 worth of ordinary stocks. The Underground were desirous of obtaining control, and were willing, if a sufficient number of the holders of stock in the Central London Railway would take guaranteed stock in exchange, to give 4 per cent. if the profits of the railway were not enough to pay that rate of interest. Applications from such stockholders were not to be received until December 31st, 1912, and at the date of the indenture it was not known if sufficient holders would exchange to enable the transaction to go through. Nor was it known what excess over profits it would be necessary to pay on the guarantee stock. It was known that the company might become liable to pay £120,000, that being 4 per cent. on the £3,000,000. Under these circumstances, the Commissioners assessed the instrument to a 10s. stamp duty (which was not objected to), and to a duty of £3,000, which was assessed by reference to the heading in Schedule 1 of the Stamp Act of 1891. It was against the latter assessment that the appeal was taken, and it was contended, said his Lordship, that the document did not come within the schedule, because at the time of the making of the instrument there was no fixed sum payable. This, if correct, would free them from £3,000 stamp duty altogether, and alternatively the appellants contended that, in any event, duty should be assessed not on the annual possible liability of £120,000, but on the possible liability of £60,000 for the half-year, which would reduce the duty by £1,500.

His **Lordship** found that both these points taken by the appellants failed, and he dismissed the appeal, with costs.

Mr. Roskill asked, in view of the importance of the point, for a stay, his object being to avoid taxation before an appeal.

Mr. Finlay (for the Commissioners) said he had no doubt the matter could be arranged.

ELECTRIC LIGHTING OF BRIXHAM.

Application was made to Mr. Justice Neville in the Chancery Division on Tuesday, June 16th, for a further suspension of the injunction granted in the action of Edwards *v.* the Brixham Gas Co. in December last, restraining the defendants from so working their electric light plant as to cause nuisance or annoyance to the plaintiff or damage to his property adjoining the defendants' works.

The injunction was originally suspended for three months to enable the defendants to so reorganise their plant as to abate the nuisance, and on an application to Mr. Justice Astbury in March last, that suspension was continued for a further three months.

Mr. Palmer, representing the defendants, said that notice of motion had been served upon the plaintiff, asking for a further suspension, but the evidence was not complete, and he had to ask that that motion should not be heard for a fortnight. In the meantime, however, the suspension granted by Mr. Justice Astbury would expire.

Mr. Peterson, K.C., for the plaintiff, said that he opposed any further suspension, but if the defendants desired time to complete their evidence he did not object to a fortnight's adjournment.

Mr. Palmer said his reason for applying now was that the suspension would come to an end before the motion could be heard.

Mr. Peterson said he would not oppose a suspension for a fortnight upon the same terms as before.

Mr. Palmer said that was all he desired, and accordingly his Lordship adjourned the motion for a further suspension for a fortnight, the original suspension of the injunction to be continued for that period upon the same terms as heretofore.

VENNER'S SIGNS, LTD., *v.* STELLAR SIGNS, LTD.

This case was again mentioned to Mr. Justice Astbury in the Chancery Division on Friday, on a motion by the plaintiffs for an injunction to restrain alleged infringement.

Mr. F. Russell, K.C., for the plaintiffs, said the evidence was now completed, and there was a serious conflict as to the facts, and as to the alleged infringement of patent. He, therefore, proposed to take no order on the motion except that, as Mr. Kerby, for the defendants, desired, the costs of the motion would be reserved to be dealt with at the trial.

The motion, therefore, stood over until the trial of the action.

Workmen's Compensation.

Whilst in the employ of Mr. J. H. Rankin, electrician, of Weymouth, an employé named Holmes lost the sight of one eye through the bursting of an electric light globe. The sum of £100 had been paid into Court under the Workmen's Compensation Act.

Mr. Wilton Reed, on behalf of the grandmother of the boy, applied at the Weymouth County Court that the sum of £10 should be paid forthwith for the purchase of clothing, the lad having obtained a position as electrician's improver at Dorchester. The lad had lately been getting 6s. a week.

The Judge considered £100 a small amount.

Holmes stated that he was now earning 19s. a week.

The Judge made an order for £10, and said that the balance would remain in Court until the lad attained 21 years of age, when a fresh application could be made. It was very unfortunate that only £100 had been obtained.—*Bournemouth Echo.*

At Accrington County Court, on June 11th, Judge Sturges approved a settlement of £125 in commutation of the claim of James John Linsley, electrical wireman, Accrington, who whilst in the employ of Mr. Arthur M. Cramp, electrical engineer, of Haslingden, met with an injury, from which complete loss of one eye resulted.

Evans *v.* Premier Electric and Hardware Co.

Last week Mr. Justice Astbury, on the motion of the plaintiff in a debenture-holder's action, appointed a Receiver and manager of the defendant company's business.

Counsel for the company consented to the appointment, and also to the usual judgment in the action, and his Lordship made an order accordingly.

BUSINESS NOTES.

Private Arrangement.—Premier Electric and Hardware Co., Ltd., 9-10, Cheapside, Golder's Green, London.—In response to a circular letter issued by Mr. James Mortimer, accountant and auditor, of 3, Pancras Lane, Cheapside, E.C., a largely attended meeting of the creditors of the above was held on June 10th. A statement of affairs was presented which showed unsecured liabilities of £967. The assets were estimated to realise £923, from which had to be deducted £175 for preferential claims, and £251 due on debentures. The net assets thus amounted to £496, and as regarded the creditors a deficiency was shown of £474. Mr. Mortimer stated that the present meeting had been called as creditors were pressing, and the debenture-holder was taking steps to appoint a Receiver. He suggested that the business might be continued under the supervision of a Receiver appointed by the creditors, with a view to the debentures being paid off within three or six months. That would be better from the point of view of the creditors than a sale of the assets. The unsecured creditors could be secured by the issue of a second debenture. He also suggested that the creditors should accept a composition of 7s. 6d. in the £, but as it was necessary for the company to first provide for the debenture the composition could not be paid at once. The 7s. 6d. in the £ could be paid by three instalments at 9, 15 and 21 months. There was a debenture in existence for £250, which was issued for cash in April of the present year. The money received from the debenture was paid away to creditors. Mr. Mortimer said that the creditors should remember that at a forced sale, after paying all charges, they could not hope to receive much by way of a dividend. The company occupied a good position in Golder's Green, and could trade successfully in the future. In the past it had been hampered by lack of capital, and considerable legal expenses had been incurred. During the 14 months to February 28th last, there was a net profit, after paying all expenses and the directors' fees, of £188. The company was formed in March, 1913, with a nominal capital of £2,000 in £1 shares. The company took over a business which had previously been carried on by Mr. George Cohen at the above address. The assets taken over were valued at £1,500, and they were paid for by the allotment to the vendor of fully paid-up shares. Mr. Geo. Cohen was appointed managing director of the company for life, at a salary of £200 per annum, and as general manager he was to receive a further £300 in discharge of all claims for travelling and incidental expenses. The debenture was issued on April 29th. Mr. Tubbs, solicitor, expressed the opinion that the debenture was not valid, as its issue was only authorised by one director, whereas the articles of association provided that two directors should form a quorum. After some discussion a resolution was passed instructing Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, chartered accountant, 4, Charterhouse Square, E.C., to prepare a report in order that counsel's opinion might be taken as to the validity of the debenture. A committee of five of the principal creditors was also appointed to consider what steps should be taken when counsel's opinion had been received.

Australia.—His Majesty's Trade Commissioner at Melbourne announces that on and after 11th inst. his address will be Commerce House, Flinders Street. An inquiry and reading room will be available in connection with the new offices, where information in regard to British trade may be obtained, and British trade journals and catalogues consulted.

London & North-Western Switchgear Contract.—We learn that the British Westinghouse Electric and Manufacturing Co., Ltd., have secured the contract for the extra-high-tension switch-gear, and also the low-tension switchgear and connections for 11 sub-stations, in connection with the London & North-Western Railway Co.'s North London electrification. The switchboard panels on order at the present time total 258, comprising 129 high-tension panels and cubicles, 107 direct-current sub-station panels and 22 low-tension A.C. and D.C. boards in the main station. The sub-stations in question are situated at Camden, Queen's Park, Stonebridge Park, Kenton, Pinney, Bushey, Dalston, Broad Street, Willesden, West End Lane and Acton. There are three rotary converters in each sub-station, excepting at Broad Street and Acton, in which there are two; of these rotaries six situated in Camden and Bushey sub-stations are of 1,000-KW. capacity, and the rest of the rotaries have each a capacity of 750-KW. The number of high-tension feeders coming into the sub-stations total 30, and there are also 18 H.T. outgoing feeders. The oil break circuit breakers are of British Westinghouse design and manufacture, and are to be of the remote mechanically-operated type, excepting in the case of Stonebridge Park sub-station, where the switches will be of the solenoid electrically-operated type. The switches are of the latest design, and are arranged in such a manner that phase separation can be carried out throughout the whole of the switchboard structure, each separate phase of the switch being contained in a separate tank, and in a moulded stone cubicle entirely separated from the other phases. The bus-bars are sectionalised in each sub-station, and each machine can be connected through isolating switches to either of two main bus-bar sections. Isolating switches are being provided on each side of the main oil switches. All incoming feeders will be fitted with reverse current relays for tripping the oil circuit-breakers, and all outgoing feeders and transformer circuits will have overload relays with time limit attachments. The rotary converter E.H.T. circuits will also be fitted with overload time limit relays. Each section of bus-bar will be fitted with Horn type static dischargers combined with the usual resistances and isolating switches. The panels on which are mounted the instruments and handles for operating the oil circuit breaker are situated on the floor level, and behind them are the cubicles containing the oil switches. These are linked to the operating handles which are mounted on the switchboard by means of levers and rods. In the case of the Stonebridge Park sub-station, the operating panels will also be on the floor level, and the switches will be electrically operated. The cell work is to consist of moulded stone. The slate panels of which the H.T. control board and also the L.T. switchboards are made will not be enamelled, but will be finished with a black marine finish. The low-tension panels, exclusive of battery and booster panels, which form the subject of another contract, deal with 100 out-going feeders and 31 rotary converters on the D.C. side. The rotary converter circuits are fitted with reverse current single-pole circuit-breakers, fitted with a tripping arrangement for operation by speed limiting devices on the rotaries. The track feeder panels which control both poles of one feeder are fitted with single-pole overload circuit-breakers for 2,000-ampere and two single-pole knife switches for the same current. Sector pattern moving-coil ammeters are used, and have illuminated dials. The circuit-breakers are of the well-known Westinghouse type "C" traction pattern, which are in use on so many other traction systems throughout the country and abroad. In addition to the above panels, there are lighting and auxiliary panels in all the sub-stations, and in the power station a low-tension alternating current and low-tension direct-current board are also to be supplied under this contract for dealing with the circuits feeding the auxiliary machinery, lighting, &c. The value of the contract is estimated at between £50,000 and £60,000.

Annual Outings.—The works of the Walsall Electrical Co., Ltd., will be entirely closed to-morrow (Saturday), when the annual outing takes place at Blackpool. Employés are receiving from the company a free ticket and a bonus valuing £1 1s. downwards, according to length of service.

The fire brigade attached to the head office of the General Electric Co., Ltd., spent a very enjoyable time at Southend-on-Sea on June 5th, on the occasion of their annual outing. The party included the captain of the brigade, Mr. W. H. Snowden, and Instructor Riley. Dinner was served at the Grand Pier Hotel.

The annual excursion of the employés of Messrs. E. Brook, Ltd., of Huddersfield, took place on Saturday, June 13th, the party going in char-à-bancs to Morecambe *viâ* Skipton, Settle and Lancaster, returning *viâ* Preston, Bolton and Manchester. A very enjoyable day was spent in exceptionally fine weather. The arrangements were carried through by Mr. Frank Rothwell, who acted as secretary.

Turbine Manufacture in Norway.—At the Myrens Mechanical Workshop in Christiania, the finishing touches are being applied to a new turbine for the company which is harnessing the Vamma water-course. It is a Francis turbine, and will be used with a head of 26 metres; it will run at 214 R.P.M., and generate 12,000 E.H.P. The water will be conducted through a pipe of 4½ metres diameter, and the supply of water is estimated at 45 cubic metres per second. The over all diameter of the turbine is 5½ metres. This is the largest, although not the most powerful, turbine that has ever been delivered from a Norwegian workshop. The same firm has now 45 turbines of various sizes under construction, and it has also exhibited at the Christiania Exhibition a turbine of 16,400 H.P., which is going to be delivered to Rjukan II, to work under a head of 250 metres.

Catalogues and Lists.—The Brompton and Kensington Accessories Co., Ltd., 254-260, Earl's Court Road, S.W. Collection of illustrated price lists in expanding cover describing their model "C" electric cooking stove, with temperature curves and diagrams of connections; also the combination electric cooking range, model "E," hot cupboards and carving tables, and electric grills and toasters.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—An interesting pamphlet of 40 pages, written by Mr. T. Birkett, late of the firm of Jesson & Birkett (now incorporated with Simplex Conduits). It is entitled "Notes on Period Designs in Electric Light Fittings," and is a reprint of a series of articles from a contemporary, followed by illustrations and prices of some "period" designs of Simplex fittings.

The British Thomson-Houston Co., Ltd., Rugby.—Price list No. 7,660 describes and gives prices of the "Calorite" electric stove for rapid boiling of water.

Mr. G. Bishop, Mary Ann Street, Birmingham.—Leaflet giving prices of electric fans.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.—Illustrated priced leaflet giving particulars of c.i. junction boxes (approved by L.C.C.) and improved spacing saddles for damp situations and clips for conduit.

The Sterling Telephone and Electric Co., Ltd., 210-12, Tottenham Court Road, London, W.—8-page pamphlet (No. 228) containing a full description, with a number of illustrations, of their new type of moving vane variable air condenser (Dr. Seibt's process) for electric oscillations.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.—Illustrated and priced folder (No. 10,300) relating to their glass reflectors for direct lighting—Veluria, Holophane, Opalux and Sudan—a circular for contractors to distribute.

The Waverley Co., Indianapolis, U.S.A.—Attractively illustrated 8-sheet publication showing and describing their Silent Waverley electric broughams.

Phœnix-Licht-Gesellschaft m.b.H., Babelsbergerstrasse, 40, Berlin-Wilmersdorf.—Leaflet describing the "magnetic mirror," a new shop-window advertising device.

The Franco-British Electrical Co., Ltd., 50, Oxford Street, London, W.—Twenty-four-page catalogue giving prices and showing specimens of a variety of electric box signs, window reflector signs, electric letter signs, hanging signs, sign flashers, illumination strip, time switches, sign lamps and holders.

Trade Announcements.—Messrs. Morris & Lister, Ltd., of 3 and 4, Palace Chambers, Bridge Street, Westminster, S.W., and Carlton Works, Lockhurst Lane, Coventry, who have hitherto been representing Messrs. Nalder Bros. & Thompson, Ltd., to a limited extent for the sale of their manufactures, have now been appointed the firm's representatives in the London and country districts heretofore worked by Messrs. Frampton & Paine, whose agreement for the agency has expired.

New business premises at Gillygate, Pontefract, have been opened by Messrs. Parker & Jubb, electrical engineers.

Mr. Norman Tegetmeier has lately been appointed sole London agent for Messrs. Pitter's Ventilating and Engineering Co., Ltd., and on the 24th inst. he will be opening showrooms at 70, Great Portland Street, W., where he will trade as the Norman Electrical Agencies and display electric light fittings made by Messrs. Peyton & Peyton, Ltd., whose sole agency he holds. He will also carry a stock of Messrs. Pitter's multiblade fans for all voltages.

The name of The Private Telephone Co., Ltd., has been altered to The Private Telephone and Electric Co., Ltd., and the address changed from 9-11, Cursitor Street, to larger premises at 28, Great Queen Street, Kingsway, W.C., where, in addition to offices and stores, there is a showroom for exhibition and demonstration purposes.

Liquidations.—Rankine Patent Feed-Water Filter Co., Ltd.—This company is winding up voluntarily, with Mr. T. B. Maccabe, 30, North John Street, Liverpool, as liquidator. A meeting of creditors is called for June 22nd. Creditors, &c., should send the usual particulars by June 27th.

The Anglo-Norwegian Aluminium Co., Ltd.—A meeting will be held at 28, Victoria Street, S.W., on July 17th to hear an account of the winding-up from the liquidator, Mr. F. C. Potter.

The Durham Collieries Electric Power Co., Ltd.—A meeting will be held at the offices of Messrs. G. A. Touche & Co., Basildon House, Moorgate Street, E.C., on July 17th, to hear an account of the winding-up from the liquidator, Mr. A. W. Tait.

Hydro-Electrical Gear Co., Ltd.—A meeting is called for July 14th, at 11, Pancras Lane, E.C., to hear an account of the winding up from the liquidator, Mr. J. A. Henderson.

Bankruptcy Proceedings.—T. M. Woodcock, electrical engineer, Sheffield.—Last day for receiving proofs for dividend, July 3rd. Trustee, Mr. J. C. Clegg, 14, Figtree Lane, Sheffield.

Annual Conference.—The branch and departmental managers of Simplex Conduits, Ltd., have just held their annual Conference at Southport, under the presidency of Mr. L. M. Waterhouse, the managing director of the company. We understand that these conferences are of great value, enabling the company to deduce conclusions from individual experiences, and so form a straightforward policy ensuring good relationship between itself and its customers.

Book Notices.—"Canada: The Western Cities, their Borrowings and their Assets. By Henry Howard. London: *Investors' Guardian* Office. 2s. net. The author who is a financial observer of wide experience, has visited Canada on two occasions, in 1910 and 1913 traversing the Dominion from the Atlantic to the Pacific, collecting information respecting the financial position of many places, comparing their capital outlays and indebtedness with the results produced thereby. In the present book there is a series of chapters or letters dealing separately with each of the following Western cities:—Winnipeg, Prince Albert, Edmonton, Calgary, Victoria, Vancouver, Medicine Hat, Moose Jaw, Regina, Saskatoon, Brandon, Port Arthur and Fort William. The concluding chapter consists of an interesting and brief summary of general impressions. The author expresses the opinion that the ability of the Western cities, which have sprung up out of the prairie, to meet their financial obligations, and their prosperity generally, will depend upon the extent to which agricultural land and operations are developed. His general conclusion is that the British capital invested in the securities of the Western municipalities has a good and sure basis in the valuable assets owned by these cities, that interest on debentures will be promptly forthcoming, and that at its due date, the capital will be repaid. The book is an informing one for anybody interested in Canadian affairs and their future.

Holidays.—Holiday-makers whose thoughts are toward the Continent, will be charmed with a little brochure of some 70 pages, entitled "To the Continent." The pictures are executed in colour, and they convey an impression that the journey may be made one of comfort and attractiveness by G.E.R., Harwich route. A postcard to the Continental Manager, G.E.R., Liverpool Street Station, E.C., will bring a copy along.

For Sale.—Huddersfield Corporation has for disposal a Ferranti single-phase switchboard. Particulars are given in our advertisement pages.

LIGHTING and POWER NOTES.

Bangor.—Year's Working.—The income of the electricity department for the past year amounted to £3,562, and the gross profit was £1,886. The deficit on the year was £461, a decrease of £163, compared with 1912-13.

Belfast.—New Plant.—In his interim report on the condition of the plant at the electricity works and the further development of the electricity undertaking, Mr. J. F. C. Snell advised the immediate purchase of a rotary transformer, the necessity for which was urgent, as, in the event of a breakdown, the tramway system might be temporarily held up. The Committee approved, and authorised the electrical engineer to advertise for one, the price being about £4,500.

Bradford.—The Electricity Committee has decided to supply energy to the Baths Committee for cooking and heating at the new Central Baths Annexe at ½d. per unit.

Burnham.—New Mains.—The Slough and Datchet E.S. Co. has informed the P.C. that it intends laying cables from Fulmer to Farnham Common.

Canada.—According to the *Standard*, the new water-power development on the St. Lawrence, at Cedars Rapids, about 30 miles above Montreal, will be in operation by November 1st, when the first installation of 100,000 H.P. will be complete. The first unit of 10,000 H.P. is now being installed; the dredging of the canal, 2 miles long, 500 ft. wide, and 30 ft. deep, through which water will be led, and the various other works, are making good progress, and the company is well within the schedule laid down when the work was started some two years ago. The cost of the development will be $10,000,000. The company is largely backed by the Montreal Light, Heat and Power Co. and the Shawinigan Water and Power Co. It has contracts for the delivery of some 80,000 H.P. immediately on the completion of the plant.

Carlisle.—Extensions.—The T.C. has received the consent of the L.G.B. to borrow £7,427 for extensions of the electricity mains and plant, and that of the B. of T. to supply energy to Scotby House and the Croft. The Electricity Committee has decided to supply current to the Stanwix Garden suburb.

Cheshunt.—Proposed E.L.—The North Metropolitan E.P.S. Co. and the Waltham Abbey and Cheshunt Gas Co. have informed the U.D.C. that they are considering the question of supplying electricity in Cheshunt. The Council has deferred consideration of the matter pending the receipt of further particulars.

Chesterfield.—Proposed Bulk Supply.—The Electrical Energy Committee has been authorised to depute a sub-Committee to negotiate with the Staveley Coal and Iron Co. for a supply of electricity in bulk.

Continental Notes.—Hungary.—The Municipality of Fiume has decided to erect a factory for the electrical production of oxygen. It is also contemplating the erection of a hydro-electric station on the River Recina, some 10,000 h.p. being estimated to be available. A private offer has also been made to provide the city with an installation free of cost, on a 50 years' agreement, the plant lapsing to the city at the end of the term.

Germany.—The T.C. of Barmstedt (Schleswig-Holstein) has voted £5,000 for the erection of a power station. The erection of power stations has also been decided upon by the authorities at Hennersdorf (Silesia), Oberrotterbach (Pfalz), Bad Oldesloe, and Rödding (Kreis Hadersleben).

Russia.—In a recent issue, the *Financier* mentions the following authorised or projected electricity undertakings in Russia:—The generating station at Warsaw is to be enlarged, including the installation of new turbo-generators, and the mains are to be considerably extended. The Minister of the Interior has authorised extensions, estimated to cost £168,125, at the generating station on the Vistula. The Town Councils of Kineshma and Sviyazhek are considering E.L. schemes. The Ekaterinodar Town Council has decided to acquire a Diesel engine plant and steam turbines, of a capacity of 1,500 h.p., at an estimated cost of £34,000. At Rostoff, on the Don, the Council contemplates expending £42,211 on its electricity undertaking, and is also considering the removal of the station from the centre of the town to the suburbs. A concession for F.L. at Bielaya Tzerkoff has been granted to Count Branitzky, with a condition that the station shall be completed by the autumn. It is stated that at Vladikavkaz, in the Caucasus, land on the River Rion has been granted to Messrs. Palashkovsky & Urbanovitch, engineers, for the construction of a hydro-electric station. All the energy produced is to be used at a factory to be built at Chiaturi for the production of ferromanganese, which has hitherto been handicapped by the want of fuel.

The municipal authorities of Nijni Novgorod are considering the establishment of a central station; the Archangel Municipality proposes both an electricity works and an electric tramway; and the Rovno Council has secured sanction to a loan of about £105,400 for the establishment of a central E.L. station.

Norway.—The electrical industry in Hardanger has, in the last few years, developed very rapidly, and it will in a few years' time have brought about 300,000 e.h.p. into operation. There is now to be erected a new large power station at Kinservik, where about 60,000 h.p. will be harnessed, and a railway is under construction for the transport of the building materials from the coast to the station. At Aalvik 100 men are employed in connection with the harnessing of the Bjöloo River, which will be capable of producing 80,000 h.p. in all. At the Tysse River at Odda, where some old water conduits are now being replaced by new ones, the amount of power utilised will soon be brought up to 125,000 h.p. The Osa Fossekompani, a new company, has submitted an application for a concession, which means the harnessing of about 50,000 h.p.

At the last meeting of the Government it was proposed to submit a Bill to the Storthing, by which the A/S Bremanger Kraftselskap will be granted a concession for which it has applied. The case in question comprises the acquisition of the water rights and the harnessing of the Svälgen River in Bremanger, which is able to produce 28,000 e.h.p. The water course includes three small lakes, which will be dammed and regulated, and the electrical power, according to the plans, will be generated in two separate power stations. The concession will be granted for a period of 65 years, and it is stipulated that the directors shall be Norwegian citizens, and that a certain portion of the capital shall be owned by Norwegians. The royalty to be paid to the State is fixed at 6½d. per h.p. per year for the first 10 years, 9½d. for the following five years, and 1s. 1d. per year for the remainder of the concession.

Dundee.—Year's Working.—The result of the past year's working of the Corporation's electricity department shows a reduction in the net profit from the preceding year, which is accounted for by circumstances outside the control of the management. The cost of coal increased by £2,700, and the assessment, which increased by £600, now amounts to 20 per cent. of the total working expenses. Interest charges also increased by £1,300. The units sold numbered 12,062.228, an increase of two million units. The revenue was £58,783, an increase of £5,400. The net profit was £5,150, from which £1,643 has been taken to meet the loss on the Broughty Ferry undertaking, which was taken over during the year. The balance, £3,507, has been transferred to reserve. The charges for energy for heating and cooking are to be reduced.

East Grinstead.—Prov. Order.—The U.D.C. has appointed a Committee to consider the advisability of applying for a prov. order for electric lighting, the proposal being to establish works in conjunction with the new refuse destructor. It was also decided to ask Mr. J. B. Morgan, electrical engineer to the Horsham U.D.C., to confer with the Council's surveyor and report on the scheme.

Elland.—Street Lighting.—The U.D.C. has decided to light Long Wall with electricity.

Friern Barnet.—Proposed E.L.—The Council has appointed a Committee to interview representatives of the Hornsey B.C. on the subject of a supply of electricity for the district.

Glasgow.—Year's Working.—The income of the Corporation electricity department for the past year was £376,983, an increase of £32,735 over the previous year, while the number of units sold was 76,950,764, an increase of 13,767,701, which was entirely on sales to private consumers. The average price of energy to consumers was 1·156d. per unit.

Grimsby.—Rate Relief.—The T.C. has been recommended to pay £500, less income-tax, out of the surplus of the electricity undertaking to the relief of the rates, and to transfer the balance to the reserve fund.

Hereford.—The R.D.C. has consented to the application of the T.C. for permission to supply electricity in Holmer and Shelwick parish.

Horsham.—Year's Working.—The gross profit on the U.D.C.'s electricity department for the year ended March 31st was £2,458. After paying loan instalments, £1,159, and interest, £840, the net profit was £459.

King's Lynn.—Year's Working.—The net profit of the Corporation electricity department for the year ended March 31st last was £1,777, as compared with £876 in the previous year. The total income was £8,519, compared with £7,314, and the total expenditure £6,742, against £6,438. The energy sold was 669,874 units, at an average price of 2·66d. per unit, the previous year's total being 559,647 units at an average of 2·78d. The whole of the surplus is to be applied to the repayment of borrowed capital. A bonus of £40 was awarded to the engineer, Mr. C. W. Jackson, who planned and supervised the recent extensions to the works.

London.—Bethnal Green.—The B.C. has been recommended to appoint Mr. Harold W. Couzens consulting electrical engineer to carry out its electricity scheme, at a fee of 5 per cent. upon the capital cost incurred, excluding amounts expended on land and buildings.

Manchester.—The T.C. has approved a recommendation of the Electricity Committee that the chairman, deputy-chairman and engineer be authorised to visit Paris, Berlin, New York, Boston, Philadelphia, Pittsburg, Chicago, Schenectady and Montreal to inquire into the most modern practice in regard to the design and equipment of large generating stations for economical production, and the lay-out of modern extra-high-voltage transmission systems.

New Zealand.—The Corporation of Invercargill proposes to borrow £10,000 for the extension of its electric lighting system.—*B. of T. Journal.*

Nottingham.—Street Lighting.—The T.C. has referred to the Lighting Committee a proposal for experiments to be carried out in certain streets with centrally-suspended metal-filament lamps.

Pittington (Co. Durham).—Proposed Lighting.—A meeting of ratepayers has decided in favour of the adoption of the Lighting Acts.

Salford.—The T.C. having sought permission from Manchester to supply electricity to houses in Park Road, Crumpsall, the Manchester Gas Committee has decided that, inasmuch as this would mean a reduction in the consumption of gas in the houses in question, consent shall only be given on condition that the Salford T.C. contributes £1 per annum in respect of each house so supplied.

L.G.B. Inquiry.—An unopposed inquiry was held on the 10th inst. by Mr. T. C. Ekin into the application of the T.C. for sanction to the borrowing of £13,500, for the supply of electricity to the docks of the Manchester Ship Canal Co.

Proposed Loan.—The T.C. is to seek the sanction of the L.G.B. to a loan of £16,500 for a new turbo-alternator, to be purchased from the British Westinghouse Co. at a cost of £14,137, and for alterations to foundations and switchgear.

Stretford.—New Plant.—The Electricity Committee has resolved to have a specification prepared, and to invite tenders, for an additional battery of 700 amperes' rating. The cost is estimated at £3,500.

The B. of T. has consented to overhead wires being attached to tramway standards in certain roads.

Sunderland.—Proposed Loan.—The Electricity and Lighting Committee has decided to apply to the L.G.B. for sanction to borrow £12,000 for additional machinery and switchgear for sub-stations.

Swansea.—Owing to numerous applications for electricity for power purposes outside the borough, the T.C. has decided to apply to the B. of T. for powers to supply outside its area, in specific cases.

West Ham.—L.G.B. Inquiry.—On Thursday last week an inquiry was held by Mr. H. R Hooper into the application of the B.C. for sanction to borrow £3,621 for new works in connection with the electricity undertaking, and £3,085, the excess on previous loans. The Ratepayers' Association objected to the granting of the loans until the whole of the books of the Council had been audited by the Government.

Swinton and Pendlebury.—Year's Working.—The profit on the past year's working of the electricity undertaking was £34, compared with a deficit of £98 in the previous year.

Torpoint.—Proposed E.L.—After discussing letters from the promoters of the E.L. Co., one of which intimated that the scheme would not be carried out, and that the company would not be formed, while a later one withdrew this and said that the company would be formed without delay and the contract with the Council carried out, the U.D.C. has passed a resolution to the effect that it is of opinion that the letter of May 30th determines the contract of April 2nd, 1914, and it is undesirous of entering into further negotiations.

Tynemouth.—Half-Watt Lamps.—The Electricity Committee has resolved to supply energy for ½-watt lamps, using 1,000 watts, at 1½d. each per hour, the lamps to be provided and kept up by consumers.

Warrington.—Loan Sanction.—The T.C. has received sanction to borrow £4,950 for the purposes of the electricity undertaking, including £1,950 for a rotary converter, £650 for cables, £1,350 for armoured cables, and £1,000 for services.

Wimborne.—New Generating Station.—The U.D.C. has approved of a site, near Ethelbert Terrace, for the proposed electricity works.

Winchester.—Year's Working.—The total revenue of the Corporation electricity department for the past year amounted to £10,266, compared with £9,581 in the previous year. The gross profit was £7,819, compared with £6,692; and the net profit was £404 against £1,102, which has been carried to the reserve fund. The sales of energy increased during the year from 67,204 to 240,000 units for power; from 16,000 to 49,000 for heating and cooking; and from 9,000 to 16,000 for public lighting. Running costs were reduced by 17 per cent., despite an increase of 1s. 1d. per ton in the cost of coal.

TRAMWAY and RAILWAY NOTES.

Bristol.—Proposed Purchase.—As the result of a poll on the question of the purchase of the local tramways, 18,057 votes have been received in favour of municipal ownership and 14,894 against.

Canada.—Royal assent has been given to the London and Port Stanley Railway Bill, whereby the city of London is authorised to expend $700,000 upon the electrification of its steam railway to Port Stanley. Work will begin almost immediately, and it is expected that the electrified line will be in operation early next year.—*Canadian Engineer.*

Continental Notes.—Germany.—The Hessian Government has decided to spend £100,000 on the construction of an electric railway from Undenheim, *viâ* Wörrstadt, to Bingen a/Rh.

Switzerland.—A credit of 38,500,000 fr. has just been voted to equip with electricity the St. Gothard line, and that from Estfeld to Bellinzona. Later on the Lucerne to Chiasso line will be converted to electric traction, the whole of these works being carried out with a view to the eventual conversion of the other lines. The construction is estimated to last four years.

Japan.—A sum of £250,000 is included in the current year's Budget of the Japanese Imperial Railway Board for the electrification of railways.

Linthwaite.—Tramway Extension.—The Huddersfield T.C. has notified the U.D.C. that it is about to extend the tramways from the Linthwaite terminus to Marsden, a distance of about 2½ miles.

Nottingham.—Year's Working.—The receipts of the Corporation tramway department for the past year amounted to over £175,000, an increase of £8,200 over the previous year. The passengers carried increased by 2 millions, the car-miles run by 57,000, and the expenditure by £148. The smallness of the increase in the working cost is due to the saving in energy resulting from a bonus scheme for drivers coming into force during the year, although the wages bill increased by £1,265.

Rotherham.—Proposed Extensions.—The B. of T. and the L.G.B. have approved of the applications of the T.C. for prov. orders for tramway and railless traction systems, and Bills to confirm these orders have been introduced into Parliament. No petitions in opposition have been lodged.

South Africa.—The undertaking of the Victoria Tramway Co. in Kimberley, on which the Kimberley City Council had an option of purchase at £35,000, has been taken over on a 25 years' lease by the De Beers Co. The fares are to be reduced from 6d. and 3d. to 2d. and 1d., which represents a reduction of £5,000 per annum in revenue, and will make the system the cheapest in South Africa. The Corporation will receive £900 per annum.

United States.—The final draft of the tentative agreement between the Philadelphia Rapid Transit Co. and the Council, providing for an elevated and underground electric railway for the city, has been completed. The details have not yet been made public, but it is understood that the construction of the system except the tunnel to Camden, which is to be financed separately, will be paid for by the Council and leased to the company, which is to equip and operate it as part of one system. The company is also to lease the underground line to Camden. It is estimated that the Council will invest 45 to 50 million dollars, and the company from 11 to 15 million dollars, in the undertaking. The company will also assume rental obligations amounting to six million dollars.—*Railway Review.*

Warrington.—Year's Working.—There was a net profit of £3,239 on the Corporation tramway undertaking for the year ended March 31st last, compared with £2,981 in the previous year. The total income was £23,753, compared with £23,205, and the expenditure totalled £15,217, against £14,798. The average receipts per car-mile amounted to 12·246d., compared with 12·235d. The receipts on the Sankey route decreased from 8·895d. to 8·830d. per car-mile, probably on account of the competition from the motor-'buses. The profit has been carried to the appropriation account, increasing the balance in hand to £5,059, of which £2,500 is to be transferred in relief of rates.

TELEGRAPH and TELEPHONE NOTES.

Belgium.—The Government has formed a special Radio-telegraphic Department under the Ministry of Posts and Telegraphs; the wireless station at Nieuport Bains is to be brought up to date, and a new one will probably be erected at Antwerp. It is proposed to set up receiving stations at 35 centres, to receive the time signals from the Eiffel Tower.

Germany.—The new motor road near Berlin is being provided with an elaborate system of electric alarms for notifying accidents.

Japan.—So great is the demand for the installation of the telephone in Japan, that it is reported that the Japanese Department of Communications has drawn up a scheme for the extension of the system on a much larger scale than hitherto. The scheme provides for an expenditure of £400,000 per annum for a period of five years, during which time it is hoped to install about 70,000 telephones.

Parliamentary.—In the House of Commons on Monday, the Postmaster-General stated that with the completion of the underground cables from London to the landing places of the foreign cables, there would be no need to extend further the telegraph system, but where the telegraph overhead routes between large centres were locally congested the wires would be put underground.

Russia.—Until recently Russia had the distinction of being the only important country without international telephone connections. The Libau network has now been connected to the German system in Memel.

The Imperial Chain.—Discussing the Post Office vote in the House of Commons last week, Sir Henry Norman commented on the slow progress that was being made with the erection of the Imperial wireless stations, and pointed out that the Marconi Co. was establishing a monopoly in wireless communication, which would be disastrous to the public interest.

The Postal Service.—In a discussion of the Post Office vote, on Wednesday last week, the conclusions of the Holt Committee were severely criticised by many speakers in the House of Commons, and a Government defeat appeared imminent; the Postmaster-General, however, at the instance of the Labour Party, agreed to appoint a Committee of five experts outside the House to consider the matter, and to report. He added that the Government would set up some body to inquire into the future relations of the State and the employés of the various Government Departments, and accepted the principle that there should be some body outside the House that would stand between the State and its employés and adjust their differences.

Stirling.—The Tramways Committee has had a conference with representatives of the County Council with reference to the proposed electric tramways from Bridge of Allan to Bannockburn. The County Council will give careful consideration to the proposals, and will not act in an obstructive spirit. Power will be supplied from the Council's electricity works. A single line is suggested, except through the town of Stirling. The Town Council suggests that it shall be responsible for the maintenance of the rails, and that the County Council shall undertake the maintenance of the track outside the burgh. The Council agreed that its views should be communicated in writing to the County Council and Bridge of Allan Town Council, and that the Stirling and Bridge of Allan Tramways Co. should be asked to name a price at which they would be prepared to sell their present undertaking.

CONTRACTS OPEN and CLOSED.

OPEN.

Alford.—June 27th. Public lighting, for the U.D.C. Mr. T. N. Loy, Clerk.

Atherton.—June 24th. E.H.T. cable switchboard and transformers for the Electricity Department. Mr. C. T. Astbury, Resident Engineer.

Australia. — Sydney. — July 20th. Box compound, meters, maximum-demand indicators, arc lamp carbons, and straight-stem insulators, for the Council. Specifications for each section 10s. 6d., from City Electrical Engineer, Town Hall.

July 20th. Municipal Council. 33,000-volt insulators (Contract No. 278); two coal conveyers, motors, &c. (Contract No. 307). Copies of particulars can be seen at the Board of Trade Commercial Intelligence Department in London.

Department of Public Works. 4,000 tons of 100-lb. and 850 tons of 109-lb. grooved steel rails for tramways.

August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

Perth.—August 5th. Copper wire and binders, for Postmaster-General. See "Official Notices" to-day.

August 5th. Telephone instruments and parts. Telegraph accumulators and power board, Kalgoorlie, for Postmaster-General. See "Official Notices" to-day.

August 12th. Cable, lead-covered and various, for Postmaster-General. See "Official Notices" to-day.

August 12th. Insulators, for Postmaster-General. See "Official Notices" June 12th.

August 19th. Electric lamps and fittings, for Postmaster-General. See "Official Notices" to-day.

Melbourne.—July 28th. Testing apparatus for the P.M.G. See "Official Notices" to-day.

July 6th. Rotary converters and frequency changers, for Melbourne Suburban Railways. See "Official Notices" June 5th.

July 6th. Electrically-operated car-shed cranes for Melbourne Suburban Railways. See "Official Notices" June 12th.

August 26th. Eight 50-ton, one 30-ton, and three 10-ton electric overhead travelling cranes for Victorian State Railways. Specification, &c., from Messrs. John Coates & Co., Ltd., 115, Victoria Street, S.W.

Aylesbury.—July 6th. U.D.C. Lighting and power switchboard with connections, battery of accumulators, underground mains, including house services, conversion of existing lamp standards, &c. See "Official Notices" June 12th.

Ballaghadereen.—July 6th. Hydraulic turbine and accessories, dynamo and reducer set, aerial line, switchgear, for the Electricity Committee. See "Official Notices" to-day.

Ballsbridge (Dublin).—June 27th. U.D.C. Twelve months' supply of steam coal, for the Pembroke U.D.C. Electricity Works. Specification from the Town Hall, Ballsbridge.

Beckenham.—June 22nd. U.D.C. Evaporative condenser (500-KW. set). See "Official Notices" June 12th.

Bolton.—July 19th. Corporation. Converting plant, sub-station E.H.T. and H.T. switchgear. See "Official Notices" June 12th.

Doncaster.—June 22nd. Light railway extensions for Corporation Tramway Department. Specification, &c. (10s., not returnable) from the Borough Engineer, 3, Priory Place.

Dublin.—June 25th. Corporation. Feed pump, tanks, pipework, &c. See "Official Notices" June 5th.

Exminster.—June 29th. Electrical appliances for a year for the Devon County Lunatic Asylum. Mr. H. E. Morgan, Clerk.

France.—Seine.—June 26th. Supply, in 10 lots, of lead-covered telephone cable, and of rubber and cotton-covered copper wire, two lots. Particulars, Sous-Secretariat d'Etat des Postes et des Télégraphes, 103, Rue de Grenelle, Paris.

Glasgow.—June 25th. Corporation. Electric light installation at the stables, stores and workshops, Graeme Street, for the Corporation. Forms of tender from Mr. W. Greig, 20, Trongate.

Guisborough.—July 2nd. U.D.C. Cables, transformers, sub-station equipments and fittings, for the U.D.C. Specifications (£1) from Messrs. May & Hawes, Consulting Engineers to the Council, Caxton House, Westminster, S.W.

Harrogate.—June 22nd. Corporation. Economiser, 288 pipes, for Electricity Department. See "Official Notices" May 29th.

Hoylake and West Kirby.—June 26th. Coal (washed peas, about 3,500 tons) for the U.D.C. electricity works. Mr. C. J. Turner, Electrical Engineer.

Huddersfield.—22nd June. Electric light installation at Crosland Moor Institution. Mr. T. W. Armitage, Clerk to the Guardians, Union Offices, Ramsden Street.

Hull.—June 16th. Electrical requirements for the B. of G. Mr. R. H. Winter, Clerk, St. Mary's Chambers, Lowgate.

Keymer (Sussex).—June 27th. Public lighting, for the P.C. Mr. H. Plummer, Clerk, Lyntonville, Hayward's Heath.

Leeds.—June 29th. Corporation. Air-cooled transformers. See "Official Notices" May 22nd.

Lincoln.—Coal (cobbles or slack) for a year, to the Corporation Electricity Works. Engineer, Brayford Side North.

London.—L.C.C.—June 23rd. 50, 100 or 150 complete trailer-cars, and equipment of 200 existing electric motor-cars with couplers and traction gear for drawing trailer-cars. See "Official Notices" May 29th.

June 30th. 150 sets plough collector gear. See "Official Notices" June 12th.

July 13th. One, two or three electrically-driven chassis, for Fire Brigade. See "Official Notices" to-day.

July 14th. Five rotary converters of 1,500 KW. each; 15 main static transformers, two starting static transformers, and re-erection, &c., of existing motor generators. See "Official Notices" to-day.

July 30th. 10,000 or 5,000 driving and pony wheel tramcar tires, 300 axle forgings for tramcars. Chief Officer, Tramways Department, 62, Finsbury Pavement, E.C.

City.—The Music Committee of the Court of Common Council is to spend £400 on altering the electric lighting arrangements of the stage at the Guildhall School of Music.

Battersea.—June 24th. B.C. Coal telpherage plant. See "Official Notices" May 29th.

Hackney.—The B.C. Electricity Committee recommends that tenders be invited for the supply of white open-type and yellow flame arc lamp carbons for the public lighting service.

St. Pancras.—June 25th. B.C. Large water-tube boilers. See "Official Notices" June 5th.

H.M. Office of Works.—June 30th. Wiring public offices extension, Westminster, S.W. See "Official Notices" June 12th.

July 1st. Twelve months' supply of incandescent electric lamps. See "Official Notices" to-day.

July 7th. Three years' supply of electrical accessories. See "Official Notices" to-day.

Manchester.—June 26th. Corporation. Potential and current transformers, C.C. and A.C. motors, electricity meters, C.C. motor-starting switches and three-phase star-delta switches. See "Official Notices" June 12th.

Morecambe.—June 25th. Corporation. 2,500 tons of coal or slack, for the Electricity Supply Department. See "Official Notices" May 29th.

New Zealand. — Auckland. — August 6th. Three 750-KW. D.C. mixed-pressure turbo-generators; one 1,500-KW. three-phase turbo-generator, including auxiliary plant and sub-station equipment. See "Official Notices" May 22nd.

July 27th. Electricity meters, &c., for the Borough of Tauranga. Specifications (£1), from H. W. Cimie and Son, Hastings, N.Z.—*N.Z. Shipping and Commerce.*

Norway.—June 29th. Norwegian State Railways. Electric clocks for the Narvik district. See *Board of Trade Journal.*

Peterborough.—Coal, for the Corporation Electricity Works. Electrical Engineer.

Rochester.—June 30th. Corporation. Electric lighting of the Corn Exchange Buildings. See "Official Notices" to-day.

Rochdale.—July 1st. Corporation. 94 wet-air filter. (1914.) See "Official Notices" to-day.

Rotherham.—July 8th. Corporation. Tramway stores, coals, cables, meters, &c. See "Official Notices" to-day.

Salford.—June 26th. Corporation. Switchboard for the docks sub-station. Specification from the Borough Electrical Engineer, Electricity Works, Frederick Road Pendleton.

Stalybridge.—June 27th. 12 months' supply of stores for the Joint Tramways and Electricity Board. Specifications and form of tender obtainable from Mr. R. Blackmore, Engineer-in-Chief, Generating Station, Stalybridge.

Swansea.—June 25th. Corporation. Main generating station and sub-station. Extra H.T. and L.T. switchgear. See "Official Notices" June 5th.

June 22nd. Steam coal, for the Corporation electricity works; Borough Electrical Engineer.

Sweden.—July 4th. Royal Swedish Water Power Administration. Four transformers. Specifications from, and tenders to, "Kungl. Vattenfallsstyrelsens Elektrotekniska byra, Regeringsgaten 15," Stockholm; no special form of tender is required. A specification (in Swedish) may be seen at the Commercial Intelligence Branch of the Board of Trade, London.

Skelton and Brotton.—July 2nd. U.D.C. Overhead lines, underground cables, transformers, sub-station equipment, public lighting fittings. See "Official Notices" June 12th.

Spain.—June 28th. Municipal authorities of Motrico (Province of Guipuzcoa). Concession for the electric lighting of the town during a period of five years.

June 29th. Municipal authorities of Cornella de Llobregat (Province of Barcelona). Concession for the electric lighting of the town during a period of 30 years.

June 30th. Municipal authorities of Llanes (Province of Asturias). Concession for the electric lighting of the town.

Walsall.—July 14th. Corporation. Four water-tube boilers, superheaters, economisers, pumps, pipes, &c. See "Official Notices" to-day.

July 14th. Corporation. Two 3,000-KW. turbo-alternators with surface condensers, motor generator. See "Official Notices" to-day.

Warrington.—July 3rd. Electric equipment, &c., for transporter bridge over the River Mersey, for Jos. Crosfield & Sons, Ltd. Drawings, &c. (£2 2s.) from Mr. W. H. Hunter, M.I.C.E., 12, Spring Gardens, Manchester.

York.—June 25th. Corporation. H.T. overhead line material. See "Official Notices" to-day.

CLOSED.

Aberdare.—The U.D.C. has received the following tenders for a refuse destructor :—

Heenan & Froude	(accepted)	£3,416
Meldrums, Ltd.		3,455
Hughes & Stirling		3,523

Australia.—Sydney.—The City Council has received the following tenders :—

Fibre conduits.—Haes & Eggers, £703 (recommended); Noyes Bros., £828.
Transformers (outdoor).—Australian G.E. Co., £3,173; N. Guthridge, Ltd., £3,210; British G.E. Co., £3,535; Noyes Bros., £3,825; Standard, Waygood, Hercules, Ltd., and Australian Metal Co., schedule.
Transformers (indoor.)—Noyes Bros., £1,802; N. Guthridge, Ltd., £1,962; British G.E. Co., £2,268; Gardiner, Woern & Co., £2,445; Australian G.E. Co., £2,474; Standard, Waygood, Hercules Co., Ltd., Siemens Bros. and Australian Metal Co.

Melbourne.—Postmaster-General's Department :—

Automatic switchboard at Brighton Telephone Exchange, and apparatus for equipping junction lines at Manual Exchange, £15,951.—Automatic Telephones (Aus.), Ltd.
C.B. multiple switchboard, £17,772.—Western Elec. Co. (Aus.), Ltd.
Strips relays, £151.—Siemens Bros. Dynamo Works Co., Ltd.—*Australian Mining Standard.*

Aylesbury.—The T.C. has provisionally accepted the tender of Messrs. Willans & Robinson, Ltd., for Diesel engines and plant, at £4,753.

Bedford.—On the recommendation of the Electricity Committee, the following tenders for pipework in connection with the new alternator, have been accepted :—

R. Jeakings.—21 in. conduit and pipework	£321
W. H. A. Robertson & Co., Ltd.—Steam and exhaust pipework	495

Belgium.—Eleven concerns—seven German, two Belgian, and one each French and Italian—last week submitted tenders to the Belgian Post and Telegraph authorities in Brussels, for the supply of a quantity of telephone cables. The lowest offer was that of the A.E.G.-Union Electrique Co., of Brussels.

Bolton.—The Tramways Committee has accepted the tender of Messrs. Hadfields, Ltd., for special track work in connection with the relaying of Manchester Road and Great Moor Street tramways.

The Electricity Committee has accepted the tender of Messrs. Jas. Baxendale & Sons for metal air-ducts.

Bristol.—The Docks Committee has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for the supply of 19/14 S.W.G. electric cable.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

Admiralty.—Contract Department.

Motors and controllers.—Laurence Scott & Co., Ltd.

War Office.

Hand telephones.—Automatic Telephone Manufacturing Co.
Electric lamps.—Corona Lamp Works, Ltd.; Cryselco, Ltd.; Dick, Kerr and Co., Ltd.; Rugby Lamp Co., Ltd.; Stearn Electric Lamp Co., Ltd.

Crown Agents for the Colonies.

Diesel engines, &c.—Willans & Robinson, Ltd.
Telegraph poles.—Bullers, Ltd.
Copper wire.—F. Smith & Co.; T. Bolton & Sons, Ltd.

India Office.

Wireless apparatus.—Marconi's Wireless Telegraph Co.
Dynamos.—Lancashire Dynamo Co., Ltd.

Post Office.

Laying lines of ducts, Newcastle-Sunderland.—James McLaren, junr.
" " Chatham-Sheerness.—A. H. Ball & Co., Ltd.
" " and pipes, Eastbourne.—Peerless, Dennis & Co., Ltd.
" " " Leeds.—J. A. Ewart, Ltd.
Sub-station electrical equipment, Birmingham.—British Thomson-Houston Co., Ltd.
Telephone exchange equipment, Devonport.—Western Electric Co., Ltd.
" " " extension, Worthing.—Automatic Telephone Manufacturing Co., Ltd.
Telegraphic apparatus.—Elliott Bros.; Siemens Bros. & Co., Ltd.
Telephonic apparatus.—B.I. and Helsby Cables, Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; International Electric Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Western Electric Co., Ltd.
Battery boxes.—Standard Woodwork Co., Ltd.
Telephone cable.—B.I. and H. Cables, Ltd.; Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Stoneware ducts.—T. Wragg & Sons, Ltd.
Metallic filament lamps.—British Thomson-Houston Co., Ltd.; Edison and Swan United Electric Light Co., Ltd.; General Electric Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.
Telegraph paper.—Waterlow & Sons, Ltd.
Insulator spindles.—F. W. Cotterill, Ltd.; Guest, Keen & Nettlefolds, Ltd.; T. W. Lench, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; B.I. and H. Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., &c., Ltd.
V.I.R. wire.—C. Macintosh & Co., Ltd.
Leclanché zinc rods.—Siemens Bros. & Co., Ltd.

G.N. Railway.—The Brimsdown Lamp Works, Ltd., has obtained the contract for the supply of metallic filament lamps to the Great Northern Railway Co.

Gravesend.—The tenders of the British Thomson-Houston Co. at £999 (plus £28 for switches of a size larger than specified), and of Messrs. B. R. Rowland & Co. at £433 (or £418 without fan), have been accepted by the Council for extending the switchboard and fitting automatic stokers to two boilers at the Electricity Works. In the latter case the engineer is to have the fan fitted if he considers it desirable. The tender of Mr. A. E. Tong has also been accepted at £367 for extending the switchboard platform and building a high-tension room.

London.—Stoke Newington.—The B.C. Electricity Committee recommends the acceptance of the quotation of the Union Cable Co., Ltd., for the supply of cable for 12 months.

Bermondsey.—The B.C. is being recommended to accept the tenders of Messrs. A. Usher & Co. and Messrs. Bradbury, Sons and Co., Ltd., for an annual supply of Wingfield small nuts through 1¼ in. and over 1½ in. screen Derby, at 16s. 2d. per ton, and Gedling nutty slack, 1½ in. Notts, at 13s. 8d. per ton respectively.

Hammersmith.—The B.C. Electricity Committee reports the receipt of the undermentioned tenders for cable ducts required to March 31st, 1915.

—	Price per yard.				Split ducts.			
	1 way	2 way	3 way	4 way	1 way	2 way	3 way	4 way.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d
Sutton & Co...	1 0¾	2 5½	3 6¼	4 8½	1 5	3 3	4 9	5 8½
Doulton & Co.	1 0¼	—	—	—	1 4	—	—	—
T. Wragg & Sons	1 0¾	2 4¼	3 4¼	4 1½	0 8¼	1 2¼	1 8¼	2 0¾
Albion Clay Co.	1 0¼	2 7½	3 9¼	4 7	1 0¼	2 7½	3 9½	4 7
Mansfield.	1 0¾	2 4½	3 5	4 2	0 8½	1 7	2 3½	2 9½
Oates & Green, Ltd.	11	2 0	2 10	3 8	—	Not quoted.		—

The Committee recommends that subject to the sample ducts proving satisfactory, the tender of Messrs. T. Wragg & Sons be accepted.

For the supply of air-cooled static transformers tenders were received from the following firms, viz., the British Electric Transformer Co., Ltd., Foster Engineering Co., Ferranti, Ltd., Brush Electrical Engineering Co., Burnand & Co., Willem Smet and Co., and Brown, Boveri & Co. The Committee reports that the tender of the British Electric Transformer Co. was the lowest received for the six 100-KW. and for the 200-KW. transformers. For the 50-KW. the firm were second on the list, but upon the report of the engineer this tender is also recommended.

The Metropolitan Asylums Board has accepted tenders from the following firms for annual supplies :—General Electric Co., Ltd., Baxter & Caunter, Ltd., Veritys, Ltd., Siemens Bros. Dynamo Works, Ltd., Sterling Telephone and Electric Co., Ltd.

Manchester.—The Tramways Committee has accepted the tender of Messrs. Chambers, Scott & Co., Ltd., for a rail-bending machine; and that of Messrs. Paulding & Co. for the supply of block tin.

The Baths and Wash-houses Committee have accepted the tender of Messrs. L. E. Wilson & Co. for electric lighting at the new Quay Street Baths.

The following tenders have been accepted by the Electricity Committee :—

L.T. switchboard for Stuart Street Station.—Ferguson, Pailin & Co.
Foundations for additional cooling towers.—C. H. Normanton & Son, Ltd.
C.I. pipes and valves for water coolers.—J. H. and A. Coulthurst, Ltd.
Cables.—Johnson & Phillips, Ltd., and B.I. and Helsby Cables, Ltd., and W. T. Glover & Co., Ltd.

New Zealand.—The Auckland City Council has accepted the tender of Messrs. Riley & Co., at £1,850, for insulated cable.—*Tenders.*

Ramsbottom.—The U.D.C. has placed an order with the R.E.T. Construction Co., Ltd., for two railless traction vehicles.

Salford.—The T.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., amounting to £14,137, for a 5,000-KW. turbo-alternator at the electricity station.

South Shields.—Messrs. Johnson & Phillips, Ltd., have received an order for providing, drawing into cast iron conduits and jointing up complete, a low-tension electric cable system at New Dock, South Shields.

South Wales.—The contract for a double inlet Keith reversible mine fan, to handle 100,000 cb. ft. of air per minute at 6-in. water gauge, to be installed at Nantgarw Colliery, South Wales, has been placed with the James Keith & Blackman Co., Ltd.

Sunderland.—The T.C. has accepted the following tenders on behalf of the Electricity and Lighting Committee :—

Phœnix Dynamo Co.—Feeder booster.
J. W. White —Repairs to electricity works and sub-stations.
Ferranti, Ltd.—Transformer and meters.
Siemens Bros. Dynamo Works —Meters.
Morgan Crucible Co., Ltd.—Carbon brushes.
J. Allen, Senr. & Son, Ltd.—Cast iron box frames and covers.
B.I. & Helsby Cables, Ltd.—Cable.
Hans Renold, Ltd.—Chain drive for stoker.

Swansea.—The Harbour Trust has accepted the following tenders :—

General Electric Co., Ltd.—Generator and switchboard extension in central sub-station.
British Thomson-Houston Co., Ltd.—Voltage regulator.
E. Sisterton. 300 tons of rails.
W. Richards & Co , Ltd.—Electric cable.
Harland Engineering Co.—Crane plug boxes.

Tynemouth.—The tender of the Macintosh Cable Co. is recommended to the Council for acceptance at £412 for a supply of cable.

Wallasey.—The Corporation has made a contract with the British Thomson-Houston Co., Ltd., for 12 months' supply of their type R.H. A.C. meters.

The T.C. has accepted the following tenders in connection with the new generating station :—

Transformers.—Messrs. Ferranti, Ltd., £1,304.
Three steel chimneys.—M. Louis Prat, £1,084.

West Bromwich.—The T.C. has accepted the tender of Messrs. C. L. Wells, Ltd., for the supply of four motor-'buses.

Woolwich.—The tender of Messrs. Mechan & Son, Ltd., has been accepted by the Borough Council, at £357, for a supply of main circulating water pipes required in connection with the extension of the Globe Lane Electricity Works.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued :—

Friday, June 12th.—"D" Company. Infantry drill, 7 to 8.30 p.m. Technical instruction, 8.15 to 10 p.m. Miniature range instruction, 8.15 to 10 p.m.

Saturday, June 13th.—All Companies. Annual course of musketry at Purfleet rifle ranges. Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

Monday, June 22nd —"A" Company. Infantry drill, 7 to 8 p.m. Technical instruction, 8 to 10 p.m.

Tuesday, June 23rd.—Advance party for Berehaven Camp will parade at headquarters at 12 noon. "B" Company.—Infantry drill, 7 to 8 p.m. Technical instruction, 8 to 10 p.m.

Wednesday, June 24th.—All Companies. Rating examination will take place from 7 to 8.30 p.m.

Thursday, June 25th.—"C" Company. Infantry drill, 7 to 8 p.m. Technical instruction, 8 15 to 10 p.m.

Friday, June 26th.—"D" Company. Infantry drill, 7.30 to 8 30 p.m. Technical instruction, 8.45 to 10 p.m.

Saturday, June 27th.—Main body for Berehaven Camp will parade at headquarters at 12 noon. Regimental business will be transacted till 12 noon.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

FORTHCOMING EVENTS.

Municipal Electrical Association.—Friday and Saturday, June 19th and 20th. At Birmingham. Annual Convention. Concluding meetings.

National Physical Laboratory. Friday, June 19th. At 3 30 p.m. Annual inspection.

Physical Society of London (Fellows only).—Saturday, June 20th. (Morning.) Visit Cambridge Scientific Instrument Co.'s Works. (Afternoon.) Visit to Cavendish Laboratory.

Salford Technical and Engineering Association.—Saturday, June 20th. Visit, Broadheath.

University of London.—Tuesday, June 23rd. At 8.30 p.m. At University College. Conversazione.

Institution of Electrical Engineers.—Thursday, June 25th. At 9 p.m. At the Natural History Museum, South Kensington. Annual Conversazione.

Batti-Wallahs' Society.—Saturday, June 27th. River trip.

North of England Institute of Mining and Mechanical Engineers.—Saturday, June 27th. Visit to Home Office Experimental Station at Eskmeals.

ITALIAN ELECTRICAL PROGRESS IN 1912-13.

ITALIAN electrical enterprise in 1912-13 is passed under a comprehensive review by the *Nachrichten für Handel und Industrie* as follows :—Of the large electrical undertakings of Italy only four in the year 1912 (as against three in 1911) failed to pay a dividend. Of the remaining 26, 14 paid the same dividend, nine a higher dividend, and three a smaller dividend. In the aggregate dividends increased from 6·56 to 6·96 per cent. In the matter of the amount of capital invested, that of the industry supplying electrical energy stood above all others. On the other hand, there is much foreign, and in particular Swiss and Belgian, capital invested in it. Its favourable situation is due to the fact that the relation of capital to reserve in it is second only to that in the chemical industry; against an aggregate capital, for instance, of 491 million lire, there is a reserve of 51 million lire—*i.e.*, 10·4 per cent. of the capital. The capital increases, including the new formations (some 10 million lire), totalled in 1912 (deduction made of undertakings which were dissolved, or whose capital was written down) upwards of 40 million lire. Of the 12 companies which increased their capital may be cited the following :—

	Mill. lire.
Officine Elettriche Genovesi, at Genoa	from 17 to 20
Società Elettrica Riviera de Ponente	,, 12 to 20
Società per lo Sviluppo delle Imprese Elettriche in Italia, at Milan	,, 4 to 10
Società Adriatica de Elettricità, at Venice	,, 12 to 15
Società Varesina per le Imprese Elettriche, at Varese	,, 6 to 7

The Officine Elettriche Genovesi again distributed in 1912 (with a net profit of 1·7 million lire, against 1·6 million lire in 1911) a dividend of 10 per cent., and decided, after increasing its capital, to augment its bond debt from 12 to 20 million lire, four millions of which amount was issued, at 4½ per cent. interest, by June, 1913; it is intended to issue the balance gradually as pecuniary needs require. The new shares were taken over by the Elektrobank, of Zurich, and six million lire of the shares of 1910 and 1912 were offered to the shareholders at 135 per cent. The company enlarged its network by an addition of 79 km., so that on December 31st, 1912, it totalled 1,522 km., and extended the lighting equipment of the city of Genoa, and of the port and of the outside communes, and also augmented the number of customers connected to its network from 32,944 to 38,167. For 1913 were projected, besides the reconstruction of the transformer stations on the Riviera di Levante, the inauguration of the long-distance line from Recco to Riva Trigoso, then approaching completion, with a view to annexing to its distributing network the large industrial centres there located. The Unione Italiana Tramways Elettrici, which derives its motive power from the Officine Elettrichi Genovesi, and, like it, stands in close relation with a German firm and with the Bank für Elektrische Unternehmungen (Elektrobank), at Zurich, distributed a dividend of 9½ per cent., against 9 per cent. in 1911.

The character of the progress which the distribution of electrical energy is making in Italy is shown by the Governmental statistics of the number of concessions granted for the utilisation of water-power by electrical undertakings. According to the last published returns, for the statistical year 1910-11, there were altogether 125 of such concessions granted, for the working of undertakings aggregating 80,000 H.P., which raised the grand total of water-power used for the production of electrical energy to 966,000 H.P. These figures are allocated as follows:—678,000 to Northern Italy, or more than two-thirds; 215,000 to Central Italy, and 61,000 to Southern Italy and the Italian Islands.

Although it is not to be denied that there has been a slackening of the increase in the consumption of electric power for the driving of machinery and for lighting purposes in certain regions, and notably in the North, in consequence of the general situation and the crisis in the cotton industry, nevertheless, the call for railway and tramway working, with the many electric conversions constantly being launched, has created a compensatory consumption of no mean importance. In this connection may be mentioned that the Società per le Forze Idrauliche della Maira recently arranged a contract with the Railway Administration for the installation of electric working on the Giovi auxiliary line from Sanpierdarena (Genoa) to Ronco, which is a parallel line to that from Pontedecimo to Busalla, lately converted. With this business the German Negri group previously mentioned was intimately associated, and it is also concerned in the electrification of the Riviera line from Genoa to Ventimiglia and the supply of motive power to the Savona to San Giuseppe section. There is also observable a strong movement in favour of the electrification of the Genoa-Campoligure-Ovada-Asti line.

New water-power installations of considerable importance were sanctioned by the Italian Parliament last summer. They had to do with the erection of great storage dams and water-power installations in Calabria and Sicily through the exploitation of the Sola and Tirso rivers. These dams were to have an extent greatly surpassing the largest existing European reservoirs, their overflow yielding some 150,000 H.P. to be used for industrial purposes, and in Calabria, more especially, distributed by a network of 300 to 400 km. over a very wide region.

Furthermore, with the erection of these dams, whose construction will cost upwards of 60 million lire, is bound up the purpose of improving agriculture. In Sardinia especially, the collected waters will be used to irrigate the great plain stretching from Cagliari to the north-west, thereby supplying fodder for the cattle and horse-raising industries there, the most important in Italy, and freeing them from the existing food scarcity. In the same way a regulated water system in Calabria will benefit the districts lying at the foot of the hills by securing them from droughts on the one hand and from floods on the other, with their concomitant of malarial fever, &c. The concession for the reservoirs in Calabria has been granted to the Società per le Forze idrauliche della Sila.

THE WORKS OF MESSRS. J. H. TUCKER & CO., HAY MILLS.

"By their works ye shall know them"; and probably the works by which Messrs. Tucker & Co. are most widely known are the familiar "Tucker switches," which attained the rare distinction of setting a standard of quality that has often been quoted in consulting engineers' specifications as adequately defining a first-class article. But the firm's operations are by no means confined to small tumbler switches; while these form the solid foundation on which their reputation was built up, they also make large numbers of knife switches and fusible cut-outs, up to 2,000 amperes' rating, and construct main lighting and power switchboards and switchgear generally, for pressures up to 600 volts, in all sizes that are called for. They also turn out a large quantity of ironclad switches, service fuse-boxes, fuse and distributing boards, &c., paying in this respect special attention to the requirements of the Home Office.

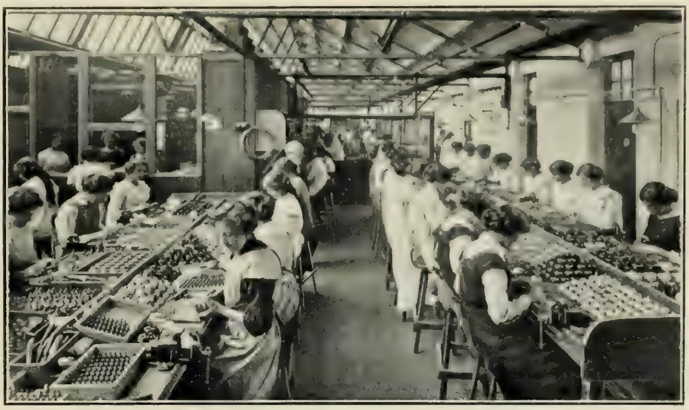


Fig. 1.—Assembling "Tucker" Switches.

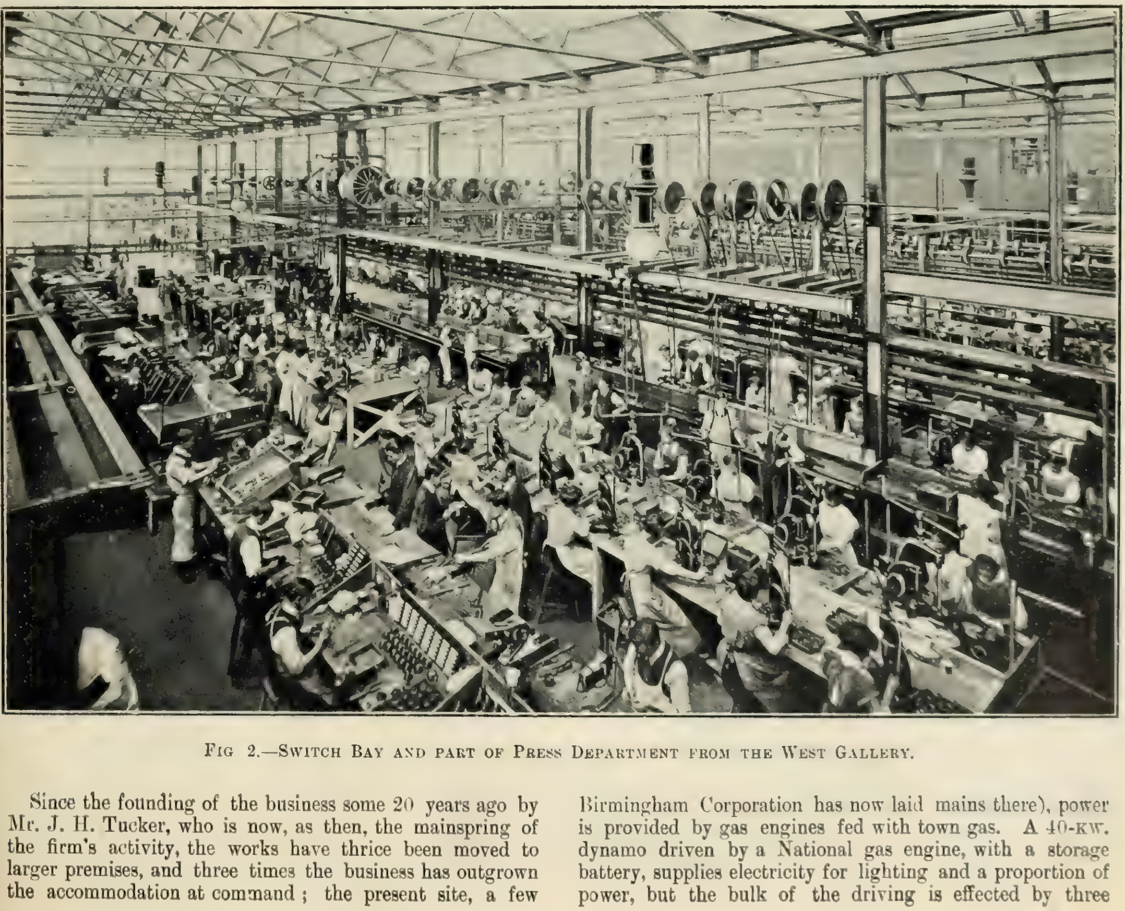


Fig 2.—Switch Bay and part of Press Department from the West Gallery.

Since the founding of the business some 20 years ago by Mr. J. H. Tucker, who is now, as then, the mainspring of the firm's activity, the works have thrice been moved to larger premises, and three times the business has outgrown the accommodation at command; the present site, a few miles outside Birmingham, in a rising industrial district, covers four acres, of which one-half is occupied, and the employés number about six hundred. The buildings were erected six years ago by the company, and further extensions are already under consideration.

The front of the building on King's Road comprises the finished goods warehouse and dispatching department on the ground floor, with the offices above; the latter adjoin a gangway running across the end of the works, and joining longitudinal galleries at either side. The offices are divided into sections corresponding to the various departments, including a large drawing office, staff mess-room, and a recently equipped showroom. Intercommunication telephones, with some 30 lines, connect up the different offices and works.

No electricity supply being available in the neighbourhood at the time when the works were erected (but the Birmingham Corporation has now laid mains there), power is provided by gas engines fed with town gas. A 40-kw. dynamo driven by a National gas engine, with a storage battery, supplies electricity for lighting and a proportion of power, but the bulk of the driving is effected by three other engines, one being a 75-H.P. Crossley of the latest throttle-governed type, and another a 58-H.P. National engine.

With the exception of the cabinet-making shop, electric light station and annealing house, which are situated in the goods receiving yard alongside of the works, all the departments are accommodated under one roof. A large stock of raw material is kept in hand, the only items that are not manufactured throughout in the works being iron castings and porcelain parts. A spacious and well-equipped tool-room is also provided, in which all of the numerous tools, dies, jigs, &c., employed in the works are made. The manufactured products may be classified under three heads: tumbler switches, accessories, and switchgear, and the works are nominally divided correspondingly into press and automatic machine departments, machine shop, and assembly departments, in addition to which are the various stores, pattern shop, experimental department, and what we may call the finishing shop, where polishing, plating, dipping and lacquering processes are carried on.

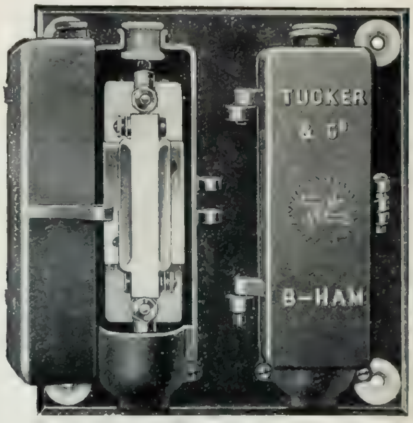


Fig. 3.—Tucker Ironclad Service Fuses.

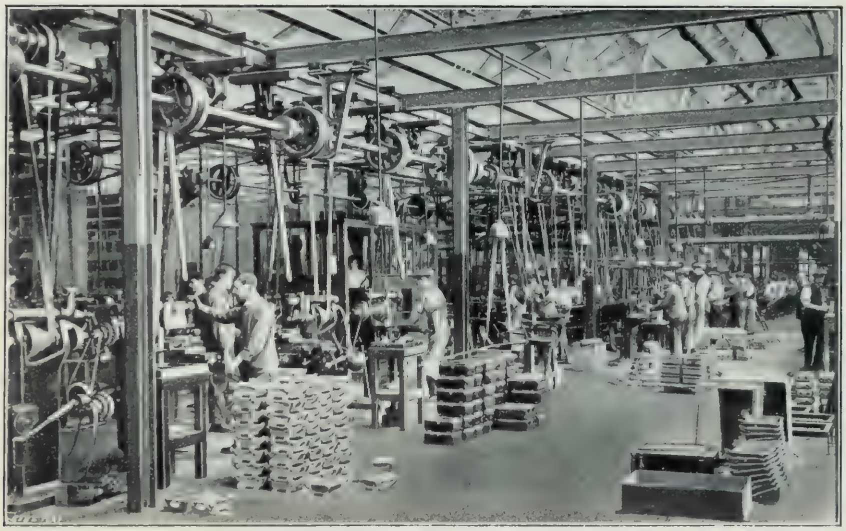


Fig 4.—Machine Shop.

Naturally, a great deal of the work is done with hand and power presses, and the press department occupies a large area, near the front of the building; parts of it appear in two of the views which accompany this article. Beyond this are 33 automatic machines, which turn out all the screws, dollies and similar parts. More than half a million small turned parts and small screws are required every week. Some extremely ingenious devices are employed in this department for certain processes, such as the screwing of lampholder barrels with chasers, which carry out the operation in six stages, producing a practically perfect thread. The switch parts are made to limit gauges, with an allowance of ½ a mil up or down. Certain parts of switches and small fuses are made on semi-automatic machines. Most of the work is piece-work, and after each process the parts go into the stores, whence they are re-issued for further manufacture; those that undergo several operations in the press department are annealed at intervals in a coke-fired furnace. Tumbler switches are assembled in one of the side galleries, where they are also carefully inspected before passing into store; cheap switches are apt to be found inaccurately adjusted on delivery, but this cannot be said of the Tucker switches, in

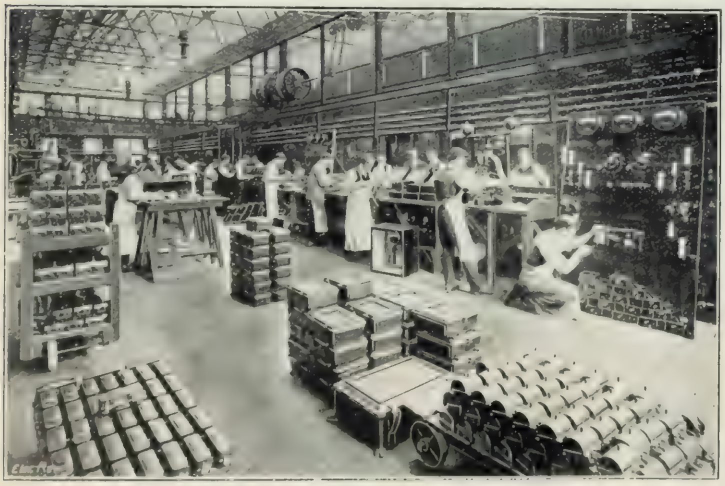


Fig. 5.—Switchgear Bay.

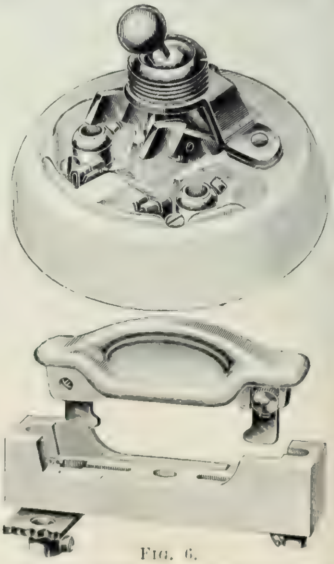


Fig. 6.
Tucker Tumbler Switch and Fuse.

the manufacture of which rigid inspection is an essential feature.

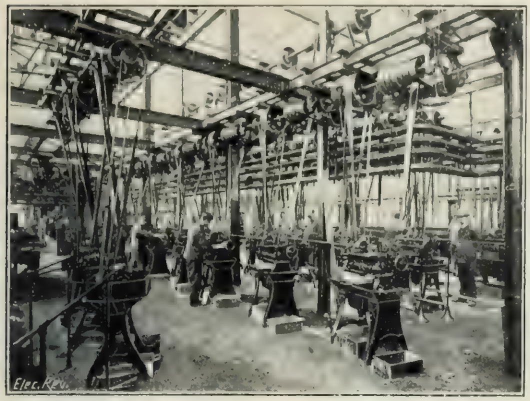


Fig. 7.—Automatic Machines.

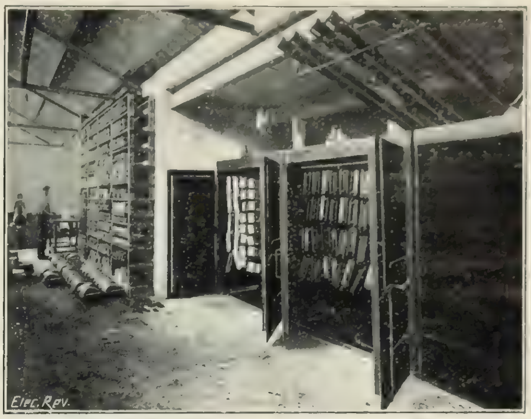


Fig. 8.—Stove Enamelling Room.

The work of the accessories department, where fuses, small switches, &c., are made, is carried on at the opposite side of the building, these items being assembled in the gallery on that side. Amongst the items there dealt with are neat little ironclad service fuse boxes, fuse boards, fuse clips, and ironclad watertight turn switches. A special range of fuse clips and sockets has been designed to meet the H.O. regulations, all metal parts being sunk into or enclosed in porcelain, so that accidental contact with any live metal is practically impossible. Larger switches and fuses are made in the switch shop, which occupies a considerable proportion of the building, and for part of its length adjoins the machine shop, where the cast-iron cases are handled. For the latter purpose comparatively heavy machine tools, multi-spindle drills, &c., are provided, and the work is done with jigs, which are designed with a special eye to economy in production—using the same drills for different holes, and so on, as far as possible. Milling machines are installed for switch and fuse parts, and capstan lathes.

One of the most interesting departments is that where the metal parts are finished ; it is the pride of this department that any known finish can be reproduced here, and that the company employs a greater variety of finishes than any other firm in Birmingham. Fourteen standard plating finishes are used, but these are subject to innumerable variations ; and, in addition to the familiar steel bronze and black finishes, we noted in particular old and rusty iron, mildewed green, and American royal copper—all on brass domes. Cable lugs are here electroplated with tin, to produce a thin and uniform coating without the defects that result from dipping into molten tin. The plating vats are heated with steam ; the dipping vats are provided with hoods and a large fan which draws off the fumes ; and the polishing shop, which is clean and airy, is provided with downward ventilating ducts which carry the dust to a cyclone separator.

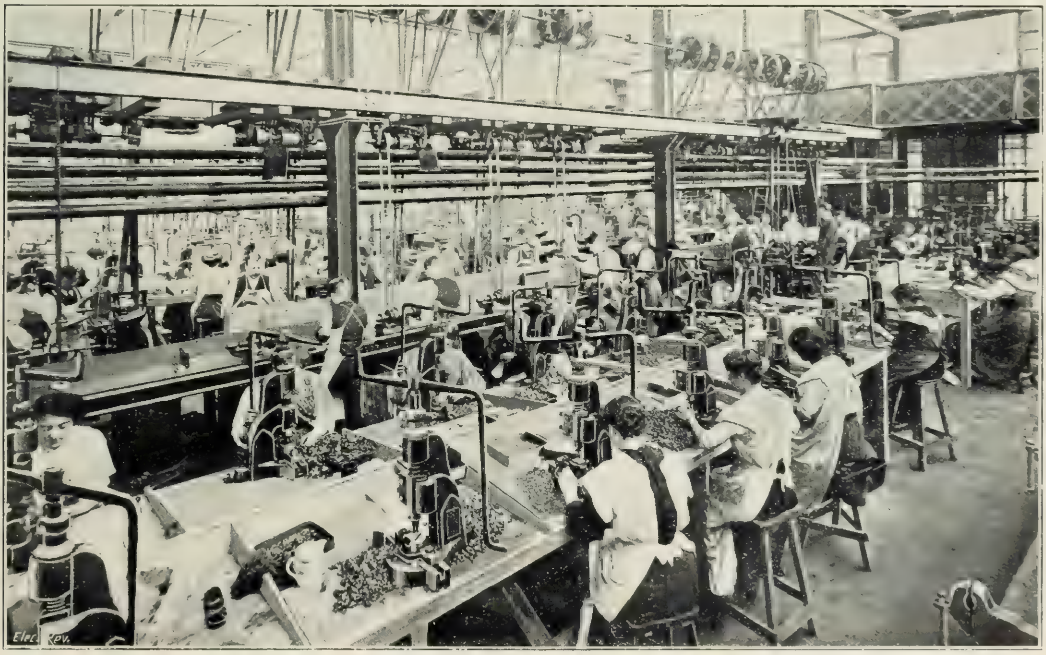


Fig. 9.—Press Shop ; Office Gallery in Background.

Adjoining the annealing house is a new shop containing a range of ovens for stove-enamelling all cast-iron parts ; the ovens are heated with hot water at a pressure of 500 lb. per sq. inch, and are kept at the different temperatures required to produce the best results with enamels of various colours. A special silicate enamel that the firm has evolved for the interior coating of switch, fuse, and iron cases generally is also applied in this department.

The cabinet shop is well equipped with a variety of wood-working machines and holds a large stock of timber in course of seasoning. All french-polishing is done by hand.

Amongst the special features noted in a tour of the works, some of which have been mentioned above, were specimens of china switch domes tinted to resemble wood exactly, standardised boxes for switches and wall sockets, providing for interchangeability, and various handsome wall-plates, &c.

A complete modern system of booking is in force throughout the departments, and it is possible at any time to determine what work is in hand, the state of the stores of raw materials and finished goods, and the cost of production. An instance of the efficiency of the organisation was recently afforded when a rush order for 1,000 bell-pushes for the ss. *Aquitania* was received in the morning and the goods were dispatched the same evening, though the bulk of them had to be manufactured, specially coloured, *ab initio*. The motto of the firm is "Quality first," and no attempt is made to compete with goods that are cheap because they are flimsy.

Special facilities are provided for the staff to obtain their meals on the premises at a remarkably low tariff, and the social welfare of the staff is promoted by the firm in various ways.

As indicated above, Mr. Tucker himself directs the affairs of the company. Mr. T. R. Martin is the commercial manager, and Mr. J. A. Crabtree chief of the technical staff: we are indebted to these gentlemen for many courtesies extended to us on the occasion of our recent visit to the works.

During the present Convention of the Incorporated Municipal Electrical Association at Birmingham, probably not a few of the members will take advantage of the opportunity to visit these works, and the company has made arrangements to facilitate the journey, at the end of which a hearty welcome may be confidently anticipated.

HOTEL LIGHTING FITTINGS.

For the lighting of the Piccadilly Hotel a number of special electrolier fittings and ceiling lights have been supplied by Messrs. Veritys, Ltd., of 31, King Street, Covent Garden, W.C., who, among other things, are making a speciality of this class of work. Two of the principal classes of fittings installed by them for the hotel referred to are shown in the accompanying illustrations. Fig. 1 is one of four large cast-brass electroliers, each of which has 54 lights. The total diameter of each fitting is 6 ft. Semi-indirect cut-glass bowls are fitted in the centre, made up of specially bent panels and fitted with dust covers to retain efficiency. Fig. 2 is an example of 60 cast-brass ceiling lights which were also supplied, fitted with semi-indirect cut-glass bowls. The bowls were finished in a manner so as to avoid glare, and at the same time to retain the brilliancy of the cuttings. We understand that the lighting of the hotel has been described as a perfect example of modern hotel illumination.

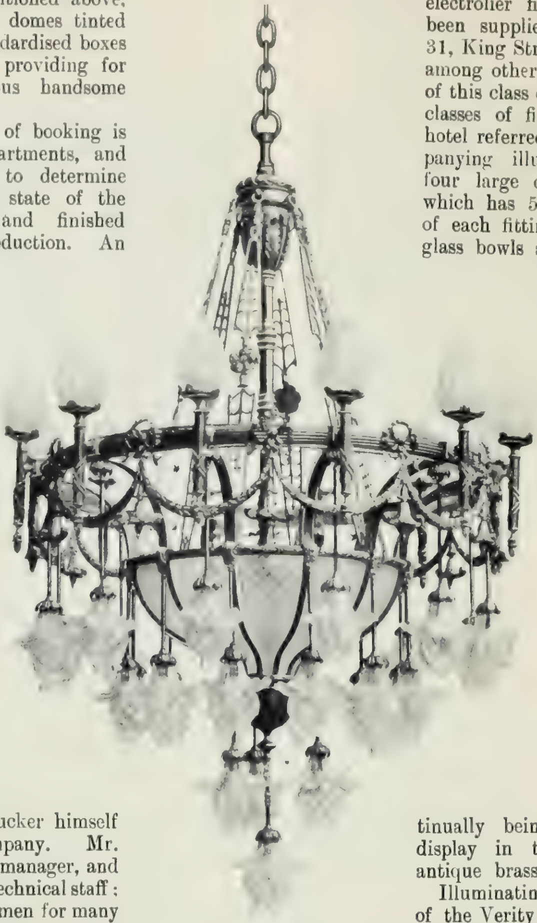


Fig. 1.
One of the Electroliers at the Piccadilly Hotel.

Messrs. Veritys, Ltd., have sent us some advance proofs of new bracket fittings that will be included in their big fixture list which makes its appearance in the autumn. New models are continually being produced and placed on display in the showroom. A specimen antique brass bracket is shown in fig. 3.

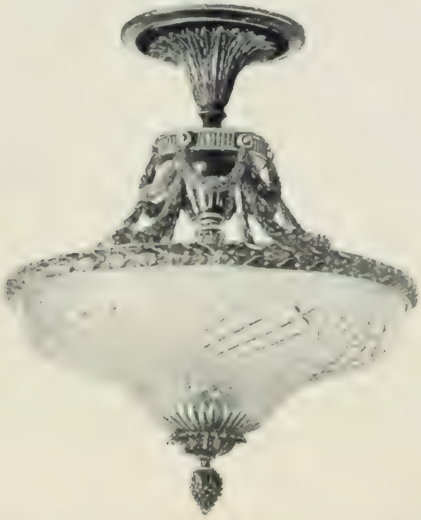


Fig. 2.—A Ceiling Light at the Piccadilly Hotel.

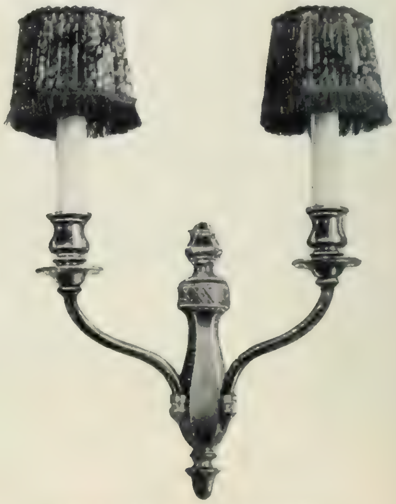


Fig. 3.—An Antique Bracket.

Illuminating fittings have been a feature of the Verity business ever since it had its beginning, between ninety and a hundred years ago. Gas fittings were, of course, for many years one of its leading features, but for the last thirty years at least, specialised knowledge and skill have been brought to bear upon fittings for electrical illumination — a department affording infinitely greater scope in the production of beautiful designs and artistic effects.

A QUESTION OF STATUS.

Since our last issue appeared, we have been favoured with a copy of a letter written by the Local Government Board for Ireland to the parties chiefly concerned in the matter of the appointment of an assistant engineer to the electricity department of the Corporation of Dublin, to which we referred in our leading article last week.

It appears that the majority of the members of the technical staff of the department, feeling themselves aggrieved at the action of the Committee in making an appointment over the heads of many of them, entirely at variance with the advice of their chief, sent a memorial to the L.G.B., which replied that it had addressed a letter to the Corporation on the subject. That letter is, in our opinion, so important that we make no apology for printing it in full. It is true that the contents of the letter are of immediate interest only to our Dublin friends, but no one can read the last portion of it without seeing at once how municipal offenders may be attacked under certain conditions with the aid of the heavy ordnance of a State Department.

We do not gather that Mr. Ruddle, the city electrical engineer, or Mr. J. L. Kettle, his chief assistant, has made any effective protest against the indefensible action of the Committee in ignoring their advice, but the members of their staff have shown the right spirit, and we hope that the *esprit de corps* which they have displayed will bring them the result which rarely fails to crown the loyal, determined, and continued efforts of a body of men who seek to redress a gross injustice.

These men should be cheered in the performance of a duty, which we must not forget involves, at least at the outset, a good deal of danger to the individual, by the reflection that victory will provide for the staffs of all the municipal supply stations throughout the kingdom a precedent of no mean value.

The L.G.B. in this case threatens the Corporation with the only weapon which seems to strike any terror into its heart, namely, the golden rod, and it delights us to see that the L.G.B. is prepared to hold up a loan of many thousands of pounds until it is satisfied that the technical staff which will handle the new apparatus is properly qualified to do so without disaster to the undertaking and inconvenience to the consumers.

It will be interesting to see what happens, and we will keep our readers informed.

[COPY.]

Local Government Board, Dublin,
June 11*th*, 1914.

No. 29,045/1914.

Dublin County Borough.

Sir,—I am directed by the Local Government Board for Ireland to forward, for the consideration of the Dublin Corporation, the enclosed memorial which the Board have received, signed by 20 members of the technical staff of the electricity supply department, and other documents relating thereto, with regard to the recent appointment of an assistant engineer in connection with the electricity supply.

It appears from the report of Mr. Ruddle, city electrical engineer, that, owing to the large increase in the work, he recommended the appointment of an assistant to Mr. H. L. Elward, the engineer-in-charge of the important work of testing and connecting up all consumers' installations, and of seeing that all technical and official regulations are complied with for the protection of both the Corporation and the consumer. Mr. Ruddle, it seems, stated that the assistance to Mr. Elward could only be given by a highly-trained electrical engineer capable of carrying out the full duties in one district while Mr. Elward was engaged in another, and Mr. Ruddle recommended that, in furtherance of the principle of promotion, Mr. McKeown, as senior on the list of engineers qualified and available, should be regularly appointed as assistant to Mr. Elward, without increase of salary. This recommendation, however, was not accepted by the Committee.

At a subsequent meeting of the Committee, it seems that Mr. Ruddle reported that he had received 10 applications for the position, and he recommended that in the best interests of the Corporation, and having regard to the importance of the duties to be performed, the appointment should be made from one of the following four engineers, namely, Messrs. C. McKeown, J. Harding, W. Nolan and W. Downey. The Committee, however, ignored the recommendation of their expert adviser and recommended Mr. B. Muntz, an installation wiring inspector, for the post, and this recommendation of the Committee appears to have been adopted by the Corporation.

Mr. Muntz, it is alleged, has had only four years' experience in the employment of the Corporation, and would not seem from Mr. Ruddle's report to be properly qualified to take full charge of the electricity supply works.

The Board have under consideration an application from the Corporation for a large loan for the extension of the electricity works, and it is incumbent on them to be satisfied regarding the proper management of these works. They further desire to call the attention of the Corporation to the danger which may arise in placing any important electric work in charge of a man with insufficient experience and qualifications as it is obvious that any mismanagement might lead to serious accidents and to inconvenience to the public.

The Board, therefore, suggest that the Corporation should be guided by the advice of their responsible engineer, and appoint an assistant engineer possessing the necessary technical experience.

The documents sent with this letter should be returned to this department with the reply of the Corporation.

I am, Sir,
Your obedient Servant,
A. R. Barlas, *Secretary*.

The Town Clerk,
City Hall, Dublin.

OPENING FOR ELECTRICAL GOODS IN THE LEVANT.

M. Giraud, President of the French Chamber of Commerce at Constantinople, gives, in a recent issue of the Chamber's *Bulletin*, a useful article on the outlet for electrical goods in the Levant. Ottoman statistics, he states, do not discriminate imports relating to electricity. Moreover, the latest publication deals only with the statistical year 1910-11, since when electricity has made huge progress in Turkey. It is now in course of being definitely installed in Constantinople. As a matter of fact, this metropolis will shortly be endowed with an important network of electric tramways; four principal lines are already working—the Tunnel to Chichli line, the Tunnel to Tatavla, Carakeuy to Bechtitache, and Carakeuy to Emin Eunu—and others are being rapidly got out of hand. The public have accorded an emphatic welcome to these lines of tramway, which are built of first-class material and work well. The greater number of the motor-cars have two trailers. The electric light will shortly be installed in the city; the mains are laid already. This will rejoice the inhabitants of Pera, whom the gasworks at Dolma-Bagtché now force to live in perennial darkness. Lastly, the telephone is being placed at the disposal of the public. Electricity is thus about to make its official entry into Constantinople to the lively satisfaction of those who inhabit the city. We may say, however, that it is not altogether a novel institution. Electric bells are installed almost everywhere; private electric plants have furnished the electric light to a certain number of houses; State departments are connected up by telephone, which is likewise installed in many business establishments and even in private houses. But what was only the exception is now to become general. It is probable that the greater number of the electric generating plants belonging to private individuals will stop working when the municipal service starts. Electric lifts and cranes will likewise be served with current from the public supply, also the motors used in small trades, now driven by petrol, &c. Taking in detail the applications of electricity in the city, electric bells, as previously said, are found everywhere in Constantinople and even in the provinces. The major part of the wires comes from Germany, although those from France are of better quality. Similarly, the indicator boards are imported from Germany. Of the whole of these items, Germany, we are informed, supplies 70 per cent., 20 per cent. only falling to France and 10 per cent. to Belgium. A German bell can be obtained for 12 p., or 2·50 fr.; a French bell costs double. The cheap bells are set up by stove makers who have no notion of electricity. These installations are always getting out of order, and continually need repairing.

As previously stated, since the granting of the Constitution many telephones have been set up; this is also the case in the provinces. Those most in use, on account of their low price, are German; in the provinces they are all German. As a result of the creation of the Société Ottomane des Téléphones, there has been a stoppage of private installations. In the supply of telephone wire and cable the French are fairly active, some seven French firms participating.

The Société Ottomane des Téléphones is, as regards its capital, Anglo-Franco-American. It has imported its cable from England, and its equipment from Belgium. Its manager is an Englishman. The several electric lighting installations which have been in existence for some time at Constantinople, namely, those at the Banque Ottomane and the Department de la Dette Publique, are French, and were supplied—the former by the Société d'Eclairage Electrique, of Paris, and the latter by the firm of Sautter, Harlé et Cie., also of Paris; they have given excellent results. Later, Messieurs L. Faure et Cie. installed the electric light in several establishments. But in more recent times all the big German firms have opened agencies in the city; with the commercial agent is located a technical expert, which practice facilitates business. They also accord very great facilities for payment and their prices are low. A Hungarian company likewise opened a branch, and an Italian firm followed suit, with strong support from an Italian bank. La Société Ottomane d'Electricité entrusted with the public electric lighting, opened a branch to carry out private installations, and, lastly, all the chief workmen, trained by the various firms mentioned above, formed themselves into a company and offered to carry out small installations. Competition in consequence became very keen, and French firms remained for a certain period almost at a standstill. Lately a turn in the tide has set in. The Société Ottomane d'Electricité, recognising the difficulties attending on private work, and the consequent vexations, have closed their private installation branch. The other big firms, become wiser by experience, have raised their prices and become more cautious. The very small contractors have succumbed to the exigencies of credit, and retaken positions with their old employers. French firms are now, therefore, encountering a more reasonable competition.

ELECTRICAL TERMS AND DEFINITIONS.

(*Continued from page* 969.)

The following are new definitions:—

R.M.S.—Abbreviation for root-mean-square.

Rail, Live, Third, Fourth.—See Conductor Rail.

Rated Load or Output (of generators and motors).—The output which generators or motors are intended to produce under specified conditions.

Rating of generators, motors, accumulators, etc.—The designation of the proposed output under the specified conditions, such as continuous working or intermittent working.

Ratio of Transformer, Ratio of Transformation.—The number obtained by dividing the primary volts or amperes by the secondary volts or amperes in voltage and in current transformers respectively. The number is not quite constant, and depends to some extent on the conditions.

Reactance.—That component of impedance which is not caused by resistance.

Reactive Current.—The component of the current in quadrature with the voltage.

Reactive Power.—In an alternating-current circuit, the product obtained by multiplying the volt-amperes into the sine of the angle of phase-difference between the current and the potential difference.

Reactive Voltage.—The product of reactance and current.

Receiver, Telephone.—That part of the telephone apparatus which reproduces the sounds.

Recorder.—Any apparatus which makes a permanent record.

Rectifier.—An apparatus which converts an alternating current into a unidirectional current.

Rectify, To.—To convert an alternating current into a unidirectional current approaching more or less to a continuous current.

Regulation (*a*) of a generator.—The variation (up or down) of pressure between no load and full load under specified conditions. *Special meaning*: The percentage rise in pressure when full load is removed from a generator, the speed and excitation being kept constant. (*b*) of a motor.—The variation (up or down) of the speed between no load and full load under specified conditions, usually constant supply voltage. (*c*) Telegraph and overhead wire-work.—The equidistance of wires on a span.

Relay.—An apparatus for opening or closing a circuit, controlled by the current in another circuit.

Reluctance.—*See* Magnetic Reluctance.

Reluctivity.—*See* Magnetic Reluctivity.

Remanence.—*See* Magnetic Remanence.

Remote Control.—The controlling of apparatus and plant from a distance, *e.g.* the operation of the main switches from a switchboard at a distance from them.

Residual Magnetism.—The magnetism remaining after the magnetizing force has been removed.

Resistance.—(*a*) That property of a substance or body which causes in it a dissipation of electrical energy as heat when a current flows through it. (*b*) The resistance of a conductor is the quotient of the potential difference between the terminals of the conductor by the current, usually expressed in ohms.

Resistance, Magnetic.—*See* Magnetic Reluctance.

Resistance, Specific.—*See* Resistivity.

Resistivity.—The resistivity (specific resistance) of a substance is the reciprocal of the Conductivity.

Resonance.—A circuit is said to be in resonance when the oscillations produced in it have the frequency of the natural oscillations in the circuit.

Retentivity.—A synonym for Coercive Force.

Return Feeder.—In electric traction. The conductor conveying electric current from the rails to sub-stations or to the generating station.

Reverse Current Breaker.—A circuit breaker which is opened automatically when the direction of the current is reversed.

Reverse Current Relay.—A relay which is only operated by a current in one direction.

Rheostat.—A readily adjustable resistance.

Rotary Converter.—*See* Converter.

Rotor.—That part of an alternating-current generator or motor, whether armature or field magnet, which rotates.

(*To be continued.*)

NOTES.

Apparatus Needed for Woking Technical Institute.—A few weeks ago we referred to the opening that existed for some of our manufacturers generously to assist in furnishing certain electrical and engineering equipment required for the new school and institute at Woking. We are pleased to say that offers have been received from several firms, and, for the information of those who may be still thinking the matter over, we print below full particulars of the apparatus and articles that they are invited to contribute:—

Physics Laboratory.—*Apparatus for Electricity and Magnetism.—Electricity, Frictional:* 12 thick glass rods, 12 in.; 12 ebonite rods, 12 in.; 12 rods of sealing-wax; 12 electroscopes, 1 leaf, students' size; 4 electrophoruses; 2 Leyden jars, movable coatings; 2 each spherical, cylindrical, pear-shaped conductors of wood, covered with tin-foil, on insulated foot; 1 Wimshurst machine, simple form, 24-in. plates; 1 Franklin pane; 1 air condenser; 1 pair discharging tongs; 1 set of Faraday ice-pails; 2 Leyden jars, pint size; 1 brass sphere with hole for proof plane; 1 doz. each flannel and silk rubbers; 1 electric whirl; 1 insulating stool.

Electricity, Voltaic: 1 each Daniell, Grove and Bunsen cells; 6 Leclanché cells, 2 pints; 12 copper plates for simple cells; 12 zinc plates for ditto; 1 each bichromate cell, 2-pint size, 1-pint size; 2 secondary batteries, each 3 cells. *Instruments:* 1 tangent galvanometer; 2 D'Arsonval galvanometers; 1 ballistic galvanometer; 4 resistance boxes, 1-50 ohms; 2 Post Office bridges, students' form; 4 metre bridges; 6 two-way switches; 6 single-tapping keys; 2 double-tapping keys; 2 Ruhmkorff commutators; 24 terminals, 1½ in.; 24 binding screws, connectors 1 in.; 1 electromagnet, 8 in. long, 1 in. core; 2 induction coils; 1 students' motor; 1 students' dynamo; 2 apparatus for determining J electrically; 1 Oersted apparatus; 3 deflecting galvanometers, scales and stands; 1 voltmeter, 0-10 volts; 1 ammeter, 0-10 amperes; 1 adjustable rheostat; insulated copper wire.

Magnetism: 6 pairs bar magnets, 10 in.; 6 pairs ditto, 5 in.; 6 pairs horse-shoe magnets, 10 in.; 6 pairs ditto, 5 in.; 12 exploring magnets; 12 compass needles and stands; 2 deflection magnetometers; 2 vibration magnetometers; 1 dipping needle; 24 steel knitting needles; 24 soft iron rods.

List of Wireless Apparatus.—Alternating Current: Main switch; manipulative key; magneto key; variable inductance, low frequency; transformer; condenser; air choke; jigger; spark gap; variable inductance, high frequency; aerial inductance; arrester spark-gap; multiple tuner; magnetic detector; telephones; buzzer; leads to aerial.

Direct Current:—Starter and field regulator for transformer (rotary); main switch; buzzer.

The Power Consumption of Electric Lighting Dynamos and Engine Starters.—The question has frequently been raised as to the amount of power consumed in the running of a car electric lighting dynamo and engine starter. With the object of settling the point so far as its own particular set is concerned, one American maker of such equipments—the United States Lighting and Heating Co., of Niagara Falls, N.Y.—whose U.S.L. set is combined in a single unit, recently carried out an interesting test with a car fitted with the arrangement. Four runs were made, each with a measured gallon of petrol. Two runs were made in each direction, that is, one each way with the motor-generator at work, and the others with the apparatus out of gear; an average speed of 25 miles per hour was maintained during the four runs, so that the conditions throughout should be equal. It was found that when the generator was delivering its maximum output the car ran a distance of 11·85 miles to the gallon, while with the generator out of commission the distance covered was 12·3 miles, or 3·8 per cent. farther. A little calculation with these figures will show that it took 0·08 gallon per hour to operate the motor-generator, or, in other words, that the machine will deliver its maximum power for 12½ hours on one gallon of spirit. At 25 m.p.h., the car will travel 312½ miles in 12½ hours, so that, taking petrol at 1s. 9d. per gallon, the extra cost of spirit owing to the installation of the motor-generator is about 4d. per 100 miles, which is not a high figure considering the convenience of electric starting and lighting. It is, however, asserted that instead of using more petrol, it is more than probable that the installation of the motor-generator effects an economy in petrol consumption, owing to the fact that the easy starting allows the motorist to stop his engine when the car is stopped for only a few minutes, instead of, as in the ordinary course, keeping it running. This saves idle consumption of petrol which, in some cases, may amount to more than the extra quantity required because of the presence of the motor-generator.

The Leeds Strike.—An inquest on the body of William Culloden (42), of 58, Holborn Street, Woodhouse, Leeds, an inspector in the Leeds Corporation electricity department, was held at Kirkstall last week. It was stated that the deceased's body was found in the Leeds and Liverpool Canal near Newlay on the previous Sunday. During the recent municipal strike Culloden had remained loyal to the Corporation. The result was that he was called a "blackleg," and shortly after the dispute he was attacked by two men and kicked under the chin because he had remained at work whilst the others were on strike. These incidents had made him depressed, and his worry had been accentuated by one or two small home affairs. The jury returned a verdict of "Suicide through temporary insanity."

Seasoning Timber Electrically.—In the Melbourne *Age* of May 5th, a report was given of evidence before a sitting of the Commonwealth Powellising Commission.

Mr. F. A. Alcock, managing director of Alcock Proprietary, Ltd., billiard table manufacturers, stated that his firm needed a good deal of timber which required seasoning before it could be used. During the past five years they had employed a special process of seasoning by means of electricity. An electric current was passed through the timber, the sap acting as the conductor. The period of treatment depended upon the length and thickness of the wood. Timber 12 ft. long × 1 ft. wide could be seasoned in about eight hours, but it had to be stacked for four or five months after treatment in order to dry up all the moisture which remained. Formerly, however, when the seasoning was done naturally, they had to stack the timber for four or five years before it was fit for use. The results of the electrical process had been very satisfactory, and the losses from warping were much less than when they employed the natural method of seasoning. His firm had had a parcel of timber tested by the Powellising process, and the result was not satisfactory. The process seemed to have been too severe on the timber, and some of the wood split.

In reply to questions by members of the commission, he said his firm had experienced difficulty in getting a sufficient supply of blackwood. By means of their electrical process, however, supplies were made more quickly available.

Mr. T. J. Lawson, foreman in the employ of Alcock Proprietary, Ltd., said that natural seasoning took quite five years, and the loss of timber through warping and other sources was quite 25 per cent. After timber had been treated by the electrical process, he did not think the loss was 10 per cent. He considered that the process could be used on a large scale and that logs could be treated. It was only a question of power. The greener the timber the better the results. They had used the special process principally on blackwood, but mountain ash had also been treated successfully.

Mr. Alcock, recalled, stated that he did not think it would be a difficult matter to force a preservative, such as sulphate of zinc, into timber immediately after the sap had been removed by the electrical process.

Water-Power Congress.—A second White Coal (houille blanche) Congress is to be held at Paris on September 6th. This Congress, in which, it is said, a number of prominent foreign scientists and engineers will participate, will study a variety of important matters. M. Léon Michoud, professor of the faculty of law at Grenoble, will set out the legislation relating to "white coal" in the principal countries of the world. The legislation affecting hydroelectric stations, as regards State-owned water courses, will be treated of by M. Paul Bougault, of Lyons. M. Pillet, professor of the faculty of law at Paris, will study the legislation of hydroelectric stations as regards non-navigable water courses; and, lastly, M. Balleydier, dean of the faculty of law at Grenoble, will handle the subject of riverain rights, and especially the law as to the flow of water.

Water-power Society in Sweden.—From the annual report of the Svenska Vattenkraftforeningen (Swedish Water-power Society), we learn that that body now comprises 226 members, an increase of seven during the past 12 months. The Swedish Timber Export Association, the Swedish Wood Pulp Association, the Swedish Paper Manufacturers' Association and the Jernkontoret are represented on the board of the Society, which has recently published a number of brochures on the water-power, waterfalls, &c., of Sweden.

Terrestrial Magnetism.—The report of the Astronomer Royal for the past year states that the new instruments for recording the variations in the magnetic elements are to be housed in a new building in the Park, in which the temperature will be maintained constant by electric heaters and a thermostat. The mean values of the magnetic elements for the past four years were as follows:—

Year.	Declination W.	Horizontal force in C.G.S. units.	Dip (3-in. needles).
1910 ...	15° 41·2′	0·18532	66° 52′ 37″
1911 ...	15° 33·0′	0·18529	66° 52′ 6″
1912 ...	15° 24·3′	0·18528	66° 51′ 46″
1913 ...	15° 15·2′	0·18514	66° 50′ 27″

Time signals are regularly received from the Eiffel Tower and Norddeich; they are slightly late on G.M.T.—generally 0·04 to 0·05 second in the case of the former, and about 0·06 in the case of Norddeich.

Diesel Engine Users' Association.—The next meeting of this Association will be held at 4 p.m. on Wednesday, July 8th, at the Institution of Electrical Engineers, Victoria Embankment, W.C. There will be no meeting of the Association in August.

Copper.—Returns for the end of May, as shown on Messrs. H. R. Merton & Co.'s tables, give a further increase in European visible supplies, which rose during the month from 29,278 tons to 32,370. Of this increase, England had 1,165 tons, and France 3,624, there being a decrease in German and Dutch stocks, and the quantity afloat from Chile. Supplies for the month were high from North America, and below average from Spain and Portugal to this country. Chile shipments were slightly above average, and Australian well above. Total supplies were strong at 51,417 tons, well exceeding deliveries. American stocks at the end of April exceeded those at the end of March by 2,558 tons. The world's supplies at the end of April were 60,679 tons, an increase of 5,707 tons over the quantity for the end of March.

Educational Notes.—Birmingham University.—Sir George Kenrick has offered to endow a chair of physics in memory of the late Prof. Poynting, at a cost of £18,000, and the Council has gratefully accepted the gift. Sir George has already given £20,000 to the University.

Manchester Municipal School of Technology.—An internal combustion engine laboratory is to be provided, at a cost of £21,000; leading manufacturers have undertaken to lend examples of their latest types of engines.

Electricity in Farming.—Everything in a new pigsty outside Randers, Denmark, which has two storeys, and accommodates 1,500 animals, is worked by electricity. There are railway lines all over the sty, and only three men are needed to do the work, which includes grinding corn and fetching milk, foodstuffs, and young pigs from Randers.

Storms in London and Paris.—On Sunday last a violent thunderstorm raged over South London for four hours, with frequent lightning discharges and heavy rain and hail. On Wandsworth Common four adults and three children were killed by lightning whilst sheltering under trees, and many persons were injured more or less severely. Many buildings were struck and damaged, and a house near Folkestone was burnt down. The L.C.C. conduit tramways were stopped by floods in Tooting and Norbury, and the District Railway traffic was blocked for two hours on the Wimbledon branch owing to the bursting of a sewer, which flooded the line to a depth of nearly 4 ft. The tramway service between Croydon and the Crystal Palace was also held up for some time. Fire alarms were set ringing in various places by the storm. The telephone service with Paris was temporarily interrupted.

On Monday a similar storm, of great violence, burst over Paris, and many lives were lost. The Underground Railway was flooded, and traffic was disorganised; the construction works of the Metropolitan Railway were also flooded, and fell in in several places, leaving yawning gaps in the streets, in which a number of vehicles and passengers were entombed. Electric light and telephone services were dislocated.

The following letter on this subject arrived too late for our "Correspondence" columns:—

"The sad fatalities which occurred during the thunderstorm on the 14th inst. cause one to reflect as to the best thing to do when caught in the open country by such a storm. I have read, and I am inclined to believe, that the safest course is to get one's clothing thoroughly drenched and to lie flat on the ground; the process is, however, so unattractive that few people would ever adopt it. To shelter under trees is obviously hazardous, the neighbourhood of the trunk being the most dangerous position. The question occurs whether relative safety might not be secured by climbing up into the tree and so obtaining the shelter of the branches; should the tree be 'badly struck,' the result would probably be very serious, though not necessarily fatal, as it would certainly be if the person were standing under it. I am inclined to think that comparative safety would be secured by climbing into the tree. The expression of opinion of some of your readers on this point would be of interest. "Chas. A. Baker.

"*June 16th*, 1914."

Provided that one climbed out on a branch to some distance from the trunk, Mr. Baker's suggestion might be adopted with success; but even a slight shock such as might result from induction, or the mental shock due to the tree being struck, might cause a fall as fatal as the lightning flash.

Many years ago we published a table prepared by the Dutch Meteorological Institution showing the frequency with which different trees were struck; this was printed in "Modern Lightning Conductors," by Mr. Killingworth Hedges, in 1905, and we reproduce it below:—

Poplar, 232
Oak, 130
Willow, 70
Yew, 50
Fir, 27
Pear, 25
Ash (?), 18
Lime, 14
Walnut, 8
Beech, 5
Chestnut, 5
Apple, 5
Cherry, 4
Alder, 4
Birch, 2

These data should be heavily discounted to allow for the prevalence of one or other tree in the district examined, as to which we have no information; fruit trees, for instance, are scarce compared with oaks and poplars. However, in an inquiry carried out by the German Government in 1899 over an area of 50,000 acres, some useful figures were obtained, which we reproduce from the same source:—

	Prevalence.	Frequency of striking.	Susceptibility.
Oak... ...	11 per cent.	58 per cent.	46
Fir	6 ,,	21 ,,	31
Beech ...	70 ,,	8 ,,	1
Pine ...	13 ,,	7 ,,	5
Other ...	——	6 ,,	—

The figures in the fourth column, which we have added, indicate roughly the relative susceptibility to lightning strokes of the different kinds of tree, based upon the data given in the second and third columns, but disregarding the "other" trees of which the prevalence is not stated. It will be seen that the beech and pine are rarely struck. It is noteworthy that the elm does not appear in either set of data.

Marconi v. Helsby Wireless Telegraph Co.—Mr. Justice Eve agreed on Tuesday that the hearing of this case should not be taken before June 23rd.

Inquiry.—Makers of the "Halliwell" electric hair dryer are asked for.

Cheap Electricity in British Columbia.—In the course of an article in the *Austin Advocate*, descriptive of a trans-Canadian motor trip, the author states that in passing through Hedley, a gold-mining town in British Columbia, late one night, he came upon a peculiar circumstance:—"All the shops in the main street, and most of the houses, had the electric light brightly burning. It looked very weird somehow, just as if the people had suddenly deserted the town. From the watchman at the mine, I learnt that the electric current was so cheap that people never bothered to turn it off!"

Appointments Vacant.—Switchboard attendant for Erith (20s. to 25s.); armature winder, age 26, for East Indian Railway (200 rupees per month); overhead mains working foreman (£2 2s.) for Neath R D.C.; stores clerk (£78) for Bexley U.D.C.; visiting teacher of electric wiring for two evenings a week, assistant visiting teacher in electrical engineering for two evenings a week, and visiting teacher in electrical engineering, D.C. and A.C., for three evenings a week, at Hackney Institute; assistant visiting teacher in electrical instrument making, at Shoreditch Technical Institute, four evenings a week, for the L C.C.; jointer, chief assistant and mains engineer (£160), for Rhondda U D.C. Electricity Department. See "Official Notices" to-day.

Panama-Pacific International Exposition, 1915.—The arrangements for the International Electrical Congress to be held next year at San Francisco are far advanced, and a great success is confidently anticipated. The proceedings will be published in 13 volumes, and it is expected that 7,500 members will be present, including at least 1,200 delegates. The I.E.C. meets during the week beginning September 6th, and the Congress in the next week; the International Engineering and Gas Congresses will meet in the two weeks following. Members who belong to some engineering or scientific body of recognised standing will be entitled to attend the Congress, and to receive any four of the volumes, together with the general index, for the membership fee of $5.

The allotment of space in the Machinery Section of the Exposition, which was over-applied for, has been practically completed, and it is stated that the exhibits will make the finest collection of electrical and other machinery ever assembled under one roof. The erection of foundations for machines has already commenced. The Exposition opens on February 20th, and remains open till December 4th, 1915.

Parliamentary.—BRENTFORD GAS BILL.—The Court of Referees has declined to allow the Metropolitan Electric Power Co. a *locus* against part of the Brentford Gas Bill. Amongst the powers sought by the Gas Co. are authority to make applications for electric lighting orders and to acquire by agreement undertakings already possessing such powers.

ELECTRIC LIGHTING ORDERS.—The Hinckley U.D C. has deposited a petition against the Hinckley and District Electric Lighting Order; and the Lurgan Light and Chemical Co. against the Lurgan Order.

In the House of Commons on June 9th, the London County Council (Tramways and Improvements) Bill was read a third time.

In the House of Commons on Tuesday, the Shropshire, Worcestershire and Staffordshire Electric Power Bill was read a second time.

In the House of Lords on Tuesday, the London Electric Railway Bill and the Central London Railway Bill were read a third time.

Institution and Lecture Notes.—INSTITUTION OF CIVIL ENGINEERS.—The annual conversazione will be held at the Institution on Thursday, July 2nd, from 8.30 to 11.30 p.m.

INSTITUTE OF METALS.—The autumn Conference of the Institute will be held at Portsmouth on September 10th and 11th, in the Municipal College, a number of important papers being read each morning.

The annual meeting of the Union of Austrian and Hungarian Electric Lighting Undertakings was held in Cracow from the 7th to the 11th inst. Among the papers read was one by Dr. Lederer on "New Departures in the Field of Electric Lighting," and one by Herr W. von Winkler, of Klagenfurt, on "The Working of Hydro-Electric Stations under Snow and Ice Conditions."

THE GERMAN ELECTROTECHNICAL SOCIETY. — The annual meeting of the Verband Deutscher Elektrotechniker has just been held in Magdeburg, under the presidency of Herr D. W. Christiani, of Freiburg. The proceedings extended over three days, during which time the various Committees of the Society submitted reports, among the subjects dealt with being the Standardisation of Insulated High-Tension Conductors, Standard Tests for Iron and Steel Plates, and Proposals for Uniform Tests of Installation Material. A number of papers were also read, these including one by Dr. Fritz Forster, of Dresden, on "Electro-Chemistry and Thermo-Electricity in the Metallurgical and Chemical Industries"; one by Prof. Dr. Diesselhorst, of Brunswick, on "Progress in Wireless Telegraphy"; one by Dr. Guggenheim, of Berlin, on "Electric Steel"; one by Prof. E Josse, of Berlin, on "Condenser Installations"; and one by Herr O Krell, of Berlin, on "Electricity on Board Ship." As a mark of appreciation of his work in connection with electrical engineering, Dr. Ing. Rathenau was elected an honorary member of the Society, which has now no fewer than 6,011 members. Dr. G. Klingenberg, of Berlin, was elected President of the Society for the current year, and it was resolved that the next annual meeting should be held in Strassburg.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. H. LOVE, fourth engineer in charge of the Hammersmith B.C. electricity undertaking, has resigned his appointment, having obtained a similar position with the Shoreditch B.C. It is proposed that in the meantime engine-driver J. E. Pearce, who has been in the service of the Council since 1903, and whose wages at present are 47s. 6d. per week, should be promoted temporarily on trial to the vacant position at the commencing salary assigned thereto—£130 per annum.

The Lowestoft T.C. has increased the salary of MR. H. HOBLEY, first assistant engineer at the electricity works, to £156 per annum.

The King's Lynn T.C. has granted the engineer at the electricity works (MR. JACKSON) a bonus of £40 in respect of extra work in connection with departmental extensions during the past 18 months.

The Wakefield City Council has decided to increase the salary of the electrical engineer (MR. NEVILL) from £400 to £450 per annum.

MR. EDWARD E. HAMAR, late shift engineer at the Frindsbury power house of the Kent Electric Power Co., has been presented with a silver rose-bowl by the power house and office staff, on the occasion of his leaving to take up a similar appointment at the Smethwick power house of the Birmingham and Midland Tramways Joint Committee.

Whitby U.D.C. has increased the salary of MR. J. W. PIGGOTT, electrical engineer, to £150 per annum.

Tramway Officials.—MR. WILLIAM POOLE, formerly with the N.S W. Government Railways and Tramways Department and the Adelaide Tramways Trust, has been appointed assistant electrical engineer to the South Australian Government Railways.

General.—At Clarborough Church, on June 11th, the marriage took place of MR. J. T. GLENDINNING, chief electrical engineer at Wiseton Hall, and Miss E. Brown, daughter of the late Mr Geo. Brown. Over 100 presents were received.

The marriage took place at Kirkby Stephen on June 11th of MR. MATTHEW HOMLER, manager of the North-Eastern Railway Co.'s E L. plant at Kirkby Stephen, and Miss May Elizabeth Kilner.

MR. ERIC BERGSTROM, a Swedish engineer, who has practised in London for several years, has been appointed managing director of Ferrum, Ltd., Winchester House, Old Broad Street, London, E.C, specialists in the manufacture of steel tubes for hydro-electric stations, &c.

MR. H. J. GROVES WEBB has resigned his position as manager of the apparatus department of the Electrical Co., Ltd., with whom he has been connected for the last five years.

The Parliamentary and Electricity Committee of the Turton (Lancs.) D.C. has appointed MR. FREDERICK CHARLES SPRIGG as electrical engineer, from July 1st next.

Obituary.—MR. NORMAN WATT.—Our Johannesburg correspondent writes with reference to the death of this gentleman, already announced in our pages:—"A very sad accident occurred at the Brakpan Station of the Victoria Falls and Transvaal Power Co. on Saturday morning, May 23rd, resulting in the death of Mr. Norman L. Watt, the resident engineer in charge. About 9 a.m. Mr. Watt went to inspect a new compressor and was passing near a cast-iron compressed-air pipe, when the pipe burst, owing probably to a defect in the casting. Several fragments of pipe struck him in the face, and his skull was badly fractured. He was conveyed immediately to the Boksburg Hospital, but died without recovering consciousness. The deceased came out to this country from Falkirk in 1911, and was appointed shift engineer at the Simmer Pan Station. There he showed such ability and promise that he was appointed engineer in charge at Brakpan about 12 months ago. Mr. Watt, who was 35 years old, leaves a widow and one daughter. The funeral cortège left the Boksburg Hospital on Sunday afternoon, and was largely attended by representatives of the V.F.P. Co., among whom were Major the Hon. W. L. Bagot, the general manager, and Mr. Bernard Price, chief engineer."

NEW COMPANIES REGISTERED.

Electrical Finance and Securities Co., Ltd. (136 276).—Registered June 8th, by Barnett, Chadwick & Co, 8, Camomile Street, E.C. Capital, £50,000 in £1 shares. Objects: To invest in the securities of electrical, engineering, telephonic and telegraphic appliance, tramway, railway, power, light and similar companies, &c. The signatories are:—G. H. Nisbett, Huyton, Liverpool, electrical engineer, 1,000 shares; J. Taylor, Helsby, Warrington, manufacturer, 1,000 shares; D. Sinclair, Prescot, Lancs., manager, 1,000 shares; E. K. Muspratt, J.P., Seaforth Hall, near Liverpool, 1,000 shares; J. B. Harmood-Banner, 21, North John Street, Liverpool, chartered accountant, 1,000 shares; D Bates, Huyton, Liverpool, electrical engineer, 500 shares; W. B. Cownie, 3 Laurence Pountney Hill, E.C., 500 shares. Minimum cash subscription, 1,000 shares. The first directors (to be not less than three or more than seven) are G. H. Nisbett, J. Taylor, and W. B. Cownie; qualification, £500; remuneration (exclusive of any managing director), £100 each per annum, and £50 extra for the chairman. Registered office, 3, Laurence Pountney Hill, E C.

United States Railless Electric Traction Co., Ltd. (136,401).—This company was registered on June 13th, with a capital of £1,000 in £1 shares to carry on in the U S A. or elsewhere the business of an electric traction, light and power company, &c. Despite the title, power is taken to manufacture rails, tramway and railway plant and rolling stock, &c. The subscribers are:—Sir Alick D. Gibbons, West Cliff, Bembridge, I. of W. (50 shares); H. H. Bathurst, Finsbury Pavement House, E.C., secretary (1 share). Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration as fixed by the company; secretary, H. H. Bathurst; solicitor, A. G. Jones, 6, Stone Buildings, Chancery Lane, W C.

Hemming Conduit Grip, Ltd. (136 373).—This company was registered on June 12th, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers and factors of electrical and other fittings. The subscribers (with one share each) are:—A. E. Beck, High House, Kings Norton, Worcs., Birmingham, engineer; J. R. A. Hemming, 39, Westbourne Street, Walsall, Staffs., manager; A. E. Sayer, First Tower, Jersey, gentleman. Private company. The number of directors is not to be less than two or more than five; the first are A E. Beck and J. R. A. Hemming; qualification, 250 shares. Registered office, Lincoln's Inn Chambers, Corporation Street, Birmingham.

Telenews (1904), Ltd. (136,386).—This company was registered on June 12th, with a capital of £30,000 in £1 shares (15,000 participating preference), to adopt agreements (1) with Telenews, Ltd., A. B. D. Lang and J. A. Powell, and (2) with the National Telewriter Co., Ltd., to carry on the business of advertisers, advertising contractors and agents, publishers, news, and press agents, distributors of writing signs, news, messages and information, manufacturers of, and dealers in, telewriters, teleautographs, lamps, wires, cables, insulators, accumulators and other apparatus, electrical engineers, &c. The subscribers are:—R. Bence-Jones, D.L., J.P., Lisselan, Clonakilty, Co. Cork, 500 shares; V. W. F. Dickins, The Oaks, 20, Arkwright Road, Hampstead, N.W., director, 500 shares; F. A. Dickens, Julian Hill, Weybridge, director, 500 shares; J. A. Powell, Oakleigh, Brighton Road, Purley, Surrey, merchant, 1 share; F. English, Dunolly, Bow Lane, North Finchley, secretary, 1 share; L. Stevens, Weycote, Byfleet, Surrey, chartered secretary, 1 share; G. C. L. Money, 36, Lexham Gardens, Kensington, solicitor, 1 share. Minimum cash subscription, £7,500. The number of directors is not to be less than three or more than seven; the first are R. Bence-Jones, V. W. F. Dickens, J. A. Powell and F. English; qualification (except first directors), 500 shares; remuneration, £100 each per annum (chairman £150), to be increased according to profits. Registered office, 6, Broad Street Place, E.C.

G. W. Green & Co. (Feltham), Ltd., (136,357).—This company was registered on June 11th, with a capital of £5,000 in £1 shares, to take over the business carried on at Q Fel Works, Feltham, as "Geo. W. Green & Co.," and to carry on the business of mechanical and electrical engineers, ironfounders, contractors, manufacturers of, and dealers in, agricultural, railway, tramway, electrical and other apparatus, &c. The subscribers are:—G. W. Green, 13, Mortlake Road, Kew, Surrey, civil engineer, 1 share; R. O. Pickmere, 74, Disraeli Road, Forest Gate, E, electrical engineer, 1,000 shares. Private company. The number of directors is not to be less than two or more than five; the first are G. W. Green and R. O. Pickmere; secretary, R. O. Pickmere. Registered office, Q-Fel Works, Feltham, Middlesex.

CITY NOTES.

Globe Telegraph and Trust Co., Ltd.

The directors report that the net revenue for the year ended May 31st, after deduction of expenses, amounts to £209,773, plus £26,817 brought forward. There has been distributed £131,085 in interim dividends, leaving an available balance of £105,505. The directors now recommend the payment of the following final dividends, viz.: 3s. per share, less income-tax, on the preference shares, making, with previous distributions, a total dividend for the year on those shares at the rate of 6 per cent. per annum, less income-tax; and 6s. per share net on the ordinary shares, making, with previous distributions, a total dividend on these shares at the rate of 6 per cent. net for the year. These dividends will absorb £79,781, and leave £25,724 to be carried forward.

National Telephone Co., Ltd.

The liquidator (Mr. George Franklin) has issued his report to the shareholders of his acts and dealings and of the conduct of the winding-up for the period from the 26th January, 1913, to the 30th May, 1914 (the close of the liquidation). His last report dealt with the accounts for the period ending 25th January, 1913. There was, at that date, a balance due from the Postmaster-General under the award of the Railway and Canal Commissioners, of £2,515,264, and the Postmaster-General had given notice of his intention to appeal against so much of the judgment as related to the award of £247,189 for the cost of raising capital and £150,000 for the cost of obtaining subscribers' agreements. A cross notice of appeal was served by the company. After a preliminary question raised by the company had been decided in favour of the Postmaster-General by the House of Lords, a compromise was effected whereby the award was reduced by the sum of £45,000, making the net balance due under the award £2,470,264, the company also agreeing to forego their claim for costs in the arbitration. The Postmaster-General was entitled to set off against the amount due under the award the rentals for unexpired terms and other sums due from the company, amounting in the aggregate to upwards of £1,700,000. This claim, including further payments made by the Postmaster-General on account of the liquidator, was eventually settled by agreement at £1,725,367. On the 16th July, 1913, Mr. Justice Sargant decided that the whole of the surplus assets then remaining in the liquidator's hands, after satisfying the claims of creditors and the costs of winding up and of those proceedings, were divisible amongst the holders of the deferred stock, and that the first, second, and third preference shareholders who had been repaid the amount of their capital at par, and the holders of preferred stock who had received repayment of capital and in addition a bonus of five per cent., were not entitled to participate in such surplus assets. The preference shareholders and holders of preferred stock were allowed until 13th October, 1913, to appeal against this decision, but no notice of appeal was given. Various difficulties arose in connection with unclaimed dividends and subscribers' deposits, and on the advice of counsel a summons was taken out and heard before Mr. Justice Sargant on the 9th February last, when an order was made for a final distribution, subject to the payment of all claims of which notice had then been given and the deposit of £250 in Court to meet any subsequent claims which might arise. This sum of £250 was paid into Court on 24th February, 1914. The deferred stockholders have been paid the par value of their holdings together with a premium of 5.48 per cent., as follows:

12th March, 1913	75	per cent.
29th July, 1913	22	,,
31st October, 1913	7	,,
25th March, 1914	1.48	,,
	105.48	,,

A sum of £10,375 was paid into the company's liquidation account on the 12th April, 1913, and £20,000 on 31st October, 1913. On making special application, interest at the rate of 2 per cent. per annum was allowed on these deposits, but on the withdrawal of these sums poundage at the rate of 3d. in the £ was deducted. The interest (less tax) amounted to £815, and the poundage to £765. The loss on the realisation of the exchequer bonds amounted to £552,016, equal to 4.42 per cent. on the total amount receivable from the Postmaster-General under the award, and 5.90 per cent. on £9,352,698, payable by him in exchequer bonds. This loss represents 14.8 per cent. on the amount of the deferred stock. The expenses of the arbitration proceedings and liquidation (£171,766) are together equivalent to 1.32 per cent. on the total amount realised. The liquidator places on record his appreciation of the very valuable assistance given in the arbitration proceedings and during the conduct of the liquidation, by the company's solicitor (Mr. W. E. Hart), engineers (Messrs. Gill & Cook), secretary (Mr. Albert Anns), general superintendent (Mr. S. J. Goddard) and other officers, who have all worked loyally in the interests of the company.

Imperial Tramways Co., Ltd.

The directors report as follows to the 31st December last:

Middlesbrough, Stockton and Thornaby Electric Tramways.—The gross receipts of this undertaking amount to £60,286 as compared with £56,719 for the preceding year, an increase of £3,567. The passengers carried were 12,006,616, against 11,214,750, an increase of 791,866. The net profit was £17,824, as compared with £17,413 for the corresponding period. The traffic receipts shew considerable expansion, being nearly £4,000 higher than in any previous year. The work of reconstructing the permanent way has been continued during the past year, with the result that the whole of the track, except about one and a half miles, has been completely renewed. Since the close of the year the directors have inaugurated services of motor omnibuses in Middlesbrough and intend to introduce the further number of omnibuses necessary to provide all the travelling facilities which may be required by the districts in proximity to the company's tramways. A large building in Middlesbrough, covering nine-tenths of an acre, and formerly used as a skating rink, has been secured for the purpose of a motor omnibus garage.

Corris Railway Company.—The working of this undertaking shews a profit of £187, being an increase of £77.

London and Suburban Traction Co., Ltd.—In lieu of its former holding of London United Tramways preference shares, this company now holds 122,230 five per cent. cumulative preference shares of £1 each and 112,451 ordinary shares of £1 each in the London and Suburban Traction Co., Ltd., and has received the full dividend for the past year on the preference shares of that company. The published revenue account of the London and Suburban Co. does not shew a sufficient balance to pay a dividend on the ordinary shares, but the directors explain that their motor omnibus fleet was not in full service until August last, and they anticipate a considerably increased revenue in future years.

General.—The company's net revenue account for the year shews an available balance of £31,819, and, after payment of interest on the debenture stock for the year, there is an available amount of £19,107, which it is proposed to appropriate as follows:—Dividend for the year at six per cent. on the preference capital (less income tax), paid 1st January last, £11,300; Dividend for the year at four per cent. on the ordinary capital (less income tax) £7,533, and to carry forward £273.

Nairobi Electric Power and Lighting Co., Ltd.— The annual meeting is postponed for one week, and will be held at 50, Mark Lane, E.C., on July 8th.

Canadian General Electric Co., Ltd.—The directors have declared a quarterly dividend of 1¾ per cent. for the three months ending June 30th on the common stock.

Vulcan Boiler and General Insurance Co., Ltd.— The directors announce an interim dividend of 4s. 6d. per £2 10s paid share.—*Financial Times.*

Aluminium Corporation, Ltd.

Mr. Kenneth M. Clerk presided on Wednesday at Salisbury House, E.C., over the fourth annual meeting.

The Chairman, in moving the adoption of the report (Elec. Rev., p. 990), said that the second debenture issue had now been paid up in full and there were loans amounting to £11,000. This money was absolutely necessary to meet certain heavy expenditure, principally for the purpose of completing the carbon works at Dolgarrog, the making of a canal from the river right up to the works, and the preparatory work in connection with the cutting of the tunnel to connect the Dulyn water to their present lake. The new carbon works had proved of very much greater advantage to the company than was originally anticipated and the canal had been a distinct success. With regard to the tunnel referred to, last year he told them the directors had decided to proceed with this work, and a contract had now been entered into for its construction. It had so far been a somewhat slow undertaking, but he thought they could look forward to having the use of the Dulyn water at no very distant date. By then their water power would have been very greatly increased, and the increase, the directors trusted, would in course reflect favourably as regarded the trading profit. The trading profit showed an increase of £6,000 over last year. After deducting debenture interest, legal expenses and trustees' charges, and making allowance for directors' fees which had not been drawn, there had also to be taken into account last year's debit balance- the special expenditure during the year of the Bauxite Refining Co., as well as the figures for preliminary expenses which the directors had deemed expedient to wipe out. Notwithstanding all this, they carried forward a small balance to the good, and he trusted they had seen the last debit balances. He regretted that it had not been possible during the past year to earn sufficient to pay off something of the accumulated interest upon the preference stock, but as they would have noticed, their progress had been steadily upward and had it not been for the abnormal shortage in the rainfall at Dolgarrog during 1913 they should have shown a still larger return. On the other side of the balance sheet the figure under the heading of water power, &c., had increased by £25,000, and this expenditure he had explained. In view of the fact that they were closing the works at Wallsend, the directors considered it advisable to have an independent valuation made of these assets and he was very pleased to inform them that the valuation had fully justified the figures shown and had proved that the company's assets were not by any means overvalued in the books. The investments in subsidiary companies were composed almost entirely of shares in the Bauxite Refining Co. and a small amount for the company's interest in the Société Anonyme des "Bauxites du Var," which was a small French company formed for holding this company's properties in France, as it was found that the holding of these properties by their own company in England would involve considerable risk and expense. All the shares in the French company were, of course, in the hands of the Aluminium Corporation. The stocks in hand showed a slight increase while the sundry debtors and cash in hand were decreased. They would no doubt recollect that on the reconstruction of the company considerable difficulty was experienced in placing the small debenture issue of £50,000 and it was necessary to create 5,000 participating shares entitling the holders to one-fifth of the profits and one-fifth of the assets, immediately after the debentures. These shares had proved somewhat of an inconvenience and as they would readily understand, made it almost impossible for the company to raise further sums of money from outside sources at a reasonable rate of interest. After some negotiations, he succeeded in purchasing, at a premium, a considerable block of the company's debentures accompanied by their proportion of participating shares, and in conjunction with Mr. Bott, who was also considerably interested in the debenture issue, they had succeeded in coming to an arrangement, subject to the approval by the shareholders, by which the present 5,000 participating shares would be given the same rights as 10,000 preference shares, thus definitely deciding their value and place in the company's capital. This arrangement was of a give and take nature, for while it clearly defined the value of the participating shares, which would be an advantage both to the holders and the company, it did not take advantage of their full rights, for to obtain one-fifth of the assets, it would really be necessary to give the participating shareholders over 40,000 preference shares and an equal number of ordinary shares. In connection with this matter it had been anticipated that an extraordinary meeting would have been held after that meeting, but owing to a printer's error in regard to the notice calling the meeting, that would have to be held another day. He would like to add that the arrangement, if approved of, would have the effect of freeing the company from their present difficulty in presenting a clear statement, should, as he thought it very possible, they wish to obtain further financial assistance for the increase of the water power, etc. He thought it only fair to himself and equally fair to the shareholders to mention that the cash of the second debentures as well as the loans referred to at the outset, had all been found by himself. No other means were available and he saw such personal assistance was absolutely essential to the company's success. He was not at all disposed, however, to continue to finance the company and as he had indicated it was highly probable the directors would have to resort to other financial arrangements in respect of the increase of water power, &c. With regard to the future, he could only repeat the remarks he made last year. He had still much faith in the maintenance of the price of the metal at its present reasonable level and it became daily more evident that the uses to which aluminium could be put with advantage, were being increased. It was with the company, practically a question of how much water power they could obtain. The initial difficulties to get the manufacture into swing had been overcome, and he felt quite safe in saying that the organisation of the company had been placed on a sound footing and that they were now on the way to overcome what they trusted would be the last of their difficulties. It must be borne in mind, however, that there were two years' dividends due upon the preference shares and that the full benefit of the entire water supply available would not be obtained without the necessary funds to carry out the required works and the time necessary within which to complete the operations.

Mr. S. G. Bibby seconded the motion and said he thought he ought to say that it was due to the Chairman that the promising position of to-day had been reached. The Chairman had continually found money to atone for the mistakes made in the inception of the scheme and also to increase the output of the furnaces. He therefore thought they ought to record their great appreciation of the work Mr. Clerk had done for the business.

The report was adopted and the retiring directors re-elected.

Dr. Moody proposed a vote of thanks to the Chairman for the services he had rendered to the Company, and this was seconded by Mr. Ashton, and agreed to.

Delhi Electric Tramways & Lighting Co., Ltd.

The directors report that for the year ended 31st December, 1913, the gross receipts were:—Tramway undertaking, £8,861; Electric supply undertaking (including £3,089 on account of current sold to tramways), £16,439. The revenue from the Tramway Undertaking shows an increase of 32 per cent. over the revenue earned in 1912. The increase is due to the revision of the fares and stages referred to in the last report. The gross revenue from the Electricity Supply Undertaking (excluding supply to tramways) shows an increase of 46 per cent. There has been a considerable growth in the demand for the supply of current for power purposes during the year. The combined undertakings show a net revenue of £6,252, as compared with £2,990 in 1912; £7,832 for the fourteen months to 31st December, 1911 (Durbar period); and £3,232 for the twelve months to 31st October, 1910. After charging expenditure in London and Delhi, and debenture and loan interest, the profit and loss account shows a profit for the year of £2,585. Of this sum, £1,596 has been transferred to renewals reserve account, and, after deducting the loss brought forward, there remains £214 to be carried forward. The net result of the year's operations may be regarded as encouraging, particularly in view of the fact that, for several months during the year, the oil engine had to be laid off owing to the breakage of the main crank shaft. One of the steam engines was laid off for some time owing to a similar mishap. The company suffered considerable loss owing to these breakdowns, particularly in the Tramway Undertaking, where, for some months, the service was curtailed, and, for a period, entirely suspended. The cost of these special renewals has been charged to renewals reserve account. In addition to the special renewal work above referred to, the whole of the company's plant and equipment, including rolling stock, has been systematically overhauled during the year under review. The expenditure under this head has been charged against the year's working. The manager reports that the whole of the equipment, with the exception of the cars, is now in good condition. With a view to meeting the increased demands upon the system, the directors recently decided to instal a further Diesel engine and generator, and the set commenced working on 9th instant. The reports of the general manager indicate that it will be necessary, owing to the continually increasing demand, to instal further power plant next year, in addition to which funds will be required for extensions of mains and the provision of new cars and other equipment. The directors are at present considering the advisability of making an issue of second debentures in order to meet these requirements.

Prospectus.—There has been circulated among shareholders of the British Coalite Co., Ltd., a statement offering an issue of 50 000 6 per cent. participating preference shares of £1 each at par, in the Barnsley Smokeless Fuel Co., Ltd. The company has been formed to erect and work in co-operation with the Old Silkstone Collieries, Ltd., on their property at Barugh, Barnsley, a smokeless fuel plant capable of treating 200 tons of coal per day under the patents and processes of the British Coalite Co., Ltd. The Yorkshire Electric Power Co., one of whose generating stations adjoins the proposed site of the new fuel plant, has agreed to take the whole of the surplus gas from the plant, for the production of electrical energy, and it will nominate one of the first directors after allotment.

United Electric Tramways of Montevideo, Ltd.

Mr. G. A. Touche, M.P., presided on Monday, at Winchester House, E.C., over the annual meeting.

In moving the adoption of the report (Elec. Rev., page 1003) the Chairman said that they were met to review the results of a rather unsatisfactory year. From a tramway point of view it had been a bad weather year, not a bad weather year in the meteorological sense, that had been reserved for the present year in Montevideo. They had 237 fine days as compared with 171 in the previous year, while the percentage of cloudy, windy and rainy Sundays and holidays was only about one-half that of the previous year; but it was a year of bad weather financially in South America, and, indeed, other parts of the world. The effects of the money stringency were manifest in Montevideo. The number of visitors from the Argentine, where there was a great financial depression, was much reduced. The summer season, when bumper traffics were expected, was terminated at an unusually early date, and involved the loss of almost a whole month's extraordinary traffic at the best season of the year. Then many of the most important services were disorganised owing to extensive paving works which were in progress throughout the year. The principal street in Montevideo, 18 de Julio, the backbone of the city, through which some of their most important lines ran, was practically closed to traffic. Services were diverted to other streets, but it meant a considerable loss of traffic. The condition of affairs was unfortunate, but it could not be avoided. These various circumstances combined to affect traffics adversely, and the net result did not show the same ratio of improvement as in former years. The traffic receipts for the year were £373,526, as compared with £346,306 in the previous year—an increase of £27,220, or 7.86 per cent. The number of passengers carried was 44,622,690, as against 40,736,202 last year, an increase of 3,886,488, or practically 9½ per cent. The population of Montevideo was carried about 120 times, as against 117 times last year. The operating expenses were 59.58 per cent of the gross receipts, as compared with 57.44 per cent. a year ago—an increase of 2.14 per cent. That was partly accounted for by the increase in wages, and partly by the increase in renewals and maintenance charges. The net traffic receipts were £150,985, as compared with £147,401, showing an increase of £3,584, or 2.43 per cent. The small ratio of increase was due to the fact that, while expenses had shown a normal expansion, the ratio of gross receipts had not been so good. Profit and loss account showed total credit of £147,684, as compared with £139,882 a year ago, or an increase of £7,802. The charges to profit and loss were increased by £4,242, being chiefly interest on additional debenture stock and extra income tax. The net profit for the year was £91,281, compared with £87,720. It was usual to give some information with regard to the figures of the current year, and he was now in a position to give those in respect of the half-year of the native company to the 30th April, 1914. The traffic receipts were £200,181, an increase of only £419 over the same period in the previous year. Unfortunately, unsettled weather prevailed during practically five out of the six months, and this was reflected in the receipts. The working expenses were 55.99 per cent. as compared with 55.49 per cent. in the corresponding period of the previous year. Some economies had been put into force, and it was hoped that these would in some degree counteract the lack of growth in takings. The net receipts for the half-year were £88,095, as compared with £88,915, or a decrease of £820. Practically, there had been no season, in the ordinary sense, in the year which was now current, which had been one of bad weather and bad trade. The results for the half-year were further adversely affected by an exceptionally heavy storm—practically a cyclone—about the middle of April. Much damage was caused and services were seriously interrupted. The capital expenditure during the year had been heavy, partly due to various extension works in progress, and partly to the cost of new paving and track reconstruction in connection therewith. The expenditure during the year amounted to a total of £122,157, as compared with £78,228 in the previous year. The property account now stood at a total of £2,032,426. Most of the extensions carried out during the year were referred to at the previous meeting. The construction of the Reducto car-shed had been completed, and also the extension to the main car-shed at Carmen station. The amount expended on these works during the year was £29,193. The construction of the two new sub-stations was proceeding satisfactorily. The buildings were practically finished, and the batteries installed. The first Diesel set had been erected at Maroñas, and it was expected that this station would soon be ready for operation. The sub-station at Sayago was expected to be ready for service in time for the heavy traffic of the next summer season —from December, 1914, to February, 1915. The expenditure during the year in connection with both sub-stations amounted to £17,062. The construction of double track in Calle Minas —a service previously operated by a single track with turnouts—was also carried out during the year. This work was necessary owing to the growth of traffics on the lines using the street, and had enabled services to be run with more advantage, not only to the company but also to the travelling public. That represented a cost of £1,173. The new buildings for the administration offices were completed and in occupation. The centralisation of practically all the staff under one roof had great advantages. The further expenditure on this work during the year amounted to £[illegible]. The repaving of certain streets in Montevideo with asphalt and the consequent reconstruction of the company's track had continued during practically the whole year, and the expenditure incurred in this connection alone amounted to £[illegible]. This expenditure was more or less outside the control of the company, and was likely to be continued over a period of years if the repaving scheme of the municipality were carried into effect. The company, under its concessions, had to pay a proportionate cost of new paving in streets. Where there were double tracks they had to pay practically two-thirds of the cost. The provision of additional rolling stock was necessary in order to meet traffic requirements. Further cars would have to be purchased during the current year and also during the following two or three years. It might be found necessary to make further extensions to the plant, but at the present time nothing definite had been settled. With regard to this and all such matters they would find Mr. George Balfour's advice and counsel of great assistance. Further share and debenture capital for a total of about £230,000 was issued during the year. In a progressive business in a growing city it was impossible to stand still, and, as the limit of expansion had, happily, not been reached, a further enlargement of capital account to meet inevitable extensions should be looked forward to, if the conditions were favourable. The political situation was an important factor in considering the wisdom of a programme of extension involving further capital expenditure. In Uruguay political questions were interwoven with nearly all matters, and this had not made the financial situation any easier. It was useless to ignore the fact that Uruguayan securities, which, until a few years ago had been steadily advancing in credit, had been rather out of favour in recent years. The Chairman dealt at some length with the political situation, and said that one great safeguard of Uruguay was that her statesmen were honest and her courts pure and impartial. In conclusion the Chairman expressed the approval of the board for the services rendered by the staff.

Mr. H. A. Trotter seconded the motion, and it was carried.

The B.E.T. Report.

The income from interest and dividends on investments, net profit on working of undertaking, interest on loans and deposits, and sundry profits and fees (termed gross profit in the report) as exhibited by the revenue account for the twelve months ended 31st March, 1914, at £225,751, shows an improvement of some £15,000 as compared with the result of the year 1912-13. Augmented by the balance brought into the account from the previous year, we have a total of £238,248, of which debenture stock interest absorbs £91,383, and improvement and general expenses, and other charges dispose of £20,781. Various amounts written off or placed to reserve account for £56,485, leaving a balance of £69,597, £24,215 of which satisfies the dividend for the year on the 6 per cent. cumulative preference stock. The payment of 3½ per cent. for the year on 7 per cent. non-cumulative preference stock requires £28,251, leaving the carry forward at £17,129. The resources of the revenue account do not afford any return on the 6 per cent. ordinary non-cumulative stock and the deferred ordinary stock. Besides there are the non-interest bearing income certificates redeemable out of profits only amounting to £266,371. A marked feature of the accounts is the reservation against investments and undertakings out of the income of £50,000, which is a step in the right direction.

During the year there was a profit on the sale of investments of £19,686, which was added to the reserve, but there were losses of some £20,000 on the sale or realisation of investments in Brighton and Shoreham Tramways, Cavehill and Whitewell Tramways Co., and other investments.

There is now reserved £27,500 against expenditure on undertakings at Barrow and Mumbles, and the reserve for depreciation appears at £602,922. There are additional reserves against specific assets of debtors, and buildings and land, of £36,666 and £4,935 respectively.

The sundry debtors and debit balances, less revenue, appear in the balance sheet at £201,687, of the nature of which the schedule appended to the accounts affords no indication.

The amount outstanding on the mortgage on Federation Offices, Kingsway, figures among the liabilities at £19,200. It is satisfactory to note from the report that a memorandum will be presently issued with regard to proposals for reduction of the capital arising out of the question of depreciation in the value of the company's assets. This course is imperative when we read that of the investments standing in the books at £5,143,473, £1,529,533 which had published values or were dealt in on the London Stock Exchange, at 31st March, 1914, showed a depreciation if taken at middle prices of £374,466, the auditors being unable to form an opinion of the value of the remaining investments, stating that out of the total investments (£5,143,473) securities representing approximately £1,300,000 yielded no return to the company in the year.

During the past year the Northern General Transport Co., Ltd., was formed for the purpose of consolidating the interest of the following B.E.T. subsidiary companies:—Tynemouth and District Electric Traction Co., Jarrow and District Electric Traction Co., Ltd., Gateshead and District Tramways

Co.—the majority of the share capital of the three companies being held by the Transport Co.

The Scottish General Transport Co., Ltd., was also formed for similar purposes in regard to the B.E.T. Scottish subsidiaries, viz.: Airdrie and Coatbridge Tramways Co., Greenock and Port Glasgow Tramways, and the Rothesay Tramways Co., the majority of the share capital of the three companies being now held by the Transport Co.

Underground Electric Railways Co. of London.—A special meeting of this company was held at the Westminster Palace Hotal, on 15th inst., at which resolutions were passed, so altering the articles as to convert the company into a share and securities holding company. Sir Edgar Speyer, who presided, said that the assets now consisted almost entirely of holdings in stocks and shares in subsidiary companies, but as it was not such at law they could not declare a dividend without an annual valuation of assets.

India-Rubber, Gutta-Percha and Telegraph Works, Co., Ltd.—A half-yearly general meeting will be held at 106, Cannon Street, E.C., on Thursday, 25th inst., for approving of the following dividends :—Preference shares, 5s. per share, less income-tax, half-yearly dividend (at the rate of 5 per cent. per annum); ordinary shares 5s. per share, free of income-tax, being an interim dividend of 2½ per cent.

James Keith & Blackman Co., Ltd.—The accounts for the year to March 31st show (says the *Financial Times*) that after providing for debenture interest and making allowance for depreciation and doubtful debts. the net profit was £24,564 and £3,550 was brought forward. The directors recommend a dividend on the ordinary at the rate of 10 per cent. per annum, free of tax, writing off additional depreciation £3,000, off patents and goodwill £1,878, transferring to reserve £10,000, and carrying forward £3,247.

Stock Exchange Notices.—The following has been ordered to be quoted in the Official List:—

Mississippi River Power.—$16,000,000 common capital stock and $6,000,000 6 per cent. preference capital stock in $100 shares.

Continental.—Hungary.—A net profit of £50,382 is reported for the last financial year by the Vereinigte Gluhlampen und Electricitäts Gesellschaft, of Budapest, an increase of £3,957 over 1912. The dividend is being advanced from 10½ to 12 per cent.

France.—Among the new electrical companies recently formed in France, are the Société d'Energie Electrique du Secteur Voltaire, Paris (94, Rue Amelot), capital £18,000; and the Société Charentaise de Distribution Electrique, formed at Gemozac (Charente Inferieure), with a capital of £12,000.

Austria.—The report of the Oesterreichische Siemens-Schuckertwerke Gesellschaft, of Vienna, for the last financial year, shows a net profit of £116,185, an increase of £25,012 over 1912. A dividend of 7 per cent. is again being declared.

Automatic Telephone Manufacturing Co., Ltd.—The share and transfer books are closed from 17th until the 24th inst., for the purpose of preparing the warrants for the 6 per cent. preference shares for the half-year.

National Electric Supply Co., Ltd.—The directors have declared an interim dividend at 3s. per share on the ordinary shares for the half-year ending June 30th.

Penarth Electric Lighting Co., Ltd.—After providing for debenture interest, and transferring £500 to renewals fund, the accounts for 1913 show that the credit balance of £29 brought forward was reduced to £11.

Victoria Falls and Transvaal Power Co., Ltd.—The directors have declared a dividend at the rate of 6 per cent., less income-tax, on the preference shares for the six months ended December 31st, 1912.

STOCKS AND SHARES.

Tuesday Evening.

General conditions in the Stock Exchange vary a good deal from day to day. The conflicting factors in the situation—such as Ulster, Brazil, Mexico, Canada; the prices of tin, rubber, and so on—are giving the Stock Exchange considerable anxiety, but paramount above these considerations there arises that of the ease in the money market. Money being plentiful towards the end of June is regarded as a healthy sign; and Consols, after a sharp dip upon the French political crisis, started to recover their lost ground. The Brazilian rate of exchange gives no indication of settling down to steadiness, and Mexican issues were put up on Monday for no other reason than that the latest news from that country was less bad than might have been expected.

The Home Railway department is one of the most unsatisfactory round the Stock Exchange. Labour unrest has certainly got upon the nerves—to use the popular colloquialism—of the investing public. It is true that the London General Omnibus Company has managed to arrange terms with its men with a minimum of friction and a maximum of discretion which may well be the envy of stockholders in certain leading English railways that compliment shall leave nameless. Underground Electric shilling shares have hardened to 9s. 9d., and the Income bonds at 90½ are a point higher on the week. Districts, however, after their dramatic movements, eased off a little, which is not surprising, in view of all things. Metropolitans are 1 lower at 38¾; a dull market, too, at that. The Surplus Lands Stock fails to recover from its 2 points drop.

The British Electric Traction group is heavy, pending the unfolding of some scheme for re-arrangement of the Company's capital. Falls have occurred in the Deferred, the 6 per cent. Preferred and the 7 per cent. non-cumulative Preferred stocks. It may be that some of the proprietors are apprehensive of the most junior securities being dealt with in somewhat drastic fashion. The London and Suburban issues are steady.

One of the features in our lists this week is the strength of the Brush Debenture stocks, each of the three securities rising 2 points. This came about as much as the result of the recent inquiries for electrical manufacturing issues as a whole, as of any special demand in the Brush market, although a few buying orders came in, to find holders by no means eager to realise at the present low range of values. Brush Second Debenture stock has for some time past been one of the few stocks paying regular interest and yielding double figures on the money. British Westinghouse Preference have halted a little in their aspiring course, the price at 1¾ showing $\frac{1}{16}$ decline, the first for many weeks past. The 4 per cent. Debenture stock is a point to the good.

Other Manufacturing stocks and shares are slightly dull. Small falls are marked in Babcock & Wilcox, Aron Ordinary and British Aluminium Preference. On the other hand, Callender's Preference and Castner-Kellners are both a shade harder, and British Insulated keeps very firm at 9¾.

Electricity Supply shares are quiet. The London group retains its firmness, and there are rises in City Preference, both classes of Westminster shares, Metropolitan Preference, and one or two Debenture stocks. It is declared that, so far from the recent scheme having been scotched by its withdrawal from Parliament, proposals are now receiving close consideration from the principal parties concerned, with a view to evolving yet another scheme patterned on lines rather similar to the last, though differing in various details. As to this, further developments will be awaited by a circle much wider than that comprising proprietors of electrical supply securities.

The Mexican group, as already observed, has strengthened in several of its constituent parts. Mexico Trams have risen to 75, Mexican Light & Power Common shares to 46½, and Mexican Northern Power bonds to 23½. The pitiful losses occasioned through the difficulties of the Canadian agency, and the Southern Alberta and Western Canada Land Companies, have produced little effect upon other Canadian enterprises. Canadian General issues, for example, are unchanged, and in Shawinigan Water a loss of a point has no connection with the troubles just mentioned. Cordoba Light & Power Debenture stock has tumbled 3, to 85½, and one bargain this week has been recorded at 79¾. Victoria Falls Power shares are $\frac{1}{32}$ easier, because apparently some had hoped that the company would have been able to clear off more arrears than it has done. By this month's dividend announcement, the dividend is now paid up to the end of 1912.

West India and Panama Telegraph shares of all three classes are now quoted *ex* dividend, and it is worth noticing that the yield on the Ordinary shares now come to 7½ per cent., on the basis of the last dividends. That these are likely to be maintained it is generally expected. The chairman's speech at the recent meeting was couched in none too hopeful fashion, and probably had something to do with certain sellers coming to market. The jobbers, already well supplied with shares, were not eager to take more, and, consequently, the price is dull. For a lock-up, West India and Panama Ordinary should be a good purchase, although it may be a year or two before the Company feels the benefit of the opening of the Canal.

Other Telegraph and Telephone issues hold their ground. American Telephone and Telegraph are better, and a few rises took place in Debenture stocks in this department. Globe Ordinary hardened to 11¼. Great Northern Telegraphs at 32½ are 10s. up. Telegraph Constructions fell a similar fraction to 37. Reuters continue a weak spot, and although 2⅞ was bid for the parent shares at the end of last week, the buyers had no difficulty in being satisfied, with the result that the quotation reacted to its previous level. Canadians are the turn better at 6s. 9d., while American Marconis stick at 14s. and Marconi Marines at 1⅜.

Brazilian Tractions have been an erratic market; at the end of last week the price touched 78¾, from which it has recovered to 80. Most things connected with Brazil have reflected the pleasurable anticipations felt at the prospect of the Brazilian Government being able to raise a loan of about 15 million pounds sterling, which would draw into Brazil the cash that would be so welcome at the present time. Para Electric Railways Ordinary stiffened ⅛, and the Tramway Bonds are strong. Anglo-Argentine Trams have again improved, and rises occurred in the Brisbane group.

The rubber share market is as quiet as ever. There seems to be little reason for paying heed to the latest-of-all synthetic scares, but the price of the product keeps about 2s. 4d. a pound, checking enterprise on the part of those who might be inclined to speculative purchases of the shares.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 16th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16— 5/16	..	Nil
Do. 5 % Pref.	1	5	5	½— ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	13½— 15½	—1	..
Do. Do. Deferred ..	100	..	..	6 — 8	—1	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89½— 91½	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	3	3½	56 — 59	—1	5 18 8
Do. 5 % Perp. Deb. ..	100	5	5	92½— 94½	..	5 6 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 80	..	5 12 9
Central London Railway, Ord. ..	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1903	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref. ..	1	6	6†	15/32— 23/32	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord. ..	1	..	..	3/16— 9/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	9/16— 11/16	..	7 5 8
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	75 — 80	..	5 12 5

NAME.	Stock or Share.	Dividends for		Closing Quotations June 16th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	56 — 60	..	6 13 4
Metropolitan Railway Consol. ..	100	1⅝	1⅝	38½— 38¾	— 1	4 3 10
Do. Surplus Lands	100	2¾	2¾	59 — 61	..	4 10 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	79 — 81	..	4 6 4
Metropolitan District Ord. ..	100	Nil	..	23½— 24	— ½	Nil
Do. 6 % Deb.	100	6	6	138 —141	..	4 5 8
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 86	..	5 4 8
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
Do. 5 % Deb.	100	5	5	85½— 88½	..	5 13 0
Potteries, Ord.	1	3½	3½	9/32— 13/32	..	8 12 10
Do. 5 % Pref.	1	5	5	17/32— 21/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81¾— 84¼	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	8¼— 8½	+ ⅛	Nil
Do. "A"	1/-	..	..	7/16— ½	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	115 —117	..	5 2 7
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 8 2
Do. 6 % Income	100	6	6	90 — 91	+1	6 11 10
Yorkshire (West Riding), Ord. ..	5	Nil	Nil	¼— ½	..	Nil
Do. 6 % Pref.	5	3	4	4¼— 4¾	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	85 — 88	+1	5 2 3

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 13/16— 5 1/16	+ 1/16	5 8 5
Do. 2nd Pref.	5	5½	5½	4 5/16— 4 9/16	..	6 2 3
Do. 4 % Deb.	100	4	4	93 — 95	+ ½	4 4 3
Do. 4½ % Deb.	100	4½	4½	98½—101½	..	4 8 6
Do. 5 % Deb.	100	5	5	94½— 96½	..	5 3 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 —106	..	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11¾	..	5 2 2
Do. 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9
Do. 5 % 2nd Deb.	100	5	5	100 —102	+1	4 18 0
Brazilian Traction, Light and Power	$100	6	6†	79 — 81	—1	7 8 2
Brisbane Trams Invt., Ord. ..	5	8	8	6¾— 7¼	+ ⅛	5 10 3
Do. 5 % Pref.	5	5	5	4¾— 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —102	+1	4 8 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	109 —113	—1	7 1 8
Do. Pref. Ord.	100	6	6	103 —107	..	5 12 1
Do. 5 % Pref.	100	5	5	104 —107	+1	4 12 7
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	97 —100	..	4 10 0
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	94½— 96½	..	4 8 1
Calcutta Trams, Ord.	5	7½	9½	6½— 7	..	6 15 9
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	98 — 101	+1	4 9 0
Cape Electric Trams	1	5	5	⅝— ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5 3/16— 5 7/16	..	4 11 11
Do. 4 % Deb.	100	4	4	93 — 98	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	91 — 95	+1	5 5 3
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½— 97½	..	5 2 6
Kalgoorlie El. Trams 5% A Deb.	100	5	5	82 — 87	—2	5 15 0
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord. ..	1	..	..	¼— ½	..	..
Do. Pref.	1	4⅜d.	[illegible]	23/32— 31/32	..	6 5 0
Lisbon Elec. Trams, Ord. ..	1	6	6	1 3/32— 1 11/32	..	4 9 8
Do. 6 % Pref.	1	6	6	15/16— 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	95 —100	..	5 0 0
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅞— 5¼	..	5 14 3
„ Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	78 — 81	..	6 3 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½—100½	..	4 19 6
Mexico Trams Com	$100	7	7	72 — 76	+3	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	80 — 84	+1	5 19 1
Do. 6 % Bonds	100	6	6	77 — 81	..	7 8 2
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	3⅞— 4⅜	+ ⅛	11 2 2
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	86½— 89½	..	5 11 8
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	99½—101½	+1	4 18 6
Do. 5 % Mort. Bonds	100	5	5	89 — 91	..	5 10 1
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	96 —100	+1	5 0 0
Singapore Trams, 5 % Deb. ..	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3
Un. Elec. Trams Monte Video ..	5	7	7	4⅝— 5⅛	..	6 16
Do. 6 % Pref.	5	6	6	4⅞— 5¼	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	92 — 95	..	5 5 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½— 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord. ..	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10⅝— 10⅞	..	5 10 4
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 9
Brompton & Kensington, Ord. ..	5	10	10	8¾— 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8½— 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	89½— 92½ xd	..	4 6 8
Charing Cross, West End & City	5	5	6	4⅞— 5⅜	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝— 5	..	4 10 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅜— 4¾	..	4 14 9
Do. Do. 4 % Deb.	100	4	4	90½— 92½ xd	..	4 6 6
Chelsea, Ord.	5	5	5	4⅝— 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	9	10	16¼— 17¼	..	5 16 0
Do. 6 % Cum. Pref.	10	6	6	12¾— 13¾	+ ¼	4 7 3
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 7 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 —103	..	4 8 1
County of London, Ord.	10	6	7	11¾— 12¼	..	5 14 3
Do. 6 % Pref.	10	6	6	11⅞— 12⅜	..	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	103 —106	..	4 5 8
Do. 4½ % Second Deb. ..	Stock	4½	4½	99 —102	+1	4 8 1
Edmundson's, Ord.	£3	..	..	5/16— 9/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3½— 4	..	7 10 0
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝— 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 6
Folkestone	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9

Hove	5	8	9	8¾— 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7⅜— 7⅞	..	5 14 3
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1¼— 1⅝	..	5 10 7
Do. 6 % Pref.	5	6	6	4⅞— 5¼	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	90½— 93½ xd	..	4 5 9
Metropolitan	5	4¼	4½	3⅜— 3⅞	+ ⅛	5 16 2
Do. 4½ % Cum. Pref.	5	4½	4½	4½— 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	98 —101	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾— 10½	..	5 14 3
Oxford..	5	7	7	5 13/16— 6 5/16	..	5 11 0
St. James' and Pall Mall, Ord. ..	5	10	12	9½— 10	..	6 0 0
Do. 7 % Pref	5	7	7	6¾— 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2¾— 3⅜	..	6 10 4
Do. 5 % First Mort. Deb. ..	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/16— 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	Nil	..	5/16— 9/16	..	..
Do. 5 % Cum Pref.	5	3‡	4	2½— 3	..	6 13 4
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord...	5	10	10	8⅜— 8⅞	+ ⅛	5 12 8
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5¼	+ 1/16	4 5 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 16th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5¼ — 5⅝	..	5 11 7
Calcutta, Ord.	5	8½	9	7½ — 7⅝ xd	..	5 18 0
Do. 5 % Pref.	5	5	5	5 1/16 — 5 3/16	..	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	5 8 0
Canadian Gen. El. Com.	$100	7	8	103 — 108	..	7 5 6
Do. 7 % Pref.	$100	7	7	118 — 123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	5	..	⅝ — 11/16	..	7 12 0
Do. 5 % Deb.	100	5	5	83 — 88	−3	5 13 8
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	81 — 83 xd	..	6 19 6
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	− ½	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	4	⅜ — ⅝	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 — 104	−1	4 16 2
Madras, Ord.	5	Nil	..	1½ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	105 — 108	..	4 12 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	61 — 66	..	7 11 6
Mexican Lt. & Power, Common	$100	4	4†	46 — 48	+1½	..
Do. 7 % Cum. Pref.	$100	7	7	71 — 76	..	9 4 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	72 — 77	..	6 9 10
Do. 5 % 2nd Mort. Bonds	100	5	5	59 — 64 xd	..	7 13 3

NAME.	Stock or Share.	Dividends for		Closing Quotations June 16th.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	51 — 55	..	..
Montreal, Lt., H. and Power	$100	9	10†	226 — 231	..	4 6 7
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 — 245	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 — 108	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	101 — 103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 — 102	..	4 8 3
Shawinigan Water, Capital	$100	5½	6	132 — 138	−1	4 8 8
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 — 109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	99½ — 101½	..	4 8 8
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	96 — 98 xd	−2	4 12 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	85 — 87	..	5 15 0
Victoria Falls Power, Pref.	1	6	6	11/16 — ¾	−1/32	8 0 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 3

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 16th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	..	11/16 — 13/16	−1/32	8 12 4
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	6 17 2
Babcock & Wilcox	1	16	16	2⅞ — 3	−1/16	5 6 8
Do. Pref.	1	6	6	1¼ — 1⅜	..	4 7 6
British Aluminium, Ord.	1	..	5	15/16 — 1 1/16	..	4 14 1
Do. 6 % Cum. Pref.	1	6	6	25/32 — 29/32	−1/32	6 9 0
Do. 5 % Prior Liens Debs.	100	5	5	97 — 100	..	5 0 0
Do. Deb. Stk.	100	5	5	90 — 95	..	5 5 3
B.I. & Helsby Cables	5	10	13	9⅜ — 9⅞	..	6 11 8
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	101 — 104	..	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	2	Nil	5	1⅝ — 1⅞	−1/16	5 6 8
Do. Deb.	100	4	4	74 — 76	+1	5 5 3
Do. 6 % Prior Lien	100	6	6	101 — 104	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	8/- — 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	82 — 87	+2	5 15 0
Do. 4½ % Deb.	100	4½	4½	52 — 57	+2	7 17 10
Do. 4½ % Second Deb.	100	4½	4½	31 — 35	+2	12 17 2
Callender's Cable	5	15	15	11⅝ — 12⅛	..	6 3 8
Do. Pref.	5	5	5	5⅛ — 5⅝	+ ⅛	4 13 0
Do. Deb.	100	4½	4½	97 — 100	..	4 10 0
Castner-Kellner	1	20	22½	2 15/32 — 2 19/32	+1/32	8 9 5
Do. Deb.	100	4½	4½	104 — 107	..	4 4 1

NAME.	Stock or Share.	Dividends for		Closing Quotations June 16th.	Rise + or Fall —	Present Yield p.c.
Crompton & Co., Deb.	100	5	5	83 — 85	..	5 17 8
Dick, Kerr	1	Nil	..	⅜ — ½	..	..
Do. Pref.	1	6	6	¾ — ⅞	..	6 17 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	1	5	6	⅝ — 11/16	..	8 14 6
Do. Pref.	1	7	7	1 — 1⅛	..	6 4 5
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 18 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10 1/16 — 10 3/16	..	5 18 9
Do. Deb.	100	4	4	87 — 91	..	4 8 0
Henley's, Ord.	5	15	20	14½ — 15½	..	6 9 0
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	99½ — 101½ xd	..	4 8 8
India-Rubber, G. & T.	10	7½	7½	9¾ — 10¾	..	6 19 5
Do. Pref.	10	5	5	8¾ — 9½	..	5 5 8
Telegraph Construction	12	20	20	86 — 88	− ½	6 6 2
Do. Deb.	100	4	4	98 — 100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	63 — 67	..	5 19 8
Do. B 4 % Cum. Pref.	100	..	£4	40 — 41	..	9 1 10

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 16th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾ — 6¼	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 98	+1	5 2 0
American Telep. & Teleg., Cap.	$100	8	8	124 — 128	+1	6 5 0
Do. Collat. Trust	$1000	4	4	92 — 95	+1	4 4 3
Anglo-American Telegraph	Stock	3	3	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	107¾ — 108¾	− ¼	5 10 1
Do. Def.	Do.	30/-	30/-	23 — 23½	..	6 7 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	..	4 16 2
Chili Telephone	5	8	6†	7¼ — 7½	..	5 6 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	..	4 18 9
Cuba Telegraph	10	6	6†	8½ — 9½	..	6 6 4
Do. 10 % Pref.	10	10	10	16 — 17	..	6 17 8
Direct Spanish Telegraph, Ord.	5	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7¼ — 7¾	..	6 9 0
Direct United States Cable	10	4	4	6⅝ — 6⅞	..	5 16 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	129 — 132	..	5 6 3
Do. 3½ % Pref. Stock	Do.	3½	3½	77 — 79	..	4 8 9
Do. 4 % Mort. Deb.	Do.	4	4	94½ — 96½	+ ½	4 3 0
Eastern Extension	10	7	7	12½ — 13	..	5 7 9
Do. 4 % Deb.	Stock	4	4	95 — 97	+ ½	4 2 6
Globe Telegraph and Trust	10	6	6†	11 — 11½	+ ⅛	5 4 4
Do. 6 % Pref.	10	6	6	12⅜ — 12⅞	..	4 13 4
Great Northern Telegraph	10	20	20	31½ — 33½	+ ½	5 19 5
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	5	5	80 — 85 xd	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 72 xd	..	5 11 1

NAME.	Stock or Share.	Dividends for		Closing Quotations June 16th.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph	1	20	20	2¾ — 2⅞	..	6 19 0
Do. 7 % Cum. Partic. Pref.	1	17	..	2 3/16 — 2 7/16	..	6 19 0
Monte Video Telephone, Ord.	1	6	6	⅞ — 15/16	..	6 8 0
Do. 5 % Pref.	1	5	5	23/32 — 27/32	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 — 101	+ ¼	4 9 0
Oriental Telep. and Elec.	1	10	10	2 7/32 — 2 9/32	− 1/32	4 7 6
Do. 6 % Cum. Pref.	1	6	6	1 7/32 — 1 9/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	4 0 0
Reuter's	10	10	7	7½ — 8½	− ¼	8 4 8
Submarine Cables Trust	Cert.	6	6	126 — 129	..	4 13 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 — 100	..	4 10 0
United River Plate Telephone	5	8	6†	6½ — 6¾	..	5 18 5
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 9 0
West Coast of America	2½	2½	Nil	⅞ — 1⅛	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	1¼	1 7/16 — 1 11/16 xd	..	7 8 2
Do. 6 % Cum. 1st Pref.	10	6	6	9 — 9½ xd	..	6 6 4
Do. 6 % Cum. 2nd Pref	10	6	6	8½ — 8¾ xd	..	6 16 9
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	10	7	7	13¼ — 13¾	..	5 1 11
Do. 4 % Debs.	Stock	4	4	96 — 98	+ ½	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	94 — 97	..	4 12 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Electrical Smelting of Iron Ore in Sweden.—The report for 1913 of the Uddeholms A/B. which is the second largest iron manufacturing concern in Sweden, has recently been published and gives some interesting details about the progress of electrical smelting of iron ore. The manufacture of electrical pig-iron was started in 1912 with two furnaces of the Electrometal type, using charcoal for the reduction, each of which has a capacity of about 5,000 tons per annum. In 1913 a third furnace was completed, and the output of electrical pig-iron, which in 1912 amounted to 7,796 tons only, was raised to 13,902 tons. There are now under construction two similar furnaces of a somewhat larger size. This is a sure proof that the company is very well satisfied with the results from the electrical furnaces, and this is emphasised by the following remark that appears in the report: "The electrical pig-iron has continually turned out to be of excellent quality, and it is therefore anticipated that the company will be able to cover its whole requirements for pig-iron from the electrical furnaces as soon as the two last ones have been completed."

The output of ordinary pig-iron from the blast furnaces, which in 1910 was 18,416 tons, had been reduced to 13,713 tons in 1913, and is very likely in the near future to cease altogether. The activity of this company is not based on the production of pig-iron for sale, but on the production of steel, for which the whole output of pig-iron is employed. The company has two electrical power stations, of which one, the Forshult station, has been extended by the installation of additional electrical machinery, so that it is now able to supply 16,000 H.P. instead of 10,000 H.P. The second, the Malta power station, was completed this year, and is capable of producing 4,000 H.P.

The Uddeholm Co. is not a small concern, as the assets at the end of 1913 amounted to about 2¼ million pounds sterling. The total turnover in 1913 was about £560,000, of which about £385,000 were iron and steel manufactures.

THE DRYING AND PRESERVATION OF TIMBER BY ELECTRICITY.

By GEORGES DARY.

Wood, as soon as it ceases to exist as a growing tree, quickly becomes a prey to the germs enclosed within it. Therefore, as it constitutes one of the most necessary materials of industry, it is readily realised that it is advantageous to utilise the wood as quickly as possible after the tree from which it is taken has been felled, and to preserve it in perfect condition. The problem is one that has, so far, only been partially solved, for the subject is extremely complex, and comprises, apart from the technical difficulties, various very important economical and industrial requirements. It is, primarily, necessary that the processes employed for the rapid drying of wood shall not be costly or difficult of execution. They should be applicable not only in suitable works, but also on the land, *i.e.*, in woods and forests themselves. It is necessary, also, that the results obtained shall be uniform throughout the whole mass of the wood, and that the constituents of the same shall be absolutely and permanently unalterable in character.

All these conditions are completely realised in the electric process recently patented and put into practice by M. Albert Nodon, whose method of extracting nitrates from peat was noticed in the columns of the Electrical Review a few months ago. So far back as 1896, M. Nodon devised a process for the "senilisation," or ageing of wood, by electricity, but it required a somewhat complicated and costly equipment of vats, screw jacks, cranes, heating apparatus, etc., which rendered the cost of working too high. Not only so, but the method gave somewhat irregular results. M. Nodon, however, continued his experiments, and at last succeeded in modifying the process to such an extent as to render it both practicable and economical. Exhaustive tests carried out in the application of a current of electricity to the drying of wood show it to give rise to a triple action—chemical, physical, and aseptical. As a matter of fact, the results achieved comprise (1) a total and rapid oxidation of the resiniferous materials contained in the sap, (2) a molecular transformation of the cellulose, and the various derivatives which modify the mechanical properties of the timber, and (3) a complete and definite suppression of all the destructive germs contained in the wood.

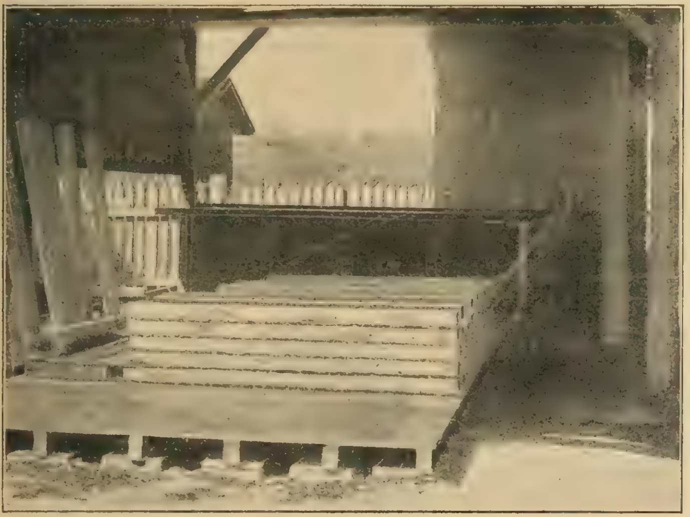


Fig. 1.—The Nodon Process in Operation.

The very simple arrangement for drying and preserving wood devised by M. Nodon is depicted in the accompanying illustrations. It consists of the employment of what is known as "carpet" electrodes, which may readily be transported for use at any place, when previously rolled on a wooden core. The carpets are made of a flexible metallic "cloth," of galvanised iron, fixed between two large sheets of jute, which form absorbing mattrasses. The carpets, after being extended over the wood to be treated, are saturated with water, thus rendering them good conductors of electricity.

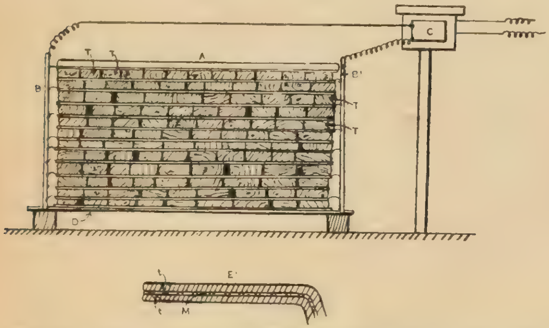
If the process is to be carried out in a factory, as shewn in the illustration (Fig. 1), a simple floor is made of joists and floor boards, on which the first wet carpet electrode is laid. On this a layer of green wood, that has been cut to the desired shape and size, in the form of baulks, sleepers, beams, planks, etc., is placed. (In the illustration, the wood in course of treatment consists of baulks of pine *(pinus maritima)* intended to be cut up into wood blocks for street-paving purposes in Paris.) This first layer of wood is covered with another carpet electrode, then another row of wood, and another electrode, and so on, until the pile has reached the desired height, say 1 m. or 1½ m.

The metallic portions of the carpets are connected to conductors at the sides, the poles of the successive carpets being alternated, in order that the current may pass through each layer of timber (see diagram, p. 1050). In this way, the internal resistance of the pile is reduced to a minimum. The current passes through all the baulks in the direction of their thickness, owing to the conductivity of the electrodes, and the sap in the green wood. The resistivity varies according to the thickness, the amount of essential oil, the degree of humidity, and the time of felling, and ranges between 6 and 20 ohms per cubic metre, remaining practically constant during the whole period of the treatment. To cause a current of an intensity of from 5 to 6 amperes to pass through a cubic metre of wood in the form of baulks, the E.M.F. varies, according to circumstances, from 30 to 100 volts. An alternating current at 110 volts, and 40 to 50 periods, may be utilised, but it is preferable to adopt a lower frequency, say 15 to 20 periods per second, and a lower E.M.F. The latter is regulated to give the desired current by means of induction regulators or transformers. Continuous current at 110 volts may also be employed. The results are the same as with alternating current, but the electrolysis that takes place quickly affects the carpet electrodes, necessitating a frequent reversal of the direction of the current flow through the pile of timber. Regulation of the continuous current can only be effected by means of ohmic resistances, the efficiency of which is lower than that of the induction regulators. For these reasons, it is preferable to employ alternating current.

The process can also be carried out with great advantage in woods and forests when the timber is in full sap, during the summer time, for it is at that period the wood possesses its maximum of vitality and industrial qualities. It is also the best season of the year for outdoor work. The trees can be advantageously cut up by portable electric saws worked by current from a portable steam-operated generating plant, the boiler of which can be fired with the waste timber resulting from the felling and sawing. The piles of wood, with their carpet electrodes, are arranged on a small area of cleared land near where the trees are being felled, while the treated wood can be stored in any position where it is exposed to strong winds.

The time necessary for drying wood by the Nodon process varies from one to two full days, according to the nature of the timber, and the results it is desired to secure. It may be noted that when the process is carried on too rapidly cracks or splits may be caused in the wood. The current should therefore be regulated to from 4 to 5 amps. per cubic metre, for timber intended for carpentry and cabinet-making work. For other uses, such as railway sleepers, the strength of the current may be increased to 10 amps. per cubic metre. The sum total of the current which should be passed through a cubic metre of wood is 150 amp.-hours; that is to say, the time varies from one to two days according to whether a current of 10 or 5 amps. is employed. The operation can be suspended at the end of the regular working day, and restarted the next morning without inconvenience or drawback. All that is necessary in such a case is to keep the carpet electrodes damp, in order that the resistivity of the pile may not increase. If the timber is not stripped of its bark, an E.M.F. of from 80 to 100 volts is necessary; if, however, it is stripped, and in full sap, a pressure of 40 volts is sufficient.

Wood dried by the Nodon process, or "nodonised," as it is rapidly becoming known in France, is deprived of starch, but retains the resiniferous materials throughout the whole mass. The cellules of the sap-wood have also a characteristically regular appearance, which enables, by means of reactions, and micrographic examinations, the wood that has been treated electrically to be distinguished from that which has not been submitted to the process.



T, Railway sleepers of green wood; E, "Carpet" electrodes; *t t*, Jute covers of carpets; M, Flexible metallic cloth; A, Baulk of wood lying on top carpet; B, B', Connections for alternate carpets; D, Floor; C, Current distributor.

Fig. 2.—Diagram of Arrangement for Drying Timber by the Nodon Electrical Process.

The cost of installation and working is restricted to the purchase of the carpet electrodes and the energy consumed. The electrodes are easily made, and their cost works out at an average of about 4 francs per square metre. The cost of electrodes per cubic metre of treated wood is approximately 40 francs, while they have an average life of twelve months, if the necessary care is taken to reduce the wear to a minimum. The depreciation, on this head, works out at approximately 1d. per day and per cubic metre.

As for the industrial applications of the process, these are almost as numerous as those of wood itself. For carpentry and joinery work, perfectly dry timber, that will not become moist, or rot, is necessary. Especially, also, is this the case as regards material for the construction of boats, vessels of small tonnage, bridges, gangways, jetties, etc. Military authorities and public works departments also find it advantageous to employ perfectly dried timber. Some official tests have recently been made, on the application of the French Government, the results of which, and the reports on the same, have been entirely favourable to the process, and some further specific tests for Government Departments are at present in progress. The Nodon process can also be advantageously adopted for the rapid and complete desiccation of certain Colonial species, such as pseudo-mahogany, which come from the African coast in the form of large bark-covered logs, and which, on arrival in France, are still full of sap, rendering their treatment in stoves unsatisfactory. Such material can be treated by the Nodon method not only efficiently but also at a much lower cost.

As regards wood paving blocks, the use of which is steadily increasing in large towns, it has been a general experience that, owing to their relatively short life, they have frequently to be renewed, the processes hitherto employed having failed to give the desired results. An official report, issued in January last by the municipal authorities of Bordeaux, shows, however, that electrically-treated wood gives full satisfaction as regards durability. Indeed, the official report, a copy of which lies before us, states that one of the busiest roads in Bordeaux was partially paved in 1906 with wood blocks treated by the Nodon process, and that, although eight years have since elapsed, the part of the road so paved is still as level as on the day it was laid, while other portions paved with blocks treated in the ordinary way have had to be relaid.

Finally, we may draw attention, among the other important applications, to that of railway sleepers, and pitwood, in addition to telegraph and telephone poles, and electricity transmission masts. It will thus be seen, from the numerous directions in which it can be applied, that the Nodon process promises to effect a radical change in the methods of drying and preserving wood. It may be added in conclusion that the process is in the hands of the Société A. Beaumartin & Co., of 33, Rue St. Genes, Bordeaux, from whom specimens of the treated wood, and any additional information regarding the process, can be obtained.

REVIEWS.

Transformer Practice, by W. T. Taylor. London: McGraw-Hill Book Co. Price 10s. 6d. net.

This is the second edition of a book published in 1909, on the manufacture, assembling, connections, operation and testing of transformers. The work has been entirely re-written, enlarged and re-set.

The book opens with an account of the enormous increase in the capacity and voltage of transformers of late years. The author points out that the limiting feature in a transmission scheme is now the line itself and not the transformers. In discussing iron losses in a transformer his remarks on the effect of varying the frequency are not clear. He also states that the loss due to hysteresis varies with the hardness of the steel, whereas, as is well known, the loss in alloy steel is very low, and these alloys are generally very hard. There are several other points to which the reviewer has to take exception. For example, it is stated that the core losses in a transformer represent a great loss of revenue, whereas it is the cost of working which is affected, and the revenue is only affected indirectly. Further, it is stated that the copper loss "is within easy control of the designer," but so are all losses within limits, always provided the buyer will pay for it. The copper section cannot be increased without also increasing the iron, or cutting down the quantity of insulation. Manufacturers of the core type of transformer are not at all likely to agree with the author in the statement that the core type has not in general so good a regulation as the shell type. A general statement of this kind is unjustifiable, since it depends entirely upon the design of each individual transformer whether the shell or the core type will have the best regulation. The reviewer prefers the core type owing to the greater simplicity, and the ease with which repairs can be carried out.

A very brief account of vector representation of transformer problems is given at the conclusion of the chapter.

Chapter 2 deals with simple transformer manipulations. A number of connection diagrams are given, tne majority of which are of a quite elementary character.

Two-phase transformer connections are next considered. Undoubtedly some useful information is given, but the reviewer does not admire the style in which it is presented.

Chapter 4 discusses the three-phase transformation system. This subject is one of the most complicated that electrical engineers have to deal with. For instance, while certain transformer connections are unsafe, and should in general be avoided, special circumstances may arise in which it will be found that the danger incidental to their use is so remote as to be counter-balanced by some advantages which they may offer in the special case, and their use will thus be justified. Probably every type of connection that has been used is given, and very possibly some that have never been used at all. The reviewer has carefully checked those in common use, and finds them correct.

Three-phase transformer difficulties are next considered, but the difficulties dealt with are principally those due to faulty connection only.

Chapter 6 is devoted to the discussion of three phase to two phase systems and transformations. The systems due to Scott, Steinmetz (mis-spelt Steinwetz), and the author are considered in detail.

Methods of cooling transformers are next considered, and the usual arrangements are well described. On page 131, in describing transformer oils, it is stated that for oil-filled water-cooled transformers it is customary to use another grade of oil than that used in the self-cooled type, the oil working at a lower temperature, and consequently a high flash point is not of the utmost importance. Really the use of "white" oils, which have a lower flash point than the "amber" types, is due to their much less tendency to throw down deposit when heated, than the darker coloured high flash test oils. If this depositing goes on in a self-cooling transformer the only harm done is that the ventilating ducts become clogged. In a water-cooled transformer, however, the cooling coils become coated with deposit. Now this deposit is a bad conductor of heat, and consequently the transformer becomes hotter and hotter, and finally burns out, unless the cooling coils are removed and cleaned periodically. Several useful hints on testing transformer oil are given in this chapter.

Chapter 9 is perhaps the most interesting in the book, and deals with the construction of large transformers strictly of the shell and core types of American manufacture. A good deal of useful information is given, but the reviewer has to take exception to several points. It is stated that transformers are very seldom sent in their tanks, but this is becoming more and more a standard practice, and moreover, where practicable, has everything in its favour. A calculation for the forces on transformer coils when a short circuit occurs is given, but the units used are confused. A force is expressed in inch lb., and later on this is called work, and generally the calculation is not at all clearly expressed, which is unsatisfactory. The introduction of a limiting reactance is well discussed, although the treatment would have been improved by the introduction of a numerical example.

Chapters 10 and 11 deal quite shortly with auto transformers, and constant current transformers respectively.

Series transformers and their operation are dealt with in chapter 12, and this important but relatively small type of transformer is well described.

Chapter 13 contains a clear account of regulators, and compensators, together with a number of useful diagrams.

The last two chapters deal respectively with transformer tests in practice, and transformer specifications. The reviewer has no special complaint to make of the former, except to remark that certain statements made in the earlier parts of the book are repeated. Regarding the specifications, it must be noted that the first specification is purely a manufacturer's specification, and contains expressions which are only intelligible to manufacturers, while the other two are types of specifications given to buyers of this apparatus from one particular firm.

An appendix is given in which the majority of large high voltage transformers operating in various parts of the world are catalogued. In reading down this list, the majority of these transformers are seen to be star connected.

It will be seen from the above that while the book contains a good deal of genuine information, there are many statements made to which exception must be taken, and since it consists of only 278 pages, including the index, it cannot be said to be cheap at the price.

Several obvious misprints occur, and the author has a repetitive style. The binding leaves a good deal to be desired since the new copy that the reviewer is using is already coming to pieces.—H.G.S.

Wireless Telegraphy, by W. H. MARCHANT. London: Whittaker & Co. Price 5s. net.

THIS book is primarily intended for the use of those engaged in practical radio-telegraphic work and for students who already possess some knowledge of electrical science. As such it is to be recommended without reserve, for it deals in thoroughly useful manner with the principles and apparatus of all systems at present in extensive use or of considerable practical importance, and does not describe large numbers of circuits and pieces of apparatus which have been proposed and patented without making further advance. In short, the author has provided a well-written and produced treatment of wireless telegraphy as it concerns the average practical worker and student. It is good to see that other systems than the Marconi system receive a proportionate share of the total space. Certainly the Poulsen, the Telefunken, the Lepel and Goldschmidt high frequency alternator systems (here treated in Chapters VII-X) deserve more extended treatment than has been given to them in many works now on the market. One noticeable omission from the present volume is adequate treatment of directive wireless and its importance in general radio-practice and in navigation. Some of the blocks and text are reproduced from the "Radio-Telegraphist's Guide and Log Book," by the same author, but this applies only to fundamental matter of permanent applicability. Though following along the same lines as the earlier work, the present volume is by no means a mere reprint, but contains about 50 per cent. more matter and is brought up to date.

The author spares us an historical introduction, for which we are suitably grateful. Chapters I—V deal with the production and radiation of electrical oscillations and waves, and include descriptions of the various pieces of apparatus which go to make a radio-telegraphic installation and the principles which govern their construction and erection. Considerable space is given to the description of the Marconi 1½ KW. ship set, this being in such general use that few candidates for the P.M.G.'s certificate pass on any other apparatus. Since ship operators will doubtless represent a large proportion of the purchasers of this work, a chapter should surely have been devoted to radio-phares and other special applications of wireless to shipping and navigation.

A full description of the Poulsen apparatus for hand and automatic working is presented in Chapter VII, and the quenched-spark system of producing oscillations is represented by descriptions of the Telefunken I.T.K. set and of the Lepel system. The Goldschmidt alternator is dealt with briefly and clearly, and a special chapter is devoted to portable installations, including sets for military use, airships, yachts, and small craft generally. The remaining five chapters are specially valuable, and deal respectively with the apparatus necessary and methods of making all the more important wireless measurements; the making and interpretation of diagrams (a short and elementary but very useful chapter); the chief regulations and instructions for radio-stations licensed by the P.M.G.; various codes and abbreviations used in working; and the localisation of faults. No mention is made of radio-telephony. This subject is here specifically excluded by the title, but it is noticeable that several works have appeared recently which deal with telegraphy to the exclusion of wireless telephony. Whether this is wise, is at least open to question, for it seems doubtful whether there will ever be anything like such great distinction between the two wireless systems as between the two methods of communication by wire. Indeed, it is quite within the bounds of possibility that wireless telegraphy will in future be effected by apparatus designed specifically for telephonic work. Omission to deal with radio-telephony must not, however, be counted against the treatise here reviewed. Numerous as are the wireless treatises now available, we believe this volume will be given an easily accessible place on the bookshelves of most radio-workers and students.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

Some considerable time ago the writer of these notes suggested that a branch of the B.E.A.M.A. might be formed in Canada for the furtherance of British electrical export trade with this country; an editorial a short while previously also referred to the same matter.

The writer does not know whether the question has ever been taken up and discussed by the B.E.A.M.A. Committee or not, but he has recently been approached by the representatives of several home firms here who are anxious that, if possible, some action might be taken, having for its object the formation of a local branch.

There are represented in Eastern Canada alone about 25 British electrical firms who are believed to be members of the Association referred to; the local representatives of 10 of these have been communicated with, and nine of them at once said that they would be very glad to see a Canadian section formed, and would do what they could to support any proposal made with that end in view, and would recommend it to their principals at home; the tenth man made some demur, but did not deny that such a branch ought to be able to make itself useful and advance the interests of British firms.

The said British firms by no means have too rosy a time of it over here for the following reasons :—

1. Very many Canadian-born engineers get their training in the U.S.A., and, therefore, have little or no knowledge of, or sympathy with, British manufacturers or their products.

2. The National Electric Code Rules do not make it any too easy for home products in certain lines to be sold in the Canadian market.

3. There is a tendency in some quarters to decry British products and enlarge upon any differences in type or features of design as being actual defects—such things require to be nipped in the bud.

4. It is difficult for British born representatives of home firms to get really behind the scenes (at any rate until they have been here several years) and know what is going on; in some respects they might just as well be in a foreign country.

In regard to the first point, the suggestion was made some time ago in these notes that an effort might be made by a few of the large firms at home to, each year, take in one or two engineering students of the most promising sort for a course of training in their works; there is little doubt that the Universities here would welcome any proposals of the kind.

All such students get nearly six months' vacation per year, and the great majority of them spend practically the whole of this period in each year of their college career in engineering workshops either in Canada or in the States—why not in Great Britain?

As has been argued before, those who went to the mother country for some of their training would be more likely, when they rose to positions of responsibility in this country, to give British firms at least a fairer chance than is the case under present conditions.

Such a scheme is quite feasible; cannot something be done on the lines suggested?

With reference to the second item, the London representatives of the Underwriters' Laboratories of Chicago will be able to assist the British manufacturer to some extent, and it is believed that some amount of useful work has already been accomplished; but more might be done.

As to item No. 3, good strong articles in the Canadian technical journals might be utilised with advantage, taking up such matters point by point and refuting them.

A Canadian section of the B.E.A.M.A. could, if properly organised, take up all such matters as the foregoing, including item No. 4, and, doubtless, from time to time, many others. New men coming out could be put up to a good many things which otherwise it would take them a long time (at the expense of their principals at home) to find out.

It is to be hoped that this matter may at least be discussed both in England and here as to its feasibility, and as to the advantages which might accrue from the existence of a Canadian branch of this Association.

BRADFORD ELECTRICAL EXHIBITION.

We have received a copy of the preliminary prospectus of the Corporation of Bradford Electrical Exhibition, 1914, which is to be held at the Manningham Lane Skating Rink, Bradford, from October 6th to 24th inclusive. We understand that it has been the desire of the Electricity Committee of the Bradford Corporation for some years past that an exhibition of electrical apparatus should be held in the city in order that the inhabitants might have an opportunity of becoming acquainted with the great strides which have been made in the utilisation of electricity for all purposes, more especially in connection with the driving of textile machinery, the heating of premises, and for cooking. For various reasons it has been found impossible to hold such an exhibition until the present year, one of the chief being that a suitable hall to accommodate the exhibits could not be obtained, and another that the electrical manufacturers were not disposed to participate in exhibitions run on the lines which have hitherto been the practice.

A conveniently situated and fairly spacious building has now been found in Manningham Lane Skating Rink, and an annexe will be erected at the back of this building if applications for space are sufficiently numerous to warrant this being done. The British Electrical and Allied Manufacturers' Association (as representing the electrical manufacturing industry) have also come to an agreement with the Incorporated Municipal Electrical Association (as representing the Municipalities) as to the lines upon which exhibitions should be run. and the Bradford Exhibition will be the first to be held in accordance with the terms of that agreement.

The Exhibition is being promoted and run under the joint auspices of the B.E.A.M.A. and the Bradford Corporation, each party having appointed a number of their members to form a Special Committee of Management. The persons elected by the Bradford Electricity Committee are :—The Chairman (Ald. Geo. H. Robinson, J.P.), the Deputy-Chairman (Councillor J. Haley), Councillor

A. Ayrton, and Councillor H. Seed, together with the City electrical engineer (Mr. Thomas Roles) while the British Electrical and Allied Manufacturers' Association have appointed Mr. H. C. Palmer (General Electric Co., Ltd.), Mr. B. Longbottom (Electromotors, Ltd.), Mr C. Rodgers (Siemens Bros. Dynamo Works, Ltd.) and Mr. A. J. Ireland (British Thomson-Houston Co., Ltd.) along with the Secretary (Mr. D. N. Dunlop). Mr. James M. Freer, of the firm of Freer & Howard, Ltd., who have been appointed organisers and managers of the Exhibition, is also a member of the Committee.

The Special Executive Sub-Committee authorised to undertake the detail work of management consists of the following three persons:—Mr. Thomas Roles (city electrical engineer, Bradford), Mr. D. N. Dunlop (secretary of the B.E.A.M.A.), and Mr. James M. Freer (Freer & Howard, Ltd., Exhibition organisers and managers).

The Electricity Committee of the Bradford Corporation are taking the greatest interest in the project, and it is hoped that the Exhibition will be of a standard which will attract not only the inhabitants of the city, but the public of the West Riding generally. It is the desire of the promoters that the hearty support of the committees or directors controlling all electricity supply undertakings in the West Riding should be obtained with a view to ensuring the success of the Exhibition. It is hoped that exhibits of textile and printing machinery, machine tools, laundry machinery, &c., will be displayed under working conditions driven by electric motors, and every facility will be given exhibitors for making such displays.

All persons and firms interested in the Exhibition should apply for particulars to Messrs. Freer & Howard, Ltd., of Ludgate Chambers, 30-32, Ludgate Hill, London, E.C.; and Mr. Thomas Roles, city electrical engineer, Bradford, will be pleased to give any information which may be required with regard to the venture.

We recommend all manufacturers to apply for a copy of the prospectus. It gives the following "Classification of Exhibits":—

1. Appliances and Apparatus for the Generation, Transmission, Transformation and Conversion of Electrical Energy.
2. Switches and Regulating and Control Gear.
3. Direct and Alternating Current Motors.
4. Electric Fittings for House, Shop, Office, Factory and Street Lighting.
5. Electric Lamps of all descriptions.
6. Electric Stoves and Cooking Apparatus.
7. Electric Water Heaters, Circulators and Geysers.
8. Electrically-operated Domestic Appliances.
9. Fans and other Appliances for Ventilating, Refreshing or Cleansing the air.
10. Vacuum Cleaning Plants.
11. Electric Hoists and Lifts of all kinds.
12. Textile Machinery.
13. Printing, Laundry, Engineering, Wood-working, Colliery, Mining and Quarrying Machinery.
14. All other kinds of Apparatus for the Utilisation of Electricity.

The Exhibition will be open from 11 a.m. to 10 p.m. daily for 17 days, and the charge for admission will be 6d. Current required by exhibitors on their stands will be supplied by the Corporation at ¾d. per unit. Exhibitors will have the privilege of issuing their own invitation tickets to clients or friends. There will be no stalls permitted dealing in cheap articles of ornament or amusement having no special reference to the objects of the Exhibition.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The Metrohm.

We illustrate in fig. 1 a new pattern of insulation testing set which has been put on the market by Messrs. Everett, Edgcumbe & Co., Ltd., of Collindale Works, Hendon, under the name of the "Metrohm."

The instrument consists, as will be gathered from the figure, of an ohmmeter and generator combined in one case. The generator in the standard pattern gives 500 volts, and the instrument is scaled up to 50 megohms. In spite of the very modest dimensions of the case, the scale is nearly 5 in. in length and of extreme openness, and the indications are entirely independent of the generator pressure. Two important features of the Metrohm are its small size and light weight. It measures 7 × 8 × 9 in., and weighs but little over 16 lb., complete with generator. The latter is of special construction, giving a very large output with minimum weight. The armature runs in robust ball-bearings, and is provided with a "free-wheel" attachment to prevent damage through rough handling.

Amongst minor improvements may be mentioned the boldness of the pointer and scale, the "snappiness" of the reading, whereby considerable time is saved, and the fact that when the case is locked, not only is the glass protected from damage, but it is quite impossible for any unauthorised person so much as to turn the generator handle. As a result, the instrument can safely be left about without any fear of its being tampered with. For ease of carrying, a shoulder strap can be provided, or, if desired, a leather carrying case. Besides the standard range of 50 megohms and 500 volts, a number of others, such as 1,000 megohms at 1,000 volts, can be supplied, and instruments adapted for workshop or switchboard use are constructed for the measurement of resistances of almost any value.

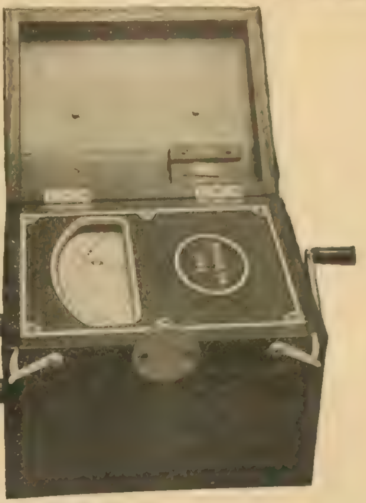


Fig. 1.—The "Metrohm."

Motor Drive in Laundry.

We illustrate below a large calendering machine at Messrs. Connell's Laundry, London, which is driven by a Vickers 5-h.p. 480-volt 600/840-r.p.m. motor, and controlled by Vickers switchgear. The latter consists of a semi-enclosed double automatic starter and shunt regulator combined, to vary the speed of the motor from 600 to 840 r.p.m.

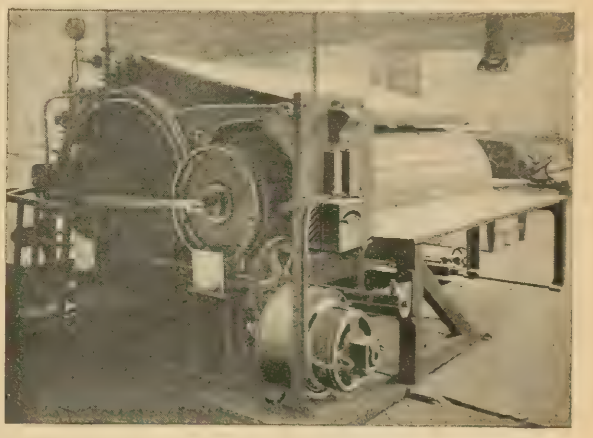


Fig. 2.—Motor-Driven Calender with Safety Gate.

It is of particular interest to note in connection with this installation that a special gate is fitted across the rollers which prevents the hands of the girl operators from being drawn into and crushed by the rollers. Immediately on the slightest pressure, the gate trips a main switch which short-circuits the no-volt coil of the motor starter, and, at the same time, causes a brake to act on the motor shaft. This appliance works admirably, and we understand that what might have proved serious accidents have been prevented by the use of the safety gate. The safety device was designed and constructed entirely by Messrs. Tyler and Freeman, of 20, New Bridge Street, E.C., who were also the contractors for the electric driving installation in question.

Flexible Containers for Accumulators.

We have received from the New York—Hamburg India-Rubber Co., Ltd., of 89, Milton Street, E.C., samples of their containers and separators for storage cells, which are made in all qualities. The special features of the containers are their remarkable toughness and pliability; we have gone so far as to stand on the side of one of them at the open end—the weakest position; the box was, naturally, somewhat flattened, but was easily restored to its original shape, and is none the worse for this brutal treatment. The advantage claimed is that these boxes are immune from breakage by vibration or rough handling, while they are resistant to acids. The separators are of "hard rubber," and appear to be of very good quality.

Pyrometric Apparatus.

Mr. R. W. Paul, of New Southgate, London, N., has recently issued section M of his big catalogue, dealing with apparatus for temperature measurements of all kinds. Thermoelectric, resistance, and radiation pyrometers are described, each in various forms and for divers purposes. The Unipivot galvanometer usually forms part of the outfit, and is illustrated in the smaller wall pattern in fig. 3, with a scale reading in degrees, for use with a thermoelectric couple. The couples are made of different metals and alloys depending upon the range of temperature to be dealt with; Eureka rod couples have an exposed junction of very robust construction, consisting of a pure iron tube welded to an internal rod of Eureka metal, and can withstand temperatures up to 1,200° F. To avoid the necessity of correcting the readings for the temperature of the cold end of the couple, the indicator can be fitted with Darling's compensator, as shown in fig. 4, which consists of a spiral B of two strips of metal welded together, and automatically adjusts the pointer P of the indicator by rotating the control spring S of the coil C. This correction becomes important in the measurement of low temperatures.

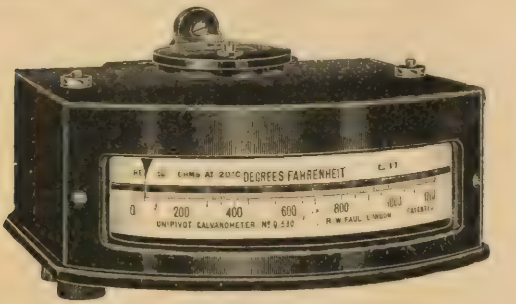


Fig. 3.—Unipivot Temperature Indicator, Pattern P.

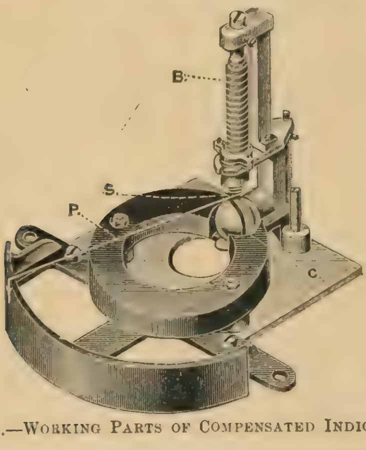


Fig. 4.—Working Parts of Compensated Indicator.

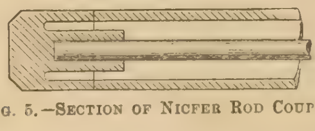


Fig. 5.—Section of Nicfer Rod Couple.

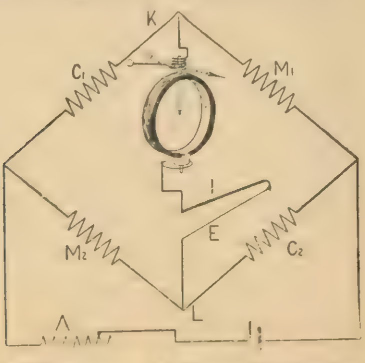


Fig. 6.—Connections of Electrical Compensator.

For temperatures up to 1,800° F. Nicfer couples are used; the hot junction in this case consists of a Eureka rod welded into a cap of Nicfer alloy. The cap is welded to a Nicfer tube, and as will be seen in fig. 5, efficiently protects the junction.

Iridio-platinum and rhodio-platinum couples carry the temperature range up to 2,400° F. and 2,900° F. respectively; with these, in order to allow of the use of a shorter and less expensive couple, an electrical automatic compensation system is employed, as shown in fig. 6. The arms of the Wheatstone bridge C_1 C_2 are of copper, M_1 M_2 of manganin; the current through the latter from the battery is limited by the resistance A to 0·1 ampere.

The galvanometer circuit includes the couple I E, and is joined across the points K L. All the resistances are compactly fitted in the thermo-couple connector. When the connector is at the standard cold-junction temperature (20° C.), no battery current flows through the galvanometer, but when the temperature of the cold junction departs from this value, a small out-of-balance current flows through the galvanometer and exactly compensates for the error.

In resistance thermometry the Harris indicator renders measurement as convenient and easy as in the thermoelectric system; various patterns are made, to which we have not space to refer in detail, nor can we deal with the alarms, recorders, accessories, &c., described in this interesting list.

Commutator Grinders.

The accompanying illustration shows a "long-snout" commutator grinder made by the Witton-Kramer Electric Tool and Hoist Co., Ltd., Witton, Birmingham, for whom the General Electric Co., Ltd., of 67, Queen Victoria Street, London, E.C., are the sole selling agents; the grinder is in position for grinding the commutator of a 750-kw. "Witton" rotary converter. The method of fixing the grinder is very simple; the bolts of the bearing cap are slackened and a pair of bent angle irons inserted between the bearing cap and the pedestal, the bolts being then screwed down again tightly to hold the angle irons, which are cut away to receive the bolts. The slides for the grinder are bolted on the rigid horizontal platform formed by the two angle irons. On 50-cycle rotary converters the distance between adjacent brush sets is small, so that it is necessary to remove one set of brushes; in the illustration a second set has been removed to give a clear view of the grinding wheel. With a machine of this description it is not unusual, when occasion demands it, to undertake the grinding with the generator on load.

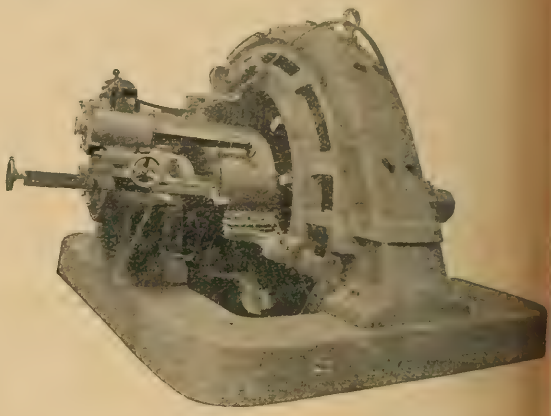


Fig. 7.—"Witton Kramer" Long-Snout Grinder in Use.

The Hemming Conduit Grip.

A new patent grip for ensuring the electrical continuity of steel conduit has been introduced by Messrs. Hemming Conduit Grip, Ltd., of 174, Corporation Street, Birmingham, and is illustrated in fig. 8. The essence of the device consists in the steel screw set in a boss on each way; as shown in the figure, a portion of the screw is cut away when boring the socket; after the tube has been inserted, a half-turn of the screw brings the uncut part of the thread into play, the sharp edges cutting into the tube and the threads firmly gripping the latter. At the same time the head of the screw comes home on the fitting, making a tight joint. The screw can be turned with either a spanner or a screw-driver, and a mark on the head shows where the thread is cut away, rendering it an easy matter to release the tube if desired at any future time. Tests show that the electrical conductivity of the joint is as good as that of the tube. The fittings are machined, with the screws in position, in the makers' works, and there are no loose parts.

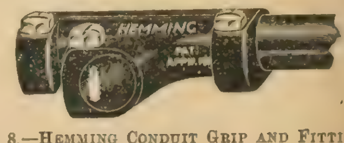


Fig. 8.—Hemming Conduit Grip and Fitting.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AUSTRALIA.—A recent issue of the Board of Trade Journal states that advices to the Commercial Intelligence Branch of the Board of Trade from Australia emphasise how important it is that British firms exporting goods to the Commonwealth should comply strictly with every detail of the Australian Customs Regulations. Of primary importance to United Kingdom manufacturers are (1) the Regulations as to the Certificates of Origin which accompany goods, in order that they may be entitled to entry under the Preferential Tariff, and (2) The Commerce (Trade Descriptions) Act, 1905, and the Regulations issued thereunder.

(1) With regard to the certification of goods, H.M. Trade Commissioner for Australia (Mr. G. T. Milne) states that in view of complaints he has received, it is desirable that the attention of manufacturers and others making shipments to the Commonwealth should be called to the fact that the slightest informality in the matter of observance of the Regulations may involve delay in the delivery of goods.

For convenience of reference a copy of the form of certificate as at present prescribed is appended. The certificate is to be written, printed, or stamped on the invoice, or, attached thereto, and shall, in the latter case, show such particulars of the goods as will satisfy the Officer of Customs that the certificate and invoice refer to the same goods.

Form of Certificate to be Produced with Entry and Invoices of any Imported Goods Claimed to be Entered under the Preferential Tariff as being the Produce or Manufacture of the United Kingdom.

I (*full name of person signing the certificate*), the ("*manufacturer*" or "*supplier*" *as the case may be*) of the articles included in this invoice, amounting to £ , and dated of goods supplied to (*name of purchaser*) do hereby declare that I have the means of knowing and I hereby certify as follows:—

1. That the said invoice is in all respects true and correct;
2. That every article mentioned in the said invoice has been either wholly or partially produced or manufactured in the United Kingdom;
3. As regards those articles only partially produced or manufactured in the United Kingdom—
   - (*a*) That the final process or processes of manufacture have been performed in the United Kingdom.
   - (*b*) That the expenditure in material of British production and (or) British labour (*calculated subject to the qualification hereunder*) in each and every article is not less than one-fourth of the factory or works cost of such article in its finished state;
4. That in the calculation of such proportion of British production or British labour none of the following items has been included or considered:—Manufacturer's profit or the profit or remuneration of any trader, agent, broker, or other person dealing in the article in its manufactured finished condition; cost of outside packages or any cost of packing the goods thereinto; any cost of conveying, insuring, or shipping the goods subsequent to their manufacture;

*5. With regard to any bottles, flasks or jars being containers of goods mentioned in the invoice, that such bottles, flasks or jars are of British manufacture, and if purchased from bottle exchanges have distinctive marks or features which enable me to certify to their British origin.

Witness........................... Signature...........................

Dated at this day of 19 .

*If Clause 5 cannot be certified to, the certifier should strike it out.

Certificate of Authorised Agent.—When the certificate is signed by some person *on behalf of* a manufacturer or supplier such person must state that he is duly authorised to do so. In such case the certificate shall be in the following form:—

I (*full name of person signing the certificate*) hereby certify that I am (*insert words "partner," "manager," "chief clerk," or "principal official," giving rank, as the case may be*) of (*name and address of manufacturer or supplier*) the ("*manufacturer*" *or* "*supplier*" *as the case may be*) of the articles included in this invoice amounting to £ , and dated , of goods supplied to , and do hereby declare that I am duly authorised to make and sign this certificate on behalf of the said (*name of manufacturer or supplier*), that I have the means of knowing and do hereby certify as follows:—(*then as in the Form above.*)

The following additional regulations should be noted:—

(1) Amendment of Preferential Certificate allowed in certain cases.—In the case of goods wholly produced or manufactured in the United Kingdom, there is no objection to manufacturers eliminating clauses 3 (*a*) and (*b*) and 4 from the declaration, and altering clause 2 to read:—

> "That every article mentioned in the said invoice has been wholly produced or manufactured in the United Kingdom."

In cases where goods are put up in bottles, flasks, or jars, clause 5 of the present declaration must be included, and would then become clause 3.

In the case of manufacturers who do not deal in goods put up in bottles, flasks, or jars, there is no objection to their eliminating clause 5 and the footnote from the declaration printed on the invoices.

(2) Preferential Treatment of Goods Manufactured wholly in the United Kingdom. Goods in which the *whole* of the manufacturing processes are performed in the United Kingdom are entitled to preference, notwithstanding that the proportion of the value produced by British labour is less than that prescribed for goods partially manufactured in the United Kingdom.

(3) Direct Shipment of Goods from the United Kingdom for Entry at Preferential Rates.—It is to be observed that in order to entitle goods to entry at preferential rates they must be shipped *direct* from the United Kingdom to Australia. Goods are however treated as shipped direct, even though they are transhipped at a port outside the United Kingdom, provided that they are not landed at such port for any other purpose than for transfer to another vessel.

Particular attention is directed to the necessity of having the signature to the certificate witnessed. The witness need not necessarily be a magistrate, notary, or other public official, but may be any person competent to sign as a witness to signatures on ordinary business documents.

In instances where manufacturers' invoices accompany suppliers' invoices, and it is clear from the marks and numbers or other evidence on the documents that the manufacturer was aware the goods were destined for Australia, the Preference certificate must be made on the manufacturers' invoice, if entry is claimed under the United Kingdom Preferential Tariff.

(2) With regard to the Commerce Act special regulations are in force regarding certain goods which are not of interest to readers of the Electrical Review, but it is well to point out that in all cases where goods of any kind are marked in any way which may lead it to be supposed that they are the product of a country other than the actual country of origin, the goods are liable to be held in bond until they are properly marked, and in cases of wilful intent to be forfeited. Care is therefore necessary to see that goods are properly marked in accordance with the requirements of the Act, a copy of which may be seen at the Board of Trade, 73, Basinghall Street, London, E.C.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

13,374. "High-frequency current rectifier for rectifying high-frequency wave impulses in a wireless receiving circuit." C. S. Lenz. June 2nd.

13,383. "Telephone receivers." C. A. West. June 2nd.

13,410. "Telephone systems." M. S. Conner and R. E. Robinson. June 2nd.

13,471. "Telegraph key." Sterling Telephone and Electric Co., Ltd., and A. S. L. Kopp. June 2nd

13,472. "Crystal and like detectors." Sterling Telephone and Electric Co., Ltd., and T. D. Ward-Miller. June 2nd.

13,474. "Rotary spark gap." Sterling Telephone and Electric Co., Ltd., and T. D. Ward-Miller. June 2nd.

13,497. "Arrangements for regulating timepieces and the like by wireless signals." E. Belin. June 3rd. (Complete).

13,520. "Radiating system for signalling by electric waves from aeroplanes." Signal Ges.m.b.H. June 3rd. (Addition to 736/13, and 23,728/13). (Complete).

13,523. "Telephone exchange systems." Western Electric Co., Ltd. June 3rd. (F. T. Woodward, Belgium). (Complete).

13,524. "Automatic switching mechanisms." Western Electric Co., Ltd. June 3rd. (F. T. Woodward, Belgium). (Complete).

13,529. "Electro-magnetic devices for imparting reciprocatory motion to objects." E. Bachelet. June 3rd.

13,538. "Electric welding and fusion deposition of metals." A. P. Strohmenger. June 3rd.

13,541. "Manufacture of incandescent electric lamps." C. Gladitz. June 3rd.

13,549. "Manufacture of metal wire." British Thomson-Houston Co., Ltd. June 3rd. (General Electric Co., United States).

13,553. "Vehicle-lighting plants working with dynamo and storage battery." Ges. für Elektrische Zugbeleuchtung m.b.H. June 3rd. (Convention date, July 11th, 1913, Germany). (Complete).

13,554. "Vehicle-lighting plant working with dynamo and storage battery." June 3rd. Ges. für Elektrische Zugbeleuchtung m.b.H. (Addition to 13,553/14. Convention date, April 28th, 1914, Germany). (Complete).

13,566. "Hermetically-sealed electrical apparatus." British L. M. Ericsson Manufacturing Co., Ltd., and J. W. Ellett. June 4th.

13,567. "Intercommunication telephone systems." British L. M. Ericsson Manufacturing Co., and A. Brookes. June 4th. (Addition to 22,253/12). (Complete).

13,575. "Telephony and telegraphy." A. T. M. Johnson, F. H. Varley, and A. C. N. Fry. June 4th.

13,579. "Thermical warmer for electrically heating induction pipes and carburettors of motor spirit-driven engines." J. P. Goody. June 4th.

13,589. "Electrode carriers for electrolytic apparatus." Soc. Anon. L'Oxhydrique Française. June 4th. (Addition to 18,818/13. Convention date, June 25th, 1913, France). (Complete).

13,591. "Dynamo and system of electric lighting of trains and the like." H. Leitner. June 4th.

13,605. "Spark-plugs." S. C. Stockdale. June 4th. (Complete).

13,624. "Electric lamps for motor-cars and other road vehicles." J. C. Wood. June 4th.

13,626. "Protection of electrical distributing or current-carrying systems." F. Coates, H. W. Clothier, and A. Reyrolle & Co., Ltd. June 4th.

13,669. "Electric starters and lighting and battery charging systems applicable to motor vehicles and the like." W. H. Glaser, and H. R. Lloyd. June [illegible]

13,674. "Telephone transmitting-apparatus." W. K. L. Dickson. June 5th.

13,699. "Apparatus for electroplating wire and the like." V. F. Feeny. June 5th. (Fabrik Elektrischer Zünder G.m.b.H., Germany). (Complete).

13,706. "Centrifugal governors for the internal-combustion engines of vehicles having electric power transmission mechanism." Geb. Sulzer. June 5th. (Convention date, September 16th, 1913, Germany). (Complete).

13,707. "Devices for putting up and taking down electric lamps." A. H. [illegible] and R. [illegible] Alderman. June 5th. (Complete).

13,709. "Starting-apparatus for alternating-current motors of the slip-ring induction type." W. T. M. Ayres. June 5th.

13,713. "Mica-separating machines." A. G. Elliott. June 5th.

13,715. "Electro-magnetic locking devices." L. Cadenel. June 5th. (Convention date, June 10th, 1913, France). (Complete).

13,752. "Automatically-illuminated advertising-apparatus." Deutsche Effektlicht-Reklame Ges.m.b.H. and G. Wilpert. June 6th.

13,759. "Electric lamps." British Thomson-Houston Co., Ltd. June 6th. (General Electric Co., United States).

13,771. "Apparatus for electro-plating iron and steel plates with other metals." S. O. Cowper-Coles. June 6th.

13,784. "Electric insulators." P. Raffi. June 6th. (Convention date, September 22nd, 1913, Italy). (Complete).

EXPIRING PATENTS, TAKEN OUT IN 1900.

(*Concluded from page* 1016.)

17,262. "Electricity Measuring." Wright, A., and Reason Manufacturing Co. September 28th. Mercury voltameters are provided with platinum cathodes placed lower than the anodes, and the anodes may be partly platinum. The invention may be applied to the meters described in Specifications Nos. 2,222, 5,046, 5,593, and 9,746, A.D. 1900. In one arrangement the anode is mercury in an annular trough. In another form, the anode consists of mercury in a pocket provided with a feeding-bulb and of a roll of platinum foil, carried by a connecting wire, and partly above the mercury. The vessel is nearly filled with an electrolyte such as mercurous-nitrate solution, and sealed.

17,642. "Electricity Measuring." Duddell, W. du B. October 4th. Drawings to Specification. A continuous or alternating current is passed through a stationary non-inductive resistance, situated near the movable thermo-couple of a radio-micrometer, the deflection of which is a measure of the heat developed in the resistance, and of the current.

18,284. "Electric Transformers." Berry, A. F., and British Electric Transformer Manufacturing Co. October 13th. Relates to improvements upon the transformers described in Specifications Nos. 2,801 and 9,457, A.D. 1897. The core or magnetic circuit is formed of groups of iron sheets. Each group, when the sheets are assembled, is approximately sector-shaped, the plates in the centre being widest, and the others being shorter to give a stepped edge.

18,617. "Electric Switches." British Thomson-Houston Co. (Hewlett, E. M.). October 18th. Relates to switches for high-potential currents operated by a motor which is controlled from a safe distance. An arrangement is described for breaking a three-phase current.

18,865. "Wireless Telegraphy." Fleming, J. A., and Marconi's Wireless Telegraph Co. October 22nd. Relates to apparatus for the production of electric oscillations as employed in wireless telegraphy. An arrangement at the transmitting station is described in which an alternating generator has its circuit connected to the primary of a transformer through a double mercury cup switch, of which the bridge is mounted on a lever forming the rocking armature of two electromagnets. The magnets are in circuit with the front and back contacts of a key of which the circuit includes brushes rubbing on a metal ring on the generator shaft.

18,921. "Electric Furnaces." Benedicks, G. October 23rd. An induction furnace, for smelting or heating ores, metals, and the like, has an annular chamber formed by refractory walls surrounding a cylindrical space, in which is situated a coil carrying alternating current to induce heating-current in the substances in the chamber, or in a conductor in contact with these substances. The coil surrounds a part of an iron core.

19,451. "Electric Condensers." Mansbridge, G. F. October 30th. Condensers are made with paper, coated on one or both sides with metal in a finely-divided condition.

19,659. "Electrodeposition." Szirmay, L., and Kollerich, L., von. November 2nd. To coat iron and steel goods by electrodeposition with zinc, an electrolyte is employed consisting of a mixture of zinc sulphate, "magnalium" sulphate, and dextrose. The anode is of pure rolled zinc, the temperature of the bath 18 deg. C., the current density 100 amperes per square metre of cathode surface, and the tension 4 to 4½ volts. The bath is kept agitated during deposition. Polarization is prevented by this process.

19,674. "Railways, &c., Electric." Lake, H. H. (Brown, W. M.). November 2nd. Relates to electric railways and tramways on a surface contact system with switches operated by magnets on the vehicle, and cannot be well described without reference to drawings.

19,988. "Railways and Tramways." Sykes, W. R., Johnson, A. H., and Cooke, C. J. November 7th. Fishplates are made in two parts, each held to the rails by ordinary fish-bolts, and held together by bolts through lugs. Insulating-material is placed between the ends of the rails and plates, and insulating collars and washers protect the bolts. Various forms are described.

20,507. "Gas and Like Engines." Hall, R. F. November 14th. The insulator in a sparking plug comprises a number of mica discs placed on the conductor and pressed together by a nut. The mica is covered with a suitable varnish, such as shellac varnish, and subjected to high temperature for a considerable time; it is then turned to a taper in the lathe to fit the plug which may carry the other sparking point. Modifications are described.

20,576. "Wireless Telegraphy." Fleming, J. A., and Marconi's Wireless Telegraph Co. November 14th. Relates to the transmitting-apparatus in wireless telegraph systems when the generator consists of an alternator working through a high-tension transformer. The secondary circuit of the transformer includes a condenser and the primary of an oscillation transformer, but is bridged by a spark gap. The sparks normally form a short circuit, and the interruptions are obtained by blowing out the spark by means of a jet of compressed air. The various circuits are tuned to give electric resonance.

21,216. "Carbon." Justice, P. M. (International Acheson Graphite Co.). November 23rd. Relates to a method of graphitizing electrodes and other carbonaceous articles, and consists in subjecting them in an electric furnace to a sufficiently high temperature and for a sufficient time to convert a greater or less proportion of their amorphous carbon into graphite, the electrodes or articles being embedded in a relatively low-conducting material and arranged in piles so that the flow of electric current is transversely to their length or greatest dimension. The piles are also separated by layers of low-conducting material.

21,629. "Converting Electric Currents." Duddell, W. du B. November 29th. Relates to means for converting direct into alternating currents, such alternating current being so symmetrical in character as to be utilized for reinforcing varying currents, such as in telephone circuits, &c. When a direct current is sent through a circuit containing a conductor such as an arc lamp, and the resistance is varied, an alternating or varying current may be obtained in a shunt circuit. Alternating currents of different character may be produced and used in wireless telegraphy or for producing a musical arc, for lighting purposes, etc.

21,879. "Lighting Theatre Stages." Digby, T. J. December 3rd. Gradual variations in the colour or intensity of the light projected by a single electric arc or similar apparatus upon theatre stages are effected by the use of frosted screens mounted in frames and applied like photographic shutters, in combination with the ordinary transparent screens of different colours. A method of making such screens is described.

22,126. "Wireless Telegraphy." Fleming, J. A., and Marconi's Wireless Telegraph Co. December 5th. Relates to a system of transmission in wireless telegraphy, such as described in Specification No. 20,576 A.D. 1900. A second primary of a regulating-transformer is arranged in the alternator circuit. The regulating-transformer transforms down, and its secondary circuit is provided with a key and two resistances of different values, each having a signalling-key.

22,372. "Treating Wool, Etc." White & Co., J. G., and White, J. G. December 8th. Relates to a method and apparatus for discharging or neutralizing electricity developed or collected in wool or other fibres during the process of manufacture. In one arrangement, one terminal of the secondary circuit of an induction coil is connected with a comb or series of metal points arranged in proximity to the wool. Static electricity may be discharged on to the fibrous material, or the material may be passed subsequent to the spinning operation in front of a Crookes tube.

23,389. "Dynamo-Electric Machines." British Thomson-Houston Co. (Lunt, A. D.). December 21st. Relates to the regulation of dynamo-electric machines, and more particularly to the regulation of rotary converters receiving direct current and delivering alternating current, which machines are liable to wide variations of speed owing to variations in the armature reaction. The field strength of the converter is automatically regulated by means which are responsive directly to variations in the amount of lagging or leading current in the alternating-current circuit of the machine.

23,774. "Producing Numerals, Letters, &c. by Electric Lamps." Johnson, W., and Makin, J. December 29th. Letters, numerals, and words, &c., are formed by electric lamps, which are mounted on a board within square or diamond-shaped cells formed by interlocking-strips which serve as reflectors. Switch gear for lighting certain lamps to form numerals, &c., is described.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

16,647. Railway Safe-running Devices. A. R. Angus. February 17th (February 17th, 1913).

1913.

8,866. Means for Controlling the Supply of Fuel to, and the Ignition in, Internal Combustion Engines on Motor Vehicles. M. J. W. Pike. April 15th.

8,956. Incandescent Body for Electric Glow Lamps and Process for the Manufacture of such Bodies. A. Just. April 16th. (April 18th, 1912).

10,105. Apparatus for Singeing the Hair by Electricity. J. H. Watkins. April 30th. (October 29th, 1913).

11,503. Mariners' Compasses. Kelvin and James White, Ltd., M. B. Field and D. Renfrew. May 17th. (Cognate Application, 14,293/13).

11,533. Regulation of Lifts, Elevators and the like. D. Tessieri. May 17th.

11,590. Graded Service Automatic or Semi-automatic Telephone System. H. Baron. (Heimann). May 19th. (Addition to 11,261/12).

11,878. Optical Lantern with Gas Evacuating Device. F. G. Huber. May 21st.

11,886. Commutators for Dynamo-electric Machines. C. Zenk. May 21st. (May 21st, 1912).

11,888. Automatic or Semi-automatic Graded Service Telephone System. H. Baron. (Heimann). May 21st.

11,998. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). May 22nd.

12,168. Coil Particularly for Electrical Purposes, and Method of and Apparatus for Manufacturing the Coil. H. Wade (Leeson). May 24th.

12,527. Means for Indicating or Recording, or Indicating and Recording when a Storage Battery has been Charged or Discharged to a Desired Extent. R. Rankin and Electrical Power Storage Co. May 29th.

13,588. Sunk Electric Switches, Wall-sockets, and Brackets. J. B. Meiklejohn. June 12th.

13,989. Construction of Electrical Elements for Cooking Purposes. R. F. Venner. June 17th.

14,112. Electric Switches. P. S. Turner. June 18th.

14,631. Microphones. International Electric Co. (Akt. Ges. Mix & Genest). June 24th.

15,550. Protective Devices for Electric Distribution Systems. British Thomson-Houston Co. (General Electric Co.). July 5th.

15,757. Processes of Producing Boron Suboxide. British Thomson-Houston Co. (General Electric Co.). July 8th.

16,054. Regulating Systems of Electrical Distribution. British Thomson-Houston Co. (General Electric Co.). July 11th.

16,299. Refractory Fibrous Material and the Process of making the same. British Thomson-Houston Co. (General Electric Co.). July 15th.

16,964. Protective Attachment for Telephone Mouth-pieces and Ear-pieces. S. T. Richardson. July 24th.

16,969. Telegraphic Receiving Apparatus Adapted to Actuate a Perforator or Analogous Device. Eastern Telegraph Co., & J. S. Jenkins. July 24th.

19,085. Boxes for Electrical Contacts. J. Bonham. August 22nd.

19,755. Registering Device for Mounting Stereo, Electro, and like Printing Plates. E. W. J. Barnett. September 1st.

20,270. Device applied to Submarine Sirens for Producing Short Signals in rapid succession, especially Morse Signals. Signal Ges. September 8th (October 11th, 1912).

22,319. Arc Light Carbons. H. Ayrton. October 3rd. (Cognate Application, 7,792/14).

23,570. Synchronised Electrically-controlled Clocks. C. E. O'Keenan. October 17th. (October 25th, 1912).

23,766. Adjustable Arm or Support for Chairs, Tables, Beds, and the like, Applicable also for Supporting Telephones, Typewriters, and Similar Appliances, and for other purposes. W. Irwin. October 21st.

25,834. Electric Motor-driven Vehicles. K. Von Kando. November 11th.

25,851. Safety Signalling and Controlling Devices for Railways. D. A. Cooper. November 11th. (Convention date not granted).

26,388. Keyboard Musical Instruments with Electro-magnetically Vibrated Strings. R. Poetzelberger. November 17th. (November 18th, 1912).

26,802. Electrostatic Separators for Treating Inflammable or Explosive Materials. J. Kraus. November 21st. (October 27th, 1913).

26,906. Automatic Regulating Devices for Dynamos or other Electric Machines. Robert Bosch (Firm of). November 22nd. (November 1st, 1913).

27,645. Attachments for Moving-picture Apparatus. A. Szeliga. December 1st.

28,532. Lighting-plant for Studios and the like. J. B. McDowell. December 10th.

29,284. Electric Lamp for Advertisements, Signals, or the like. S. Klein. December 19th. (December 20th, 1912).

29,821. Electric Switches. S. C. Davidson. December 27th.

THE

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LIGHTNING AND TREES.

THE prevalence of thunderstorms during the past fortnight, and the alarming number of fatalities caused by lightning, have drawn public attention to the danger of sheltering under trees to avoid the downpour which usually accompanies the fire of Heaven.

During the remarkable storm which visited South London on Sunday, 14th inst., no fewer than seven persons were killed on Wandsworth Common alone, four of the victims being little children. A Mr. West and his fiancée, together with a Mr. Betts and his daughter of 3½ years, were standing under a poplar tree, Betts holding an umbrella in one hand, while he held his child with the other, and all were knocked down and lost their lives, although West did not expire until he had been taken into the Hospital near by. A Mrs. Munday was wheeling a perambulator with a baby, but was not close to the tree trunk, and although she was knocked down, the child was uninjured.

A young chauffeur, who was standing under a tree within 20 yards of the spot where the other three children were playing, said the fatal flash also struck him. He was closely questioned by the Coroner with the object of ascertaining his sensations, and amongst other questions was the following:—

"Were you wearing rubber soles?—I had a pair of rubber heels on my shoes.

"Coroner: I daresay that saved you."

Our readers will, no doubt, appreciate at its proper worth the worthy Coroner's electrical knowledge!

The Wandsworth Common keeper was asked by the Coroner whether it was in his experience dangerous to stand under trees. He replied that it was not very dangerous if there was plenty of earth round the base of the tree and if persons did not stand too near the trunk. Personally, he often stood under trees, and had never been struck. He usually warned people about the danger of standing under trees.

The Coroner, in summing up, remarked that he did not know that one could learn any lessons in the case, but it was certainly significant that Mrs. Munday was not standing close to the trunk of the tree, but at some distance away, while by her side was a baby in a perambulator; the baby was not injured, but the woman was.

Practically day after day since this lamentable occurrence the newspapers have published instances of fatalities and injuries in various parts of England and abroad, and the lesson to be learnt is the very old lesson which should be instilled into the mind of every school boy and girl by every school teacher in the kingdom, that everybody, however small his instinct of self-preservation, should avoid the vicinity of trees during a thunderstorm and allow himself to be drenched on the road rather than offer his life as a sacrifice to the lightning, for, as M. Camille Flammarion, the astronomer, remarks, the oak's robust trunk, or that of the poplar, elegantly plumed with its graceful foliage, may be the altar on which the sacrifices in honour of Jupiter are made. The lesson thus instilled into the youthful mind could in turn be imparted by the children to their parents who, in rural districts, are certainly as ignorant as their own offspring.

In our issue of last week, on page 1041, we published two tables showing the frequency with which different trees were struck, and we are now able to supplement these with others. M. Flammarion collected during recent years the following list of different kinds of trees, with the record of the number of times each species had been struck by lightning within a given period :—54 oaks, 24 poplars, 14 elms, 11 walnuts, 10 firs, 7 willows, 6 pines, 6 ashes, 6 beeches, 2 limes, 2 apples, 1 mountain ash, 1 mulberry, 1 alder, 1 laburnum, 1 acacia, 1 pseudo-acacia, 1 fig, 4 pears, 4 cherries, 4 chestnuts, 3 catalpas, 1 orange, 1 olive, 0 birch, 0 maple.

The following table gives data based on the number of trees of different species struck by lightning during a series of recent years in the forests of Lippe, in Germany :—

Species of trees.	Oak.	Fir.	Pine.	Beech.	Larch.	Ash.	Birch.
Total struck ...	159	59	20	21	7	5	4
Mean liability ...	57	39	5	1	—	—	—

In calculating the liability, allowance is made for the relative numbers of the different species, and the liability of beech to be struck is treated as unity throughout. Oaks, poplars and pear trees, and we may add from our own experience, elms, are especially liable to be struck, while beech is exceptionally safe.

Height incontestably accounts for a great deal. There is but little doubt that, in the case of a clump of trees standing in the middle of a plain, lightning will, in the majority of cases, select the tallest, although this is not an absolute rule. The qualities of trees as conductors, the degree of moisture in the soil in which they stand, the character of their foliage and of their roots—all are important factors.

Numerous experiments made with the view of ascertaining the resistance offered to the electric spark by, say, pieces of beech and oak, exposed lengthways to the spark of a Holtz machine have shown that oak was pierced after one or two revolutions of the machine, whereas beech required a dozen or twenty, and black poplar and willow were penetrated by a few revolutions. There are innumerable examples of the imprudence of taking shelter from rain under trees during a thunderstorm, but if we have to take such refuge, give us a beech tree for preference, with the birch a close second.

In these days, indeed, the beech is believed to go unscathed, although we have quoted examples of its occasionally being struck, and in the State of Tennessee, in the United States, the opinion is so deeply rooted, that beech tree plantations are often resorted to as a refuge in times of storm, although, as we have shown, it would be a mistake to trust them absolutely.

Workers in the fields, too, have often been warned, but apparently to no purpose, of the dangers to which they expose themselves by carrying their implements with the points in the air. Carrying forks over their shoulders, putting scythes on carts with their points in the air have caused many deaths, and the casualties caused by open umbrellas are numerous and well authenticated.

Finally, to close this all too brief article—for one could write pages on this fascinating subject—we would say that, without allowing one's self to get lightning on the brain, certain precautions during a storm should never be forgotten :—

First and foremost, do not get under a tree, but if you choose to take the risk be careful to select the shortest amongst a clump; but *in any case stand well away from the trunk*. Do not run in a storm, for movements of the air have the effect of preparing an excellent route for lightning. Always close doors and windows in a house to avoid a draught, and keep well into the middle of the room. This reference to the house is mentioned as it concerns the number of people who are annually killed by lightning. The figures are largely influenced by the fact that persons employed indoors have much less chance of being struck by lightning than those engaged out of doors. As emphasising this fact, data obtained between 1852 and 1880 go to show that only 104 women were killed by lightning, as against 142 men.

We trust that the day is not far distant when a careful and systematic study will be carried out each year, preferably in the summer, of the caprices and vagaries of thunder and lightning.

Technical Training. The training of the rising generation is a subject of infinite complexity, resulting from the complicated conditions of modern civilisation, which call for an endless variety of courses of instruction, ranging from the elementary steps common to all classes, to the highly-developed curricula of the Universities and Technical Colleges. Between these wide limits, unfortunately, there are many gaps in our educational system, and nowhere is this more manifest than in the stage between the elementary schools and the colleges. The unskilled workman and the trained superintendent are well provided for, but, except in certain industries, little provision has been made for the skilled artisan.

The apprenticeship system, which was formerly relied upon wholly to meet the need, is quite inadequate to supply the wants of many trades, and the scientific teaching of the colleges is usually framed upon too broad a basis to take its place. In theory, the teaching of fundamental principles, and, above all, instruction in the art of thinking, should cover all requirements, but in practice insuperable difficulties are met with. The time available is limited, and many a youth who has the makings of a first-class artisan is, nevertheless, temperamentally unfitted to profit by the intellectual feast spread out before him.

The letter from Mr. R. W. Paul, which appears in our "Correspondence" columns to-day, and which, we understand, represents also the views of many of his colleagues in the instrument-making industry, draws attention to a specific instance in which the need of a trade school is clamant, and we commend the subject to the notice of the authorities who are concerned with the provision of facilities for the training of artisans, in the hope that steps may be taken towards remedying the deficiency.

Lead. The past few weeks have seen a renewal of the rather tight conditions which for months have been a recurring feature in the lead market, and by means of which the bears have been forced to pay for their temerity in attacking the article on the strength of the assumption that the position as regards forward deliveries was rapidly becoming permanently relieved. All such anticipations and theories have once again been doomed to disillusionment, the early part of June again witnessing a period of considerable strength and a very pronounced degree of scarcity as regards prompt and early delivery metal. With the price at £19 15s. and thereabouts, the temptation to American holders to sell metal for near shipment proved irresistible, and some considerable quantities were thrown upon the market, the buyers being not only dealers in London, but dealers and consumers in the provinces. Probably not less than 1,500 tons of American lead was thus disposed of last week, and and it is quite likely that the total amount marketed in this way runs into considerably larger figures, but, naturally, it is impossible to trace transactions when they are scattered all over the country. There is still a considerable premium on early lead, too big a premium for the position of the market to be regarded as thoroughly satisfactory, and if the price keeps up in this way the possibility of further considerable sales of American metal must be kept well to the fore. The big premium referred to is really the least satisfactory feature in the market, for it betrays an uncertain position, and inevitably leads to the throwing out of suggestions that the position is to a certain extent of a manipulated character. With good quantities of metal now afloat, however, it is just within the bounds of possibility that there may be some relaxing of the tightness for a time. Certainly the amount lately sold is quite enough to assist the market to an easier frame of mind, though this is not to say that there may not be a renewed squeeze as June contracts begin to mature. Compared with all other metals, lead certainly stands at an unconscionably high price, but the mere fact that this is so is not sufficient to bring about a reduction, which must rest upon different circumstances.

The statistics of the lead trade, issued by Mr. Julius Matton, are really remarkable. The exports from Spain for the first three months of the year showed a reduction of over 9,000 tons, but this deficit was made up later on, and for the five months the Spanish returns indicated an excess, compared with last year, of 4,500 tons. There was an almost similar increase from Australia. The total imports of lead into the United Kingdom for the five months showed an increase against last year of 3,200 tons, while the exports were 1,500 tons less, hence there was an excess in the quantity available for consumption of 4,700 tons. Yet the market has for months past been in a condition of insipient squeeze, a condition which seems likely to recur indefinitely, and which to a certain extent must be attributed to the Mexican position. It is little short of remarkable that the world's market should not have felt the Mexican affair more severely than it has done. Notwithstanding the cutting off of a large part of the Mexican output, the United States, which draws largely upon Mexico for its raw smelting material, has been able to ship lead freely abroad, having in the first four months of the year dispatched only about 1,000 tons less than last year—13,000 tons. Any restoration of comfortable industrial conditions in Mexico would have a rapid effect upon the world's lead market.

New Zealand Trade.

Mr. W. G. Wickham, H.M. Trade Commissioner for New Zealand, has been spending several months in London and the provinces, during which period he has been placing himself at the disposal of British firms to give information in response to inquiries. He was kind enough to give us a quarter of an hour of the last of his crowded days for a brief conversation on the position of British electrical trade in New Zealand, at the Board of Trade Commercial Intelligence Department in London. There is really no material alteration in the position of affairs since our last reference to the subject. Our readers are already aware that several hydro-electric installations of some importance are being carried out, especially that at Lake Coleridge, and there has been considerable talk regarding a proposed electrification of the tunnel railway from Littleton to Christchurch, through which heavy traffic has to pass. In regard to installation work in New Zealand, this is almost entirely carried out through private contractors. Continental competition has been successful recently in connection with the supply of insulated cable for telephonic purposes, and for house installation work cheap and inferior wiring, not of British manufacture, is found in use. As most of the structures are built of wood, it is essential that installation work should be made as safe as possible, but there appears to be a need for better regulation in this respect by the authorities. For Government purposes a stringent test is imposed in such matters, and it seems only reasonable that in other installation work public control should not be wanting. A weakness in our dealing with the New Zealand market is the unwillingness of our manufacturers to agree to the testing of material on the spot. This criticism has been offered regarding our relation with the Australian market. It is considered most important that an agent of standing and good remuneration should be engaged in whom the Home manufacturer has complete confidence, so that he can be equal to carrying full responsibility on behalf of the manufacturer for any such tests that authorities may require machinery and other goods to stand. On the whole, it may be said that while our New Zealand kith and kin are not averse to American manufactures, they have strong predilections in favour of British goods, if price and quality are right.

ELECTRIC LIGHT AND POWER REGULATIONS IN THE ROUMANIAN OILFIELDS.

From time to time, for some years past, there have occurred serious fires and explosions in many of the Roumanian oilfields, involving not only great damage to property but also loss of life on more than one occasion, and the Roumanian mining authorities have had reasonable ground to suspect that faulty electrical work or carelessness in the use of electric light and power has been responsible for some of these terrible accidents, so far as can be ascertained from subsequent investigation.

Whether any such defects have really been the proximate cause or not, one result has been at any rate the putting into force of more stringent rules and regulations by the authorities in regard to the use of electricity on the oilfields. Indeed, so alarmed were those officials in charge of the industry that conditions verging on the impossible were last year promulgated as binding on all the oil enterprises, and a considerable outcry followed from the drilling companies who showed at once that they could not possibly comply with these rules, however much they might be willing to do so.

For instance, a ministerial decision laid down the definite rule that for power purposes on the oilfields no electric motors, except those of the short circuit alternating type, should be employed, owing to the possible danger of sparks from the collectors of the ordinary three-phase motors setting fire to any gas emanating from the wells, and penetrating the motor-houses.

It had already been insisted upon that all electric motors and transformers should be installed in brick-built and iron-roofed houses or sheds under lock and key, and to this wise precaution no one could have made or did make any objection.

As for the type of motor, however, the new decision of the authorities simply led to a deadlock; no new wells could be authorised; none already authorised could be drilled; and at many already commenced, the work had to be stopped. While in theory the short circuited type might give freedom from sparks, it is obviously not a suitable motor for the varying speeds and powers required in drilling, and after most urgent representations from the various companies concerned, the whole question of electric energy in use on the oilfields was gone into by an official commission, the results being embodied in a series of regulations which are summarised in the following paragraphs, representing the latest ideas upon the question from the Roumanian Government's standpoint, though to our stricter notions of safety measures, they still allow too many loopholes for bad workmanship and faulty material.

No generating plants—it is insisted—for any form of current at any pressure, and no transformer plants involving a tension above 1,000 volts, shall be installed nearer to an oilfield than the regulation minimum distance already prescribed for boiler-houses or blacksmiths shops. Exceptions are only allowed for existing transformer plants on fields where the oil-gas is piped off from the wells, and where there are no flowing wells. These transformer stations or plants must have no free contacts which might produce sparks, and must be fitted with oil switches, the transformers being also immersed in oil.

Any generating or transforming plant must be installed in a building of masonry, metal or other incombustible material, and be kept under lock and key, accessible only by those in responsible charge.

Overhead wires carrying current at a tension above 1,000 volts between any two conductors [Note: The public supply of electricity on the chief oilfields of Roumania is at a working pressure of 500 volts alternating three-phase, with a periodicity of 50 cycles.] must not be installed nearer to an oilfield than the prescribed distance for boilers and forges.

No overhead wire may be less than 16 sq. millimetres cross section. The minimum distance between overhead conductors must be 60 cm. (23.6 inches), and they must not come within 8 metres (26 ft. 3 in.) of the ground. The poles carrying overhead conductors are to be of metal, reinforced concrete, or wood, of dimensions suitable for the weight to be carried or the tension supported, and must be set not more than 30 metres apart. Insulators must be suitable for the working pressure.

No switches or fuses must be fixed on the overhead wire poles, except those of the high tension type under oil, intended to isolate the well in case of accident.

Lightning arresters capable of producing sparks (as, for instance, those of the horn type) are forbidden on the field itself.

The supply wires must be installed in such a manner that in case of a fire at any well, this well may at once be cut off from the supply by oil switches.

Wires or cables entering into the derrick buildings, and in all buildings on the field itself in the danger zone, must be insulated with rubber as far as the nearest pole of the overhead supply, and inside the building must be run in steel tubes. Flexible wires or connections, and free insulated wires on insulators, are forbidden. Similarly all lighting circuits using continuous current must be run in steel tubes with proper screwed hermetic joints and tee-pieces..

Single pole switches and fuses must no longer be used. If supply mains are brought on to a field, a single network must be employed for power and lighting, and a single circuit introduced into each derrick for the same purpose, but separate main switches and fuses are required in each derrick for lighting and for power, and are to be fixed in the motor-house under control solely of the person in charge of the motor.

For lighting the surface roads and open spaces between wells, special transformers may be installed on the overhead wire-posts, but they must fulfil the conditions already laid down.

Telegraph, telephone, or signal wires may be run on the overhead wire-posts, but in all cases below the high tension wires, and they must not produce sparks or incur any danger from possible contact with the latter.

Arc lamps and open-flame lamps are forbidden to be used on the fields; incandescent lamps only may be employed, and must be protected by hermetic glass globes and wire guards outside. The maximum lighting pressure is to be 110 volts, but any existing installation may continue working at pressures up to 220 volts if satisfactorily installed. Portable hand lamps with movable contacts are forbidden, as are also continuous current motors.

The motors to be used on the fields must be of the short-circuited induction type; other induction motors may be employed, for example, those with moving contacts or with rings and collectors for starting and speed regulation through resistances, but in all such cases the motors must be absolutely and totally enclosed, the parts where sparking might arise being covered over hermetically, and thereafter locked so that no spark may possibly pass in the open. The electrician in charge is to be responsible for the key. In gas-free fields, or where the gas is piped away completely, other types of alternating motors may continue to be employed by consent of the Council of Mines, where such are now in use.

Speed regulators must be oil-immersed, and all resistances must be capable of working satisfactorily below a temperature of 150° C. when the atmospheric temperature is 35° C. Fuses or other means must be employed to break the circuit when the current is greater than corresponds to the temperature above named.

Resistances must be of such dimensions that they shall function properly at any point of contact in the regulator.

Proper certificates must be shown before motors or resistances are installed; those for motors must give the results of tests in gaseous atmospheres, and those for resistances must show their maximum working temperature and conditions during tests.

For lighting circuits up to 10 amperes the fuses need not be under oil, but their construction must be such as to prevent them being moved while the switch is closed, and also to avoid any danger of working loose by vibration.

Similarly the switch under these conditions need not be under oil if it is closed hermetically and without danger of explosion.

All connections between switch-boards, motors and other apparatus must be of insulated cable, armoured or mechanically protected.

Installations must be carried by none but specially authorised firms or companies, under the control and responsibility of engineers certified by the Direction of Mines.

Every drilling company must have in each field where it operates at least one duly certified electrician authorised by the Direction of Mines. Individuals will be so certified who possess the diploma of suitable schools or colleges, or who have for at least two years worked in responsible positions on the fields.

The latter must undergo an examination by a commission of specialists appointed by the Direction of Mines.

No installation material, plant or apparatus must be employed unless it has had the approval of the Ministry of Commerce and Industry.

Samples and models of all such materials, etc., must be deposited at the Ministry for permanent reference, and if any object does not fulfil its aim, the Minister will authorise a type to be used.

An installation though finished and put into service may be shut down by any delegate of the Minister if he is satisfied that the work has not been carried out in accordance with the regulations.

The State confines itself to announcing these changes and transformations, the exploiting companies must carry them out, and every demand to the State by the exploiting companies or individuals for authority to carry on work must be preceded by the necessary information called for in regard to material, etc., used, and certificates required in regard to motors and resistances.

For effecting the changes in type of motor to be used, a delay of one year is given, for the proper appliances, materials and apparatus otherwise to be used; samples and models must be submitted within three months for approval, and they are to be installed within two months of approbation. Shorter periods down to eight days are given for complying with other parts of these regulations, and any person or persons contravening the regulations will be liable to punishment under the Mining Laws, all their exploitation work being at the same time stopped.

L. & N.W. Switchgear.—With reference to the notice on page 1028 of our last issue regarding the London and North-Western Railway switchgear contract, as this article may give the impression that the British Westinghouse Co. has secured the order for the whole of the low-tension switchgear panels for the 11 sub-stations mentioned, we are asked to state that Messrs. Whipp & Bourne, of Castleton, have the order for the whole of the switchgear controlling the automatic reversible boosters of "Entz" type which are being supplied by Messrs. Bruce Peebles and Co. The circuit breakers on these panels are of Messrs. Whipp & Bourne's manufacture, and of their standard type. None of the instruments on these panels will be of Westinghouse manufacture, the indicating and recording instruments being by Messrs. Everett, Edgcumbe & Co., and the ampere-hour meters and watt-hour meters of combined Chamberlain & Hookham and Everett, Edgcumbe & Co.'s manufacture. The D.C. panels that are being supplied by Messrs. Whipp & Bourne form, we understand, a substantial percentage of the D.C. switchboards.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Training of the Instrument Maker.

In the advancement of any branch of science, and particularly that of electricity, the art of scientific instrument making and the training of the instrument maker are important factors. Considerable progress has been made during the past decade in the design and accuracy of electrical standard and testing instruments, but the all-round skilled English craftsman of earlier days is becoming more and more rare, while no organised effort is being made to train men of this type, and the progress of the trade of this country is being seriously handicapped on this account. Firms which manufacture a few special instruments in quantity may not need large numbers of well-trained and skilful workmen, since by subdivision of the work and increased supervision and inspection, combined with thorough organisation, it is possible to substitute machine operators and assemblers for instrument makers. Nevertheless, there is an ever-widening demand for high-class instruments, which, in many cases, must be made throughout by individual workers able to grasp the requirements and to turn their hands to a great variety of operations. In such work a poor standard of attainment on the part of the worker involves constant watchfulness and strain on the part of the management if endless mistakes and defects, and consequent loss, are to be avoided.

Recalling, for a moment, the conditions of the trade 25 years ago, one found a number of excellent workmen recruited from the ranks of clock, optical and philosophical instrument makers, able to construct a well-finished piece of apparatus from a rough sketch or pattern, and taking no little pride in their personal skill and in the result of their work. The Post Office and submarine cable companies, then the principal users of measuring instruments, enforced a good standard of workmanship, and the variety of testing instruments was practically limited to their requirements, chiefly consisting of resistance boxes, tangent and astatic galvanometers, Kelvin galvanometers, testing keys, and so forth. The work was usually carried on as a department of a firm or concern which manufactured other electrical apparatus or other forms of scientific instruments. Almost every worker had served his time and was somewhat of a personality; as far as possible each man had his pet job, which came to him as a matter of course; his lathe and hand-tools were regarded as personal to him, and milling and drilling machines were not too common, some of the old stagers still using the fiddle-bow drill.

Under such conditions were made the earlier forms of ammeters, voltmeters, supply meters, and similar apparatus, which soon afterwards formed separate trades working under entirely different conditions; the comparative simplicity of construction, the quantities dealt with, and the necessity for economical production led to minute subdivision of the work and organisation on manufacturing lines; youths were able to enter such shops and earn good money almost from the commencement, while retaining their ignorance of electrical principles and of the craft as a whole.

At the present time, it is no uncommon experience when questioning an applicant for work to find that he is unable to set a slide gauge or micrometer to an odd size, such as 19/64 in., or, if he professes a knowledge of electricity, to find that he is unable to draw a Wheatstone bridge diagram, or to describe the principle on which a moving-coil galvanometer works.

Close inquiry and observation have forced me to the conclusion that technical classes have done little or nothing for the instrument maker. For over 20 years I have trained apprentices in my works with fair success, and have allowed each lad to leave early for the purpose of attending evening classes, which he is expected to do regularly. The courses available comprise elementary electricity and magnetism and elementary electrical engineering, with laboratory work. At one or two of the institutes a workshop is available, but, from a practical point of view, this offers small advantage to the apprentice on account of the shortness of the lessons. The apprentice sees no direct application of the lecture and laboratory work to his daily task, nor, so far as I am aware, is any attempt made by the teachers to keep in touch with the conditions and requirements of the instrument trade, perhaps because the classes consist chiefly of a mass of students from other branches of the electrical industry. During these 20 years I have had the honour of meeting many technical teachers, but none has ever asked me for information on the needs of the young instrument-maker. To the principal of one of our best technical colleges I once said: "What we need is craftsmen;" he only repeated that unfamiliar word in astonishment.

On eliciting the views of half a dozen of my works staff who have served their apprenticeship here, as well as those of about a dozen of my apprentices, I find that they are unanimous in the statement that their class work appears to have nothing to do with their work in the factory. As one of the lads said: "You don't gain much all round, because the main thing is they do not apply to the trade." On account of the ambitious scope of the classes and the attempt to make them suitable for lads in all branches of the electrical trade, these apprentices have, almost without exception, felt it necessary to go over each course two or three times because "he could not get hold of it the first year and could not do the calculations, and lots of things are gone before the next year." The laboratory work is regarded as interesting, but "it does not seem to bear in any way on the work in the factory, and the instrument is never explained from the point of view of the maker." The classes are in many cases overcrowded, and, through lack of equipment, it is often impossible to arrange the laboratory work to follow up the preceding lecture; and at most institutes it is difficult for the student to get individual attention. The latter defect has also occurred with the comparatively small percentage of apprentices who have taken classes in drawing, the importance of which the average apprentice entirely fails to realise. Those who have attended drawing classes have, I find, been occupied in copying from blue prints and taking out details, but the instruction appears to have been entirely divorced from any consideration of design, even in regard to minor details such as would be within the capacity of the student.

The London apprentice who attends evening classes generally spends from two to three hours in travelling, and reaches home very late. The omission of a few attendances puts him entirely out of touch with the course which, as one of them says, "always goes much too fast for us." No wonder that the average lad becomes discouraged with the difficulty and remoteness from his trade life of the class work, and abandons the classes entirely before the end of the session.

In the opinion of a successful ex-apprentice, who has witnessed the career of about 40 apprentices in the shops, "None of them have gained anything by their classes except those who went into the test-room permanently."

There is no trade offering greater scope for an intelligent lad to develop his faculties and to acquire such skill as will ensure him a good and secure livelihood. There are plenty of lads who, on leaving school, are keen to produce something with their hands, and who might become creditable workmen under a proper system of training. The foreman has neither time nor opportunity to teach such a lad shop arithmetic, the properties of materials, the elementary mechanics and physics necessary in shop work, or, in fact, such information as could be imparted rapidly and systematically in a trade school, but which the apprentice takes about two years to pick up in a casual and inefficient manner.

In a school devoted entirely to one trade lads could obtain that companionship in work, common interest, and freedom to discuss their difficulties, and to help each other, which I find entirely lacking in the present mixed classes. To use the expression of one of them: "A number of fellows in the same trade would work together with more interest."

The time has at last arrived when the London County Council, having investigated the magnificent trade schools of France and Germany, and in particular the compulsory trade schools in Munich, is considering the establishment of additional preparatory trade schools in London. There would be many advantages in the association of a trade school with an instrument factory, but the individual employer would scarcely feel justified in assuming the whole expense, since the benefit would be common to the community, although he might partly be recompensed by the increased efficiency and more rapid progress of his apprentices. Moreover, many shops do not take indentured apprentices, and would have no means of ensuring the continued services of the lads. Nevertheless, I believe that a joint representation by firms conversant with the necessities of the trade would receive consideration on the part of the educational authorities, and that such a school could be established without undue delay. Personally, I am of opinion that one or two years' preliminary instruction in trade drawing and arithmetic, elementary physics, mechanics and electrotechnics, with some simple laboratory work during the morning, and systematic instruction under a skilled workman during the afternoons, would enable a lad of, say, 16 years of age, to enter the shop under far better conditions than at present.

I believe it to be essential for the success of such a school that the trade, employers and employed, should have a voice in the management, and that there should be a frequent interchange of ideas between the employers and the teachers. Continental experience has shown the advantage of dividing the instruction between a trained teacher and a trained workman, and, that course being adopted, there should be no difficulty in obtaining suitable instructors. On account of the distance apart in London of the various instrument factories, one school would not conveniently serve all the lads, but a start might be made with a single school situated conveniently for two or three factories, and would be none the worse for starting on a small scale.

I solicit the views of firms who would join in bringing the matter to the notice of the authorities, and who would give information and advice on the subject of trade schools for scientific instrument makers.

Robt. W. Paul.

London, N., *June* 17*th*, 1914.

"Transactions": Standardisation of Size.

Is it not possible for the Institutions of Civil, Mechanical, Electrical and Gas Engineers, the Royal Institution of British Architects, &c., to agree mutually on, and to recommend officially to the other technical institutions and societies, a standard size of paper for printing the "Transactions?"

Such an arrangement would be of inestimable benefit to the man who methodically files valuable information from many sources, and also to the engineer who is a member of two or more institutions.

The writer suggests 9 in. × 7½ in., which is the standard size of the well-known Walker's Loose-Leaf Note-Book.

Ronald Grierson.

London, W., *June* 18*th*, 1914.

The Institution and the Electrical Industry.

The letters which have recently appeared in your columns on the above subject indicate that considerable dissatisfaction exists as to the relationship now existing between the Institution and the electrical industry; and, as has been pointed out by more than one writer, it is for the members to see that an alteration in constitution and policy should be made, if, indeed, such alteration be desirable and beneficial. To paraphrase a pronouncement now about 1900 years old, the Institution exists for the benefit of the members, and not members for the benefit of the Institution.

But how can members effectively voice their discontent or suggest remedies for improvement?

The best means would appear to be through the local centres, and a case in point is the recent action of the Dublin Local Section, as reported in your issue of the 12th inst., and commented upon in your leading article of that date.

But is it likely that the Council of the Institution would act upon a suggestion from one local centre? I think not. What is required is joint action of all the local centres. And this brings me back to a matter I advocated in your columns some years ago, viz., the formation of a London Local Section, because in any combined action which the local centres might take, the London members who form probably a majority of the whole membership would be unrepresented.

There are other strong reasons which may be urged in favour of a London Local Section. These I have referred to before, but the ability to act in combination with provincial local sections is perhaps now the strongest. If all the local sections were unanimous upon any proposed course of action in the interests of the industry generally, they could, in the event of the General Council being unfavourable, combine to form a new federated association whose constitution would permit it to carry out an active instead of a passive policy.

Frank Broadbent.

London, E.C., *June* 16*th*, 1914.

There must be many members of the I.E.E. who have but the vaguest notion of the events resulting in the dissolution of the Industrial Committee, and of the real issue between that Committee and the Council.

The last Council report, the speeches at the general meeting, and the various references in the electrical Press, all fail to enlighten the rank and file to any material extent, though they indicate some strength of feeling.

If the late members of the Industrial Committee consider the matter to be of so much importance to the electrical profession and industry as their utterances indicate, surely it is desirable to get the formal opinion of the members as a body on their proposals, for the guidance of the Council, and of everyone concerned.

The constitutional method open to them is that of requisitioning a special meeting to discuss a substantive proposition, and the present time, between the sessions, and before the new President and Members of Council assume their duties, is opportune.

Before such meeting, it is desirable that the Council and the late Committee should jointly issue an agreed statement of the events which resulted in the dissolution of the Industrial Committee, that members may have an authoritative foundation for their judgment.

I write in the interests of the great majority of members, who have not taken sides, who do not know what is really at issue, but feel that it may be of great importance to the Institution itself, and to all interested in electrical work and progress; and that they are entitled both to full information, and to an opportunity of expressing a considered opinion.

Henry M. Sayers.

London, S.W., *June* 22*nd*, 1914.

[On the written requisition of 10 Corporate Members or Associates, the Council must call a special general meeting.—Eds. Elec. Rev.]

OPERATING EXPERIENCES ON THE LOETSCHBERG RAILWAY.

A recent issue of our American contemporary, the *Electric Railway Journal*, contained some particulars, derived from Swiss engineering sources, of the operating conditions of this railway. In the open the line construction conforms with standard single-phase practice, but a special construction has been adopted in the tunnel, where the catenary is of duplex wire with a 6-mm. diameter steel core and a coating of 1·25 mm. copper. The trolley wire is 6·7 m. above the rail at stations and 4·8 m. in the tunnels. The double insulators and trolley wire in the tunnel are supported at distances of 22 to 28 m.

Three telegraph and three telephone lines and a signal line are installed along the railway right-of-way, when underground, in paper-covered air-insulated cables, and elsewhere on wooden poles, the wires being transposed every fifth pole to minimise induction.

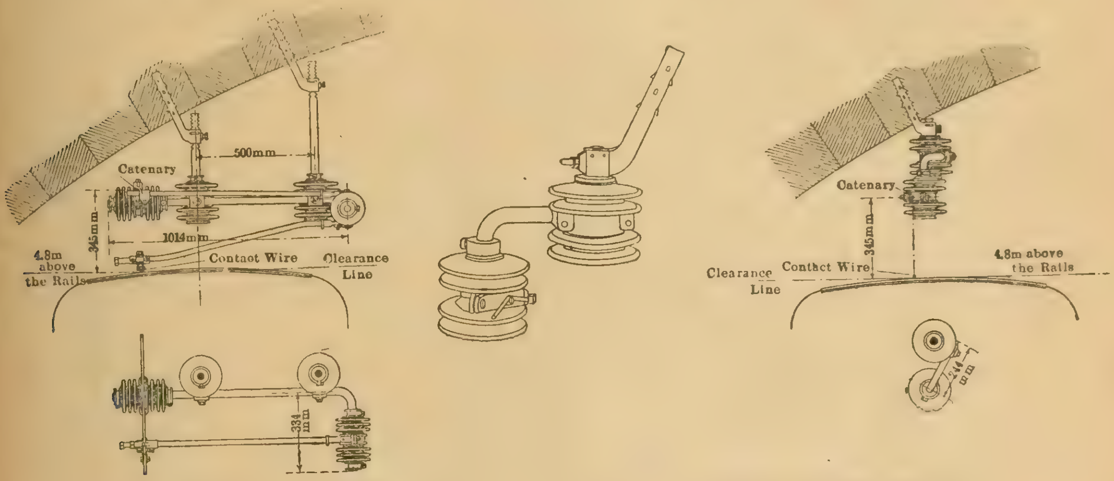
The tunnel telephones are operated from a central battery, and their receivers are equipped with signal sirens. Louder sirens give warning of the approach of trains, and are operated from small transformers of high periodicity. All these lines have operated satisfactorily, and clear speech is obtained over the telephone, despite the long cable used with numerous parallel cables and no Pupin coils.

Fuses are used where the cables pass aerial lines, and these have blown a number of times, but this has not caused trouble, as they can be easily replaced.

On the trial trips the locomotives met all the conditions for which they were designed, but they were not operated to full capacity in actual service, partly for the sake of caution and partly because a few mechanical and electrical details of the apparatus were found incapable of carrying the maximum loads.

The locomotive transformers gave trouble from static discharges, both between the individual turns and between the apparatus and the ground. As these very places had been insulated with particular care, the fault is held to be due to extraordinarily high voltages generated in some unknown manner. The latter may be caused by lightning disturbances, since the trouble decreased on the approach of winter. It is possible, however, that the trouble is due to high-tension discharges at the line insulators. To prevent a repetition of these troubles, the insulation at the entrance turns of the load transformers has been increased appreciably. It is considered remarkable that the 12 cases of disturbance did not occur during lightning storms or high-tension line disturbances, but, nevertheless, it is believed that there may be some connection between these phenomena.

The overhead construction, excepting for initial troubles, has given satisfaction. The drop in voltage is in accordance with theory, which is regarded as important, as the most favourably situated power station is 31 miles from the end of the line, and the long tunnel prohibited super-voltage transmission lines. The tunnel insulators caused the greatest difficulties. In the open no high-voltage discharges took place, but in the tunnel "spillover" discharges, commonly across both insulators, were quite numerous.



Views showing Details of the 15,000-volt Overhead Construction, Lötschberg Railway.

Several discharges from the cover of the insulator to the pin were also observed. At first these troubles were ascribed to defects in the insulators, and this may have been true in some instances, but it was necessary to seek other causes when the short-circuits continued. It was then found that the localities most subject to this trouble were those where the moisture on the tunnel roof was sufficient to form drops of water, which fell on the insulators. In time this water built up a conducting path for discharges. It was also found that some damp insulators were scarred by particles of stone which had been blown against them with great velocity through the action of trains passing at high speed. To correct this trouble, the roof near the insulators has been waterproofed with lead wool and cement, and copper shields have been placed over the insulators. These changes were made without interfering with operation. The line inspectors now clear the insulators of dust at regular intervals, for even the precautions mentioned do not prevent the atmospheric conditions in the tunnel from vaporising the insulators to some degree.

In view of the great length (9 miles) of the tunnel and the fact that insulators are installed at 3,500 places, it is not remarkable that a very small percentage of them should have caused trouble. As the remedies have succeeded, it is believed that even very long tunnel sections with unfavourable moisture conditions may be operated safely at 15,000 volts.

Cables for Victorian Railways.—The British Insulated & Helsby Cables, Ltd., have secured the contract for the supply of the extra-high-tension feeder cables required in connection with the electrification of the Melbourne Suburban Railways. This is understood to be the largest contract for power cables ever placed, and it includes 73 miles ·15 sq. in., 44 miles ·1 sq. in., and 21 miles ·05 sq. in. 20,000-volt 3-core split concentric cables. This company has also received the contract for the supply of the overhead equipment of the same railway. The cables will be laid and the overhead equipment erected under the supervision of the company's staff. The combined value of the two contracts approximates £600,000.

ELECTRICAL FEATURES OF THE ANGLO-AMERICAN EXHIBITION.

The Anglo-American Exposition now open at the White City, Shepherds Bush, W., presents a number of features of electrical interest though, with the exception of the Metropolitan railway signalling exhibit, these are to be found only in the permanent equipment of the buildings, grounds and side-shows. Current for all purposes is taken from two independent supply systems through four sub-stations, located approximately at the four corners of the exhibition grounds. Three-phase current at 5,000 volts, 50 cycles, is taken from the Notting Hill and Kensington Co.'s mains and single-phase current at 2,200 volts, 50 cycles, from the Hammersmith Council's Fulham Palace Road station. Three 0.25 sq. in. concentric cables from the Hammersmith system and three 0.125 sq. in. three-core cables from the Notting Hill system are carried into the main sub-station at Wood Lane, whence single and three-phase cables run to the other sub-stations in the grounds. Three 200-kw. single-phase and three 200-kw. three-phase Berry transformers at Wood Lane; and three 200-kw. single-phase and two 250 kw. three-phase transformers in the machinery hall sub-station provide a 440/220 volts three-wire single-phase supply and 220 volts per phase in a three-phase star system. For the supply of direct current there are installed a 150 kw. G.E.C. motor generator (single-phase slip-ring induction motor driving 500 volt. interpole dynamo) and two 400 kw. Bruce Peebles motor converters. The lamps in each building being staggered on single and three-phase services taken from separate switchboards at opposite ends of the hall and the lamps in the grounds being arranged on the same principle, total failure of lighting is practically impossible, and the private generating station in the grounds, where two 250 kw. producer and town gas-driven sets are installed, is not in commission this year, though it is, of course, available in case of emergency. Lead-covered mains in ducts with draw-in boxes are used to supply the lighting circuits and side-shows.

By far the greater part of the total electrical demand in this exhibition is for illuminating purposes. In outlining the various buildings some 100,000 5 c.p. 220 volt lamps are connected in simple parallel by strip cable with weatherproof screw sockets having rubber washers and filled-in backs. Carbon filament lamps are still used owing to the softness of the light which they provide and the long life which they yield. The simple parallel connection adopted restricts extinction to individual lamps. We would suggest that the time has now arrived when replacement of these carbon by metal filament lamps might well be taken in hand. Altering the wiring connections would involve considerable outlay, hence the best procedure would probably be to replace lamps on one branch circuit at a time, simultaneously connecting the latter to a step-down transformer. The Court of Progress, which contains excellent horticultural exhibits, is now illuminated by 16,000 miniature lamps and the number of lamps in the Elite Gardens has been increased to 13,000 and in the Court of Honour to 15,000. Several "living" signs representing flames, waving flags, an eagle with flapping wings, and so on are in course of construction. General lighting in the grounds is by enclosed arcs burning four in series and 36 hours per trim. As replacements become necessary the "works" of the arcs are being removed and half-watt lamps mounted in the arc lamp shell and globe. Similar replacements are being made as necessary in the 16-hour flame arcs used for interior illumination. As present the flame arcs placed above the drapery in the various buildings are trimmed from gang planks running across the roof girders. The necessity for this work is being eliminated by use of half-watt lamps. Any reduction in the skilled staff required is of special importance in this case since men are engaged only from May to October. All lamps have dual suspension, main reliance being placed upon flexible steel ropes. A new L.C.C. regulation requires globes surrounding high candle-power filament lamps to be wired (as for arc lamps); the interpretation to be attached to "high candle-power" in this connection has not yet been specified. About one hundred 2,000 c.p. half-watt lamps are at present in use, besides a few 3,000 c.p. lamps used for searchlights in the Stadium. In this service there is said to be a deficiency in "carrying power" of light from half-watt as compared with that from arc lamps; but no definite data is available concerning the candle power of the latter.

In all, roughly 600,000 lamps are used to illuminate the grounds, buildings and side-shows. The lighting load on the mountain railway totals 20 h.p. The cascade in the Court of Honour is fed by two 21-inch Rees Roturbo centrifugal pumps driven by 50 h.p. three-phase induction motors and delivering 12,000 gallons per hour. Five hundred high-candle power metal lamps with dipped bulbs (of five different colours) are mounted behind the glass walls of the cascade, and to obtain unending variety of effects, manual control of a piano-key switchboard is employed in preference to an automatic system. An excellent scale model of the Panama Canal, 200 ft. in length, is installed in a room lighted by half-watt lamps. The canal lights are 4 c.p. 4-volt lamps connected in series across 25-volt a.c. supply leads and the submerged haulage chain for the model ships, the lock gates and the pumps for filling the locks are all electrically operated.

The power demand of the various side shows ranges from 1/16 h.p. to 100 h.p., the latter being that of the mountain railway, which is worked by 250-volt direct current on the 4-rail system. Each car is fitted with a 2½ h.p. motor and a complete automatic block signalling installation is provided with indicating and master-control board at the station. A warning signal is mounted in advance of each main signal post, and automatic solenoid-operated trip levers prevent drivers over-running danger signals. Lengths of dead track in the dips and at sharp bends eliminate the risk of excessive speed due to drivers leaving their controllers "on." The position of each train, of which eight may be running at once, is indicated continuously and automatically on a board at the station, and the stationmaster can cut current off from any one or from all sections of the line in case of need.

The Metropolitan Railway exhibit includes a full-sized "upper quadrant semaphore" signalling head and repeater arm working in conjunction with an electric indicator board. Immediately a train enters any signalling section the signal in the rear is *dropped* to the horizontal danger position in which it remains till, the train having entirely cleared the section and every component of the equipment being in perfect working order, the arm is *raised* to the oblique safety position in the upper quadrant. Any defect causes the arm to fall by gravity to the "danger" position. The lower "repeater" arm on each post is fishtailed and shows an orange instead of a red light. It is not a distant signal, but simply indicates whether the second section ahead is also clear. Automatic trips arrest within a few yards any train which is driven past a danger signal. In the reconstructed parts of the system, low tension alternating current is used for signalling purposes in order that any disturbance due to leakage current may be confined to the sections immediately concerned. The exhibits include examples of the step-down transformers and signalling relays employed and the latest type of hooded signal lamps. All the apparatus is shown in action and its method of working and the function and operation of junction control boards, automatic train describers and electric "headway" clocks are explained admirably to visitors by one of the company's employees. Altogether this exhibit is most interesting and instructive.

In conclusion, we have pleasure in acknowledging the assistance rendered by Mr. Albert E. Kiralfy in collecting the above information.

PARLIAMENTARY.

Telephone Contracts and Labour Rates.

Mr William Thorne asked the Postmaster-General if he was aware that Messrs. Callenders, cable makers, had a contract with the Post Office for laying down telephone cables at Newport and district: if he was aware that the Newport master builders agreed to advance the wages of the various sections of men working in the building trade, which includes excavators, a ½d per hour from May 23rd, 1914, and another ½d. per hour from May 1st, 1915; that the Newport town and district rate was now 6½d. per hour for labourers, and 7d. per hour for scaffolders; if he was aware that Messrs. Callenders had refused to pay the extra ½d. per hour to the labourers who were digging out the trenches for the cables; and if he intended taking any action in the matter to make the contractors pay the town rate, in accordance with the Fair Wages Clause Resolution of the House of Commons.—Mr. Hobhouse said that inquiries would be made.

Opposition to the London County Council Tramways Bills.

Mr. Yeo asked the Chairman of Ways and Means if his attention had been called to the statement that the expense of the petition of certain frontagers to the L.C.C. Tramways Bill was defrayed by the London omnibus owners, and whether such procedure was in accordance with the rules of the House.

Mr. Whitley replied that there was nothing in the Standing Orders or Rules of the House to say that petitioners should only be heard if they paid their own costs, but he was quite sure that the members of Private Bill Committees knew the proper weight to give to any petition when they were in possession of all the facts connected with it.

York Corporation Bill.

Last week the Local Legislation Committee of the House of Commons considered the Bill promoted by the York Corporation. The Bill was of an omnibus character and included powers for the running of trolley vehicles and motor-omnibuses. Mr. Macassey, K.C., and Mr. Beveridge represented the promoters, and the North-Eastern Railway Co., who opposed the tramway proposals, were represented by Mr. Talbot, K.C., Mr. Clode, K.C., and the Hon. E. Charteris.

Mr. Macassey explained that the Corporation desired to run trolley vehicles on two routes, and the Railway Co. objected to the terminus of one route being in their station yard. He submitted that if the opposition was successful it would be a serious loss to the Corporation.

Evidence in support of the proposals was given by the Town Clerk, Mr. Meyer (chairman of the Tramways Committee), Mr. J. W. Hame (manager of the Tramways Department), Mr. C. J. Spencer (manager of the Bradford Corporation Tramways), and others.

Mr. Talbot, K.C., suggested that the turning point for the tramways should be either at Exhibition Square or Blossom Street.

The Committee decided to allow the turning point outside the station, on condition that if, in the opinion of the Board of Trade, the traffic became so congested as to make it desirable to be moved to another place, this should be done to a place approved by the Board.

North Metropolitan Electric Power Bill.

The Court of Referees of the House of Commons have decided that the L.C.C. and the London electric lighting companies shall be allowed to appear before the Select Committee which considers the Bill promoted by the North Metropolitan Electric Power Supply Co. for the erection of a generating station at St. Albans, &c., the raising of new capital, and the obtaining of electric current from other sources.

Mr. Tyldesley Jones, for the promoters, urged that neither the County Council nor the electric lighting company supplying in London had any *locus standi*.

Mr. FitzGerald pointed out that the L.C.C. would be the purchasing authority in about 17 years' time, and they were now considering what steps should be taken to meet the position when the time arrived. It was true that the North Metropolitan Power Co. was outside the county, but it supplied electricity in bulk to Stoke Newington.

Mr. Freeman, K.C., on behalf of the electricity undertakings within the county, said that under the Bill the North Metropolitan Co. were asking for powers to be allowed to obtain additional electricity from the Metropolitan Railway Co. and the London and North-Western Railway Co. He contended that it was not legitimate for the company to obtain power in this way to sell to the public.

The grounds on which the Court decided that the petitioners should be allowed to appear before the Select Committee were that the measure would make an important alteration in the existing practice.

Newcastle-on-Tyne Corporation Bill.

On Friday, June 19th, Sir John Barran's Select Committee of the House of Commons concluded their consideration of the Bill of the Newcastle-on-Tyne Corporation, which asks for powers for the construction and working of tramways in the Urban Districts of Longbenton and Weetslade, &c.

Mr. H. Lloyd, K.C., gave details as to the tramway undertaking of the Corporation, and said that last year £18,000 was contributed to the relief of the rates. The proposals in the Bill were to make two new tramway lines to the north from the city boundary. One would run through the Urban District of Longbenton and for a short distance in the West Weetslade Urban District. The second tramway would join with the first one and pass to the east, and serve the populous districts of Forest Hall. Except for the opposition of the Killingworth Estate Trustees, the only objection came from the North-Eastern Railway Co.

A great deal of local evidence was called in support of the proposals.

Questioned by the Chairman, Mr. E. Hatton, engineer and manager of the tramways, said the Committee had considered the question of a 'bus service instead of a tramway service of the proposed routes, but they felt that omnibuses would be totally inadequate to deal with the race traffic.

The Committee passed the preamble of the Bill, subject to the following conditions:—(1) That the promoters should insert a clause providing that the powers to construct tramway No. 1 beyond Salter's Lane should not be exercised until Great Lime Road had been widened; (2) that a clause should be inserted compelling the promoters to give Gosforth a service of cars on race days between certain points of not less than 3½ minutes' interval.

Third Reading.—In the House of Commons on June 18th the Stone Gas and Electricity Bill was read a third time.

LEGAL.

Ilford Gas Co., *v.* Ilford Urban District Council.

[Preferential Rates for Electrical Supply.]

In the Chancery Division on Friday, June 19th, Mr. Justice Sargant had before him a motion by the plaintiffs in the action of the Attorney-General at the relation of the Ilford Gas Co., *v.* the Ilford Urban District Council for interim relief in respect of alleged illegalities in the supply of electricity and electric fittings.

Mr. Mark Romer, K.C., who with Mr. Tyldesley Jones appeared for the plaintiffs, said that the case was a similar one to that recently tried by his Lordship (Attorney-General *v.* Long Eaton U.D.C.), and they were asking for an injunction to restrain preferential treatment contrary to the provisions of the Act of Parliament. In this case the plaintiffs were also asking for an injunction to restrain the defendants from electric fitting or supplying electric apparatus *ultra vires*. Notice of motion had been served, but he did not know whether the defendants were ready to go on, or whether they desired an adjournment to answer the plaintiffs' evidence.

Mr. Martelli, K.C., for the defendants, said they had not filed any evidence yet, and, of course, they wanted time for that purpose if the motion was to be proceeded with. He thought, however, it would be quite impossible to dispose of the main part of the action on interlocutory motion, although his Lordship had recently decided a case that was somewhat similar.

Mr. Justice Sargant said that his recollection was that in that case he threw out the suggestion that there might have been much more elaborate evidence.

Mr. Martelli said the plaintiffs seemed to think that they had an *a fortiori* case, but he thought it was found to be anything but that.

Mr. Romer said this was a much stronger case than the previous one, as the defendants in this case were differentiating solely between those who took a whole electric supply, and those who did not. There was no question of power in this case.

Mr. Justice Sargant suggested that if the matter stood over for a week, the parties would have the opportunity of considering the evidence, and they could then say whether it should be tried on motion or not.

Mr. Martelli doubted whether the defendants' evidence would be ready in a week.

His Lordship thought it could not be a matter of very great urgency.

Mr. Romer said it was, for in addition the plaintiffs were seeking to restrain them from spending the ratepayers' money.

Mr. Martelli said that the Council were quite ready to give an undertaking not to spend any more money in the purchase of fittings, or in providing, selling, or letting out on hire any electrical apparatus, and not to enter into any fresh contracts for providing, selling, or letting out on hire any electric lamps or the like. The defendants, however, desired to go on with the contracts that they had already entered into, and to complete them, for it could not be an advantage to anyone, even to the ratepayers paying the money, that these contracts should lapse.

Mr. Romer desired to know exactly what the defendants were prepared not to do.

Mr. Martelli: They would not spend any further money in the purchase of electric lamps or electric plant.

Mr. Romer: Over next Friday week?

Mr. Martelli suggested that the undertaking should be until the trial of the action.

Mr. Romer desired, however, to bring on the motion, and said that there was also a question of the defendants' right to have a showroom for their electrical appliances.

Mr. Martelli said there was no question about the showroom whatever. They never had one, and did not intend to. They were authorised by the Local Government Board to expend money in building an office, and in that office they were putting a window for displaying the fittings.

Mr. Romer: If the defendants say they are not fitting up a showroom, and don't intend to do so, that is enough for me.

Mr. Martelli said that it was obvious that the question could not be determined on motion. It was one of the utmost importance to every electric lighting authority in the country.

Mr. Romer: And we say it has been decided.

Mr. Martelli said this case differed from the previous one, and, moreover that case was likely to go before the Court of Appeal.

Mr. Romer said if the matter went over for a fortnight they would get the evidence and be better able then to appreciate the position.

Mr. Justice Sargant accordingly directed the motion to stand over for a fortnight on the undertaking offered by the defendants.

Godfrey *v.* Cox.

This case, which was a claim for the electrification of a house at Clapham, and which was heard and judgment given in May by Mr. Muir Mackenzie, one of the Official Referees of the High Courts, was mentioned on a question of costs.

Counsel applied to have the Referee's judgment varied so far as the order for the payment of costs was concerned.

The Referee: What business has a litigant to ask me to vary my judgment.

Counsel: The parties have agreed as there seems to have been a mistake.

The Referee: I am not going to alter my decision in accordance with any agreement between the parties.

Counsel: But this seems to have been an error on the part of the person who drew up the judgment.

The Referee: I drew it up myself. There has been no slip or error as you suggest, and if you think there has been an error then it will be for the Divisional Court to correct it. I can do nothing.

Lindeck, Cahn & Co. *v.* Dubilier Electrical Syndicate, Ltd.

Before the Common Serjeant (Sir F. Bosanquet, K.C.), and a jury, plaintiffs, stockbrokers and members of the London Stock Exchange, sought to recover a sum of money as commission, from the Dubilier Electrical Syndicate, Ltd., of 96, Leadenhall Street, E.C.

Mr. Morton Smith (instructed by Messrs. Michael Abrahams and Co.) appeared for the plaintiffs, while the defendants were represented by Mr. E. G. Palmer (instructed by Messrs. A. Veasey and Co.).

On behalf of the plaintiffs, it was stated that in 1912 Mr. McLean, the promoter of the defendant syndicate, approached Messrs. Lindeck, Cahn & Co. He asked them to take an interest in the concern, and they agreed to do so, and became shareholders. The syndicate was formed to work certain patents in connection with wireless telegraphy. In the early part of last year the syndicate required further financial support, and again approached the plaintiffs. The latter were then told that they could take all instructions from McLean, and that gentleman was held out as the agent of the syndicate. The plaintiffs interested themselves on the syndicate's behalf, and finally approached the General Electric Co., Ltd. Mr. McLean then suggested that in order to save time he should negotiate directly with the General Electric Co., and not through the plaintiffs. That was assented to, and the negotiations were carried out by Mr. McLean, with the result that the General Electric Co., Ltd., paid £1,000 in cash, and agreed to pay a further £1,500 for a licence to work the patents. In addition, the syndicate was to receive a royalty on all apparatus which the General Electric Co. made under the patents. The plaintiffs said that the sale was carried through in consequence of their introduction, and claimed to be entitled to commission at the rate of 5 per cent. Originally Mr. McLean was joined as a defendant in the action, but owing to his absence in America he was not served, and the proceedings against him were abandoned. On behalf of the defendant syndicate it was stated that the concern was registered in April, 1912, to acquire the British and Colonial rights of patents in connection with wireless telegraphy. Mr. MacLean was not directly associated with the syndicate in any way, but was a shareholder with 400 shares. The company possessed a capital of £10,000, of which £2,000 was subscribed for in cash, while shares of the face value of £4,900 were issued to the owner of the patents. In May, 1913, it was proposed to form a much larger company to work the patents, but the matter fell through. It was denied that the syndicate gave Mr. McLean instructions to act on their behalf. That gentleman, however, arranged the transaction with the General Electric Co., and as remuneration it was agreed that he should receive a commission of 40 per cent. on the £1,000 which the syndicate received. Mr. McLean had told the syndicate that there were certain expenses he had incurred, and that he would also have to make a payment to Messrs. Lindeck, Cahn & Co. The jury returned a verdict for the plaintiffs for £80.

Action Against Aberdeen Corporation Dismissed.

The First Division of the Court of Session has dismissed an action for damages against Aberdeen Corporation raised by the family of a carter who was crushed between a wagon and an electric standard on the pavement, and fatally injured. The Lord President held that it was out of the question to suggest that public authorities were at fault, because they had lamp-posts or electric standards or trees placed at the edge of the pavement, or on the footpath, even although the street were a narrow one. Lord Skerrington said in altering the position of the standard after the accident, the Corporation acted quite rightly, but he could not bring himself to think that they ought to have anticipated that an accident would occur such as to lead to the death of this unfortunate man.

Publicity Literature.—The County of London Electric Supply Co., Ltd., of Moorgate Court, has issued a little publicity leaflet with a diagram showing the gradual darkening of the ceiling from April (after the spring cleaning) to the following March, in the case of a house that is not lighted electrically.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Pipe-Ventilated Motor.

Fig. 1 shows the latest type of 50-B H.P. D.C. 440-volt motor made by MESSRS. MCCLURE & WHITFIELD, of Mersey Dynamo Works, Stockport, for driving a calender in a finishing works; the motor runs normally at 350 R P.M., and up to 600 R P.M. with shunt regulation. The machine is totally enclosed, and has an exhaust fan embodied in its design; the inlet is connected by a pipe to the outer atmosphere, and foreign matter, which is liable to give trouble with pipe-ventilated motors, is excluded by a system of packings devised by the makers, which prevents its entry through small crevices. Although the motor is totally enclosed, the temperature rise is similar to that of the open type. The makers have installed a number of these machines in places where dust and dirt are prevalent.

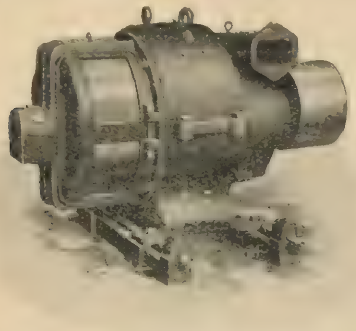
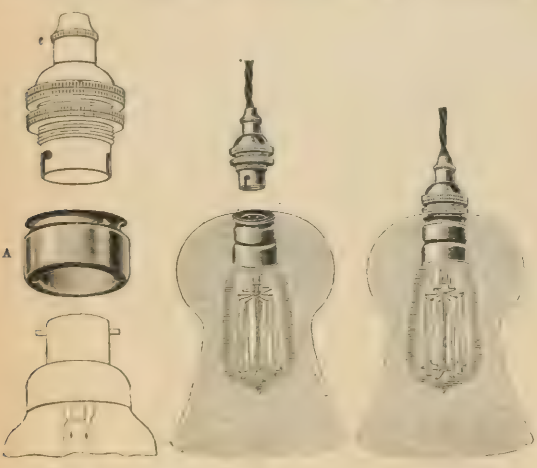


FIG. 1.—PIPE-VENTILATED MOTOR.

"Lamlok" Shade Carrier and Lamp Lock.

The accompanying illustrations show the ingenious device by which MR. C. H. JEFFCOAT, of 148, Addison Gardens, London, W., accomplishes two purposes—locking the lamp in position, and facilitating the attachment and removal of the shade, no matter how narrow the latter may be—with one small fitting, the ring marked A. This is placed on the cap of the lamp, and the shade on top of the ring, as shown in one of the figures; the lamp cap is then inserted into the holder, and the ordinary shade ring, which is usually inside the shade, is in this case screwed *down* on the top of the shade. The bayonet joint is thus locked. There is nothing to get out of order, and the cost of the device is trifling; it is easy to remove the shade for cleaning, and the carrier can be used with any type of lamp.



FIGS. 2-4.—LAMLOK SHADE CARRIER AND LAMP LOCK.

Magnetic Separation of Iron Ore from Gangue.

An interesting modification of the usual method of separating magnetic iron ore from gangue is employed at MESSRS. WITHERBEE, SHERMAN & CO.'s mines, Mineville, N.Y., where it is applied to 0 25 in. lumps or finer ones. The belt feeding the crude ore is placed with respect to the take-off belt as shown in the diagram, fig. 5. A series of electromagnets is suspended above the lower span of the take-off belt, and the coils are connected so that adjacent magnets are of opposite polarity. As the crude ore on the feed belt passes under the first magnet the magnetic ore is attracted to the take-off belt while the gangue drops off into the tailings hopper.

The particles of ore in being carried along by the take-off belt have first one end attracted by one magnet and then the other attracted by the adjoining pole-piece, because of the changing polarity. This turn-over process continually mixes up the ore and allows the gangue to drop out. The concentrated ore drops off the take-off belt in the concentrates hopper after passing the last magnet. The bulk of material delivered from this hopper to the rolls and final treating machine is thus reduced, without in any way sacrificing the iron content. Direct current at 125 volts is used in the magnets. From 3 amperes to 7 amperes is required in the belt machines, depending on the size of the ore handled. The degree of refinement obtained depends partly on the attractive force of the magnets, the air-gap and the belt speed.—*Electrical World.*

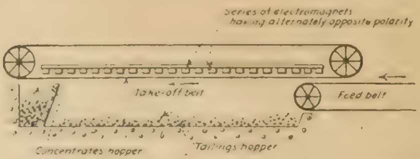

Series of electromagnets having alternately opposite polarity
Take-off belt
Feed belt
Concentrates hopper
Tailings hopper

FIG. 5.—DIAGRAM ILLUSTRATING THE MAGNETIC SEPARATION OF IRON ORE FROM GANGUE.

B.T.H. "Calorite" Electric Stove.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby, are introducing a new stove under the above title, for boiling water and stewing, frying and steaming; it is made of materials not easily injured by heat, moisture or grease, and is of simple and substantial construction, with few component parts. The heating surface is an annealed casting with a machined face 6½ in. square, and is clamped to a frame provided with legs, which have porcelain feet, to prevent the transmission of heat to any article on which the stove is placed. The heating element is of "Calorite" metal, which has a very high melting point—about 2,800° F. Worn-out parts are easily replaced. The terminals are provided with a sheath, which protects the user from contact with live parts, and the flexible from damage in the event of liquid boiling over. The stove takes 1,000 watts, and will boil a pint of cold water in eight minutes, starting with the stove cold; once it is hot, it will boil a pint in five minutes. Ordinary cooking utensils are used, preferably, of course, with flat bottoms.

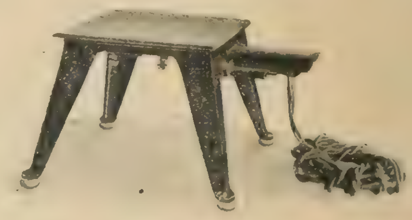
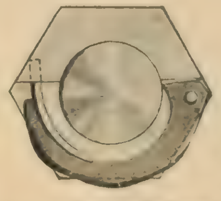


FIG. 6.—B.T.H. "CALORITE" STOVE.

The Rex Lock Nut.

Another new patent lock nut has been brought to our notice, this time by the REX LOCK NUT CO., of Winchester House, Victoria Square, Birmingham. Judging by a sample bolt and nut before us, the nut is both novel and effective. It depends for its action upon a pawl actuated by a spring; the pawl is pivoted in a slot, and has a sharp-cornered heel, which engages with the summits of the threads and exerts a grip which is the more tenacious in proportion as the effort to unscrew the nut is greater. The application of a spanner to the nut from any direction to unscrew the latter, however, automatically releases the lock by holding the pawl clear of the threads. The nut can be screwed on with the fingers, but cannot easily be removed without a spanner, and certainly cannot be jarred off by any vibration. The accompanying sectional illustration, fig. 7, shows the pawl in the



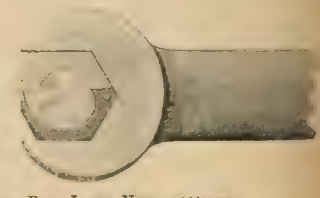


FIG. 7.—SECTION OF REX LOCK NUT, JAMMED.
FIG. 8.—SECTION OF LOCK NUT, LOCK RELEASED BY SPANNER.

gripping position. The nut obviously cannot be accidentally put on the wrong way up. Fig. 8 shows how the spanner releases the lock. It would seem that the slot would weaken the nut; a test by Prof. S. M. Dixon, of Birmingham University, on a ½-in. bolt and nut showed that the bolt was the weaker of the two, and other tests which he made bore out the makers' claim that the nut could not be shaken off the bolt.

BUSINESS NOTES.

The Panama Canal and South American Trade.—We print the following interesting editorial comments from the pages of our American contemporary the *India-Rubber World*. That journal has naturally, because of the particular material and commodity in which it specialises, made a very close study of the South American Continent for many years, and its Editor has, we believe, made a number of tours for that purpose. The opinions expressed can, therefore, safely be regarded as those of an American expert authority on the effect of the Panama Canal upon the international trade position:—

"Much has been said about the vast new market for American goods which will be opened up on the completion of the Panama Canal, and the manufacturers of the United States have been entreated to make ample preparations to occupy this market before it has been preempted by our active rivals across the water. This is good advice, and American goods ought certainly to be much more largely in evidence on the West Coast of South America than they ever have been along its Atlantic side.

"On the surface, at least, it looks as if this new market were most promising. Here is a vast stretch of territory extending from the Pacific to the Andes, and over the Andes, and reaching from the Isthmus of Panama to the Strait of Magellan—a distance of almost 5,000 miles—and occupied by about 15,000,000 people, who hitherto have been so remote as to be of comparatively little interest to us, but who now, in the matter of trade, are to be brought almost to our doors. This would certainly seem like a great opportunity for extending our commerce.

"But here is an instance where enthusiasm should be tempered with discretion, for these 15,000,000 people are not altogether like an equal number of our own countrymen. In fact, the situation is far otherwise. To go a little into detail, there is Colombia with 5,000,000 inhabitants, only 300,000 of whom are white, the rest being of mixed breeds or Indians and negroes; and Ecuador, with 1,500,000 people, only 150,000 of them being white and 1,000,000 of them being Indians; and so on down the coast. Of the 15,000,000 the Caucasian element represents about one-eighth. The mestizos, or mixed race, constitute a little less than one-half, while the rest of this aggregation—or nearly one-half—is composed of negroes and Indians. Obviously, this is quite a different market from any that the American manufacturer is familiar with. Its ability to absorb manufactured goods in great variety and in large quantities has yet to be proved.

"The opening of the Canal will undoubtedly substantially increase the prosperity and the buying power of our neighbours along the West Coast of South America, and these communities will begin to develop as never before, but in view of the ethnological character of a vast majority of these people, this development is not likely to be phenomenally rapid. It seems quite safe to predicate, therefore, that while the Panama Canal will assuredly open up a new and ever-expanding market for American goods, it is a market that must be investigated with care and entered with considerable circumspection."

Railway Station Lighting.—Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston, have sent us two illustrations—one of the exterior, and another of certain platforms, of a well-known London terminus where Wotan half-watt lamps have been applied for lighting. The photographs were taken about midnight. The photograph of the platform illumination shows in skeleton, two trains which drew up to the platform and out again during the time necessary for the exposure of the plate, while the headlights of passing vehicles are discernable on the other. The lighting effect is thoroughly efficient. In these installations Wotan half-watt lamps of 1,000 c.p., running two in series on a 200-volt circuit, are being used to replace a portion of the arc lighting. The existing arc lamp fittings have been converted for use with half-watt lamps in order to keep a uniformity of fitting, and it is quite probable that further circuits will be re-arranged in a similar manner in the near future.

Bankruptcy Proceedings.—Percy Raphael, lately carrying on business as a fur and skin merchant at 2, Edmund Place, Aldersgate Street, E.C., under the style of P. Raphael & Co. A sequel to the Grindell-Matthews Wireless Telephone undertaking, was to be found at the London Bankruptcy Court in this public examination. The debtor attended last week before Mr. Registrar Brougham upon accounts showing liabilities £7,523 and assets *nil*. He stated that for some years he had carried on business with success, but in 1910 the slump in "raw fur" set in, and the following was a most disastrous year in the fur trade; he made some heavy bad debts, and in January, 1912, he arranged to pay a composition of 6s. in the £ on liabilities amounting to £10,000. He paid 5s., but was unable to provide the remaining instalment, and £6,506 of his present liability represented the balance of 15s in the £ due to the trade creditors. In October 1912, witness made the acquaintance of Mr. Grindell-Matthews, who was the holder of a very clever invention for wireless telephony, and had formed a syndicate to exploit the patents. Works were erected at Letchworth and Northampton, and negotiations were entered upon for the flotation of a big company, with a nominal capital of £500,000. Full arrangements were made for the necessary capital to be underwritten, and witness assisted in the promotion by providing in all about £1,600. A cross-channel demonstration was to be given, but the Postmaster-General refused his sanction thereto, with the result that the underwriters withdrew, and the debenture-holders took possession of the patents; the syndicate went into liquidation, and witness lost all his investment. The examination was concluded.

T. Callender (Shamrock Cycle Co.), electrical engineer, Nottingham.—A second and final dividend of 9d. in the £ is payable on June 29th, at the Official Receiver's offices, 4 Castle Place, Park Street, Nottingham.

An Ediswan Showroom.—The illustration, of which we give a reproduction, represents the interior of the Edison & Swan Co.'s new West-End showroom, at 71, Victoria Street, Westminster, S.W. The decorative colour scheme is, of course, not apparent, but the volume and display of the showroom is easily discernable. The range of fancy fittings, from small wall brackets to the more expensive ceiling fittings, makes a very varied and pleasing show. Cooking apparatus, ranging from shaving-water heaters to electric cooking ovens, Ediswan fans and radiators, Royal Ediswan drawn-wire and carbon lamps, Ediswan accessories, and ironclad switchgear are included. The trade are invited to take their clients to Victoria Street to make their selections of either fancy fittings or cooking appliances.

Edison & Swan Co.'s New West-End Showroom.

South Africa.—The South African Customs authorities have recently given a decision to the effect that "electric batteries—refills for hand torches or pocket lamps," when imported separately, are to be classified under No. 98*a* of the Tariff, the duty being 3 per cent. on foreign manufactures, British goods being admitted free of duty. When the refills are imported as parts of torches and pocket lamps, they are to be classified under No. 175 of the Tariff, the duty under which is 15 per cent. *ad valorem* in the case of foreign, and 12 per cent. on British goods.

Bastian Meters.—In view of the increasing adoption of the electric light in small houses, and the disproportionate cost of the service and meter in such cases, the announcement of a reduction of the price of the Bastian meter to a very low figure will be welcomed by supply authorities. The electrolytic meter has the great advantage that it records the whole of the electricity consumed even by a single lamp of the smallest size—or by a leak on the circuit!—a very important consideration when 10-watt lamps are employed. There is also nothing in the meter that wears out or requires periodical adjustment, and the meter, as a rule, needs resetting only about once a year. For small consumers on d.c. circuits it possesses distinct advantages.

Liquidations.—Consolidated Diesel Engine Manufacturers, Ltd.—A petition for the compulsory winding up has been presented by Mr. W. Lawrence the younger (W. Lawrence and Son), building contractor, of 21, Finsbury Circus, E.C., creditor, and will be heard on June 30th.

Wakelin Bros., Ltd., 9, Tottenham Street, W.C. Trustee (Mr. W. A. Henderson, 3, Fenchurch Street, E.C.) released May 22nd.

The Street Lighting Co., Ltd.—Particulars of claims must be sent by July 10th to the liquidator, Mr. W. Blease, 8, Fenwick Street, Liverpool.

For Sale.—Devonport Borough Electricity Department has for disposal a 150-kw. d.c. generating set, 460-585 volts. Particulars are given in our advertisement pages to-day.

Henley's at Windsor.—A large number of the members of Messrs. W. T. Henley's head office staff had a most enjoyable trip up the River on Saturday last. The programme allowed a two hours' stay at Windsor, where luncheon was partaken of; the party then returned to Hampton Court, stopping at Staines for tea on the lawn of the Bridge House Hotel.

Trade Announcements.—Messrs. Krupka & Jacoby, Ltd., are removing to 39, Victoria Street, Westminster, S.W., where they have more commodious offices and stores. All communications should be addressed there in future. Telephone Nos. Victoria 6644 and 6645.

Messrs. Millar & Stewart have opened new premises at 42, George Street, Edinburgh, where five floors have been fitted up as showrooms for all kinds of electrical manufactures. An automatic push-button electric lift gives access to all floors. There is a trade entrance at 32, Rose Street (North Lane), where stores for accessories, lamps, cables, &c., are situated.

Mr. J. D. Lindsay, for nearly six years manager of Messrs. Crompton & Co.'s Newcastle office, has recently started business on his own account at 90, Pilgrim Street, Newcastle-on-Tyne, as agent for Messrs. Bruce Peebles & Co., Ltd., Messrs James Howden and Co., Ltd., and Mr. George Ellison, of Birmingham. Mr. Lindsay only deals with land installations for Messrs. James Howden & Co., their forced-draught business being controlled as heretofore.

Water-Softening by "Permutit."—A party of water engineers visited the Hooton Waterworks, on June 13th, to inspect the "Permutit" water-softening plant which the West Cheshire Water Co. has been the first water authority in the United Kingdom to install for the purpose of purifying water for public supply. The water treated is obtained from boreholes about 800 ft. deep, and has an initial hardness of about 19° Clarke. The company is bound by Act of Parliament to supply water of 10° of hardness, and after the investigation of various systems of water-softening, it was resolved to install the "Permutit" system, which is largely used in Germany for the same purpose. The process, which we have previously described, is based on an exchange of the calcium and magnesium salts from the hardness of the water for the sodium, which is the replaceable base in the "Permutit." The "Permutit," which is insoluble in water and undergoes no visible change, is capable of being revivified over and over again by the simple application of a solution of common salt, which expels the lime and magnesia from combination, and reinstates the sodium. The capacity of the softening plant at Hooton is 1,000,000 gallons daily. The water is softened to zero, and is mixed with an equal quantity of hard water at 19°, the resultant 2,000,000 gallons being sent to the mains with a hardness of 9½°. The plant is looked after by two men.

Book Notices.—*Journal* of the Institution of Mechanical Engineers. No. 1, June, 1914. London: The Institution.—The *Journal* is a new publication, supplementary to the *Proceedings*, and is intended to bring members resident in the country or abroad into closer touch with the current work of the Institution; it will be published once a month during the session. After this year it will replace the *Proceedings*. Following the American practice, it is divided into two parts, with independent pagination; the first part deals with general information, and includes a précis of the next paper to be read, which will enable a reader to judge whether the paper deals with matter in which he is especially interested, in which case he can obtain a copy of it in advance. The contents of Part I being of ephemeral interest, it is not intended to be permanently retained, and is, therefore, printed on thin paper. Part II is the permanent record of the *Proceedings*: at present it is printed on thin paper, but next year it will supersede the ordinary *Proceedings* and will be printed on the same class of paper as is now used for the latter. It is hoped that it will be possible to place in the hands of every member a complete copy of each paper, with a report of the discussion, within three weeks of the date of reading. It is proposed also to make arrangements for reading the papers simultaneously at various local centres.

The present issue gives particulars of the Summer Meeting to be held in Paris and Northern France, beginning on Monday, July 6th.

Glover's Almanac.—We have just received Messrs. W. T. Glover & Co.'s Almanac for 1914-15—the thirteenth issue of this unique compendium of instructive and amusing items. The present issue is arranged with a view to driving home the idea suggested in one sheet by following it up and enlarging upon it in subsequent sheets; but this is not carried to the point where it becomes wearisome, and the comic sketches which are interspersed enliven the reading, so that, having begun to turn over the pages, one finds it difficult to stop. But an old friend can be welcomed with few words, and we need not emphasise the merits of this clever production, which seems to have become a permanent institution.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIII, No. 6. June. New York: The Institute. Price $1.

"Handbuch der Elektrizität und des Magnetismus." By Prof. Dr. L. Graetz. Leipzig: J. A. Barth. Price M. 5.40.

"Mehrfach-Telegraphen." By A. Kratz. Brunswick: Vieweg und Sohn. Price M. 10.

"Electrical Engineering." (A First Year Course.) By Frank Shaw. London: George Routledge & Sons, Ltd. Price 2s. net.

"Questions and Answers about Electrical Apparatus." By J. W. Craig and W. P. Woodward. London: S. Rentell & Co., Ltd. Price 6s. 6d.

"Cours d'Electricité Théorique." By J. B. Pomey and L. Lecournu. Vol. I. Paris: Gauthier-Villars et Cie. Price 13 fr.

Catalogues and Lists.—Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—Pamphlet No. 34a contains a description, with illustrations, of the firm's h.t. ironclad switchgear for mining and sub-station work, with prices, weights and dimensions, and code-words.

Messrs. Krupka & Jacoby, Ltd., 39, Victoria Street, Westminster, S.W.—Illustrated price list of electrical conduits and fittings.

The Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, London, W.C.—Pamphlet No. 259 gives particulars and revised prices of Rawlplugs for electric installation work.

Messrs. Edison Accumulators, Ltd., 2 and 3, Duke Street, London, S.W.—Twenty-page catalogue of electric pleasure cars manufactured by Arrol-Johnston, Ltd., and fitted with Edison accumulators. Descriptive matter appears relating to the chassis design, the Edison battery, and the Sangamo meter.

The Carron Co., Carron.—A hanging coloured showcard advertising the Carron electric cooking range in a very attractive setting, the object being to introduce such apparatus into shooting lodges, &c.

Mr. Edward White, Redditch.—8-page illustrated pamphlet showing polishing and scouring machines for small metal goods and steel toy trades.

Messrs. Balcke & Co., Ltd., Broadway Court, Broadway, London, S.W.—List No. 314 gives an illustrated description of the Balcke-Harle exhaust steam accumulator, which they are just introducing on the English market.

Allgemeine Elektricitats Gesellschaft.—Price lists of "Nitra" lamps, from 200 to 3,000 c.p., reflectors, &c., and low-voltage Nitra lamps for 50 to 200 c.p., 14 to 25 volts, to be used with transformers. Leaflets relating to motor-driven pumps, blowers, machine-tools and rolling-mill auxiliaries.

Messrs. R. W. Haylock & Son, 63, Queen Victoria Street, London, E.C.—Illustrated leaflet showing the "Hotpoint" El Boilo electric immersion heater, and various electric heating and cooking apparatus.

The Electrical Co., Ltd., Charing Cross Road, London, W.C.—The *E.C. Journal* for June contains, in addition to the usual features, illustrated articles on the A.E.G. turbine factory, electric incubators and rearers for chickens, and the manufacture of rubber-insulated wires.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.—The *Mazda House News* for May-June contains photographic reproductions of a number of views showing the Mazda lighting of a large London factory; other subjects dealt with are: Shop window lighting; hospital lighting; the lighting of a squash racket court.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—A most attractively-produced pamphlet of 32 pages dealing with aluminium insulated cables. In the introductory pages the main objections that are raised against the adoption of aluminium insulated cables are discussed, such as—doubtful economy, difficulty of working and jointing, and low scrap value. The rating of cables is then fully considered, comparative cable ratings being shown by a number of curves. Low-tension cables (vulcanised bitumen and paper-lead cables, and vulcanised india-rubber cables), also high-tension cables and jointing of cables are all discussed and illustrated.

Messrs. Pass & Seymour, Inc., Solvay, N.Y.—Catalogue No. 22, of 80 pages, gives illustrations, descriptions and prices of a variety of electric wiring devices, including lamp sockets and switches, the "Shurlock" socket, wall receptacles, porcelain sockets, &c.

The Edison & Swan United Electric Light Co., Ltd., Ponder's End.—32-page catalogue of Ediswan bells for various classes of service, including fire, engine-house and mining type bells, indicators, batteries, pushes, burglar alarms and accessories.

Messrs. Atkinson Bros., Aire Place, Kirkstall Road, Leeds.—Several illustrated circulars giving particulars and prices of electric drills, small motors, ball-bearing electric fans, box-blade fans, &c.

The Thermal Syndicate, Ltd., Wallsend-on-Tyne.—Forty-four-page illustrated and descriptive publication dealing with their pure fused silica ware, manufactured by patent process, for use in chemical and other industries.

Messrs. J. J. Eastick & Sons, Oldhill Street Mews, Clapton Common, N.E.—Illustrated list describing and pricing their Chromolyte electric hand lamps, and electrolyte for same.

The British Prometheus Co., Ltd., Salop Street Works, Highgate, Birmingham.—Leaflet No. 156 contains illustrations of a variety of designs of electric kettles, and tabulates prices and code-words for same.

The Synchronome Co., Ltd., 32, Clerkenwell Road, London, E.C.—Pamphlet describing the "Horophone" for receiving wireless messages, especially time signals. Particulars are also given corrected to the current month regarding the wireless signals dispatched from the Eiffel Tower and Norddeich, together with notes regarding aerials, weather reports, &c.

Meters Approved.—The Board of Trade has approved of the following meters:—

Siemens-Schuckert unit meter type W 3, deposited by Siemens Bros. Dynamo Works, Ltd., April, 1913.

D.C. watt-hour meter type L Ra, deposited by the Electrical Co., Ltd., meter department, May, 1914.

The Pirelli Cable Works. — *The Southampton Pictorial* contains some pictures of the Western Shore, Southampton, in 1771, and at the present time. The second illustration shows the Pirelli new works, which are rapidly nearing completion.

The Salvation Army Congress Hall.—To accommodate the great Salvation Army Congress which has just been held in London, a temporary hall was erected on the vacant land at the junction of Kingsway with the Strand, and was equipped with an electric lighting installation by Messrs. Francis Polden and Co., who decided to use half-watt Osram lamps. Two distinct services were led into the building through distribution boards in the entrance hall, where all control was effected, and alternate lamps throughout were on the same service, so that the chance of the building being put into darkness by failure of the supply was extremely remote. All the wiring above 20 ft. from the ground was carried on porcelain insulators well away from any woodwork and the walls. The interior lighting was effected by means of 24 50-volt, 300-watt "Half-Watt" Osram lamps, giving approximately 600 C.P. each, enclosed in G.E.C. polished brass special "Half-Watt" fittings, with "Superlux" bowls and reflectors, and for the outside lighting on the Strand front two 100-volt, 500-watt half-watt Osram lamps of approximately 1,000 C.P. each were enclosed in lanterns with "Superlux" globes. The General Electric Co., Ltd., supplied the Osram lamps and the fittings.

The Electrical Industry in Wolverhampton.—In the annual report of the Wolverhampton Chamber of Commerce, just issued, it is stated:—"The volume of work in this industry has been well maintained during the past 12 months. The use of electricity for power applications, wireless telegraphy, chemical processes, lighting, heating, cooking, and a great variety of other purposes, continues to expand. Competition for business is not so reckless as it was in former years, and the industry is therefore more stable and settled. The local factories have been well supplied with orders, and have good bookings ahead. Some of them have found it necessary to increase their buildings and plant to cope with the demand made upon them."

LIGHTING and POWER NOTES.

Aberdeen.—Public Lighting.—Schemes for improving the lighting of Rosemount are before the T.C. They include electric lighting, high-pressure gas, and gas lighting with double-inverted burners. The latter plan is recommended by a Committee.

Aldershot.—Diesel Engine Vibration.—A writ has been served on the U.D.C. by a resident who alleges that a nuisance exists through the vibration of the Diesel engine at the electricity works; the B.C. has decided to defend the action, and, if so advised, to join the Diesel Engine Co. as third parties.

Barnes (Surrey).—The U.D.C. has referred to the Law and Parliamentary Committee the question of applying for powers to purchase and lend on hire electrical appliances and fittings.

The Council has decided to supply current for power purposes to Messrs. Watney, Combe, Reid & Co., for four years, with an annual consumption of not less than 150,000 units, at ·94d. per unit. A special cable will be laid.

Barrow.—The Education Committee has approved a scheme for the provision of a laboratory for experimental work in connection with heat engines, at a cost of £1,200; £50 was allowed for an E.L. installation.

Beckenham.—Proposed New Plant.—The U.D.C. has decided to apply to the L.G.B. for sanction to a loan of £2,233 for a 500-KW. condenser, and £570 for a 120-KW. D.C. tramway generator.

Bury St. Edmunds.—Free Wiring.—The T.C. has adopted a system of free wiring for electric light through a contractor. As an experiment, not more than 12 houses, of a rental of not less than £14 a year, will be wired.

Canada.—The Michigan Northern Power Co. and the Algoma Steel Corporation have been authorised to divert 30,000 cb. ft. of water per second from the river, which means the development at Sault Ste Marie of 106,000 H.P. of electricity. The cost of the development will be $13,250,000.—*Canadian Engineer.*

Cheadle and Gatley.—Proposed E.L.—A deputation from the U.D.C. is to interview representatives of the Manchester and Stockport T.C.s regarding terms for a supply of electricity in the district.

China.—A sum of 700,000 taels has been voted for additional plant at the Riverside electricity works, Shanghai.—*Indian Textile Journal.*

Colwyn Bay.—Promenade Lighting.—The U.D.C. has decided to light part of Cayley Promenade Road with electricity.

Consett.—E.L. Scheme.—The U.D.C. has accepted the offer of the Cleveland and Durham E.P. Co. for E.L. in the district. The Council is to pay £240, the cost of a separate lighting main, and as this will also benefit the company, the Council is to receive 90,000 units free.

Continental Notes.—Germany.—The Heiligenstadt R.D.C. has concluded an agreement with the Siemens Schuckert Werke for a supply of electricity in the district.

The Berlin suburb of Gross-Lichterfelde has just made a new agreement with the Berliner Vororts Elektricitätswerke A.G., by which for 30 years the company is to supply energy to the municipality at 0·84d. per unit for the first million units, 0·78d. for the second million, and 0·66d. above two million. The municipality determines selling prices and receives consumers' payments, but the company retains the ownership and management of the plant and mains, subject to a purchase clause regarding the latter.

The city of Hamburg has also rearranged its relations with the semi-municipal Hamburgische Elektricitätswerke in such a way as to secure a more powerful control and more advantageous purchase rights.

After many months of discussion in committee, the Berlin Municipality has now commenced public discussion concerning the future of the Berliner Elektricitätswerke. The concession is certain not to be renewed to the A.E.G. in its present form, but the comparative merits of municipal purchase and financial participation are being debated vigorously.

Finland.—It is claimed for the central electric lighting station which has recently been completed in the town of Wiborg, that it is the largest so far equipped with steam engines and boilers of the semi-portable type. The plant comprises three boilers and three sets of 500-650-H.P. steam engines, the latter being coupled direct to 380-KW. A.E.G. alternators. The plant is also interesting in that it is employed as an auxiliary to a hydro-electric power station near Wiborg.

Austria.—An hydro-electric undertaking is projected on the Mengbach, near Nenzing, on the Vorarlberg. It will have a capacity of 12,000 H.P., and will supply electricity to the municipal stations at Feldkirch and Bludenz, and also to Messrs. Jenny and Schindler. The cost of the undertaking is put at 4,000,000 kronen.

The Buda-Pesth T.C. has bought the plant, &c., of the Ungarische Allgemeinen Elektricitäts Gesellschaft for 21,757,000 kronen, and that company now ceases to exist.

One of the largest undertakings of its kind in Austria is stated to be about to be constructed at Marchegg, in Lower Austria. The great central station there projected will have a distribution network extending from the River March to Stockerau, a distance of about 20 miles.

Darfield.—Fire.—Hundreds of patent electric safety lamps, charging plant, and electric motors, valued at between £1,000 and £2,000, were destroyed by fire at the Houghton Main Colliery last week.

Exeter.—Year's Working.—The receipts of the Corporation electricity undertaking for the past year amounted to £19,544, an increase of £1,343 compared with the previous year. The working expenses were £11,605. Interest, income-tax and sinking fund charges absorbed £6,502, leaving a net balance of £1,446. The total output increased by 150,011 units, or nearly 10 per cent., and the energy sold for power and lighting increased by 17½ per cent. Coal cost £600 more than in the preceding year. All expenditure in connection with the old power station is now wiped out, and the assets in connection with it, including land, buildings, boilers, mains, &c., are valued at from £3,500 to £4,000.

Frinton-on-Sea.—Supply to Beach Huts.—The U.D.C. has sealed a contract with the E.L. Co. for lighting St. Mary's Road, as an experiment. The Council has also consented to the company supplying energy to the huts on the Sea Wall Promenade by overhead wires for lighting and heating, on condition that the company provides a lamp on alternate poles free of charge.

Great Harwood.—Proposed E.L.—The Trades Council has appointed a committee to consider the question of an E.L. scheme for the town, with a view of obtaining an extension of the U.D.C.'s prov. order, which expires in August.

Hull.—Annual Report.—The report of the borough electrical engineer, Mr. H Bell, on the last year's working of the undertaking, states that the gross income had risen, chiefly owing to the development of power supply, from £75,291 to £82,813, and the average price had dropped from 1·62d. to 1·52d. per unit. The working expenses had been £47,256, an increase of £6,798 over the previous year, 32 per cent. of which was due to the increased cost of coal. £5,354 was carried forward. The units sold numbered 12¼ millions, an increase of 16¼ per cent. The present total plant capacity was 11,800 KW. The contract with Earle's Engineering and Shipbuilding Co., which took approximately 750 H.P., has been extended for a further five years. Bulk agreements had been entered into with other leading firms. The mains had been extended by 7½ miles, and the total is now 237 miles.

Huddersfield.—New Mains.—The Electricity Committee has authorised the electricity mains to be extended to Bankfield Mills, Lockwood Brewery, the Rent Ley Silk Co., Newsome Chapel, Outlane, and the workhouse.

Irvine.—E.L. Scheme.—The T.C. has decided to take a supply of electricity for the burgh from the Kilmarnock T.C., the charges to be the same as are in force in Kilmarnock. The Irvine T.C. is to have the option of purchase at the end of 21 years.

Java.—According to *La Gazetta de Hollande*, it is proposed to introduce electric power into the tin mines. The idea is to extend a power station now building for the Banka Mines at Klabath Bay, and transmit H.T. supply to various districts.

Lees (near Oldham).—Proposed E.L.—The U.D.C. has decided to confer with the Springhead U.D.C. on the question of a joint application to the Oldham T.C. for terms for a supply of electricity.

London.—Stepney.— Proposed Loan. — Application is to be made to the L.C.C. for sanction to borrow £3,000 for electricity services.

The Electricity Committee has purchased an electric delivery van from Opel Motors, Ltd., at £185.

Woolwich.—According to the *Financial News*, the B. of T. has sanctioned an arrangement whereby the municipal electricity undertaking proposes to join two companies in the matter of bulk supply.

The L.C.C. has refused to accede to the request of a conference of Metropolitan Borough Councils, to summon a general conference of local authorities in London owning electricity undertakings, to consider the question of the maximum period for the repayment of loans granted by the Council for electricity purposes. On behalf of the Finance Committee, it was stated that the present moment was most inopportune for calling a conference, because at no distant date it was anticipated that the Special Electricity Committee of the Council would report on the whole subject of London electricity.

Fulham.—There was a surplus of £8,220 on the past year's working of the B.C.'s electricity undertaking, from which the E L. Committee proposes to transfer £5,000 to the reserve account, and to retain £3,226 as a working balance.

Lye (Stourbridge).—Proposed E.L.—The U.D.C. has appointed a Sub-Committee to consider the question of E.L. in the district, and the terms of an agreement with the Midland Electric Corporation for Power Distribution.

Maidenhead.—The T.C. has offered to supply electricity to the workhouse laundry at 5d. per unit for lighting and 1½d. for power, the latter to be increased to 2d. for current used between sunset and 10 p.m.

Luton. — L.G.B. Inquiry. — An inquiry was held on Monday into the application of the T.C. for a loan of £4,500 for extensions to the refuse destructor.

Middlesbrough.—Year's Working.—The gross profit on the Corporation electricity department for the past year amounted to £11,741, compared with £11,113 in the previous year, and the net profit was £3,814, against £3,369. The average price per unit was 1·68d., against 1·76d.

The T.C. is about to sign an agreement to take over the powers to supply North Ormesby.

Morecambe.—Promenade Lighting.—The borough electrical engineer is to be asked to prepare a scheme for illuminating the seafront in September, and the Corporation will be asked to supply current free.

The E.L. Committee has decided, to renew the economiser at a cost of £300.

Mutford and Lothingland.—Workhouse Lighting.—The B. of G. has appointed a Committee to consider the lighting of the workhouse.

Oldham.—The Electricity Committee has decided to order additional machinery for the purpose of increasing the A.C. supply of power for factory driving, &c., at an estimated cost of £40,000, and the chairman has been deputed to interview the makers of machinery, with the object of securing the best terms.

Ormskirk.—Proposed Loan.—The B. of G. has decided to apply to the L.G.B. for sanction to borrow £823, for electricity purposes.

Rawtenstall.—Theatre Lighting.—The T.C. has decided that picture house and theatre occupants with weekly accounts be allowed a discount of 10 per cent. from their electricity accounts, provided the same are paid within five days.

Rugby.—Year's Working.—The total revenue of the U.D.C.'s electricity department for the past year amounted to £5,892, and the expenditure to £3,661. The net profit was about £800. Nearly 400,000 units were sold during the year.

The charges for energy for power have been amended as follows:—Less than 100 units per quarter per H.P. installed, 2d. per unit; between 100 and 200 units, 1½d. per unit; between 200 and 400 units, 1¼d. per unit; above 400 units, 1⅛d. per unit.

Saffron Walden.—Proposed E.L.—The T.C. has appointed a Committee to consider the question of introducing E.L. into the town.

Sevenoaks.—The U.D.C. has decided to have the E.L. installed at the baths, and the E.L. Co. has offered to lay a free service cable on the Council undertaking to take current for five years.

Shrewsbury.—Year's Working.—The total income of the Corporation electricity department for the year ended March 31st last was £8,577, and the expenditure £4,828. After payment of interest on loans, £1,004, and sinking fund charges, £2,622, the net surplus was £128, against £95 in the previous year.

Southend-on-Sea.—Proposed Supply to Sanatorium.—Having been asked by the Middlesex C.C. upon what terms it would supply electricity to the Sanatorium which it is proposed to erect near Eastwood, the T.C. has agreed, subject to B. of T. sanction, to supply the institution on the C.C. consenting to pay 12½ per cent. per annum interest for ten years on the capital outlay, in addition to the usual charges; or, should the C.C. install a battery, the charge for energy would be 1½d. per unit between 6 a.m. and 6 p.m., and 6d. per unit between 6 p.m. and 6 a.m., in addition to the interest. The cost of the mains to the Sanatorium is estimated at £3,750.

The T.C. has decided, as a preliminary measure, to lay E.L. mains in 22 thoroughfares in Leigh, as required.

The Council has also decided to light the exterior of the Pier Hill Buildings, with 14 100-C.P. metal-filament lamps.

St. Margaret's (Kent).—The chairman of the P.C. has interviewed the B. of T. respecting the control of Dover T.C. on the question of a supply of electricity, and he reports that the Council can only obtain release from the control upon Dover agreeing to it, or the Corporation not having carried out its contract. Dover would not grant the release, and he was informed that it had carried out the undertaking given, as it was not obliged to supply St. Margaret's, the undertaking being to install cables in a certain number of streets. The chairman adds that the B. of T. official informed him that if the new company proposed to supply St. Margaret's, and went to the B. of T., the latter would support it, unless Dover agreed to complete its obligations without further delay.

United States.—The new hydro-electric installation of the Parr Shoals Power Co., carried out by the J. G. White Engineering Co., New York, has been started up. The power house is fireproof, and the present installation comprises five units, which will generate 18,000 H.P., while provision has been made for the eventual development of about 30,000 H.P. Energy is to be transmitted to Columbia at 60,000 volts, over a double circuit, steel-tower transmission line.

Walsall.—L.G.B. Inquiry.—An inquiry was held last week by Mr. T. C. Ekin, into the application of the T.C. for sanction to a loan of £74,830, for electricity purposes. The application was supported by several manufacturers in the town, and opposed by the Chamber of Commerce and the Tradesmen's Association.

Whitehaven.—The T.C. has decided to wire houses for E.L. where the tenants are owners, and to supply energy in such cases at 5½d. per unit, instead of 4½d., until the cost of wiring has been met.

Current is to be supplied for new lamps to be erected by the Harbour Commissioners, and consideration is to be given to a tariff for the domestic use of electricity.

TRAMWAY and RAILWAY NOTES.

Bury.—Goods on Tramways.—The Tramways Committee has instructed the manager, Mr. W. Clough, to prepare a scheme for the conveyance of goods on the tramways in Bury and district.

Continental Notes.—Austria.—The building section of the Austrian State Railways Administration has applied for sanction to the erection of a hydro-electric installation on the Mur River. Six 1,450-H.P. twin Francis turbines, a 250-H.P. exciter turbine, and a pump accumulator plant are to be installed.

India.—The concluding portion of Messrs. Merz and McLellan's report on the electrification of the E.B.S.R. suburban lines, proposes four lines from Calcutta to Naihati, and two from Naihati to Kanchrapara. Overhead conductors are recommended in place of a third rail, owing to trespassing on the lines, and the abolition of the intermediate class is proposed. A power station is suggested at Barrackpore, and the cost will be greatly cheapened if the E.I. Railway electrify concurrently and immediately their suburban line to Bandel. The principal object of electrifying the Eastern Bengal suburban lines is a financial one, and the consulting engineers report that it will pay to electrify them, as the gross capital outlay required for the scheme will be £904,855, and the annual saving in train operation alone is reckoned at £82,000, in spite of higher speeds of trains and of the better train service proposed. If it were decided to erect their own power station, the capital expenditure proposed above would be increased by £332,000, and the total gain by electrification would be £105,000. The investigation has shown that for the suburban scheme the direct-current system is the most suitable.

Liverpool.—Proposed 'Bus Service.—A recommendation of the Tramways Committee that several new motor-omnibuses be purchased has been referred back by the T.C.

London.—The G.N. Railway and Metropolitan Railway Bill, authorising the promoters to form a joint Committee to work the Great Northern and City line, to make junctions at Finsbury Park and the Bank, &c., has been withdrawn by the promoters.

Mexboro'.—Proposed Extensions.—The Mexboro' and Swinton Light Railways Co. has forwarded to the U.D.C. details of the overhead equipment of the proposed extensions, with an intimation that it proposes to commence construction.

Newport (Mon.).—Year's Working.—The past year's working of the Corporation tramway department has resulted, subject to audit, in a loss of £2,637, as against £2,326 in the previous year.

Walthamstow.—Proposed Loan.—The Light Railways Committee has recommended the U.D.C. to apply to the B. of T. for power to borrow £2,839, for the purpose of doubling the tramway track in Chingford Road. The Finance Committee is of opinion that provision should also be made for a loop near the Mark House terminus, and is recommending accordingly.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Government will spend £4,400 on the erection of two wireless telegraph stations at Posadas and Puerto Aguirre.—*Board of Trade Journal.*

Australia.—A reduction has been made in the charges for telegrams transmitted from ships trading only in Australasia to shore addresses by wireless, from 10d. per word plus the usual inland rates, to a definite rate of 6d. per word, inclusive, without a minimum charge.

China.—It is reported that a contract between the Chinese Government and the Marconi Wireless Telegraph Co., amounting to £2,000,000, for the erection of eight high-power stations and a number of smaller ones, will shortly be signed. The Marconi Co. will receive for 25 years a royalty of 15 per cent. upon the receipts from all the stations.

France.—An article in *La Lumière Electrique*, of June 20th, describes very fully the development of wireless telegraphy in the French Colonies, and the projected inter-Colonial network which will connect them with the Motherland. Already 35 stations are in operation or in course of construction, and 27 are to be erected, in addition to the future long-distance chain.

Germany.—Wireless messages have been exchanged between Nauen and Windhuk, in German South-West Africa, over a distance of 7,000 miles.

Imperial Communications.—In a letter addressed to Mr. Hobhouse, Sir J. H. Heaton suggests the appointment of an Imperial Postmaster-General, to control all postal and telegraphic business affecting the Empire as a whole, and advocates the provision of an Imperial telegraphic service at low rates.

Norway.—In June last year the Storthing voted a sum of about £1,110,000 for the establishment of wireless communication between Norway and the United States. The transmitting station in Norway is now being erected in Ullenhaug, near Stavanger, on the west coast. Three-phase alternating current will be supplied by the town power station. The receiving station is being erected at Noerbö, about 17 miles south of Stavanger. The works are all on an extensive scale, and when completed the two stations will, it is claimed, be the largest of their kind in the world. On the American side, the transmitting and receiving stations will be near Boston.

Russia.—A wireless station has been opened on the Island of Waigatz, belonging to the Government of Archangel, in the Arctic Ocean.

Submarine Wireless Telephony.—Successful experiments were recently carried out at Boston by the Submarine Signal Co., with apparatus devised by Prof. R. A. Fessenden for telephoning between vessels ten miles apart.

Telephonic Ninepins.—Under this heading, the *Standard* says that a furniture van at Brighton on Friday last collided with a cast-iron standard carrying telephone wires. The standard snapped at the bottom and fell. The strain of the wires and the weight of the standard brought down 17 other standards in quick succession. The local telephone service was disorganised and the trunk lines to London were interrupted.

Trunk Telephone Calls.—In future no charge will be made for ineffective calls on the British trunk lines.

Wireless Direction Finder.—The R.M.S. *Royal George* has been fitted with the Marconi-Bellini-Tosi apparatus, which, in the thickest weather and without the aid of the compass or sextant, will enable her to find her position when she is within a radius of 50 miles of a fixed wireless station, or one on board a ship whose position is known. Also, should she pick up the wireless distress signal on this apparatus, she will be able to set her course towards its source, even though the ship in distress has not been able to give her position. A set of this apparatus, installed by the Marconi Co. on the R.M.S. *Eskimo*, plying between Hull and Christiania, has given very satisfactory results.

CONTRACTS OPEN and CLOSED.

OPEN.

Alford.—June 27th. Public lighting, for the U.D.C. Mr. T. N. Loy, Clerk.

Australia.—Sydney.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

Perth.—August 5th. Copper wire and binders, for Postmaster-General. See "Official Notices" to-day.

August 5th. Telephone instruments and parts. Telegraph accumulators and power board, Kalgoorlie, for Postmaster-General. See "Official Notices" to-day.

August 12th. Cable, lead-covered and various, for Postmaster General. See "Official Notices" to-day.

August 12th. Insulators, for Postmaster-General. See "Official Notices" June 12th.

August 19th. Electric lamps and fittings, for Postmaster-General. See "Official Notices" to-day.

August 19th. Telephone switchboards, galvanised iron and steel stranded wire, for Postmaster-General. See "Official Notices" to-day.

Melbourne.—July 6th. Rotary converters and frequency changers, for Melbourne Suburban Railways. See "Official Notices" June 5th.

July 6th. Electrically-operated car-shed cranes for Melbourne Suburban Railways. See "Official Notices" June 12th.

Aylesbury.—July 6th. U.D.C. Lighting and power switchboard with connections, battery of accumulators, underground mains, including house services, conversion of existing lamp standards, &c. See "Official Notices" June 12th.

Ballaghadereen.—July 6th. Hydraulic turbine and accessories, dynamo and reducer set, aerial line and switchgear, for the Electricity Committee. See "Official Notices" June 19th.

Blackburn.—June 26th. Electric light installation at the Ragged School. Specifications, &c., from Mr. J. Chilman.

Blackrock.—July 13th. U.D.C. Underground mains, overhead mains, feeder pillars and public lighting. See "Official Notices" to-day.

Bolton.—July 19th. Corporation. Converting plant, sub-station E.H.T. and H.T. switchgear. See "Official Notices" June 12th.

Canada.—July 1st. For the Esteven (Sask.) T.C. Two 250-KW. three-phase generators and exciters; one 500-KW. three-phase generator and exciter; three gas engines, complete with tar and dust extractors, and one switchboard. Particulars from Mr. L. G. Dethridge, Borough Electrical Engineer. Tenders to Mr. P. J. Stephens, Borough Secretary and Treasurer.

Canterbury.—June 29th. 1,800 tons small coal, and 400 tons first-class Admiralty large Welsh, for the Corporation Electricity Works. Mr. Henry Fielding, Town Clerk.

Exminster.—June 29th. Electrical appliances for a year for the Devon County Lunatic Asylum. Mr. H. E. Morgan, Clerk.

Fleetwood.—July 2nd. U.D.C. Electricity Department. Moderately rough coal for 12 months. Mr. A. Cottam, Clerk, Town Hall, Fleetwood.

France.—Paris.—July 7th. The French State Railway authorities (Bureaux du Service Electrique, 3e Division) in Paris (72, Rue de Rome) are inviting tenders for the supply of 2,599 electric rail connections, 7,600 m. of bare copper cable of a section of 200 sq. mm., and 1,600 m. ditto of a section of 400 sq. mm.

Lille.—July 3rd. Cable and sundry electric equipment for the pumping station on the La Bassée River. Particulars of the Maire, Hôtel de Ville, Lille.

Seine.—The State Railway Administration (42, Rue de Châteaudun) will shortly place orders for: Lot 2, 12 travelling cranes, with electric gear, for the new machine shops at Sotteville; Lot 3, 12 bogie-truck railway carriages, divided into first and second-class compartments; Lot 4, 20 twin-spring bogie-truck automotor carriages and 10 trailers. Particulars, 44, Rue de Rome, Paris.

Keymer (Sussex).—June 27th. Public lighting, for the P.C. Mr. H. Plummer, Clerk, Lyntonville, Hayward's Heath.

Leeds. — July 6th. Tramways Committee. Six hundred waterproof overcoats. Mr. J. B. Hamilton, Manager.

June 29th. Corporation. Air-cooled transformers. See "Official Notices" May 22nd.

London.—L.C.C. June 30th. 150 sets plough collector gear. See "Official Notices" June 12th.

July 13th. One, two or three electrically-driven chassis, for Fire Brigade. See "Official Notices" June 19th.

July 14th. Five rotary converters of 1,500 KW. each, 15 main static transformers, two starting static transformers, and re-erection, &c., of existing motor generators. See "Official Notices" June 19th.

July 30th. 10,000 or 5,000 driving and pony wheel tramcar tires, 300 axle forgings for tramcars. Chief Officer, Tramways Department, 62, Finsbury Pavement, E.C.

H.M. OFFICE OF WORKS.—June 30th. Wiring public offices extension, Westminster, S.W. See "Official Notices" June 12th.

July 1st. Twelve months' supply of incandescent electric lamps. See "Official Notices" June 19th.

July 7th. Three years' supply of electrical accessories. See "Official Notices" June 19th.

HACKNEY.—July 9th. B.C. 80,000 pairs open-type white arc lamp carbons, and 100,000 pairs yellow-flame arc lamp carbons. See "Official Notices" to-day.

Manchester.—June 26th. Corporation. Potential and current transformers, C.C. and A.C. motors, electricity meters, C.C. motor-starting switches, and three-phase star-delta switches. See "Official Notices" June 12th.

June 30th. Education Committee. Electric light installation at the Mill Street Day Industrial Schools. Specifications, &c. (21s., returnable), from the Education Offices, Deansgate.

New Zealand. — AUCKLAND. — August 6th. Three 750-KW. D.C. mixed-pressure turbo-generators; one 1,500-KW. three-phase turbo-generator, including auxiliary plant and sub-station equipment. See "Official Notices" May 22nd.

July 31st. Seventy three-phase A.C. motors, including four 150-B.H.P., one 100-B.H.P., and eight 75-B.H.P., for the Dominion Portland Cement Co. Specifications from E. W. Hunt, secretary, Johnston Street, Wellington, or S. I. Crookes, Consulting Engineer, Auckland. —*N.Z. Shipping and Commerce.*

Particulars may be seen at the Commercial Intelligence Branch of the Board of Trade in London.

Pittington (Durham). — July 11th. Poles, lamps, cables, &c., for the Parish Council. Specification from Mr. T. Carson, Clerk.

Ramsey (Hunts).—July 6th. Public lighting, for the U.D.C.; Mr. R. F. Serjeant, Clerk.

Rochdale.—July 1st. Corporation. Wet-air filter. See "Official Notices" June 19th.

Rochester.—June 30th. Corporation. Electric lighting of the Corn Exchange Buildings. See "Official Notices" June 19th.

Roscrea (Ireland).—July 2nd. B. of G. Wiring and fittings for workhouse lighting. Specification from Mr. L. J. Lawless, 27, Castlewood Avenue, Dublin.

Rotherham.—July 8th. Corporation. Tramway stores, coals, cables, meters, &c. See "Official Notices" June 19th.

Salford.—June 26th. Corporation. Switchboard for the docks sub-station. Specification from the Borough Electrical Engineer, Electricity Works, Frederick Road, Pendleton.

Skelton and Brotton.—July 2nd. U.D.C. Overhead lines, underground cables, transformers, sub-station equipment, public lighting fittings. See "Official Notices" June 12th.

Stalybridge.—June 27th. 12 months' supply of stores for the Joint Tramways and Electricity Board. Specifications and form of tender obtainable from Mr. R. Blackmore, Engineer-in-Chief, Generating Station, Stalybridge.

Stoke-on-Trent.—Corporation. Twelve months' supply of coal and slack for the Electricity Supply Department. Specification from the Chief Electrical Engineer, St. Peter's Chambers.

Thorne (Yorks.)—July 6th. Public lighting, for the P.C. Mr. C. Waller, Clerk.

Walsall.—July 14th. Corporation. Four water-tube boilers, superheaters, economisers, pumps, pipes, &c. See "Official Notices" June 19th.

July 14th. Corporation. Two 3,000-KW. turbo-alternators with surface condensers, motor generator. See "Official Notices" June 19th.

Warrington.—July 3rd. Electric equipment, &c., for transporter bridge over the River Mersey, for Jos. Crosfield & Sons, Ltd. Drawings, &c. (£2 2s.) from Mr. W. H. Hunter, M.I.C.E., 42, Spring Gardens, Manchester.

July 8th. Corporation. High and low-tension cable. See "Official Notices" to-day.

West Ham.—July 20th. Lighting installation at Rosetta Road School, for Education Committee. See "Official Notices" to-day.

CLOSED.

Australia. — The Sydney Council has received the following tenders:—

Bare copper cable.—Standard Cable Mfg. Co., £2,190; B.I. & Helsby Cables, Ltd., £2,212; W. T. Henley's Telegraph Works Co., Ltd., £2,407.

Underground cable (11,000 volts).—Western Electric Co., Ltd., £10,120; Noyes Bros., £10,825; Australian Metal Co., Ltd., £10,760; Australian Metal Co., Ltd. (alternative), £8,225; Siemens Bros., £10,600; B.I. and Helsby Cables, Ltd., £11,082; W. T. Henley's Telegraph Works Co., Ltd., £11,839; N. Guttheridge, Ltd., £11,606.

—*Australasian Record.*

Belgium.—Seven concerns—four German, two Belgian and one French—submitted tenders last week to the municipal authorities of Antwerp, for the supply of a quantity of armoured cables for the new dry dock at the port of Antwerp. The lowest offer was that of the Hoddernheimer Kupferwerk und Suddeutscher Kabelwerk Gesellschaft.

Devonport.—The Corporation has made a contract with the British Thomson-Houston Co., Ltd., for 12 months' supply of continuous-current mercury ampere-hour meters.

Elland.—In connection with the erection of a new church for the trustees of the Southgate United Methodist Church, the tender of Mr. F. Horsfall (£440), for the lighting and heating, &c., of the building has been accepted.

Glasgow.—The T.C.'s Tramways Committee has recommended acceptance of the following tenders:—

Brass tubing.—Joseph Evans & Co., Ltd.
Copper bonds.—B.I. & Helsby Cables, Ltd.
Special trackwork.—Lorain Steel Co.
Insulated stud bolts.—Fleming, Birkby & Goodall, Ltd., and W. C. Yuille and Co., Ltd.
Three-way lighting switches.—W. McGeoch & Co.
Solid rubber tires.—Shrewsbury & Challiner Tyre Co., Ltd.

Hastings.—The T.C. on June 19th accepted the tender of Messrs. Oliver Arc Lamp, Ltd., for 100,000 pairs of carbons for Oriflamme arc lamps, at £290.

Hindley.—The U.D.C. has accepted the tender of the B.I. and Helsby Cables, Ltd., for cables, cast-iron joint boxes, and cast-iron feeder pillars, at £1,007.

Huddersfield.—The managers of Kirkheaton National School have accepted the tender of Mr. T. W. Broadbent for installing electric light.

The Tramways Committee has accepted the tender of the B.I. and Helsby Cables, Ltd., for the supply of one mile of 2/0 hard-drawn (round) copper trolley wire; and has made a contract with the United Electric Car Co., Ltd., for 14 top-deck covers for cars.

Hull.—Messrs. Clark & Graham, of Hull, have been appointed to supply electrical goods, &c., to the Board of Guardians during the new six months.

Leeds.—The Corporation Sub-Tramways and Electric Committee has accepted the tender of Messrs. Appleyard Bros. for the construction of a transformer chamber at the premises of the Kirkby Banks Screw Co., Ltd., Beeston, for £190.

Lerwick.—Messrs. Mackenzie & Moncur have secured the contract for the heating installation, the hot-water supply, and the electric lighting, of the new hostel at Lerwick.

London.—L.C.C.—The Highways Committee reports having arranged during the Whitsuntide recess for the motor generators at the Lewisham sub-station, to be repaired by Siemens Bros. Dynamo Works, Ltd., at a cost of £147.

The Committee reports the acceptance of Messrs. J. Williamson and Co., for the supply, during 1914-15, of cast-iron plough shoes for the tramway department.

The Main Drainage Committee reports the receipt of the following tenders for electrical resistance indicators for recording temperatures with the superheaters attached to the new boilers at the Crossness pumping station.

Leskole Co., Ltd.	(recommended)	£77
R. W. Paul		105
"	(alternative)	112

ST. PANCRAS.—The Electricity Committee recommends that the tender of Messrs. J. H. Beattie & Co., Ltd., be accepted for the supply of the following coal for a year:—2,100 tons of Baddesley beans at 15s. 2d. per ton, 12,000 tons of Newdigate screened beans at 14s. 3d. per ton, and 6,000 tons of Newdigate large double-screened nuts at 16s. per ton, for the King's Road generating station; and 8,000 tons of Haunchwood hard steam coal at 17s. 6d. per ton, for the Regent's Park generating station.

STEPNEY.—The Electricity Supply Committee recommends the acceptance of the following tenders for the supply of coal and coke for the Electricity Department:—

Messrs. M. Abbott & Co., 150 chaldrons of broken coke at 10s. 9d. per chaldron and 700 chaldron of unbroken coke at 9s. 9d. per chaldron; Mr. C. Franklin, 200 tons of London made small coal at 15s. 9d. per ton; Messrs. J. Hudson & Co., Ltd., 850 tons of Welsh Colliery small (Rheola) coal at 17s. 10d. per ton and 25 tons of Tanfields (Smiths) South Hetton coal at 21s. 9d. per ton; Messrs. Sargeant, Longstaff and Co., 200 tons of Sharleston Wallsend coal, 25s. 9d. per ton; Spenser, Whatley, Ltd., 550 tons of Griff 2 yd. hard large coal at 21s. per ton; 200 tons of Newdigate nut slack (through ½) nutty small coal at 12s. per ton.

The Committee reports the receipt of the following tenders for the supply of meters, demand indicators and time switches for the period ending June 30th, 1917.

For Meters.	2½ to 25 amps.	50 to 100 amps.
Bastian Meter Co.	*£362	—
Bat Meter Co., Ltd.	900	†£275
B.T.H. Co., Ltd.	871	*263
British Westinghouse E. & M. Co.	†691	†292
Ditto (alt)	1037	†292
Chamberlain & Hookham, Ltd.	*512	242
Electrical Co., Ltd.	680	*285
Electrical Apparatus Co.	*497	†250
Ferranti	967	292
G.E. Co., Ltd.	687	306
Isaria, Ltd.	770	†262
Landis & Gyr, Ltd.	671	315
Reason Manufacturing Co., Ltd.	657	*275
Siemens Bros. Dynamo Works, Ltd.	670	301

Demand Indicators, 2½ to 100 amps.—B.I. & Helsby Cables, Ltd., †£570; Reason Manufacturing Co., Ltd., £800.

Combined Meters and Demand Indicators, 200 to 750 amps.—G.E. Co., Ltd., £307; Landis & Gyr, Ltd., †£292; Reason Manufacturing Co., Ltd., £363; Siemens Bros. Dynamo Works, Ltd., £339.

Time Switches.—Ferranti, Ltd., †‡£281; W. Geipel & Co., £702; Landis and Gyr, Ltd., *‡£151; Reason Manufacturing Co., £734; Venner Time Switches, Ltd., £658.

* Not to specification. † No sample submitted.
‡ 10-amp. size only tendered for.

The Committee recommends the acceptance of the tenders of Messrs. Chamberlain & Hookham, Ltd., for the supply of meters of 50 to 100 amps.; the G.E. Co., Ltd., for combined meters and demand indicators 200 to 750 amps.; the Reason Manufacturing Co., for meters 2½ to 25 amps., and for demand indicators 2½ to 100 amps.; the Venner Time Switches Ltd., for time switches.

For the supply of carbons for 12 months the following tenders were received:—

	White arc carbons.	Flame arc carbons.	Total.
Henrion Carbons	£486	£330	£816
W. Geipel & Co.	580	328	908
Ship Carbons, Ltd.	Will not accept contract for white arc carbons only.	384	946
Siemens Bros. Dynamo Works, Ltd.	645	324	969
Electrical Co., Ltd.	624	353	977
Sloan Electrical Co., Ltd.	509	496	1,005
W. Geipel & Co. (alt.)	695	328	1,023
G.E. Co., Ltd.	677	486	1,163
Crompton & Co., Ltd.	562	614	1,176
H. Tuchman	506	No tender received for flame carbons.	506

The Committee recommends that the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for flame arc carbons be accepted, and that of the Sloan Electrical Co., Ltd., for white arc carbons.

Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a contract from the Royal Mail Steam Packet Co., for the supply of metal-filament lamps, which includes tantalum lamps for ship lighting and Wotan lamps for office lighting, both at London and Southampton, for the ensuing 12 months.

Lossiemouth.—The T.C. has accepted the tender of Messrs. Primrose & Primrose, for installing electric light in the Town Hall and public library.

Mexborough.—The U.D.C. has accepted the tender of Messrs. J. H. Tucker for 50 sets of consumers' main fuses, at 6s. 2d. per set.

Sevenoaks.—Messrs. S. Young & Son have had orders placed for wiring of New Beacon Schools, Sevenoaks; "Howdale," Oxted; and "Mount Harry," Sevenoaks.

Southend-on-Sea.—The T.C. has accepted the tender of Messrs. Edgar Allen & Co., Ltd., of Sheffield, for a curve for the tramways in Southchurch Avenue, at £296.

Wallasey.—Messrs. Chamberlain & Hookham have received the contract for A.C. meters for this town.

Walthamstow.—The U.D.C. Finance Committee has accepted the tender of Messrs. W. T. Henley's Telegraph Works, Ltd., at £678, for cable and jointing; also that of the Albion Clay Co., Ltd., at £309, for stoneware conduits.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued:—

Friday, June 26th.—"D" Company. Infantry drill, 7.30 to 8.30 p.m. Technical instruction, 8.45 to 10 p.m.

Saturday, June 27th.—Main body for Berehaven Camp will parade at headquarters at 12 noon. Regimental business will be transacted till 12 noon.

Monday, June 28th, and to a date in October which will be notified later, headquarters will be closed for drill purposes.

Headquarters will be opened daily for the transaction of regimental business from 10 a.m. till 4 p.m., except Saturdays, on which days the opening will be from 10 a.m. till 12 noon. Headquarters will be closed for all purposes on August 3rd and 4th, 1914.

(Signed) F. R. Holt-White, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

FORTHCOMING EVENTS.

Batti-Wallahs' Society.—Saturday, June 27th. River trip.

North of England Institute of Mining and Mechanical Engineers.—Saturday, June 27th. Visit to Home Office Experimental Station at Eskmeals.

Wireless Society of London.—Tuesday, June 30th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "The Production of Continuous Waves by High Frequency Dynamo Machines," by Mr. Basil Binyon.

Institution of Municipal Engineers.—Friday and Saturday, July 3rd and 4th. North-Western District meeting at Manchester.

NOTES.

The American Society for Electrical Development.—The Society for Electrical Development held its second annual meeting on June 1st at the Bellevue-Stratford Hotel, Philadelphia, Pa. Mr. J. M. Wakeman, general manager of the Society, reported that the funds necessary to begin active work had been pledged, and that the best men available to carry on the work had been secured. This work has been divided into sections as follows:—Field co-operation, new development, commercial exchange bureau, and editorial and advertising. The activities of the Society are well under way, directed by the following staff:—

Mr. George Barton Muldaur, M.E., is in charge of the work of the first section, and Mr. Robert N. Lee has been engaged to assist him. Mr. Muldaur will travel about the country forming co-operative leagues for more intensive local development of the industry, aiding architects and builders to arrange for complete electric service instead of lighting alone, bringing text-books and lecture courses up-to-date, &c. Mr. John P. Mallett, E.E., will investigate the present uses of electricity in the various industries and report how these applications can be extended. Mr. Theodore Dwight, who is in charge of the commercial exchange bureau, will secure and index information regarding the use of electricity. This information will be at the service of the members of the Society. The news and advertising department is in charge of Mr. H. C. Spaulding. Mr. L. G. Harkness-Smith has been placed in charge of a department which will aim to illustrate by means of motion pictures the uses of electricity in the home, mill, factory and farm. A window-trimming department has also been organised and placed under the supervision of Mr. A. J. Edgell. Sample electrical displays are being set up in windows and photographs taken and distributed among the members of the Society. Printed instructions on how to trim the windows are sent with the illustrations.

Mr. Wakeman further reported that the society membership consisted of 298 central stations, 186 manufacturers, 272 jobbers and dealers, 588 contractors, and 23 miscellaneous industries. He said that the Society was still desirous of increasing its membership in order that the development work may be made more extensive.

Mr. James Smieton, jun., acting treasurer of the Society, then presented his report.

The following members of the board of directors were elected to represent the central stations:—Messrs. J. E. Montague, Niagara Falls, N.Y.; manufacturers, H. B. Crouse, Syracuse, N.Y.; jobbers and dealers, Fred. Bissell, Toledo, O.; and contractors, G. M. Sanborn, Indianapolis, Ind.; each to serve four years.

At the meeting of the board of directors which followed, this resolution was unanimously adopted: "The Society's efforts shall be devoted to developing the use of electrical energy by the general public, thus increasing the market of all engaged in the industry, leaving the question of defining the channels through which, and methods by which, the present and increased market shall be reached, to experience and local co-operation."

A resolution was also adopted to the effect that, "Any member whose semi-annual subscription becomes seven months in arrears shall be dropped from membership in the Society."

The following officers were elected to serve for the ensuing year:—President, Henry L. Doherty; first vice-president, W. H. Johnson; second vice-president, A. W. Burchard; third vice-president, W. E. Robertson; fourth vice-president, J. R. Crouse; fifth vice-president, Ernest Freeman; general manager, J. M. Wakeman; acting secretary-treasurer, James Smieton, jun. The following were elected to serve as the Executive Committee during the ensuing year:—H. L. Doherty, Ernest Freeman, A. W. Burchard, J. R. Strong, Gerard Swope, L. A. Osborne, W. E. Robertson, J. R. Crouse and W. H. Johnson. Mr. Johnson was elected chairman of the Executive Committee.

Appointments Vacant.—Assistant telegraph engineer (£400), for Gold Coast Government; assistant storekeeper (£21 month) for Shanghai Municipal Electricity Department; switchboard attendant (26s. week) for Cleckheaton U.D.C.

Inquiry.—Makers of "Cleveland" accumulators are asked for.

Radium.—The Sheffield Radium Committee has entered into a contract for the purchase of half a gramme of radium; £8,989 has been raised towards meeting the cost.

The National Physical Laboratory. — On Friday last the annual meeting of the General Board was held at Teddington; Sir Wm. Crookes, P.R.S., chairman of the Board, presided, and was supported by Lord Rayleigh (chairman of the Executive Committee), Dr. A. Schuster (hon. secretary), Sir A. B. Kempe (hon. treasurer, Royal Society), and Dr. R. T. Glazebrook, director of the Laboratory.

The report and accounts for the year 1913-14 were presented and approved. Owing to a change in the financial year of the Laboratory, which now ends on March 31st, the report covered 15 months' work. The deaths of Sir Wm. White, Mr. R. Kaye Gray, and Sir David Gill were recorded with deep regret; Sir Archibald Geikie and Sir Arthur Rücker had retired, and Sir Francis Hopwood had been appointed to a seat on the Board. The report stated that owing to the great increase in the work of the Laboratory since its establishment in 1901, and the heavy financial liability incurred by the Royal Society in its management, steps had been taken by the Board and supported by the technical societies concerned, with a view to enabling the Royal Society to prepare a new scheme of organisation for submission to the Treasury.

Great progress had been made in the work and equipment of the Laboratory during the year. Time signals were received daily from the Eiffel Tower and Norddeich, as well as from Greenwich. The value of the goods sent for test approached £300,000. Since December last about 115 mgm. of radium had been certified. Numerous additions had been made to the staff, and the Committee felt that in order to maintain the high quality of the work the salaries of the senior members ought to be increased. Work had been carried out for numerous Governmental Departments, Colonial Governments and engineering institutions. Mr. F. E. Smith's research on the absolute measurement of the standard of electrical resistance had been completed, the result being accurate to about four parts in 100,000, and representing a marked advance on anything previously achieved; Mr. Smith found that the International Ohm = 1·00052 × 10^9 C.G.S. units of resistance, or that the length of the column of mercury which represented the true ohm should be 106·245 cm., instead of 106·300.

In view of the pending electrification of the London and South-Western Railway through Teddington, and the statutory requirement that the magnetic disturbances produced thereby at the Laboratory should not exceed the present value by more than 20 per cent., recording magnetometers had been set up in a building in the garden at some distance from the Laboratory by Mr. Smith. Mr. Campbell's work on the measurement of inductance and capacity at the high frequencies employed in wireless telegraphy had made satisfactory progress, as well as the measurement of the power conveyed by high-frequency currents, and researches in magnetisation under large magnetising forces. Mr. Paterson and Mr. Rayner had developed improved instruments for the measurement of large alternating currents, and Mr. Melsom had investigated the conductivity of steel rails for the Engineering Standards Committee, and the heating of buried cables for the I.E.E. Important researches in other departments had also been carried out.

During the year 1913-14 (12 months) 259 electrical apparatus had been tested in the Physics Department, and 3,828 in the Electrotechnics Department—the latter comparing with 2,512 in 1912; of these, 774 tests related to ammeters, 838 to voltmeters, 517 to shunts, 469 to dielectric strength, and 414 to supply meters. Thermometer tests numbered over 28,000.

During the year 1913-14 the income rose from £32,058 to £43,713, about 36 per cent. Expenditure increased from £32,479 to £40,968, including £2,339 extraordinary capital expenditure. Salaries and wages amounted to £28,407, compared with £24,436. The year ended with a balance of £2,745 to credit; in 1912 there was a deficit of £420. There was a debt of £2,661 on the Tank Building Fund, to the reduction of which part of the balance would be applied.

Annual Outings.—The works and offices of the Western Electric Co., Ltd., will be closed to-morrow, Saturday, June 27th, as the annual outing is taking place to Clacton-on-Sea.

Last Saturday week the staffs of the office and works of the Clyde Valley Electrical Co. went for their annual trip to Kilchattan Bay.

The members of the electrical staff at Crewe works, for their outing to Liverpool, went by train to Ellesmere Port, where they boarded a steamer and sailed down the Manchester Ship Canal and the Mersey. Upon arrival at Liverpool, the party inspected the ss. *Baltic*, which was lying in Canada Dock, and after tea various places of interest in and about the city were visited. A resolution of thanks was passed to Mr. Ernest Bull for his work in arranging the outing.

Scottish Tramway Managers' Conference.—Representatives from Glasgow, Dundee, Leith, Falkirk, Kirkcaldy, Dumbarton, Paisley, Ayr, Dunfermline, Wemyss and Perth, attended the annual conference at Perth, when Mr. F. Coutts, Paisley, presided. On the opening day the representatives were entertained to luncheon by the Lord Provost, and later motored to Bridge of Earn, where Mr. Snell, manager of the Perth Corporation Tramways, entertained the visitors to tea. The papers read at the Conference dealt with the motor-'bus and roads and tramway tracks. Mr. Snell gave interesting details regarding the Perth Corporation motor-'bus scheme, expressing the opinion that the motor-'buses had a great future before them as feeders for tramways, and were far before the railless trolley system. He did not go the length of saying that the motor-'bus would ever oust the electric tramway but there was no doubt that it was a competitor.

Liverpool Electricians' Strike.—Our Liverpool correspondent writes:—"Some 400 electricians employed by about 50 local firms are out on strike in Liverpool. The men failed to turn in to work on Monday, following a resolution passed at a mass meeting of the Electrical Trades Union, held on Sunday night. This drastic action has been taken in reply to the employers who notified them of a reduction of ½d. per hour in the rate of wages. The following is the notice which was posted in all the workshops in the city by the masters:—'Owing to no signed rules being in operation between the Master Builders' Association and the Electrical Trades Union, the wages of all Union wiremen will be reduced in accordance with the notice sent by the Master Builders' Association to the Electrical Trades Union. All wiremen's wages will be reduced by ½d. per hour as and from Saturday, the 20th inst.'

"In December last the men received an advance from 9d. to 9½d. per hour, and almost immediately afterwards they put forth fresh demands, including a 1s. an hour wages, a decrease of 3½ hours, 1s. per day extra for dirty work, and 1s. 6d. extra per day for cold storage (E.T.U. delegate to decide the definition of rules *re* dirty work). An alteration of each of the 15 rules then in operation was sought. Under the old rules deputations to employers were to consist of six working tradesmen, but the new demands provided for six delegates of the E.T.U. in place of men directly concerned, while on the Board of Conciliation four E.T.U. representatives were to be substituted for operatives. Among the other demands submitted was one providing for three months' notice, instead of six months from either side for alteration of rules, which meant that during the progress of any large job, the men might demand more wages, with a consequent loss to the employer.

"The employers could not see their way to grant the fresh demands, but no action was taken by the men's Union when the notice expired on June 1st, and the employers were unable to obtain any satisfaction from the men's Union as to what steps they proposed to take.

"The masters had no desire to reduce the men's wages, but they felt that it was the only course by which the employés could be forced to reconsider the situation and sign the agreement embodying the working rules which had just expired.

"It is important to point out that if the men's demands were conceded, Liverpool firms would be placed at a considerable disadvantage when competing with Manchester firms for country contracts. The men in Manchester are paid 9½d. per hour, and the rate of pay in London even is only 10½d. The demand of the Liverpool men for 1s. per hour if granted, would represent an increase approximately of 10s. 6d. per week on their present wages. If the men sign an agreement embracing the old working rules under which they would get 9½d. an hour, as in Manchester, it is understood that the employers would be agreeable.

"At the present time business is not over brisk in the electrical trade in Liverpool, but work is not completely at a standstill, a considerable number of men still remaining at work."

Notes from the Rand.—Our Johannesburg correspondent writes:—The third annual mining exhibition, promoted by the Chemical, Metallurgical and Mining Society, was opened on May 19th, in the Johannesburg Drill Hall. In one sense it is the most important yet held, the Society on the present occasion having directed its efforts towards imparting a much-needed fillip to the "Safety First" movement. In 1913, there were 2,345 accidents in the Rand Mines, involving 808 deaths, and injuries to 2,005 persons, and some detailed reference may be made to the award of the first and second prizes (£25 and silver medal, and £15 respectively), which have been made by the Rand Mutual Assurance Co., for exhibits in the "Safety First" section. The first prize has gone to Mr. A. Nowag, of Modderfontein, for a safety clip "for the prevention of misfires due to the pulling out of fuse and detonator from the primer." Mr. W. A. Lindberg, of the Ferreira Deep G.M. Co. was the winner of the second prize, with a device for preventing the over-winding of electric hoists. It has been designed to prevent over-winding accidents when hoisting either men or rock. There are three principal parts, viz.:—(1) Electrical contacts in the head-gear for rock hoisting. (2) Electrical contacts above the collar of the shaft for men hoisting. (3) A three-point controller operated by the hoist driver. When the "men" or "rock" contacts are operated by the skip, or cage, the main switch to the winder is opened by a no-volt coil, and the post-brakes are automatically applied. When rock is being hoisted, a lever on the controller is placed on the "rock" position, and then only the contacts in the head-gear are in circuit. When the signal is given to raise men, the driver places the controller lever to the "men" position, and (what is most important) he cannot give the return bell signal until he has done so. The plunger of the contacts at the collar of the shaft is pulled out at once by a solenoid acted upon by the controller lever when on the "men" position. On the resumption of rock hoisting, the first skip passing the plunger pushes it back out of reach of succeeding skips, saving wear. Should an over-wind take place when the controller lever is in either the "rock" or "men" position, the driver cannot start his motor until the handle of the controller is brought to the "off" position. A bell then rings until the skip has been moved from the danger point. The advantages of the device are that the contacts are operated directly by the skip, which is independent of stretching of ropes, faulty indicators, &c., and is therefore applicable to "whiting" hoists, as well as drum hoists. It is understood that four sets have been in successful operation since February, 1913.

(*Continued on page* 1079.)

THE KING'S BIRTHDAY HONOURS LIST.

In the list of birthday honours published on Monday morning last, two well-known electrical men figure.

Knighthoods have been conferred in both cases, and we offer our hearty congratulations to Sir John F. C. Snell, the well-known consulting engineer, and to Sir Albert H. Stanley, managing director of the "Underground."

Sir John Snell.

As the former of these is president-elect of the Institution of Electrical Engineers, the honour comes as one of especial interest at the present moment. Sir John took a very prominent part in the arbitration proceedings connected with the purchase by the Government of the undertaking of the National Telephone Co. He was not only the principal witness for the Post Office, being in the box for 12 or 14 days, but he shouldered the bulk of the preparation of the case on that side. It will be remembered that the award showed a saving of many millions sterling to the State, and it is understood that for his services rendered in this connection the present honour has been bestowed upon Mr. Snell. It had been expected that others who played an important part in connection with the same proceedings would also have appeared in the list, but for some reason or other they are not so rewarded. Honours are not always so swift in falling as has happened in Sir John's case; they are overdue in several directions.

Sir John Snell, when he takes up the reins of office at the Institution of Electrical Engineers, will do so as a man in his early prime, for he is only 45 years of age. In view of recent events, the reader may wonder whether he will have a "policy," but we have no authority for making any suggestions of any kind in that connection, unless such be conveyed by the knowledge which we have that he was disappointed at the collapse of the Industrial Committee. He has some experience of the needs of local sections, for he was at one time chairman of the Newcastle Section. For five or six years he has occupied a seat on the Council. He was also, when in the north-east district, vice-president of the local section of the Institution of Civil Engineers. Sir John is chairman of the Electrical Section of the Engineering Standards Committee.

During his period of office as city electrical engineer at Sunderland, he was responsible for the building up of a big electric supply industrial load, and he was a recognised authority on the engineering side of electricity supply. Two standard books have been produced under his authorship, namely, "Distribution of Electrical Energy," and "Power House Design" (1911). He left municipal service at Sunderland in 1906, and began consulting practice in Caxton House, Westminster, on January 1st, 1907, among other connections secured being the Buenos Ayres and Pacific Railway, for the electrical work of which he has been responsible, including the Bahia Blanca power house. He had earlier been retained by the London County Council in connection with one of the schemes for electricity supply, indeed, it was really his interest in this matter that induced him to come South. On the death of Major Cardew, as a result of arrangements entered into with Mr. Arthur Preece the subject of these notes became a partner in the firm of Preece, Cardew & Snell in September, 1910. His personal contribution to the operations of that firm is concerned with heavy power work, generating stations, and so forth, but he devotes himself principally to giving expert evidence and advising in a consultative capacity many municipal Corporations. Recently he was retained by the Bristol Corporation in connection with its Tramways Bill, and he is now acting similarly in connection with the Belfast Corporation extensions. He has further lately rendered assistance in the form of evidence to the London County Council in respect of its present electric supply problem.

Keith Dannatt] [Woking.

Sir John Snell,
Pres.-Elect I.E.E.

Sir Albert Stanley.

Sir Albert H. Stanley is the managing director of that great network of lines of electric railways and motor-omnibuses owned and controlled by the Underground Electric Railways Co., and the London General Omnibus Co.

He has undoubtedly played a very important part in the consolidation of these various interests which has helped greatly in the better organisation of London traffic and relieved to some extent the congestion and want of co-ordination that formerly existed. He is managing director of the Underground Electric Railways Co. of London, and of the Metropolitan District Railway, the London Electric Railway Co., the Central London and City and South London Railways. He is also a director of the London United Tramways and the London and Suburban Traction Co., Ltd. Sir Albert, who is only 39 years of age, prior to his taking control of these vast undertakings in London, was for some 12 years general manager of leading American electric railways. He is, however, an Englishman by birth—a native of Derby.

Other Honours.

Others whose names appear in the list are :—Sir J. W. Benn (L.C.C. Progressives' Leader) who is promoted from knighthood to be a baronet ; Mr. D. M. Stevenson, of Glasgow, also one of the seven new baronets, if we remember aright, had much to do with municipal telephony in Glasgow ; Mr. T. K. Rose, D.Sc., chemist and assayer to the Royal Mint for the past 12 years, is made a knight ; Mr. Richard Meredith, Director of Telegraphs, Indian Telegraph Department, is appointed C.I.E.

The Hon. Adam Beck, who receives the honour of Knight Bachelor, is chairman of the Hydro-Electric Power Commission of Ontario. He is described in the Press as "Minister without portfolio of the Province of Ontario."

The Hon. G. E. Foster, Minister of Trade and Commerce, Canada, and Lieut.-Col. G. L. Eyles, M.Inst.C.E., Consulting Engineer for Railways to the Crown Agents for the Colonies, both appear in the Colonial Office List with promotions to K.C.M.G. In the Indian List, Mr. W. Gunnell Wood, A.M.I.C.E., Chief Engineer and Secretary to the Government in the United Provinces Public Works Department, becomes a C.S.I., and Mr. P. Glynn Messent, M.I.C.E., chief engineer to the Bombay Port Trust, and Mr. R. H. Tickell, M.I.C.E., Chief Engineer to the Public Works Department, Central Provinces, are both given the C.I.E., as is also Mr. Thomas Summers, M.I.C.E., late of the Bombay Public Works Department.

We do not think that any electrical or engineering student of this year's list of honours will feel that the Government has been generous in its recognition of the great work which engineers, electrical and otherwise, and scientific men, are doing in the world to-day. Political leaders are strangely blind to the claims of men of merit, achievement and world-wide repute in these departments of profession and industry.

Pirie MacDonald] Sir Albert Stanley. [*New York.*

A SMOKE INDICATOR.

Writing on the subject of a novel form of smoke indicator, the *Electrician* welcomes the appointment of a Departmental Committee by the Local Government Board, with a view to investigating the smoke question and getting together sufficient evidence to enable it to make such regulations as shall tend to the abatement of smoke.

It is suggested that two factors must be given due weight in any consideration of the subject : the one, whether a smoke producer is too heavily penalised financially if compelled to abate smoke to below the "black" line ; the other, the provision of means to measure blackness.

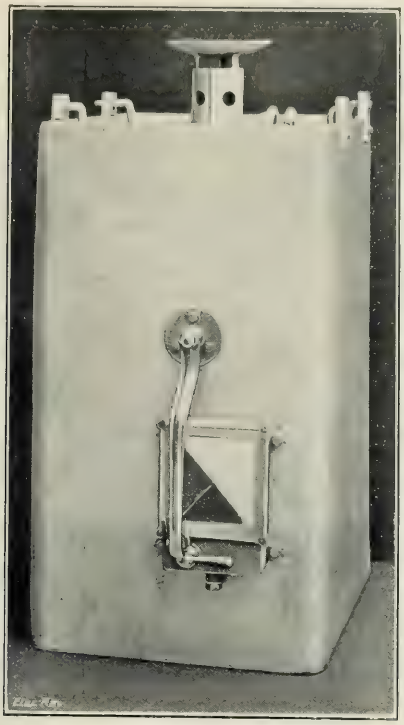
Now blackness is not at all a term of a precise order, for upon the thickness of the stream of smoke depends its apparent depth of colour. So there is no real measure of dirtiness : and the only objection to black smoke is its dirtiness. The blackness of smoke may be abolished, and we shall be brighter and happier, but the atmosphere will be very little better. Our limestone buildings will all go white, and St. Paul's will look beautiful, but it will continue to melt away in the form of sulphate, for the worst constituent of coal smoke will still exist until such time as coal for power is burned only at a distance from the town, and gas for heating purposes is desulphurised. Meantime let us welcome everything calculated to clear away the blackness if it can be shown to be practicable. Prof. Strong, in the United States, has paid much attention to smoke, and has devised an instrument to indicate its presence in a boiler flue. Clean flue gases are strongly ionised, but when smoke is present or dust or fume, the particles of these combine with the ions, leaving the flue gas ionised but slightly. Thus with a spark-gap in the flue, in parallel with two other spark-gaps under ordinary atmospheric conditions, if an alternating pressure is applied to the gaps by means of a transformer, and the gap in the flue is set so as to take the discharge when the gas is normal, then when smoke is present, the gas resistance becomes greater and the discharge passes by the two gaps in parallel. The conductor between the two parallel gaps is connected to earth through a coherer, which operates a relay and rings a bell or otherwise signals that there is smoke in the flue. The invention sounds interesting, and might be useful at night or in a fog. Not that a chimney top cannot usually be seen well at night, but in a fog chimney tops cannot be seen even by the inspector unless he goes up a high building, whence he may often see them standing above the fog, or the smoke from a buried chimney coming up into the clear above the top surface of the fog layer. The smoke indicator described would take notice of the presence of smoke in the flue, and indicate to the engineer whether his men were taking advantage of fog to relax their efforts.

The appointment of a committee is stimulating interest in the subject, but it is unfortunate that there is no money in the smoke question for the genuine man. Patentees of a hundred times patented articles may make money if, having some rig-out to sell, they have the eloquence to sell it with. The steam user is frequently a gullible creature. He cannot distinguish wheat from chaff, and so he will buy a ton of cast-iron one day and a load of fireclay goods next day, and he knows at least he has bought something, material and gross—even if he pays pounds for stuff worth as many shillings. But he will never pay cash for technical advice. Technical advice weighs nothing, and is to him valueless. And so smoke experts degenerate into humbugs, for they become panderers to ignorance in the way that our modern Douster-Swivels pander to the same sort of ignorance with their twig-twiddling antics in place of rational hydro-geology.

SELF-ACTING FIRE ALARMS AND EXTINGUISHERS.

[By our Berlin Correspondent.]

An ingenious combination of self-acting fire alarms and extinguishers has been recently designed by Messrs. Siemens Bros., in conjunction with some affiliated Continental firms. The new scheme is intended to indicate by electrical means any dangerous increase in temperature, and to put out automatically any incipient fire by the action of carbonic acid. It is especially suitable for rooms containing substances subject to spontaneous combustion, such as storage rooms for oil, petroleum, dyes, &c., powder sheds, ammunition compartments, coal bunkers, as well as libraries, archives, &c., containing valuable manuscripts and other documents liable to be destroyed by water or steam.



Automatic Fire Extinguisher.

The scheme comprises two parts, viz., the apparatus for generating carbonic acid, and the electrical installation consisting of a number of self-acting fire alarms with indicators, checking instruments and batteries.

The carbonic acid generator, which is installed in the room to be protected, is a galvanised sheet-iron vessel, the dimensions of which depend on the size of the room.

This vessel is provided with a lid carrying a small turret-shaped fitting for discharging the carbonic acid and intercepting any solution carried along by the latter. The vessel contains a wrought-iron tank free to rotate round an axis which carries, outside the vessel, a lever which in the position of rest is kept vertical by a pawl, retained by the armature of an electromagnet and disengaged by attracting the armature, thus allowing the tank to tilt under the action of gravity.

The outside vessel contains, up to about one-third of its height, a solution of potash, while the inside tank is filled with concentrated sulphuric acid.

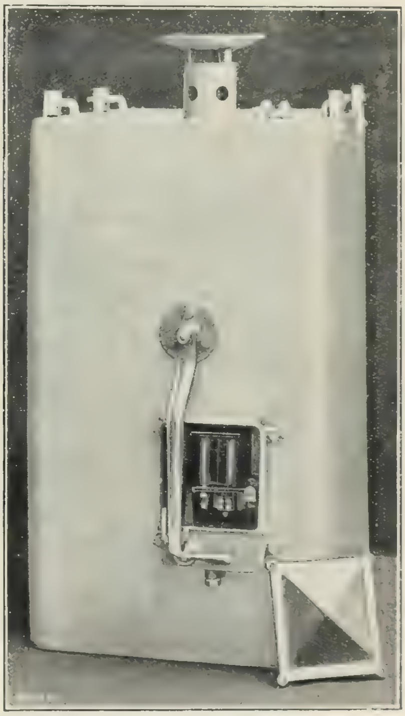
On the tank tilting, the acid is allowed to flow out through small holes, falling into the potash solution and thus developing within 25-30 seconds 5,000-15,000 litres of carbonic acid (in accordance with the size of the apparatus), which is thrown into the surrounding atmosphere by a pressure of 7 or 8 lb. per sq. in. The efficiency of the apparatus is not impaired even by some years' interval in working.

The electrical part of the installation comprises the self-acting fire alarm and the indicator. The fire alarm mainly consists of a bent double metal strip composed of two metals of different rates of expansion rolled upon one another at very high pressure so as to be intimately united. Any undue increase in temperature will result in the metal strip being unbent, thus lifting the contact of the alarm. A graduated scale allows the fire alarm to be adjusted to operate at any temperature between 35° and 100° C.

In accordance with modern practice the plant is worked with closed-circuit current. The indicator is a switchboard comprising any instruments required for checking the plant and a proper number of alarm bells. By a special arrangement of connections the accidental operation of the carbonic acid generator in case of rupture of some conductor is effectually prevented, only an alarm signal being actuated.

In order to prevent the carbonic acid generator from being set working whilst a man is present in the room, a switch attached to the door cuts out the disengaging magnet of the carbonic acid generator as soon as the room is entered by anybody. The arrangement of connections can also be designed for the apparatus to be disengaged by hand through push buttons situated outside the room.

The installation above described can, if desired, be equipped with a preliminary alarm worked at a given increase in the temperature of the room to be protected (*e.g.*, at 45° C.) without actuating the extinguisher, which is disengaged only at some higher temperature (*e.g.*, 70° C.).



Cover Removed, showing Electromagnet.

Tests made at the Royal Testing Office by the Hanover and Kiel fire brigades and on board a vessel of the German Navy have given excellent results, latent as well as open fires being put out with remarkable rapidity.

The I.M.E.A. Visit to Warwick Castle.

On Thursday, June 18th, after luncheon at Stratford-on-Avon, the members of the Incorporated Municipal Electrical Association went by motor-vehicles to Warwick Castle. Prior to the inspection of the Castle and grounds, the party assembled on the lawn for the taking of the official photograph. Copies of the photograph (18 in. × 13 in.) may be obtained from the studio of Mr. J. W. Beaufort, Easy Row, Birmingham, for a few shillings.

NOTES.

(*Continued from page* 1074.)

Electric Vehicle Demonstration.—A demonstration of electric vehicles was held by the Richmond (Surrey) Electric Light and Power Co. on the 18th inst. in the premises adjacent to the supply station. A number of tradesmen attended, and a very complete demonstration was given of the great advantages of the electrically-propelled vehicle for trade purposes—charging, handling and trial running of the vehicles being shown to the visitors. The company look forward to doing considerable business in this direction in view of the facilities they can offer, and are actively pushing the matter by demonstrations and general advertising.

Storms in the Provinces.—The atmospheric disturbances mentioned in our last issue were followed by similar outbursts in various districts.

On Wednesday last week in the North-west of England and the North of Ireland lightning discharges and rain, said to be the worst experienced for many years, damaged much property, and the electric tramway service in several towns was temporarily suspended, while telephones and telegraphs were interrupted.

On Thursday the Midlands were visited by a violent storm; a hospital at Hanley was struck by lightning and electric lighting wires were fused, but no serious results were recorded. Many other buildings were struck, and a carter was killed, as well as two horses that he was driving. At Swindon the tramway service was interrupted. On the same day a storm occurred near Dalkeith, and telephonic communication between Edinburgh and Newton Grange was cut off.

Further disturbances took place on Friday, in Essex, Notts. and in the London district, accompanied by two fatalities.

Educational Notes.—The annual meeting of the Society for the Promotion of Engineering Education has been held at Princeton, N.Y., U.S.A., this week; many papers on the teaching of engineering subjects, and on college administration, were to be read and discussed. Particulars can be had from the Secretary, Mr. H. H. Norris, Ithaca, N.Y.

University of London.—The Drapers' Company has resolved to bear the cost of the new chemical laboratories of the East London College, amounting to about £15,000.

On Tuesday a conversazione was held at University College, Gower Street, to celebrate the erection of the new buildings of the School of Architecture, in which are now combined the schools of both University College and King's College at the cost of an anonymous donor. The building is the largest and most complete of its kind in the United Kingdom. H.R.H. Prince Arthur of Connaught, President of the University College Equipment and Endowment Fund, visited the new buildings, and was received by the Vice-Chancellor, Sir Wilmot P. Herringham, and other prominent supporters and officers of the Colleges. Lecturettes and a few demonstrations were given, and music was provided; a large number of visitors were present. We venture to suggest that on such an occasion the ample resources of the laboratories should be drawn upon for the entertainment of the guests; in the physics and electrical engineering departments in particular there would be no difficulty in organising spectacular demonstrations of the greatest interest and fascination, especially to the uninitiated visitors. Apart from the reception of wireless signals and a demonstration of vibrating strings by Prof. Fleming, and the breaking of a few samples in testing machines by Prof. Coker, for a short period only, practically nothing of this kind was attempted.

Institution and Lecture Notes.—N.E. Coast Institution of Engineers and Shipbuilders.—From July 7th to 10th the Summer Meeting of the Institution of Naval Architects, the Institution of Engineers and Shipbuilders in Scotland, and the N.E. Coast Institution, will be held at Newcastle-upon-Tyne. Very complete arrangements have been made by the last-named Institution for the comfort and entertainment of their colleagues, and an interesting programme of receptions, papers and visits to engineering works has been organised. Provision has been made for the entertainment of ladies by a strong Ladies' Committee. Judging from the wealth of attractions offered in the official programme, the occasion will be a memorable one, and should be thoroughly enjoyed by all who take part in it.

American Institute of Electrical Engineers.—This week the Annual Convention of the Institute has been in progress at Detroit, Mich., U.S.A.

National Association of Goldsmiths.—At the annual conference at Margate last week, Mr. F. Hope-Jones, M.I.E.E., delivered a lecture on electric clocks before the leading representatives of the watch and clockmaking trade. He pointed out that electric time service had been established in spite of the clockmaking trade, and not with their assistance, and complained that they knew little of the subject, and had been habitually pushing electric clocks away with both hands, whilst on the Continent electric time service had been an active part of their profession and a subject of study in their horological schools for a generation. An interesting discussion followed, in which these strictures were answered by the leading men of the profession, and the proceedings closed with a spirited reply from Mr. Hope-Jones, pointing out that the loss of key-winding contracts was not to be regretted, because they were replaced by more remunerative supervision contracts, and that the prejudice aroused by past failures had now been killed in the minds of all fair-thinking men.

Fatality.—Through being caught between two wheels of the electric haulage at Redford Pit, Muiravonside, Falkirk, George Erskine (24), a machineman, sustained fatal injuries.

Ordeal by Fire and Water.—Two 10-H.P. squirrel-cage induction motors recently gave a convincing proof of their sturdy qualities at the works of Messrs. Samuel Wheeler & Sons, Ltd., Smethwick. They were employed to drive a number of machines, and were mounted on beams in the roof of the building. A fire broke out in the roof, and a large portion covering two bays was destroyed before the outbreak was finally mastered. Although the motors were not actually in the fire, the roof truss on one side of them was totally destroyed, and that on the other side was badly charred. On the arrival of the fire brigade a steady stream of water was therefore directed upon the motors, and, as these were of the ordinary protected type, the windings received a severe drenching. Half an hour later, when the fire was finally subdued, it was found that although the motors were thoroughly drenched and had been subjected for half an hour to the action of the smoke and steam emitted from the burning roof when the hose was played on it, they started up quite satisfactorily when the current was switched on. The two machines, which were manufactured by the British Thomson-Houston Co., Ltd., nearly two years ago, had given no trouble whatever before the outbreak of fire, and still continue to give satisfaction.

Holidays.—The works of the British Westinghouse Electric and Manufacturing Co., Ltd., at Trafford Park, will be closed from 5.30 p.m. on Friday, July 24th, until 7 a.m. on Tuesday, August 4th, 1914, for the annual holidays.

Mechanical Stokers at Southend.—In our article on the Niclausse boilers at Southend-on-Sea, published in our issue of May 15th, the legend under the illustration on p. 813 stated that the stokers were of the Bennis type. This was an error; as stated in the article, Niclausse stokers were used; they are of the "Britnic" type, and are unlike any stoker that is made in this country. We regret the mistake.

The Telectrograph.—On Wednesday a demonstration was given of the "Telectrograph," an instrument developed by Mr. Thorne Baker and Captain Otto Fulton for the transmission of photographs by wire for the Press, at a cost which is said to be a small fraction of that incurred a few years ago. The apparatus has at present a working range of 800 miles, and is being introduced by the Photo Telegraph and Cable Co.

Late Legal.—Osram Lamp Works, Ltd., *v.* Pope's Electric Lamp Co., Ltd.—This case came before the Court of Appeal, composed of Lords Justices Swinfen Eady and Pickford, on Wednesday, upon the appeal of the plaintiffs from a decision of Mr. Justice Joyce, declining to give the plaintiffs leave to deliver an interrogatory in a form disputed by the defendants.

Mr. Colefax, K.C., and Mr. J. Hunter Gray appeared in support of the appeal; and Mr. T. Terrell, K.C., and Mr. Russell Clarke for the respondents.

Mr. Colefax explained that the plaintiffs brought the action against the defendants for the alleged infringement of one of their patents relating to metal-filament lamps. The lamp concerned was a built-up filament lamp which was made by taking a compound of tungsten and mixing it with a binding organic medium, formed and carbonised. It was mixed with some organic substance to make a paste, and this was squirted through a hole of small diameter. Then it was heated so as to carbonise the organic matter, the result being the production of a filament which still contained a quantity of carbon, which was possibly under 1 per cent. Counsel stated that the plaintiffs objected to the form in which the learned Judge had allowed the interrogatory to be administered to the defendants. By that interrogatory the plaintiffs had not been allowed to ask the defendants what organic binding medium was used by the defendants. What the plaintiffs wanted was to be in the position to present their case properly when it came on for trial, and to enable their experts to investigate the process alleged to have been used by the defendants, and so prepare themselves for giving evidence at the trial.

Lord Justice Swinfen Eady: Do you allege that the defendants use the same process as yours?

Mr. Colefax said he did not go so far as that, but defendants admitted that they used an organic binding medium. Several other actions were pending. What the plaintiffs sought by the interrogatory was to ask the defendants what process they used for the purpose of removing the carbon from the filament. He submitted that in the circumstances the interrogatory which the plaintiffs sought to administer was neither a fishing interrogatory nor oppressive, and ought to be allowed in the form in which it had been drawn.

In the result, their Lordships, without calling upon counsel for the respondents, held that the appellants were not entitled to administer the interrogatory in the form in which it was drawn, but that they were entitled to ask the defendants whether or not they used the particular media used in the plaintiff's specification, and also whether the defendants in the removal of the carbon had used the plaintiffs' process. Appellants were not entitled to put to the defendants a fishing interrogatory as to the way they removed the carbon. With that variation the order of Mr. Justice Joyce would be affirmed and the appeal dismissed, the costs to be the defendants' in any event.

Marconi Litigation.—In the Chancery Division, before Mr. Justice Sargant, on Wednesday, in the action of Locker-Lampson and Another *v.* Isaacs and Others, counsel for the plaintiffs made a preliminary objection, and said that it would be necessary to amend the statement of claim and join other defendants. The case, it will be remembered, relates to the bargains in American Marconis, and asks, on behalf of Marconi company shareholders, for a statement of profits made in these transactions. After a lengthy discussion, his Lordship took the view that further discovery should proceed, further particulars being given. He adjourned the summonses generally, with liberty to apply to restore and with leave to amend should the amended pleadings of the plaintiffs render such a course advisable.

On the same day the hearing of the action Marconi and Marconi's Wireless Telegraph Co. *v.* Helsby Wireless Telegraph Co., for infringement of the "four-sevens" patent—which has now expired by effluxion of time—came before Mr. Justice Eve in the Chancery Division. The infringement alleged was in connection with the supply of wireless installations to four ships for the L. & N.W. Railway Co.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On Friday afternoon the staff and employés of the Corporation electricity department took their formal farewell of MR. A. S. BARNARD, the borough electrical engineer, who is severing his connection with the Walsall Corporation at the end of the present month. Advantage was taken of the occasion to express appreciation of the cordial relations which have existed between Mr. Barnard and the staff, and to present him with a suit case as a small memento and mark of esteem. Mr. Barnard was also asked to accept, on behalf of Mrs. Barnard, a silver rose bowl. The presentation was made by Mr. Cookson, and suitably acknowledged by Mr. Barnard.

The officials and staff of the Sheffield electric supply department have presented MR. H. A. HOWIE, deputy manager, who is leaving to become general manager and engineer of the electricity department at Walsall, with a silver tray and pipe.

MESSRS. FROST, SOWERBY and PADDEN have been engaged in the places of two charge engineers and one junior engineer, who have resigned their positions with the Willesden Council.

The Ilford Electricity Committee has recommended that the salary of MR. A. H. SHAW, chief engineer, be increased from £500 per annum to £525 as from April 1st last, and to £550 from April 1st, 1915.

The marriage took place on Saturday at St. Jude's Church, Bradford, of MR. W. J. TREVOR, of the electricity staff at Dunfermline, and formerly of the city electrical department at Bradford, and Miss Ivy Emily Dinsdale, youngest daughter of the late Mr. R. M. Dinsdale, Hanover Square, Bradford.

Tramway Officials.—During the present month MR. ANDREW NANCE, manager of the Belfast Corporation Tramways, celebrates his tramway jubilee. He began his work in connection with the tramway world in June, 1864, when he entered the offices of Messrs. Hood & Jacomb, railway engineers, of Westminster, who were then acting as engineers of the Landport and Southsea tramways. These were among the first tramways laid in the streets of a British town: the rails were of steel and were secured to longitudinal sleepers by counter-sunk screws. The system was subsequently taken over by the Portsmouth Street Tramways Co., of which Mr. Nance was one of the first directors. In 1881 he took over the management of the Belfast tramways under the old company, and he has seen the receipts rise from £14,500 to £272,000 per annum. When the Belfast system was transferred to the municipality ten years ago he continued his control, and has done so right down to the present time.

The Burton-on-Trent T.C. has increased the salary of MR. A. B. SLATER, tramways manager, from £200 to £225 per annum.

General.—MR. J. C. GREGG, who has for some years been principal traveller at Messrs. Falk, Stadelmann & Co.'s Glasgow branch—74, 76 and 78, Great Clyde Street—has been appointed manager in the place of Mr. Gustav Falk, who is leaving Glasgow to take up his position as director on the board of Falk, Stadelmann & Co., in London.

The marriage was to take place at St. Michael's Parish Church, Linlithgow, on Wednesday, June 24th, of MR. KENNETH ARTHUR MOUNTAIN, only son of Mr. W. C. Mountain, of Newcastle-on-Tyne, to Miss Nancy Miller, the only daughter of Mr. and Mrs. William Miller, Bonnytoun House, Linlithgow, formerly of Dishergam, Bengal, India.

MR. ERIC EATON, who has carried on business as an electrical engineer in Old Street, Ashton, has been appointed chief assistant engineer of the Woods Gilbert Rail Plane Co., London, for the British Isles.

While on a visit to South Devon, MR. HAROLD R. BURGESS, who is in the employ of the British Electric Transformer Co., was instrumental in rendering assistance to a bather who was in difficulties. Our correspondent says:—"Not knowing who Mr. Burgess was, the rescued gentleman, who was also a visitor, sent a postal order for £1 to the 'Torquay Directory' office, with a request that it should be forwarded to his rescuer, as a mark of appreciation of his timely aid."

Messrs. Bruce Peebles & Co., Ltd., have appointed MR. E. W. BROWNE as their Birmingham office manager in place of Mr. Hilton, who has resigned that position to take up other work. Mr. Browne has been connected with Messrs. Bruce Peebles & Co., Ltd., for many years, and is thoroughly familiar with their manufactures.

The Council of the London Chamber of Commerce on Friday last passed a vote of condolence with the directors of Ferranti, Ltd., and the relatives of the late Mr. A. B. Anderson, who just before his death had been elected a member of the Council.

Will.—The *Financial Times* states that MR. W. H. JOHNSON, of Altrincham, chairman and managing director of Richard Johnson, Clapham & Morris, Ltd., and chairman of Electromotors, Ltd., who died in February last, aged 64 years, left £65,022 gross and £57,620 net.

NEW COMPANIES REGISTERED.

S.A.C.J., Ltd. (136,461).—This company was registered on June 16th, with a capital of £15,000 in £1 shares, to acquire, work, develop and manufacture any form of combustion or turbine engines, &c. The subscribers (with one share each) are:—T. W. Doran, 4, Fernleigh Drive, Leigh-on-Sea, clerk; H. Jacques, Elstree Cottage, Victoria Road, Mill Hill, N.W., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Solicitors: Ingle, Holmes, Sons & Pott, Capel House, E.C.

Kiesow & Co., Ltd. (136,457).—This company was registered on June 16th, with a capital of £15,000 in £1 shares, to take over the business of a vendor, agent and importer of glass and enamelware and lighting accessories carried on by R. Kiesow at 25, Fore Street Avenue, E.C., as "Kiesow & Co." The subscribers (with one share each) are: R. Kiesow, 25, Fore Street Avenue, E.C., merchant; Miss H. M. B. Kiesow, Homewood, Bromley, Kent. Private company. R. Kiesow is first permanent managing director and chairman; qualification, £100. Registered office, 25, Fore Street Avenue, E.C.

Andcole & Turner, Ltd. (136,408).—This company was registered on June 15th, with a capital of £100 in £1 shares, to carry on all kinds of agency business, especially in regard to the electrical industry. The subscribers (with 33 shares each) are:—H. W. Anderton, 24, Oakhill Court, Putney, S.W., engineer; H. Coleman, 2, Cowley Mansions, Brixton, S.W., engineer; W. F. Turner, 78, Honeywell Road, Wandsworth Common, S.W., engineer. Private company. The first directors are H. W. Anderton, H. Coleman and W. F. Turner, each of whom may retain office while holding £30 shares; remuneration of permanent directors, £250 each per annum. Registered office, Queen Anne's Chambers, Westminster, S.W.

Autopins, Ltd. (136,439).—This company was registered on June 16th, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers of and dealers in split or cotter pins, dealers in mechanical and electrochemical products and apparatus, and electric and mechanically-operated plant, &c. The subscribers (with one share each) are:—C. Bingham, 11, Queen Victoria Street, E.C., merchant; A. S. Young, 11, Queen Victoria Street, E.C., merchant. Private company. The first directors (to number not less than two or more than seven) are C. Bingham, W. B. Leashar and F. J. Underhill; no qualification necessary; remuneration as fixed by the company. Registered office, 222-3, Mansion House Chambers, 11, Queen Victoria Street, E.C.

R. Wolf, Ltd. (136,528).—This company was registered on on June 19th, with a capital of £5,000 in £1 shares, to carry on the business of engineers, boiler and steam engine makers, superheated steam locomotive, electrical, agricultural and general machinery manufacturers, iron-masters, steel makers and converters, &c. The subscribers (with one share each) are:—O. Schweitzer, 7, Laurence Pountney Hill, E.C., manager; J. B. Macfarlane, 7, Laurence Pountney Hill, E.C., Private company. The number of directors is not to be less than three or more than six; the first are Max Wolf, A. Reiche, F. Litzmann, H. Storck, O. Schweitzer, and J. B. Macfarlane: qualification, one share; remuneration (except managing director) as fixed by the company. Registered office, 7, Laurence Pountney Hill, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electrical Engineering and Motor Co. (Carlisle), Ltd.—Debenture dated June 11th, 1914, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. L. A. Lamb, Clifton House, Newton Bar, Wakefield.

G. M. Wireless Patents Syndicate, Ltd.—Particulars of £3,000 debentures, created June 11th, 1914, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,100. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Yorkshire Waste Heat Co., Ltd.—Trust deed, dated June 9th, 1914, supplemental to trust deed dated December 4th, 1912, modifying such original deed and providing for the issue of further deb. stock. The amount of stock secured by the original deed is £25,000. Trustees: F. J. Kitson and H. I. Bowring.

Christy Brothers & Co., Ltd.—Issue on May 20th, 1914, of £800 debs., part of a series of which particulars have already been filed.

Coatbridge & Airdrie Electric Supply Co., Ltd. (89,178).—Capital, £1,000 in £1 shares. Return dated March 26th, 1914; all shares taken up; £1,000 considered as paid. Mortgages and charges: £148,962 8s. 11d.

James Keith & Blackman Co., Ltd.—A memorandum of satisfaction in full on May 15th, 1914, of debs., dated October 29th, 1901, and June 8th, 1911, securing £475, has been filed.

Direct Spanish Telegraph Co., Ltd. (6,732).—Capital, £95,000 in 15,000 ord. and 6,000 pref. shares of £5 each. Return dated April 13th, 1914. 12,9[illegible] ord. and 6,000 pref. shares taken up. £9[illegible] paid. Mortgages and charges: £29,200 first mortgage debentures, redeemable June, 1914.

Ernest F. Moy, Ltd. (17,468).—Capital, £10,000 in £1 shares (8,500 ord. and 1,500 pref.); return dated April 17th, 1914; all shares taken up; £10,000 paid. Mortgages and charges: £1,450.

CITY NOTES.

Continental Electrical Companies.

The *United Glow Lamp & Electricity Co., of Ujpest*, besides having had a larger turnover in 1913, reports having effected economies in manufacturing, the two circumstances resulting in a more favourable yield. After making an allocation to the depreciation fund the accounts show net profits amounting to £52,400 as compared with £47,900 in 1912. It is intended to pay a dividend of 12 per cent. as against 10½ per cent. in the previous year.

The report for 1913 of the *Austrian Siemens-Schuckert Works*, states that in consequence of the war in the Balkans there was a stagnation in the orders received in particular from the Near East. A more serious matter, however, was the standstill in the inland business in electric railways owing to the obscure general situation and the resulting lack of enterprise, whilst at the same time reserve was shown by domestic firms in proceeding with the adoption of new equipment in their works. The decline in one portion of the company's business was partly compensated by greater activity in overland central stations, which were affording increased work for the electrical industry. During the year the orders booked were about of the same value as in 1912 and the works were sufficiently provided with work for the greater portion of the period, the latter portion of the year indicating a fairly large reduction which still continues. The net profits are returned at £121,000 as against £94,900 in 1912, and a dividend of 7 per cent. is proposed on £1,333,000 as compared with the same rate on capital of £1,000,000 in 1912.

The report for 1913 of the *Ateliers de Constructions Electriques du Nord et de l'Est, of Paris*, which has an ordinary share capital of £1,200,000, states that all departments were very actively employed and the invoiced turnover amounted to approximately £1,120,000, or two and a half times more than in 1911. Notwithstanding the severe industrial and financial crisis prevailing at the present time (May 27, 1914), the company's books are well provided with orders and the future is regarded with confidence. Proceeding to refer to the heavy machinery workshops at Jeumont-Nord, the report mentions the completion during the year of turbo-alternators of 25,000 H.P. for the northern section of the Compagnie Parisienne de Distribution; of 15,000 KW. for the Nantes station; 16,500 KW. for Lille; and 20,000 KW. sets for Valenciennes-Anzin station. Apart from the construction of travellers for a lifting capacity of up to 250 tons, a crane of 250 tons for the Chantiers de la Loire, and cranes for Bordeaux, Nantes, Algiers and Bone, the traction department effected important deliveries of motors to the Paris Metropolitan Railway, the State railways in connection with the conversion of lines in the environs of Paris, and the Nantes tramways. The pig iron and steel founders were well provided with work, and furnished, among others, many castings for locomotives and the navy. The output of the cable department, which was equipped with improved machinery for the manufacture of high-tension cables, was very considerable; the rubber preparation factory was brought into operation; the insulating tubes branch was fully employed, and the copper rolling and drawing mills dealt with copper of the value of £340,000. The accounts show net profits amounting to £105,600 and the dividend declared is at the rate of 17 fcs. (13s. 7d.) per ordinary share.

The *Ateliers de Constructions Electriques de Charleroi, of Brussels*, reports gross profits amounting to £83,000 for 1913. After deducting £21,000 for depreciation there remain net profits of £62,000 on ordinary share capital of £795,000, permitting the payment of a dividend of 20 fcs. (16s.) per fully paid £10 share. According to the directors' report, the orders booked during 1913 represented over £1,000,000 as compared with £771,000 in 1912, and a further increase has taken place in the first four months of 1914 as contrasted with the corresponding period in last year; so that the works at Charleroi-Marcinelle and Charleroi-la-Villetta are at present in full operation. During the year numerous orders were received from the collieries where the company's winding-engines are highly appreciated, and from the iron and steel works to which were delivered, amongst others, cranes, hoists and blast-furnace charging apparatus. Turbo-alternators were ordered in large numbers for central stations, together with generating units of from 3,500 to 6,500 H.P. to be driven by gas engines; and the department for tramways and railways experienced a further development. An increase also took place in the customers for cables and numerous contracts were secured from different public authorities and supply companies. The company, in association with allied companies, participated in the formation of the Sóciété Industrielle d'Electricité pour la Russie for the development of the supply business in Russia in Europe and Asiatic Russia, the share capital being £1,000,000; in the construction of the Société des Forges et Ateliers de La Longueville, which has a capital of £400,000 and which proposes to construct rolling stock for railways and tramways; and in the exploration work being carried out in the new coal basin in the centre of Hainaut.

Electricity Supply in Paris.—Since the Paris Secteurs, or district electric lighting undertakings, were merged into or brought under the control of the Compagnie Parisienne de Distribution d'Electricité a year or two ago, the latter has possessed a monopoly of electric supply in the French capital with the exception of the business transacted by the Société d'Electricité de Paris, which furnishes to the former from its large works at Saint Denis a considerable amount of energy pending the completion of the new generating station of the Compagnie Parisienne. When the latter is brought into operation, the first effect will be a decline in the supply provided by the Société d'Electricité in the case of this particular customer, and the company may probably only again be able to record a fresh upward movement when the Compagnie Parisienne is once more compelled to apply to external sources to assist in meeting the demand—a period which is considered to be not very remote, having regard to the rapid development of consumption in Paris. In the meantime the fact may be noted that the Société d'Electricité has experienced regular progression since the Saint Denis station was opened in 1905-06, when the number of kilowatt hours sold amounted to 11,960,000. This quantity had risen to 100,317,000 KW. hours in 1911-12, and to 125,380,000 KW. hours in 1912-13, and the dividends paid on the ordinary shares have gradually grown from 10s. per share in 1907-08 to 16s. per share in 1912-13. On the other hand the amount written off first establishment costs had reached £271,000 on June 30th, 1913, thus bringing this account down to slightly less than £1,000,000, whilst the sum of £202,000 had been set aside by the same date for the renewal of machinery and plant. The actual value of the securities in portfolio, which are included in the balance sheet at cost price, largely exceeds the amount of £672,000 at which they are entered, and the shares held in the Compagnie Parisienne alone showed an excess Stock Exchange value of £480,000 on April 30th, 1914, over the prices entered in the balance sheet. Besides supplying power to the Metropolitan Railway, the Compagnie des Omnibus and the Compagnie des Tramways de Paris, the Société d'Electricité has contracts of long duration in force in the neighbourhood of Paris, apparently for many industrial enterprises, and the success of the undertaking is claimed to have justified the promoters in proceeding with a scheme based upon the development of supply in the vicinity of the French capital.

A Swiss Electrometallurgical Reconstruction Scheme.—A drastic scheme of reconstruction is contemplated in the case of the Société Electrometallurgique Paul Girod, of Neuchatel, with the aid of the French firm of Schneider & Co., of Creusot. A year ago it was proposed to reduce the ordinary share capital from £480,000 to £288,000, and to issue preference shares for £192,000 and 5 per cent. bonds for £320,000, but the plan was apparently not carried into effect. According to a Zurich newspaper, it is now intended to reduce the share capital from £480,000 to £120,000, and then to raise it to £240,000 by the issue of new shares for £120,000, which are to be taken over by Schneider & Co., although existing shareholders will have the right to subscribe. It is, however, considered that the French firm, with its existing shareholding, will control the majority of the shares in the future. The head offices are to be transferred to France, where the company's works are already situated, and the company is to be amalgamated with its French branch—the Compagnie des Forges et Acieries—so that only a French company will exist thenceforth. In addition, certain French water powers which have not hitherto been utilised by the Swiss company, are to be transferred to a new company under the title of the Hydro Electrique, and present shareholders in the former will be entitled to participate in the latter. It is expected that the firm of Schneider and Co. will derive considerable advantage from the reconstruction of the Girod company.

Delhi Electric Tramways and Lighting Co., Ltd.

Mr. A. W. Tait presided on Monday at Basildon House, E.C., over the eighth ordinary general meeting of the above company.

The Chairman, in moving the adoption of the report (Elec. Rev., p. 1044), said, taking into account the unfortunate breakdowns which had occurred in the power station during the year, they might regard the net result of the year's working as satisfactory. The increase in the revenue from the lighting section was due to the natural growth of the city and to the education of the native population to the uses and advantages of electric light and power. There had also been an increase in the revenue from the street lighting contract and in the supply of current for power purposes. Considerable expansion was to be expected in the near future, and that could be accelerated if a satisfactory hire-purchase scheme for small motors and equipments could be evolved. He was afraid, however, that owing to their heavy commitments in other directions, it was not possible for that company to undertake that class of business, at least for some time to come. The number of units generated that year was 1,429,683, an increase of 43 per cent., and the increase in the revenue, excluding the revenue from current supplied to the tramway undertaking, was 46 per cent. A new system of charging current supplied to the tramway undertaking was put into operation at the beginning of 1913, the tramways being charged at the flat rate of 1½d. per unit, and for the present year current would be charged at a flat rate of 1¼d. The increase in the revenue from the tramway undertaking (32 per cent.) was due to the revision of the fares and stages. There could be no doubt that the reduction in fares was a wise policy, and it was quite possible that further reductions would be made at an early date. The stages on the routes had also been revised and sub-divided. The number of passengers carried during the year was 4,811,166, as compared with 2,127,868 in 1912, and 52½ per cent. of those passengers were carried a distance of half a mile for a fare of approximately ¼d. The number of car-miles run was 397,969, as compared with 334,338 last year, so that with an increase in mileage of only 19 per cent., they obtained an increase in revenue of 32 per cent., and carried 125 per cent. more passengers. It was unfortunate that the breakdown in the power house plant prevented the new system having a full year's run, because, owing to the necessity of maintaining the power and lighting load, the service had to be curtailed for a considerable part of the year, and for a few weeks it was stopped altogether. With a view to developing the traffic on proper lines, they had recently sent out a European traffic superintendent. That man had had a very good experience in the regulation of traffic on one of the largest undertakings in that country, and he would be able, therefore, to do a great deal towards improving the service generally. The net revenue from the combined undertakings was £6,252, as compared with £2,990 last year, and was the largest net revenue the company had shown, with the exception of the period of 14 months to December 31st, 1911, which period, of course, included the exceptional revenue obtained at the time of the Delhi Durbar, and there was very little doubt that, but for the unfortunate mishaps in the power station, the 1911 figures would have been exceeded during the past year. The breakage of the main crankshaft of the Diesel engine, which occurred in the middle of July, involved the continual use of the more expensive steam plant for the remainder of the year, as it was not again put into commission until December. Within a short time from that mishap one of the steam sets was also put out of action, owing to a similar breakdown, and, until the company was able to obtain a supply of current from the Government power station the tramways were shut down and the power business curtailed. Supply was taken from the Government from August 7th to December 3rd. The actual cost of renewals in connection with the breakdowns referred to had been charged to renewals reserve account, but, in addition to that, the company had to suffer considerable indirect loss which was not reflected in the accounts, and which it would be difficult to estimate. The average price of coal during 1913 was also higher than in 1912, and liquid fuel firing of some of the boilers was carried on for some five months during the year, in order to increase the steam raising capacity of the plant. That expenditure necessarily increased the generation costs. Notwithstanding the facts mentioned, the average cost per unit generated during the year, including the units purchased from Government, showed a slight decrease on the average cost for 1912, the comparative figures being 1·17d. and 1·25d. respectively. Excluding the units purchased from Government, the average cost per unit was 1·08d. They would, no doubt, remember that at the last general meeting he indicated that a further Diesel set would have to be installed at no distant date; an order was placed some months ago for a 240-KW. set, and the plant commenced working on the 9th of this month. That additional set would probably enable the company to cope with the increasing demand up to the end of the next year, but by that date the installation of a further set would be necessary if the demands of the business were to be adequately met. At present they had little or no spare plant to fall back upon in case of serious breakdown to the main Diesel sets. The cost of the set now installed had, to a great extent, been met out of surplus revenue, but it was impossible to meet the cost of further considerable expenditure in like manner. In addition to the further generating set, they would undoubtedly have to add to the rolling stock at no distant date, and, even if the amount of traffic obtained did not warrant an addition of that nature, it was necessary that the existing cars, which were old and inefficient, having only single motor equipments, should be gradually replaced by cars of more suitable design and double-motor equipments. There was no doubt that the change when effected would enable the company to make considerable savings in running expenses. Several of the feeder cables were fully loaded, and they should have to face substantial requirements for mains and feeders in the near future, and some part of that expenditure, at all events, would have to be met before the end of the present year. In order to meet these requirements and also to effect improvements and additions to other parts of the company's equipment, which had now been in continuous service for over six years, the total amount required within the next year or so, according to an estimate submitted by the general manager, would not be less than £25,000. That sum did not, of course, include any expenditure which might be necessary in connection with a supply to the new city of Delhi, as it was, at the present time, impossible for the company to issue any additional share capital, and as the whole of the £50,000 first mortgage debentures had now been issued or lodged with the company's bankers to secure advances, the directors proposed to create an issue of £50,000 in second debentures. As those debentures would, of course, rank after the £50,000 already issued, it would probably be necessary to offer a fairly high rate of interest in order to enable the debentures to be placed. The rate of interest suggested was 7 per cent. The directors hoped that when the issue was made the shareholders would assist by subscribing to the same, as it was only by this means that the shares which they held would secure dividends in the near future. With regard to the supply to the new City of Delhi, he regretted that it was not possible for him to give them any definite information, but he might say that they had not yet been asked to tender for the supply. They had, therefore, decided to continue additions to the existing station, to meet present and immediate future requirements, quite apart from any question of that kind, because of the uncertainty which apparently still exists as to the intentions of Government with regard to the lighting and tramway in the new city. The chairman proceeded to deal with the accounts at some length, and with regard to the results during the current year, said that the cablegrams received from the general manager, giving approximate monthly figures, showed that there was an estimated net revenue from the combined undertakings of some £2,486 for four months to end of April, as compared with £1,840 for the same period last year. If that increase was maintained for the balance of the year, and they had no recurrence of breakdowns, the results should show an improvement of approximately £3,000 to £4,000, as compared with the year under review. He had already indicated that considerable development might possibly take place in connection with the supply of current for power and lighting. It was also probable that in view of the improvements which were being made in the old city, the revenue from the street lighting contract would also show a considerable increase. As regarded the supply in the new area, he had already stated that the company had not yet been asked to put in a tender for the supply, and it was, he thought, unnecessary for him to say that, in the event of their being approached to give that supply, the work would not be undertaken until the estimates had received the careful consideration of independent consulting engineers, and there seemed to be a reasonable prospect of the business proving profitable to the company, and then only with the approval of the shareholders first obtained. He thought it was also safe to anticipate that the results of the tramway undertaking for the current year would show considerable improvements over those of the year just closed, since, owing to the breakdowns, it had not been possible to give the new scheme a fair trial during the past year. It was to be hoped, moreover, that they should be free from any further mishaps of that nature, and that the tramway service would not again be subject to serious dislocations. There could not be any doubt that it was necessary for them to establish a reliable and speedy service at a cheap rate of fare, in order to attract the native population. In other words, the company's profit in this branch of the undertaking must be made through the medium of low fares and high earning power per mile, as opposed to high receipts per passenger. For 23 weeks to June 6th, 1914, they carried 2,418,000 passengers, as compared with 2,054,000 for the same period last year, and earned Rs. 62,800, as compared with Rs. 56,700 last year. It was certainly desirable to provide, as soon as possible, cars of more modern make, and with double equipments, in order to effect economies in working. The existing cars were not, in spite of careful and repeated overhaul, in a satisfactory condition, and there was no doubt that the annual maintenance charge was much heavier than would be the case with cars of more modern design. The results for 1913 were good, but he believed they might confidently anticipate that the results for 1914 would be much better, but, as stated at the last general meeting, he was afraid it would be necessary for them to retain the profits in the business for the purpose of meeting the cost of additions to plant and equipment, unless means could be found to raise the additional capital by the issue of debentures.

Mr. T. W. Stratford Andrews seconded the motion.

Mr. Still considered it unfortunate that after eight years they had to go to the Government station for a supply of current. He trusted that with regard to the new city of Delhi, they would not sit quietly, but would try and secure the opportunity of tendering. He also asked what the company's experience was with regard to oil plant. Was it such that it would warrant them going in for further plant of the same kind?

Mr. Pullens congratulated the company on the progress made since the board was reorganised, and the able way in which the board had pulled the company out of the mire. He thought they ought not to look forward to paying dividends in the near future, but should seek to improve the financial position of the company without resorting to onerous borrowing.

The Chairman said the Government power house was installed to meet the requirements of the Durbar, and was now being used to supply the new works in Delhi. The Government were not competing with the company. They were advised from the plans and details which they had seen that the electric supply of the new city would cost £250,000 to £300,000. They were in close touch with the Government, but the new city was going to be laid out on broad and generous lines, and it would involve a great expenditure in mains and feeders to supply a district which, after all, would only require a good supply during the six months the Government was sitting. There could be no doubt that the oil engines compared favourably with the steam plant. The first Diesel engine was undoubtedly not well designed, but the new engine was admirably designed, and the manager had expressed absolute approval of it. The business was growing so much that he did not think they could finance it with their own profits, and they must raise more money, as he had stated in his speech.

The report was then adopted

Hydro-Electric Power and Metallurgical Co., Ltd.—The *Financial Times* states that an extraordinary general meeting of this company will be held at Melbourne, Australia, on June 29th, to consider extraordinary resolutions to ratify an agreement between Complex Ores, Ltd., and the company, whereby Complex Ores, Ltd., has agreed to reassign shares of the company to the company and to ratify an agreement between the Government of Tasmania and the company for the sale of the company's hydro-electric works.

Reduction of Capital.—The Reason Manufacturing Co., Ltd., and Reduced.—A petition for the confirmation of the reduction of capital from £37,553 to £23,648, has been presented, and will be heard on June 30th.

Shawinigan Water and Power Co.—A dividend at the rate of 6 per cent. on the common stock for quarter to June 30th is announced.

General Electric Co., Ltd.

The directors report that for the year ended March 31st, 1914, the net trading profits and income from investments, &c., amounted to £157,894, plus £32,331 brought forward, making a total available profit of £190,225. Debenture interest requires £8,000, depreciation and provision for removal expenses £24,328, and dividend on the preference shares at the rate of 6 per cent. for the year ended March 31st, 1914, absorbs £24,000, leaving an available balance of £133,896. Provision for managing director's and employés' bonus stands at £10,156; provision for expenses of new issue of capital, since made, £14,000; provision for dividend on ordinary shares at the rate of 10 per cent. for the year ended March 31st, 1914, £40,000; to reserve account, £30,000; to conditional appropriation to staff benevolence, £3,000; balance to be carried forward, £36,740. The reserve account stands as follows:—The balance at March 31st, 1913, was £170,000, and the proposed appropriation of profit of the year amounts to £30,000, making a total of £200,000. The directors are pleased at the progress shown in the result of the year's trading. The company's works have been fully employed, and extensions are being proceeded with. The increase in stock and sundry debtors is normal in proportion to the company's increased sales. The contingent liability referred to in the balance-sheet is chiefly in respect of participation in the Pirelli-General Cable Works now being erected at Southampton.

We give below the comparable figures from the reports for the three years ended March, 1912, 1913 and 1914:—

	1912.	1913.	1914.
Net trading profit and income from investments	£133,564	£145,261	**£157,894**
Depreciation and debenture interest	32,400	32,543	**32,328**
Balance	113,377	144,768	**157,897**
Pref. dividend	12,500 (5 %)	19,878 (6 %)	**24,000** **(6 %)**
Available balance	100,877	124,890	**133,896**
Managing director's and employés' bonus	8,866	9,284	**10,156**
Expenses of new issue of shares	—	10,275	**14,000**
Staff benevolence	—	3,000	**3,000**
Ordinary dividend	29,960 (7½ %)	40,000 (10 %)	**40,000** **(10 %)**
To reserve account	30,000	30,000	**30,000**
Balance carried forward ...	32,050	32,331	**36,740**
Reserve fund total	140,000	170,000	**200,000**

The annual meeting is to be held on Thursday next at Cannon Street Hotel, E.C.

British Electric Traction Co., Ltd.

The annual meeting was held on June 19th at the Holborn Restaurant, Mr. E. Garcke presiding.

The Chairman, in moving the adoption of the report (see Elec. Rev., p. 1,004), said that in order to understand the position of the company it was necessary to appreciate that it was a part of a Federation of some sixty companies, having a combined capitalisation of about £24,000,000. The B.E.T. was the largest of the companies in the Federation and was in other respects the centre of the system. All except about 5 per cent. of their total assets, amounting to close on £5,000,000, were represented by holdings in, or by other properties held in connection with, the federated companies, and about 95 per cent. of all their revenues of £225,000 was derived from the associated companies. The net revenue earned by all the federated companies, that was after paying all working expenses, amounted to £1,200,000 for the year. Of this about £800,000 was distributed in debenture interest and dividends on capital, and as much as £400,000—about a third of the total net profits—was held in reserve in one form or another by the federated companies. The profits earned by the associated companies during the past year showed a substantial increase over those of the preceding year, and an analysis showed that of the increase in the total net profits earned by all the federated companies about three-fourths was due to the tramways and electricity supply departments in about equal proportions, and about one-fourth of the increase in profits was due to the working of motor omnibuses. It was not correct to assume that the tramways had gone back and that the increase in profits was mainly due to motor omnibuses. On the contrary, the tramways had had a better year and the electricity supply business of the federation had also made satisfactory progress. Of the profits distributed for the past year by the federated companies in interest and dividends, the B.E.T. Company received about £200,000. The remainder went to other debenture and stockholders in the federated companies. He had on former occasions explained the importance, for purposes of comparison of one year with another, of the figures of yield obtained by the company on its investments, and he was glad to be able to again record a substantial improvement in this respect. The yield on all their investments, taken collectively, last year was 4.47 per cent., compared with 4.11 per cent. for the preceding year, and 3.77 per cent. for the year 1911. An all round average net return of 4½ per cent was not bad. Those who looked only for the bad features in their large collection of undertakings and pointed to Bideford and Sheerness, where they made small losses, and to a few others where they made no profit, should remember that if with an average of 4½ per cent. they had some that were not yet earning anything, there must be a large proportion which were earning much more. By reference to published statistics it would be seen that an average yield of 4½ per cent was high for electrical undertakings in this country in their present stage of development. He was responsible for the compilation of a year book which contained a summary of all obtainable balance sheets of electrical undertakings in the United Kingdom and the Colonies, and that showed an average return which was less than their figure, excluding telegraph and telephone undertakings, in which they were not interested. He could not take them over the whole ground of the company's operations during the past year, but he had no hesitation in saying that considerable improvement had also been made by the various federated companies in other respects, particularly in their relations with the local authorities and in the terms on which the companies held their concessions, and generally in the efficiency of the undertakings. The means by which these numerous enterprises steadily improved their condition and prospects were to be found in the splendid organization which had been built up and which was effective for doing more and more work with ever better results over an extensive field, and although, as he had frequently explained, while profits derived from public service enterprises in this country—be it the National Telephone Company or a small tramway undertaking—were not yet commensurate to the skill and energy which were applied to the businesses, they had achieved some remarkable success, both financial and technical, in this country and abroad. Even collectively the results of their enterprises compared favourably with those obtained by others carrying on similar business in this country. In saying this he was not blowing his own trumpet, but it was only fair to those who had loyally devoted a strenuous life to the establishment and maintenance of these public utility enterprises that they should have their services acknowledged even if only in his feeble words. He could very well imagine some of the stockholders feeling that the large figures which he had mentioned, and the good report he had made of the progress which had been achieved, were not compatible with the fact that the preference stockholders were receiving only a small increase in dividend and the ordinary stockholders were still a long way off receiving any return on their investment. When the rearrangement of capital was made in 1911, it was understood that the policy would be to distribute moderate, but improving dividends on the 7 per cent. preference stock, and at the same time to increase the reserve by an annual contribution out of profits. At the first annual meeting after the rearrangement had been made, he again pointed out that the question of what reserves should be made deserved further consideration, and he stated that the federated companies were then engaged in an exhaustive examination of the whole question of reserves with a view to each of the companies allocating its profits between reserve and dividends in such a way that, while adequate provision would be made for replacement of circulating and renewable capital, dividends were not to be withheld because of indefinite apprehensions that depreciation of fixed or permanent capital had in every case to be provided for out of profits. At the following annual meeting, that was to say last year, they recommended the payment of a first dividend of 3 per cent. for the year on the 7 per cent. preference stock and the placing of £40,000 to reserve. It was admitted that the increase of dividend on the 7 per cent. preference stock which they recommended was smaller than the increase of profits justified. This year they proposed to apply the available balance of £126,000 as follows: £56,400 to be reserved, £52,000 to the payment of dividends, and £17,000 to be carried forward. That was to say, the amounts which this year were placed to reserve and carried forward were proportionately larger, and the amount applied to the payment of dividend was proportionately smaller, than last year, although the balance of profit they had to deal with was larger. It was clear on the figures that they could pay a larger dividend on the 7 cent. preference stock than the 3½ per cent. for the year, which the directors recommended, and if it were not for capital depreciation which was shown by the investments the question would certainly arise, whether, in view of the fact that the associated companies put to reserve in one form or another one-third of their net profits, it was really necessary also for this company to put to reserve one-fourth of its profits received from the associated companies. It was evident that divergent views and interests existed among the stockholders in regard to this question. It was very desirable that these differences of view should be adjusted, and it was probable that they could be reconciled only by a reduction of capital. They could not ignore the fact that the interests of the preference stockholders and those of the ordinary stockholders were not quite identical in regard to this matter. The preference stockholders, of course, desired that the profits should be distributed, at any rate to the extent of their preferential dividend rights. The ordinary stockholders on the other hand preferred that the profits should be allowed to accumulate so as to assist in the removal of the depreciation on the investments. They had therefore formulated for the consideration of the stockholders a scheme of reduction and rearrangement of capital which, if adopted, would immediately give the ordinary stockholders some return on their capital, while it did not contemplate any sacrifice by the preference stockholders for which they were not adequately compensated. At the same time, the carrying out of the scheme would improve the dividend prospects of both classes of stockholders by making available for dividends some of the profits now placed to reserve. Whether this, or any other scheme of reduction of capital should be carried out was entirely a question for the stockholders to decide. There were five different and conflicting interests to be consulted and satisfied, namely, two classes of preference stockholders, two classes of ordinary stockholders, and the holders of income certificates. The board occupied a neutral and impartial position in regard to the matter, and during the discussion that would ensue on the subject the directors would take every care that no class of stockholders should receive an unfair advantage. Subject to what might be said at the meeting, the directors proposed to submit the scheme which they had formulated to a few representative stockholders, including most of those who served on the committee of consultation at the time of the rearrangement of capital, and as soon as possible they would send a memorandum on the subject to all the stockholders in order to ascertain their views before any more formal steps for the carrying out of the scheme were taken. Having referred at length to the progress of the motor omnibus department of the company, Mr. Garcke concluded by a reference to future prospects. The electricity supply business was, he said, continuously progressive, and they were not afraid of the new increased efficiency lamps which had been put on the market on the ground that they used less current, for they would tend to increase consumption by making electric lighting cheaper and by encouraging a higher standard of lighting. They expected to secure additional profits from the new omnibus services they had started, and they believed the Brush Company would do better in future by reason of a new and highly efficient turbine, the manufacturing rights of which it had secured. The Bombay Company, the Auckland Company in New Zealand, the electric power company in Canada—in all of which they had large and important interests—were doing well and were yielding good returns. Altogether, he felt justified in saying that the prospects were good. They hoped that an understanding between the two main sections of the proprietary would enable the profits they expected to earn to be equitably shared by all, and that in the efforts which the different sections of stockholders would no doubt make to secure the best terms for themselves, the collective and permanent interests of the company would not be allowed to suffer by reason of sectional differences, and that no interruptions would be caused to the steady progress of the business.

Mr. W. L. Madgen seconded the motion, which was carried after a short discussion.

Marconi International Marine Communication Co., Ltd.

The directors' report for the year ending the 31st December 1913, states that the company's business continues to show satisfactory progress, the net profit for the year amounting to £37,029 after deducting £25,881 for depreciation and allowance for debenture interest, as compared with a net profit of £21,436 for the preceding year. The revenue from ships' telegrams, subsidies, etc., amounted to £116,317, which is a substantial increase over the amount of £100,323 for 1912. The number of telegraph stations owned and worked by the company as public telegraph stations on the high-seas increased from 580 at the end of 1912 to 788 at the end of 1913. The number fitted to the present date is 873. There are now some 2,000 ships of different nations, exclusive of ships of war, fitted with Marconi telegraph stations. The company's business is well organised and the discipline on board ships excellent. Of this there could be no better testimony than the immense number of lives and the number of ships which the company and its officers have been instrumental in saving in the past, and continue to save year after year. An International Convention for the safety of life at sea was signed in London on 20th January, 1914, and the bill to give effect thereto is now before Parliament. Under this bill wireless telegraphy is rendered compulsory upon ships carrying 50 or more persons, including crew. It is probable that this is only intended as a first step in this direction, for it is difficult to understand why when 50 persons are on board a ship they should be provided with the means of being saved, but if the number be only 49 all may be allowed to drown. In the opinion of the directors, every ship which sails 50 miles or more from the coast, should be fitted with wireless telegraphy. Apart from the necessity of providing so valuable a life-saving apparatus for those employed upon the smaller craft, it is obvious that when misfortune befalls a large vessel, every small boat within the radius of a wireless call should be capable of being summoned to immediate aid. Had this been the practice in recent years many more thousands of valuable lives would have been saved. In Australia the company's licence and business have been transferred to a company representing an amalgamation of interests in which this company holds a number of shares. In July, 1913, the directors offered 102,028 shares at a premium of 5s. per share to the shareholders in proportion to their holdings. The issue was guaranteed by the Spanish and General Wireless Trust Limited in consideration of a commission of 1s. 6d. per share on the whole issue and an option over the remaining 43,916 unissued shares of the company at the price of £1 5s. for two years from 27th June, 1913, and the whole of the shares offered were duly subscribed and allotted. In accordance with the power contained in Articles 29 and 30 of the company's Articles of Association, the directors in January last adopted regulations for the issue of share warrants to bearer and copies of such regulations may be obtained upon application to the company. Being of opinion that the time had arrived to make some provision for the employees of the company on retirement, the directors have entered into a provisional agreement with the North British and Mercantile Insurance Co. for the establishment of a superannuation fund. An Extraordinary General Meeting will be held immediately after the Ordinary General Meeting to approve the necessary alteration to the Memorandum of Association authorising the company to adopt the scheme. The directors recommend a final dividend for the year 1913 of 5 per cent., which with the interim dividend already paid will make 10 per cent. for the year, the total of which will amount to £30,604. £3,500 is allocated to the repayment of debenture account, leaving £6,068 to be carried forward. On 10th July, 1913, General Albert Thys was elected to the board.

Victoria Falls and Transvaal Power Co., Ltd.

The directors report that at 31st December, 1913, the issued share capital amounted to £3,000,000 and the debenture capital to £3,976,500, £23,500 of the 5½ per cent. second mortgage debentures having been purchased during the year 1913, against the amount which had to be redeemed on 1st January, 1914, in the terms of the trust deed. Since December, 1913, a further £650,000 of the 5½ per cent. second mortgage debentures have been issued. The year's business has resulted in a profit of £467,824, which, with the £96,787 at the credit of the profit and loss account as at 31st December, 1912, remaining after payment of the dividend on 14th June, 1913, makes a gross total of £564,611. After providing for interest on debentures for the year 1913, amounting to £203,921, and for depreciation, etc., amounting to £135,491, the balance remaining is £225,198. In respect of this balance the directors declared a dividend, on 11th December last, at the late of 6 per cent. per annum, less income tax, for the six months ended 30th June, 1912, on the preference shares, and a further dividend on the preference shares also at the rate of 6 per cent. per annum, less income tax, for the six months ended 31st December, 1912, was declared on the 11th June, 1914. These dividends were paid to the shareholders on the 6th January, 1914, and 17th June, 1914, respectively, and absorbed £119,999 14s., leaving £105,199 to be carried forward. Referring to last year's report, new machinery of the capacity of 30,000 h.p. has recently been brought into service at Simmerpan, the extensions at Rosherville in connection with the air system will shortly be in commission, and the installation of additional plant at Brakpan is progressing rapidly and will be available by the end of the year. Judgment has been given against the company in the action brought by the Consolidated Langlaagte Mines, Ltd., for about £29,000. The company has appealed to the Appeal Court against the judgment, and the matter is therefore *sub judice*. The directors record the death during the past year of two of their colleagues, viz., Mr. Hans Schuster and the Honourable J. R. Delap Tollemache. They have appointed Mr. Frank Astley Cooper a director.

Aron Electricity Meter, Ltd.

The directors' report for the year ending 31st March, 1914, states that the profit and loss account for the year, after providing for general charges and depreciation, shows a net profit of £28,771, making, with £5,865 brought forward, a total available profit of £34,635. Out of this the directors distributed in December last a dividend of 3 per cent. on the preference shares, absorbing £3,747, leaving to be disposed of £30,889. The directors recommend the payment of a further 3 per cent. on the preference shares, absorbing £3,747, and making a total for the year of 6 per cent.; a dividend of 7 per cent. on the ordinary shares absorbing £8,750; a transfer to reserve towards goodwill and patents of £15,000 (making this reserve £70,000), and carrying forward £3,392. The past year's trading in electricity meters and taximeters has again been most satisfactory, and the results would have been considerably better had it not been for the practical stoppage of business in Austria-Hungary during the critical times of the Balkan War. The directors state that the other branches, especially in Germany, France and England, have shown the usual progress, and during the last few months business in Austria-Hungary has begun to resume its normal condition. The directors refer to the death, during the past year, of the late Prof. Aron, the managing director of the company. His son, Mr Manfred Aron, who has held a position of responsibility with the company for some years past, has been appointed a director in his place.

J. G. White & Co., Ltd.

The directors report that for the year to February 28th, 1914, the results of the business, considering the depressed financial conditions which have hampered the development of new construction enterprises, have been fairly satisfactory, and show a net profit of £70,387. A further £15,000 is allocated out of profits to the general reserve, making this reserve now £135,000. The directors again recommend a dividend of 12 per cent. per annum on both classes of shares, and, in addition, an extra dividend of 10s per share on the ordinary shares. The balance to the credit of profit and loss, after bringing in £22,904 from the previous account, deducting the interim dividend paid on the preference and ordinary shares at January 1st, 1914, and making provision for percentages due to directors and staff, is £73,786. The directors recommend a dividend of 6 per cent., less income-tax, on the cumulative preference shares for the half-year to February 28th, 1914 (making 12 per cent. for the year), £9,000; a dividend of 6 per cent., less income-tax, on the ordinary shares for the same half-year (making 12 per cent. for the year), £3,000; an extra dividend of 10s. per share, less income-tax, on the ordinary share capital for the year, £25,000; to general reserve, £15,000; to be carried forward, £21,786.

Electric and General Investment Co., Ltd.

The directors report that the gross profit on the transactions for the year ended May 31st, 1914, was £15,282. After deducting all general charges, interest on debenture stock, the interim dividends already paid on the preference and ordinary shares, and providing for the proportion of the final dividend accrued on the preference shares to May 31st, 1914, there remained a balance of £5,438, plus £2,922 brought forward, making £8,360; £3,285 of this amount has been carried to the contingencies fund, making the amount to the credit thereof £84,000 as at May 31st, 1914, leaving £5,075. The directors recommend a balance dividend of 1s. per share, which with the interim dividend of 1s. per share paid in January will make the full rate of 10 per cent. on the capital paid up on the ordinary shares, £1,000; a dividend of 6d. a share on the deferred shares, £1,000; leaving £3,075 to be carried forward.

Globe Telegraph and Trust Co., Ltd.

The annual meeting was held on June 23rd, at Electra House, E.C., Sir J. Wolfe Barry, K.C.B., presiding.

In moving the adoption of the report (Electrical Review, page 1043), the Chairman said that there were certain changes in the receipts as compared with those of last year. The total receipts from all sources for the 12 months ended May 31st last, after deducting the necessary working expenses, amounted to £209,773, as against £209,827 in the preceding year, or a decrease of £54, and made with the balance brought forward £236,590. They had distributed to their ordinary shareholders the three usual quarterly interim dividends of 2s. per share net, and to the preference shareholders three quarterly fixed interim dividends of 3s. per share, being at the rate of 6 per cent. per annum, less income-tax. These distributions had absorbed £131,085, and the directors now recommended the payment of a final dividend on the ordinary shares of 6s. per share net, making with previous distributions a total dividend on those shares of 6 per cent, net. This, together with the amount required for the final dividend of 3s. per share, less tax, on the preference shares, would absorb £79,780, and leave £25,723 to be carried forward. Although they were again distributing to the ordinary shareholders a dividend at the rate of 6 per cent. per annum, as they had done for the last two or three years, the receipts, which were almost exactly the same as last year, were not in themselves quite sufficient to pay that 6 per cent. dividend; and the directors were drawing on the balance carried forward from year to year to the extent of about £1,100. This balance, which formed a very useful fund for the equalisation of dividends, was started in 1907, when it amounted to £26,565. Since that date, they had sometimes added to it, and sometimes drawn upon it, so that now, after seven years, it still amounted to much the same sum as it did, namely, to £25,723. They would thus see the directors were on very safe ground in withdrawing £1,100 at the present time to maintain their 6 per cent. dividend to their ordinary shareholders. During the year under review, the directors had continued the policy of re-arranging some of the investments of the company in cases where they had considered it advisable for the general benefit of the shareholders; and, accordingly, they would find in some cases, where they had sold stocks, that there was in the year under consideration a decrease in the receipts, while from other companies in which the directors had made purchases they had larger receipts. There were, however, in the year's accounts three items of fluctuation which were not affected by any changes in investments such as those to which he had just referred. One was that of the Submarine Cables Trust, in which case 15 certificates were drawn for payment at £120 per certificate. This money, of course, had been suitably re-invested. The second was that of the West Coast of America Telegraph Co., which, he was sorry to say, owing to heavy expenses in connection with their cable, had passed their dividend this year, involving, consequently, a loss of income; and the third was that of the Western Union Telegraph Co., which had increased their dividend from 3 per cent. to 4 per cent. It was his duty, however, to make the same remark as he often had to make when changes had taken place such as he was reporting to them then, viz., that their present accounts did not show the full effect of these changes, as it would not be until the close of the company's financial year 12 months hence that they would be able to show exactly what the result would be, in fact until they should have received the full year's dividends on the new stocks purchased. But this much they were able to say that, when that time came, it would, unless unforeseen circumstances arose, show an increase in their receipts. For example that year's accounts only included the increased dividend for one quarter of the year from the Western Union Telegraph Co. Taking everything into consideration, their prospects generally might be considered as very encouraging. There was only one other item that he thought he need mention to them and that was to tell them that the present market value of the securities they held, taking the lowest present market price, showed a surplus over the original capital of £227,598.

Sir James Pender, Bart., seconded the motion, which was carried unanimously, and the retiring directors and auditors having been unanimously re-elected, the proceedings closed with a vote of thanks to the directors and chairman.

Rushden and District Electric Supply Co., Ltd.

The report for the year ended December 31st, 1913, shows that nearly the whole of the expenditure during the year was on capital account. As the company only commenced a supply of electricity in October, no substantial revenue could be expected, and there is consequently a small adverse balance of £8 8s. The number of consumers is rapidly increasing, the number now connected to the mains or having electricity installed being 56, and the number of 32-watt lamps or equivalent being 2,180. Additional mains have been laid to the extent of 1,482 yards since the date of the last report in November, making a total length of 3 miles 762 yards.

Edgar Allen & Co., Ltd.—A dividend of 10 per cent. and a bonus of 2½ per cent. per annum on the ordinary shares are recommended for the year ended March 31st.

Winnipeg Electric Railway Co.—The directors have declared a dividend at the rate of 3 per cent. for the quarter ending June 30th.

Trafford Power and Light Supply, Ltd.—Out of a net credit balance of £4,043 the directors recommend the payment of 5 per cent. on the preference shares for the year ended March, 1914. The arrangement for the sale of the property and undertaking to the Manchester Corporation having fallen through, the directors consider it reasonable to anticipate that an offer of purchase may in the near future be received from some other source.

Bell Telephone Co. of Canada.—A financial paper states that the directors have declared a quarterly dividend of 2 per cent.

Stock Exchange Notices.—Applications for quotations in the Official List have been made for the following:—

Toronto Power.—Further £638,357 4½ per cent. consolidated guaranteed debenture stock.

Underground Electric Railways of London.—Further £179,000 6 per cent. £100 income bonds, Nos. 28,282 to 30,071.

Veritys.—7,000 5 per cent. £10 first preference shares fully-paid.

The Committee has ordered the following to be quoted in the Official List:—

Costa Rica Electric Light and Traction Co.—Further £28,050 5 per cent. first debenture, Nos. 2,557 to 2,623, 2,644 to 2,723, and 2,757 to 2,766 (£100), and 1,631 to 1,879 (£50).

Pennsylvania Water and Power Co.—$8,495,000 capital stock in $100 shares.

Russian Marconi Co.—The *Financial Times* states that at the annual meeting of the Société Russe de Télégraphes et Téléphones sans Fil (Russian Marconi Co.), held in St. Petersburg on June 13th, a dividend of 6 per cent. was declared.

Siemens Bros. & Co., Ltd.—The directors (according to the *Financier*) recommend a dividend of 5 per cent. (5s. per share) for the year ended December, 1913, placing £5,000 to a buildings reserve, and carrying forward £17,196.

New British Ever-Ready Co., Ltd.—The directors report that for the period from January 1st, 1913, to March 31st, 1914, there was a profit, after writing off depreciation, one-third preliminary expenses, &c., and transferring £2,500 to general reserve, of £17,723. A final dividend on pref. shares at the rate of 1½ per cent. per annum, making 8½ per cent., is recommended, also a dividend of 8½ per cent. on ordinary shares. £858 is to be carried forward.

The directors state that in order to cope with the increasing business of the company an additional factory of approximately 25,000 sq. ft. area has been leased at Fonthill Road, Finsbury Park, and is now in full working order.

Prospectus.—*Northern Electric Co., Ltd.*—There are being offered for subscription until to-morrow $3,500,000 first mortgage 5 per cent. sinking fund gold bonds, at 95 per cent., in this company, which is a consolidation of the Northern Electric and Manufacturing Co., Ltd., and the Imperial Wire and Cable Co., Ltd., both of which has been operating in various parts of Canada for some years.

Continental.—German Parsons Turbine Co.—The directors recommend dividends of 8 per cent. on the preference shares and 20 per cent. on the ordinary shares. The profits for the year amounted to £18,597.—*Financial Times.*

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange pendulum swings backwards and forwards in somewhat aimless fashion. Probably a good many people who are interested would say that it swung more backwards than forwards, and certainly the hopes that were raised in connection with cheap money have been dashed as regards prices by fresh outpourings of new issues, collective millions of pounds being required by the Port of London, the Union of South Africa, the Russian Government, various municipalities and other borrowers. These demands absorb available capital, and perhaps to a greater extent than people may think, for already some of the banks are intimating to customers that they will be unable to grant fresh facilities at the present time, and that if loans could be repaid, they, the banks, would not feel sorry.

The Home Railway market is in melancholy mood, by reason of the distrust felt with the labour situation. Moreover, the political outlook—especially as regards Ulster—has again assumed an obscure aspect, and the two lawless armies of volunteers in Ireland present a menace to prices in proportion as they threaten to break the peace. These things militate seriously against the values of domestic securities, and most of the Home Railway stocks are lower on the week. The weakness, however, has not affected the Underground group; in fact, Metropolitans recovered their point loss of last week, and Districts have also rallied. The Underground Electric Railways group is steady. The Birthday Honour accorded to its general manager aroused interest and pleasure in the Home Railway market.

The British Electric Traction meeting had no effect upon the prices of the company's stocks. Practical interest is now suspended, of course, waiting for the presentation of the directors' scheme of capital reorganisation. The various London traction issues are steady, and no Londoner can fail to observe the phenomenal popularity of the London General Omnibus Company's services of motor-'buses, which seems to advance by leaps and bounds.

Mexican matters are on the mend one day and in the melting-pot the next. Prices move accordingly, but the net results are trifling, so far as this week is concerned. Of the Mexican Light and Power issues, the First Mortgage Gold bonds are two points higher, but Mexico Tramway varieties are unchanged. Brazilian Tractions rose to 81½, but reacted to 79½ in company with most of the other stocks and shares connected with Brazil, which are less in favour than they were a week ago. Brazilian securities of all kinds are hanging for the moment upon the chances of the Republic raising the £15,000,000 loan which is required; and as the prospects for this issue grow big or blurred, so do quotations improve or decline. Para Electric Ordinary shares rose to 4¼, and Rio de Janeiro bonds of both classes have further advanced. Brisbane Trams hardened to 7⅛, following upon their improvement of last week.

In the list of Electricity Supply shares the movements are mainly downward. This has come about principally from sympathy with other purely investment departments. The falls which have occurred affect Charing Cross Ordinary and Preference, Chelsea, County Preference, and St. James's Ordinary, all of them influenced by the same general set of conditions which apply to the Stock Exchange as a whole. Oxfords improved to 6⅛, and both Preference issues of the Bournemomth and Poole Company advanced, the demand in the cases being based upon the expectation that the companies will be bought out at prices satisfactory to proprietors.

In the manufacturing division, the feature is a rise of $\frac{3}{16}$ in General Electric Preference to 10⅝, on the publication of an excellent report which shows the company to have made all-round progress during the past 12 months. The new Preference are ⅛ to ¼ premium, while the new Ordinary stand at 1$\frac{7}{16}$ premium, the last-named being a shade better on the week. There are also some old Ordinary shares of the company, very rarely dealt in, which stand in the neighbourhood of £12. Castner-Kellners have again improved. British Westinghouse Preference are quiet, remaining at 35s. The Brush Debentures retain their improvements. Arons are unchanged at 15s. middle, notwithstanding the reduction in the profits, as shown by the report just out; the dividend is maintained at 7 per cent.

Marconis are one of the best features of the moment. The price this Tuesday morning rose to 3¼ bid, nearly 10s. higher than it was a week ago, and the Preference at 2¾ were equally strong. Rumour has been insistent upon an important contract having been arranged between the company and the Chinese Government, but official confirmation so far is lacking. The imminence of the report is another factor that has contributed to the uneasiness of the bears, whose repurchases have been the main stimulus to the strength of the shares. A slight reaction from the best naturally occurred. Canadian and American Marconis stick at 6s. 9d. and 13s. 9d. respectively. Marconi Marines hardened to 1$\frac{7}{16}$, the company's report being read as favourable.

Telegraphs and Telephones are steady and placid. Anglo-American Telegraph Deferred and Preferred both fell ¼, and Cuba Telegraphs are 10s. lower at 8½. Telegraph Constructions remain dull at 37, nor has there been any recovery in West India and Panama issues. The Eastern group is firm.

The Shawinigan Water Company has again declared its usual quarterly dividend of 1½ per cent., and on this the shares rose to 137, a gain of 3 points. Montreals advanced 4. In fact, the Canadian division as a whole is steady to better, and a couple of British Columbia issues registered small gains. The only noticeable weakness in the Foreign Power group is a further fall of 3 in Cordoba Light and Power 5 per cent. Debenture, following upon a drop of the same extent last week.

The Metal markets have been tending to weakness, and rubber has come down to 2s. 3¼d. per lb. This week's auction sales of rubber in Mincing Lane opened rather disappointingly, and at the monthly Antwerp sale the prices realised were about 30 centimes less than those of a month ago. This week's opening of the Rubber Exhibition at the Agricultural Hall has given no fillip to interest in rubber shares; and in spite of several satisfactory reports from the younger companies, the share market remains in a state of quiet dulness.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, June 24th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	per lb.	2⅞d.	..
a " Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	"	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29	..
a Bleaching powder	"	£6 5	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£17 10	..
a Copper Sulphate	"	£21	..
a Lead, Nitrate	"	£28 10	£2 dec.
a " White Sugar	"	£27 10	..
a " Peroxide	"	£32	..
e Methylated Spirit	per gal.	2/8	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a " Chlorate	per lb.	3¼d.	..
a " Perchlorate	"	3¾d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	"	7½d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	"	£8 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5 5	..
a Soda, Caustic (white 70/72 %)	"	£10	..
a " Chlorate	per lb.	3⅝d.	..
a " Crystals	per ton	£2 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£86	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	£107 6 8	..
b " Sheet, in ton lots	"	£112	..
p Babbitt's metal ingots	"	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7d.	..
c " Tube (brazed)	"	9⅜d.	..
c " " (solid drawn)	"	7½d.	⅜d. dec.
c " Wire, basis	"	7⅛d.	..
c Copper Tubes (brazed)	"	9½d.	½d. dec.
c " " (solid drawn)	"	9½d.	½d. dec.
g " Bars (best selected)	per ton	£77	..
g " Sheet	"	£77	..
g " Rod	"	£77	..
d " (Electrolytic) Bars	"	£64	£1 5 dec.
d " " Sheets	"	£82 10	£1 5 dec.
d " " Rods	"	£70	£1 5 dec.
d " " H.C. Wire	per lb.	8½d.	⅛d. dec.
f Ebonite Rod	"	4/6	..
f " Sheet	"	4/-	..
n German Silver Wire	"	1/10	..
h Gutta-percha, fine	"	8/-	..
h India-rubber, Para fine	"	2/9½	½d. dec.
l Iron Pig (Cleveland warrants)	per ton	51/3	..
l " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Pig	"	£19 17 6	2/6 inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7	..
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e " " " medium	"	3/6 to 6/-	..
e " " " large	"	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	"	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	"	1/1 to 1/3½	..
p " " rolled bars & rods	"	1/0¾ to 1/2	..
p " " rolled strip & sheet	"	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10¼d.	..
r Steel, Magnet, in bars	per ton	£66	..
g Tin, Block (English)	"	£141 to £142	£2 dec.
n " Wire, Nos. 1 to 16	per lb.	2/3	..
p White Anti-friction Metals	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	£25 2 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Consolidated Diesel Engine Manufacturers, Ltd.—During the past 10 days the financial Press has been devoting a great deal of space and attention to circulars issued by the directors and others concerning the affairs of this company. A meeting to consider the matter was held yesterday and will be reported in our next issue.

Eastern Extension and Telegraph Co., Ltd.—An interim dividend of 2s. 6d. per share for the quarter ended March 31st is announced.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 23rd.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	½ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	13½ — 15½	..	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89½ — 91½	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	3	3½	56 — 59	..	5 18 8
Do. 5 % Perp. Deb. ..	100	5	5	92½ — 94½	..	5 6 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 80	..	5 12 9
Central London Railway, Ord. ..	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1903	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref. ..	1	6	6†	15/32 — 23/32	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	87 — 89	..	5 12 4
London and Suburban, Ord. ..	1	..	..	3/16 — 9/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	9/16 — 11/16	..	7 5 8
Do. Do. 4½ % 1st Deb. ..	100	4½	4½	75 — 80	..	5 12 5
London Elec. Railways, 4 % Deb.	100	4	4	90 — 92	..	4 7 0
London United Trams, 4 % Deb.	100	4	4	58 — 60	..	6 13 4
Metropolitan Railway Consol. ..	100	1⅞	1⅞	[illegible]	+1	4 3 4
Do. Surplus Lands	100	2¾	2¾	59 — 61	..	4 10 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	79 — 81	..	4 6 4
Metropolitan District Ord. ..	100	Nil	..	21 — 21½	+ ½	Nil
Do. 6 % Deb.	100	6	6	138 — 141	..	4 5 3
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 86	..	5 4 8
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 13 0
Potteries, Ord.	1	3½	3½	[illegible] — 13/32	..	8 12 10
Do. 5 % Pref.	1	5	5	17/32 — 21/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81¾ — 84¾	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways ..	10	..	..	3½ — 3¾	..	Nil
Do. "A"	1/-	..	..	7/16 — ½	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	115 — 117	..	5 2 7
Do. 4½ % Bonds	100	4½	4½	100 — 102	..	4 8 2
Do. 6 % Income	100	6	6	90 — 91	..	6 11 10
Yorkshire (West Riding), Ord. ..	5	Nil	Nil	¼ — ½	..	Nil
Do. 6 % Pref.	5	3	4	4⅛ — 4⅜	— ⅛	4 6 6
Do. 4½ % Deb.	100	4½	4½	85 — 88	..	5 2 3

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 23rd.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 13/16 — 5 1/16	..	5 8 5
Do. 2nd Pref.	5	5½	5½	4 5/16 — 4 9/16	..	6 2 3
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	98½ — 101½	..	4 8 6
Do. 5 % Deb.	100	5	5	94½ — 96½	..	5 3 6
Auckland Trams, 5 % Deb. ..	100	5	5	103 — 106	..	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11¾	..	5 2 2
Do. 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9
Do. 5 % 2nd Deb.	100	5	5	100 — 102	..	4 18 0
Brazilian Traction, Light and Power	$100	6	6†	78½ — 80½	— ½	7 8 6
Brisbane Trams Invt., Ord. ..	5	8	8	6⅞ — 7⅜	+ ⅛	5 8 3
Do. 5 % Pref.	5	5	5	4¾ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 — 102	..	4 8 1
B. Columbia Elec. Rly., Def. ..	100	8	8†	109 — 113	..	7 1 8
Do. Pref. Ord.	100	6	6	103 — 107	..	5 12 1
Do. 5 % Pref.	100	5	5	104 — 107	..	4 13 7
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 — 101	+1	4 9 0
Do. 4½ % Vancouver Deb. ..	100	4½	4½	94 — 98	..	4 12 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	95 — 97	+ ½	4 7 8
Calcutta Trams, Ord.	5	7½	9½	6½ — 7	..	6 15 9
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	98 — 101	..	4 9 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5 3/16 — 5 7/16	..	4 11 11
Do. 4 % Deb.	100	4	4	93 — 98	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	91 — 95	..	5 5 3
Havana Elec. Rly., 5 % Bonds ..	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie El. Trams 5% A Deb.	100	5	5	82 — 87	..	5 15 0
Do. 6 % B Deb.	100	6	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord ..	1	..	..	¼ — ½	..	..
Do. Pref.	1	4⅜d.	6	23/32 — 31/32	..	6 5 0
Lisbon Elec. Trams, Ord. ..	1	6	6	1 3/32 — 1 11/32	..	4 9 3
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16	..	5 1 0
Do. 5 % Deb.	100	5	5	95 — 100	..	5 0 0
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
„ Elec. Tr. (1904), Deb. ..	100	5	5	101 — 103	..	4 17 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	78 — 81	..	6 3 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ — 100½	..	4 19 6
Mexico Trams Com	$100	7	7	72 — 76	..	..
Do. Gen. Con. 5 % Bonds ..	..	5	5	80 — 84	..	5 19 1
Do. 6 % Bonds	100	6	6	77 — 81	..	7 8 2
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	4 — 4½	+ ⅛	11 2 2
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	86½ — 89½	..	5 11 8
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	100 — 102	+ ½	4 18 0
Do. 5 % Mort. Bonds	100	5	5	90 — 92	+1	5 8 8
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	96 — 100	..	5 0 0
Singapore Trams, 5 % Deb. ..	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video ..	5	7	7	4⅝ — 5⅛	..	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 8
Do. 5 % 1st Deb.	100	5	5	92 — 95	..	5 5 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 3

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 23rd.	Rise + or Fall	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Bournemouth & Poole, Ord. ..	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9½ — 10½	+ ½	4 5 9
Do. Second 6 % Pref.	10	6	6	10½ — 11	+ ⅛	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 9
Brompton & Kensington, Ord. ..	5	10	10	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	89½ - 92½	..	4 6 8
Charing Cross, West End & City	5	5	6	4¾ — 5¼	— ⅛	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅞	— ⅛	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅜ - 4¾	..	4 14 9
Do. Do. 4 % Deb.	100	4	4	90½ - 92½	..	4 6 6
Chelsea, Ord.	5	5	5	4½ — 5	— ⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	97 - 100	..	4 10 0
City of London, Ord.	10	9	10	16¼ - 17¼	..	5 16 0
Do. 6 % Cum. Pref.	10	6	6	12¾ - 13¾	..	4 7 3
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 7 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 — 103	..	4 8 1
County of London, Ord.	10	6	7	11¾ — 12¼	..	5 14 3
Do. 6 % Pref.	10	6	6	11¾ — 12¼	— ⅛	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	103 — 106	..	4 5 3
Do. 4½ % Second Deb. ..	Stock	4½	4½	99 — 102	..	4 8 1
Edmundson's, Ord.	£3	..	..	5/16 — 9/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3½ — 4	..	7 10 0
Do. 6 % Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 6
Folkestone	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9
Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7⅜ — 7⅞	..	5 14 3
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	5	2½	3	1½ — 1⅝	.	5 10 7
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	91 — 94	+ ½	4 5 1
Metropolitan	5	4½	4½	3⅜ - 3⅞	..	5 16 2
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	98 — 101	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	83 — 86	..	4 1 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 — 101	..	4 19 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10½	..	5 14 3
Oxford	5	7	7	5⅞ - 6⅜	+ 1/16	5 10 0
St. James' and Pall Mall, Ord. ..	5	10	12	9¼ — 9¾	— ¼	6 3 1
Do. 7 % Pref	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 4
South London, Ord.	4	5½	5½	2¾ — 3⅜	..	6 10 4
Do. 5 % First Mort. Deb. ..	100	5	5	99 - 102	..	4 18 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	Nil	..	5/16 — 9/16	..	
Do. 5 % Cum Pref.	5	3‡	4	2¼ — 3	..	6 13 4
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 4 8
Westminster, Ord.	5	10	10	8⅜ - 8⅞	..	5 12 8
Do. 4½ % Cum Pref.	5	4½	4½	5 — 5¼	..	4 5 9

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* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 23rd.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5¼ — 5½	..	5 11 7
Calcutta, Ord.	5	8½	9	7½ — 7⅝ xd	..	5 18 0
Do. 5 % Pref.	5	5	5	5 1/16 — 5 5/16	..	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	5 8 0
Canadian Gen. El. Com.	$100	7	8	103 — 108	..	7 6 6
Do. 7 % Pref.	$100	7	7	118 — 123	..	5 18 10
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 — ⅝	..	7 12 0
Do. 5 % Deb.	100	5	5	80 — 85	−3	5 17 8
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	81 — 83 xd	..	6 19 6
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ — 95½	+ ½	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	4	½ — ¾	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 — 104	..	4 16 2
Madras, Ord.	5	Nil	..	1¼ — 1¾	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	105 — 108	..	4 12 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	61 — 66	..	7 11 6
Mexican Lt. & Power, Common	$100	4	4†	45 — 48	..	..
Do. 7 % Cum. Pref.	$100	7	7	71 — 76	..	9 4 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	74 — 79	+2	6 6 7
Do. 5 % 2nd Mort. Bonds	100	5	5	59 — 64 xd	..	7 18 8

NAME.	Stock or Share.	Dividends for		Closing Quotations June 23rd.	Rise + or Fall —	Present Yield p.c.
	*	1912.	1913.			£ s. d.
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	51 — 55	..	..
Montreal, Lt., H. and Power	$100	9	10†	230 — 235	+4	4 5 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5*a*	5*a*	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 — 245	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 — 103	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	101 — 103	..	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 — 102	..	4 8 3
Shawinigan Water, Capital	$100	5½	6	185 — 189	+3	4 6 8
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 — 109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	99½ — 101½	..	4 8 8
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	96 — 98	..	4 12 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	85 — 87	..	5 15 0
Victoria Falls Power, Pref.	1	6	6	11/16 — ¾	..	8 0 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 3

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 23rd.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	7	7	11/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	6 17 2
Babcock & Wilcox	1	16	16	2⅞ — 3	..	5 6 8
Do. Pref.	1	6	6	1¼ — 1⅜	..	4 7 6
British Aluminium, Ord.	1	..	5	15/16 — 1 1/16	..	4 14 1
Do. 6 % Cum. Pref.	1	6	6	25/32 — 29/32	..	6 9 0
Do. 5 % Prior Liens Debs.	100	5	5	97 — 100	..	5 0 0
Do. Deb. Stk.	100	5	5	90 — 95	..	5 5 3
B.I. & Helsby Cables	5	10	13	9⅜ — 9⅞	..	6 11 8
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	101 — 104	..	4 6 9
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	2	Nil	5	1⅝ — 1⅞	..	5 6 8
Do. Deb.	100	4	4	74 — 76	..	5 5 3
Do. 6 % Prior Lien	100	6	6	101 — 104	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	8/- — 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	82 — 87	..	5 15 0
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb.	100	4½	4½	31 — 35	..	12 17 2
Callender's Cable	5	15	15	11⅜ — 12⅛	..	6 3 8
Do. Pref.	5	5	5	5⅛ — 5⅜	..	4 13 0
Do. Deb.	100	4½	4½	97 — 100	..	4 10 0
Castner-Kellner	1	20	22½	2½ — 2⅝	+ 1/32	8 11 5
Do. Deb.	100	4½	4½	104 — 107	..	4 4 1

NAME.	Stock or Share.	Dividends for		Closing Quotations June 23rd.	Rise + or Fall —	Present Yield p.c.
Dick, Kerr	1	Nil	..	⅜ — ⅝	..	..
Do. Pref.	1	6	6	¾ — ⅞	..	6 17 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1 — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	1	5	6	9/16 — 11/16	..	8 14 6
Do. Pref.	1	7	7	1 — 1⅛	..	6 4 5
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 1
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	10	6	6	10½ — 10¾	+ 3/16	5 11 9
Do. Deb.	100	4	4	87 — 91	..	4 8 0
Henley's, Ord.	5	15	20	14½ — 15½	..	6 9 0
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	99½ — 101½ xd	..	4 8 8
India-Rubber, G. & T.	10	7½	7½	9¾ — 10¾	..	6 19 5
Do. Pref.	10	5	5	8¾ — 9¼	..	5 8 3
Telegraph Construction	12	20	20	36 — 38	..	6 6 2
Do. Deb.	100	4	4	98 — 100	..	4 0 0
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	63 — 67	..	5 19 8
Do. B 4 % Cum. Pref.	100	..	£4	40 — 44	..	9 1 10

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 23rd.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4½	4½	5¾ — 6¼	..	7 4 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8	124 — 128	..	6 5 0
Do. Collat. Trust	$1000	4	4	92 — 95	..	4 4 3
Anglo-American Telegraph	Stock	3	3	64 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	107½ — 108½	— ¼	5 10 7
Do. Def.	Do.	30/-	30/-	22¾ — 23¼	— ¼	6 9 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	..	4 16 2
Chili Telephone	5	8	6†	7¼ — 7½	..	5 6 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	79 — 81	..	4 18 9
Cuba Telegraph	10	6	6†	8 — 9	— ½	6 13 4
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	7¼ — 7¾	..	6 9 0
Direct United States Cable	10	4	4	6⅜ — 6⅞	..	5 16 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	129 — 132	..	5 6 8
Do. 3½ % Pref. Stock	Do.	3½	3½	77 — 79	..	4 8 9
Do. 4 % Mort. Deb.	Do.	4	4	94½ — 96½	..	4 3 0
Eastern Extension	10	7	7	12½ — 13	..	5 7 9
Do. 4 % Deb.	Stock	4	4	95 — 97	..	4 2 6
Globe Telegraph and Trust	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12⅜ — 12⅞	..	4 13 4
Great Northern Telegraph	10	20	20	31½ — 33½	..	5 19 5
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	5	5	80 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 72	..	5 11 1

NAME.	Stock or Share.	Dividends for		Closing Quotations June 23rd.	Rise + or Fall —	Present Yield p.c.
Marconi's Wireless Telegraph	1	20	20	3⅛ — 3¼	+ ⅜	6 3 1
Do. 7 % Cum. Partic. Pref.	1	17	..	2 9/16 — 2 13/16	+ ⅜	6 1 0
Monte Video Telephone, Ord.	1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Pref.	1	5	5	23/32 — 27/32	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 — 101	..	4 9 0
Oriental Telep. and Elec.	1	10	10	2 7/32 — 2 9/32	..	4 7 6
Do. 6 % Cum. Pref.	1	6	6	1 7/32 — 1 9/32	..	4 13 5
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	4 0 0
Reuter's	10	10	7	7½ — 8½	..	8 4 8
Submarine Cables Trust	Cert.	6	6	126 — 129	..	4 13 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98 — 100	..	4 10 0
United River Plate Telephone	5	8	6†	6¼ — 6¾	..	5 18 5
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 9 0
West Coast of America	2½	2½	N	⅞ — 1⅛	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	1½	1 7/16 — 1 11/16 xd	..	7 8 2
Do. 6 % Cum. 1st Pref.	10	6	6	9 — 9½ xd	..	6 6 4
Do. 6 % Cum. 2nd Pref	10	6	6	8¼ — 8¾ xd	..	6 16 9
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	10	7	7	13¼ — 13¾	..	5 1 11
Do. 4 % Debs.	Stock	4	4	96 — 98	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	94 — 97	..	4 12 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. *a* Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Reason Exhibit at Birmingham.—An interesting little exhibit of meters, switches, &c., was held at the Queen's Hotel, Birmingham, during the recent M.E.A. Convention, by the Reason Manufacturing Co., Ltd. The object was to demonstrate particularly the great improvement recently introduced in the construction of these meters, which in the older types would, with violent vibration, over-register by the mercury shaking down the tube. The new tubes are provided with a simple spring suspension and were quite unaffected, though mounted on a mechanically vibrated base. The new meters are well finished, and we understand are coming into favour again with central station authorities, being, of course, specially adapted for registering the very small currents required by the modern high-efficiency lamp, which motor meters often fail to register. Various hand and electrically-wound time switches were also shown; also a new half-watt lamp fitting, and a new type of drum controller and starter which the company is now standardising, and in which a special spring operated type of finger is employed. We gather that the company proposes to make this exhibit an annual fixture.

A Canadian Court and the Code.—Justice Mercier, of Montreal, has decided that an electrical contractor is not bound to do his work in compliance with the regulations of the insurance companies unless it is so stipulated in his contract. The Routtenberg Co. ordered a $400 electric sign from the Macey Sign Co., but when it was delivered they refused to pay for it, claiming that the wiring was not up to the Underwriters' standard. The Court held that the sign had been made in accordance with all the requirements of the contract, and that therefore payment must be made. —*Canadian Electrical News.*

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MAY, 1914.

The returns of electrical export and import business for the month of May show considerable improvement in all sections as compared with the preceding month.

The export total of £618,354 is the highest so far recorded this year, and compares with £485,534 in April. Although it contains a fairly large telegraphic export, valued at £172,099, the remaining business, totalling over £446,000, was above the normal, due to the improvement in machinery and telephonic exports.

The imports total of £290,878 also compares favourably with the £273,205 recorded in the preceding month; the increase is traceable, as in the case of the exports, to improved business in machinery, and telephonic and telegraphic materials. While cabl exports were practically stationary, a slight increase occurred i the value of cable imports.

The re-exports, valued at £31,102 reached almost the highes figure recorded during 1914.

Our best customer during the month was Canada, this being du to a telegraphic purchase valued at some £86,000; it may be note that Japan's comparatively high total was due to a similar caus while India's total of over £69,000 represents fairly normal trade.

The position of the importing countries shows no particula alteration as compared with the previous month.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephone cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,729	215	462	78	70	580	6,932	304	...	131	309	1,586	12,39
Germany	2,298	5,996	87	...	339	138	1,639	...	...	33	...	264	10,79
Netherlands, Java and Dutch Indies ...	367	784	457	...	37	8	2,417	759	37	...	139	140	5,14
Belgium	1,106	...	126	31	44	25	2,666	140	235	...	2,944	53	7,37
France	595	...	3,001	...	...	...	9,903	37	114	39	172	46	13,90
Portugal	69	83	68	128	...	...	163	3,594	...	10	676	10	4,80
Spain, Canary Isles and Spanish N. Africa...	1,420	58	2	...	130	121	5,918	...	26	95	155	119	8,04
Switzerland, Italy and Austria-Hungary ...	737	59	53	31	118	32	6,607	28	...	390	...	1,168	9,22
Greece, Roumania and Turkey	541	489	227	...	...	...	704	256	46	...	1,796	1,902	5,96
Channel Isles, Gibraltar, Malta and Cyprus...	116	...	47	29	...	3	438	10	284	...	2,108	64	3,09
U.S.A., Philippines and Cuba	302	...	72	35	...	8	197	...	73	91	...	1.348	2,12
Canada and Newfoundland	727	4,940	1,060	1,507	236	1,740	16,644	415	1,970	4	419	86,479	116,14
British West Indies and British Guiana ...	114	104	56	69	...	...	337	...	5	10	13	20	72
Mexico and Central America	...	...	...	...	...	...	...	...	...	...	...	...	...
Peru and Uruguay	77	...	53	127	...	...	724	312	8	183	30	132	1,64
Chile	215	70	178	78	37	...	691	64	...	...	70	747	2,15
Brazil	1,242	972	723	173	...	13	3,104	5,164	636	39	253	1,738	14,05
Argentina	6,272	8,426	166	914	121	104	18,359	348	1,616	227	758	4,156	41,46
Colombia, Venezuela, Ecuador and Bolivia...	226	180	112	...	...	4	1,399	290	...	...	269	11	2,49
Egypt, Tunis and Morocco	215	537	75	24	...	73	685	6	31	...	44	397	2,08
British West Africa	53	316	153	76	...	32	366	...	...	11	16	27	1,05
Rhodesia, O.R.C. and Transvaal	1,818	3,352	529	1,371	51	21	7,493	...	367	...	319	865	16,18
Cape of Good Hope	2,383	2,811	458	873	218	469	28,489	494	496	...	6,801	4.224	47,71
Natal	1,192	18,081	224	135	37	...	3,298	...	922	35	111	474	24,50
Zanzibar, Brit. E. Africa, Mauritius & Aden	260	140	74	143	42	555	65	22	13	11	13	874	2,21
Azores, Madeira and Portuguese Africa ...	177	399	172	143	460	11	1,393	...	12	...	118	202	3,08
French W. Indian Islands and Madagascar	...	...	...	...	...	...	380	...	...	...	...	12,785	13,16
China and Siam	1,281	1,419	510	117	...	40	5,413	62	248	...	51	465	9 60
Japan and Korea	1,200	44	319	...	68	861	20,952	1.289	3,090	20	30	38,126	65 99
India	3,398	7,798	3,106	1,661	56	2,177	33,364	8,078	5,534	247	501	3.678	69.59
Ceylon	131	121	89	14	30	5	208	787	460	8	451	11	2,31
Straits Settlements, Fed. Malay States and Sarawak	668	3,247	261	18	15	731	3,093	254	289	98	3,056	403	12,13
Hong Kong	221	354	189	59	...	615	1,797	...	14	...	615	2	3,86
West Australia	472	721	43	395	...	327	1,174	...	180	...	9	31	3,35
South Australia	187	651	167	28	239	282	1,665	...	93	...	5,107	1,251	9,67
Victoria	1,938	4,867	374	1,619	161	2,251	3,028	411	849	21	1.070	911	17,50
New South Wales	2,026	9,805	673	1,392	249	571	6,510	343	864	...	2,659	2,389	27,48
Queensland	217	41	27	264	...	103	1,315	...	245	...	4,275	1,251	7,73
Tasmania	388	...	...	54	90	...	...	...	...	...	703	...	1,23
New Zealand and Fiji Islands	1,153	1,741	512	382	202	350	6,469	464	500	...	780	3.750	16,30
Total, £	37,531	78,821	14,905	11,968	3,050	12,250	205,999	23,931	19,257	1,703	36,840	172,099	618.35

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	1,475	...	...	12	...	...	4,129	303	713	38	15,322		21,99
Germany	5,359	24,790	2,144	8,294	6,224	3,304	94,290	576	4,115	9,621	9,013		167,73
Netherlands	28	...	30	107	647	80	10	...	187	...	...		1,08
Belgium	336	4,857	...	57	107	5	6,314	...	239	96	3,465		15,47
France	765	945	422	1,477	193	875	1,669	...	510	4,296	1,020		12,17
Switzerland	264	1,131	349	20	...	826	3,358	...	...	313	281		6,54
Italy	...	4,281	...	...	...	...	25	...	...	...	...		4,30
Austria-Hungary	62	878	98	191	...	...	46	...	...	307	54		1,63
United States	5,196	60	1,331	3	461	301	24.663	23,259	2.058	1,134	1,098		59,56
Total, £	13,485	36,942	4,374	10,161	7,632	5,391	134,504	24,138	7,822	15,805	30,253		290,50

Additional imports: Spain, carbons, £144. Portuguese East Africa, machinery, £27. Canada, electrical goods, £55; fittings, £50; meters, £5; machinery, £90.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	20,622	903	...	1,209	204	...	7,026	...	481	226	431		31,10

Total Exports: £618,354 Total Re-Exports: £31,102 Total Imports: £290,878

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third column contains many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE MUNICIPAL ELECTRICAL CONVENTION.

In our last issue we referred briefly to the opening day's proceedings of this year's Convention at Birmingham.

The morning's gathering took place in the theatre of the Midland Institute, and we cannot pass over the occasion without referring to the curious blend of illumination and no less of architecture found in the building; even Ald. Bowater, the Deputy Lord Mayor, who at the subsequent luncheon appealed to the visitors not to trouble about reducing the cost of fittings, can have felt no anxiety as regards the examples found in this hall.

It was a foregone conclusion that Mr. Vignoles's paper of the morning would meet with general appreciation, commercial development being an indispensable factor to success at the present day, and it appears to be only a question of how much to spend in this direction. As mentioned in our last issue, a feature of the afternoon was the electric vehicle display outside the G.E.C. works at Witton. Four of the vehicles were shown by Edison Accumulators, Ltd., including a passenger roadster, M.A.B. ambulance, and ½ and 2-ton vehicles of the commercial type; the Torpedo Co. had on view a ½-ton van and a passenger roadster, and the General Vehicle Co. (New York) a ½-ton van and 2-ton wagon; two Lloyd "electrics" for ¼-ton and 2½ tons loads were shown; and a new-comer, Messrs. W. A Stevens, of Tilling-Stevens fame, had on view a 3-ton delivery wagon, equipped with a Tudor battery. Another new entrant, not on the official list, was an electric car equipped with a Naylor battery, which, we were told, had on the previous day journeyed from London.

On Wednesday morning, Coventry was visited by special train, the members being welcomed in the historic St. Mary's Hall by the Mayor.

Mr. Fedden's paper on the "Design and Operation of Modern Boiler House Plant," which we print in abstract in this issue, drew a long discussion, the subject being of increasing importance owing to the scale on which power production will be carried out in the near future, and the difficulties which will arise in handling fuel and ashes in large quantities, not to mention the added complications which may be introduced with gas firing and by-product recovery. Some engineers appear to favour a short cut to simplicity by the purchase of gas in bulk from those whose business it is to make gas.

This would remove the fuel and ash problem, which, however, is only acute in a congested area; it would also enable the engineer and manager to devote his attention to the production and disposal of electricity, which is a much more potent argument, and it might result in an arrangement mutually beneficial to gas and electricity suppliers.

Dr. Ferranti admitted the attraction of such an ideal arrangement, but felt that gas making processes would have to be revolutionised for it to come about. Nevertheless, it seems to us that the problem is one with which the gas industry would not hesitate to grapple if it saw any advantage therein.

After the luncheon interval, when the visitors were entertained by the Mayor, the afternoon was given up to visits to the Coventry electricity works, and the establishments of the Daimler Co., Messrs. Willans & Robinson, and the British Thomson-Houston Co., the two last named necessitating a journey to Rugby. Having referred to the other works in a previous issue, we may briefly mention that the visitors to the B.T.H. works were shown turbo-generators ranging from quite small sizes to 6,000-KW. output in course of construction, also numerous rotary converters for English railways, traction motors for the Argentine railways, and other plant; a feature of particular interest was the new machine bays, 600 ft. long, constructed in ferro-concrete, which are being equipped with individually-driven tools. The visitors were also permitted to view a section of the lamp works, which, we believe, have never previously been thrown open for inspection, and, thanks to the courtesy of the company's officials, a somewhat arduous hour and a-half's pilgrimage retains many pleasant and instructive recollections.

It may be added that the company has 48 turbine sets and 87 rotaries going through the shops, nearly 60 of the rotaries being in 1,000-KW. to 1,500-KW. sizes.

Returning to Birmingham, the visitors were entertained in the evening to a reception and dance by the Lord Mayor and Lady Mayoress.

Thursday was a most strenuous day, especially to those who enjoyed to the full the hospitality of the Lord Mayor on the previous evening, as a comparatively early start was made for Stratford-on-Avon, the journey being accomplished in motor-vehicles, along roads which appeared to be innocent of tar macadam.

Here, in the Memorial Lecture Room, after a civic welcome reminiscent of the Shakesperian atmosphere of the locality, Mr. Horace Bowden's paper on "The Standardisation of Tariffs" was outlined by the author and discussed. Mr. Bowden takes considerable objection to the assessment system largely on account of what we may call its inexact character as regards individual electrical demands.

His own ideal tariff, however, appears to depend on assumptions and estimates based on local conditions, as some of his audience reminded him. It is probable that no standard system of tariffs can be evolved which will meet the requirements of all undertakings; conditions differ so greatly. This striving "to make the punishment fit the crime" reminds us of the man who figures out works costs to the third place of decimals and yet cannot vouch for the accuracy of his meters.

The discussion was a long one, and we need only record Mr. Wordingham's satirical comment, "Ha! Ha!" to the author's phrase, "Municipal enterprise is governed by the laws of equity."

At the conclusion of the meeting the visitors adjourned to the Town Hall for luncheon. Stratford-on-Avon possesses many attractions, not the least of them being a certain veal and ham pie, as many of the visitors discovered; as to the others, we can say very little, as shortly after lunch the party left in motor vehicles for Warwick, where time was allowed for the inspection of the Castle and grounds, and for the inevitable official photograph which we reproduce. Subsequently the journey was continued to Birmingham, the travellers catching a fleeting view of the ruins of Kenilworth on the way.

In the evening the Birmingham Entertainments Committee had provided for its guests what proved to be a highly-successful open air *fête* and concert at the Botanical Gardens at Edgbaston. Charmingly illuminated grounds, vocal and instrumental music, and an excellent display of fireworks held the attention of the visitors until a late hour, and even then the indefatigable members of the "Point Five" Association contrived on their return to the Grand Hotel to hold a meeting which lasted well into the morning.

For many of the visitors Friday marked the close of a busy week.

The annual general meeting was held in the morning, when Mr. Harry Richardson, of Dundee, was duly elected president for the coming year, the venue of the 1915 convention being, however, not definitely stated. Resolutions of sympathy with Mrs. Bruce Anderson and the B.E.A.M.A., and of thanks to those who had provided so lavishly for the entertainment of the Association and its friends were passed.

An incident of the meeting was a resolution moved by Mr. Seabrook, "on his own," as he said, giving expression to the regret of the members at the dissolution of the Industrial Committee of the I.E.E.; although this resolution was subsequently withdrawn, the later resolution moved by Mr. Vignoles, for the appointment of a special committee of the M.E.A. to deal with any matters for furthering the supply and use of electricity from public mains, with powers to co-opt outside representatives, as in the case of the Electric Vehicle Committee, was passed by a large majority.

The proceedings closed with a vote of thanks to the President, Mr. R. A. Chattock, than whom no President has merited greater appreciation for the services which he has rendered.

In the afternoon the Summer Lane generating station was thrown open for inspection, and a demonstration of the Taylor frequency changer was given at the Dale End headquarters, while the Entertainments Committee provided a Cinderella Dance at the Grand Hotel in the evening. Those of the visitors who stayed overnight had an opportunity of travelling to Worcester on Saturday, where arrangements were made for visiting the Royal Porcelain Works, the Powick hydro-electric station and other points of interest.

The Birmingham Convention will remain as an example of organised and kindly hospitality on which the local Entertainments Committee and all concerned are to be congratulated. If anything, the visitors were too well looked after, and to some at least, an ordinary day's work will provide a welcome rest.

Looking back over a dozen or so conventions, it is apparent that very great changes have taken place. The Association, of course, takes itself much more seriously than of old as befits its greater responsibilities and the grey hairs of its members.

The essentially engineering occupations and problems of its then young members have been largely displaced, or at any rate obscured by the more pressing, and possibly more profitable commercialism, which affects electricity equally with any other product of to-day.

In a word, its young hopefuls have developed into successful business men, and it would be idle to deny that their prosperity is in no small degree due to the spirit of camaraderie fostered by the Association in municipal circles. Even greater changes are apparent in the annual conventions, which from being the event of the year to the Association, have become, as one speaker said, an incident in the year's work—and this, it may be added, of a rather more than less social character, since the ladies began to take so kindly an interest in electrical matters.

Whether this change is all to the good of the Association and its members is a moot point; to the great majority of the latter the "incident" remains the one convenient opportunity during the year when they can forgather as a body, and, highly successful as the last Convention has been, both as regards its business and its pleasure, it is possible that a good many members look back with appreciation, not unmixed with regret, to the less formal, less strenuous, but no less enjoyable meetings, when, with more leisure at his command, mere man contributed so successfully to the entertainment of the hour.

Some Notes on the Commercial Development of Electricity Supply in Moderate-sized Towns.

(*Discussion on Paper by* W. A. Vignoles, *Chief Electrical Engineer, Grimsby. For abstract of paper see page* 1023).

Mr. Frank Ayton (Ipswich), in opening the discussion, referred to the importance of development work. In Ipswich they had been advertising for 10 years, but could trace very little result until the last few years; this pointed to the necessity for sustained effort in publicity work. Tramcar advertising had proved very valuable, and the type of notice containing few words had excited most interest. It was a mistake to give the consumer lengthy pamphlets and he believed in the mail card system. The expenditure in Ipswich last year on advertising was just over £140. During seven years they distributed nearly 23,000 notices, &c., through the post, and the average yearly increase of the connected load was 19 per cent., and of the sales 22 per cent. over that period. He agreed with the author as to the need for a development committee. In Ipswich they had their own sales department, but quite recognised the good work of local contractors. He hoped the author would see his way to put a resolution before the members in regard to the suggested committee, which was particularly necessary in view of the practical withdrawal of the representatives of the M.E.A. from the Publicity Committee, this action being due to the lack of support afforded by provincial undertakings.

Mr. A. H. Seabrook (Marylebone) urged the importance of municipal suppliers sticking to their selling and hiring powers or getting them; rather than give them up, he suggested that any profits made by sales should be pooled for the benefit of the electrical firms in the area. This would prove that municipal undertakings were not trying to rob private enterprise of its profits, but were working for the good of all. The I.M.E.A. was a splendid co-operative movement, and he supported the suggested committee, which he hoped would materialise. He concluded by referring to the ill-fated Industrial Committee of the Institution of Electrical Engineers, and the apathy of the members of that Institution in not taking up the matter with the Council, in view of the feeling that some such organisation was wanted. The year would be a prominent one if only it marked the formation of a development committee on comprehensive lines.

Mr. S. E. Fedden (Sheffield) took exception to the author's views on exhibitions; in his city they took every opportunity to exhibit electrical apparatus and demonstrate it to the public. The trouble in Sheffield was how to effect sales through the contractor. From experience he favoured fixing the price of energy beforehand, having regard to the business to be done. This policy during 10 years in Sheffield had resulted in increasing the sales for power purposes from 2 million to 25 million units. People were now so well acquainted with electric motors, that they were rarely called on to hire them out, as in former years. It was better to make the mistake of laying mains too large than too small; he usually had a spare duct laid in streets to provide for the heating and cooking load of the future. They had houses with 17 to 20 KW. installed, and, if the business developed on these lines, it would be necessary to run a H.T. supply for heating and cooking. Lighting was a by-product and advertising agent; they lost on some small consumers, but it advertised and extended the supply. For heating he found that 2 KW. was a minimum now, and often 3 and 4 KW. fires were installed, which it was a real pleasure to use. The four-light radiator was a back number. Cookers could be hired out at 4s. 6d. per quarter, and electrical cooking would compete with gas at only 1s. 6d. per 1,000 cb. ft. in Sheffield; he had recently sent out two dozen such cookers, but a hiring rate of 15s. per quarter was useless.

Mr. E. E. Hoadley (Maidstone) urged on members the advisability of taking powers for hire and hire-purchase, which they could get, and leaving the fuller powers sought for the future. It was very well to sell energy at ½d. per unit, but the cost of the electrical stove was prohibitive as compared with the facilities for obtaining gas stoves. It was worse to supply unprofitable flat-rate lighting consumers, as a matter of expediency, than to supply energy at ½d. per unit for cooking. In Maidstone they encouraged the contractors and found practically all their work for them, by means of the canvassing organisation, &c.

Mr. Alex. Cramb (Croydon) supported the use of showrooms, which he had found very valuable. There was nothing meritorious in small publicity expenditure; if the mains were in and waiting to be loaded up, development work was well worth paying for, and he expended over £1,100 a year in this way. He felt that some central publicity organisation was absolutely essential, but financial support was necessary to success. They should concentrate on getting their Bill through Parliament and then they would be able to subscribe to a suitable organisation, and do better work than the gas people. They had heard too much of the electrical contractor during the last few years; contractors were a valuable asset to the undertaking, they supported the work of the electricity department, and must be assisted as far as possible. He felt that the Contractors' Association had not dealt fairly with them, however, and that the M.E.A. must stick to its Bill.

Ald. Fred. Smith (Liverpool) commented on the value of the paper, but disagreed with a view put forward in the meeting that one Committee could rob another Committee of its profits. He urged a broad view of municipal work, and caused some amusement by his declaration that he had "sat on" the Liverpool electricity undertaking ever since it was bought over. He would be no party to any pooling arrangement with contractors; the latter worked for themselves, but he worked for the Corporation.

Bailie Willock (Glasgow) twitted the previous speaker with taking the electricity profits to run the police, street cleaning, &c., departments. In Scotland each department had to work by itself, and there was no disguising the results of one section of municipal work by money taken from another section.

Mr. Horace Bowden (Poplar) agreed with the author that a consumer would pay more for electricity than gas if he wanted the former, and it was practicable to supply at a competitive price. There was no considerable profit on public lighting, but they did not want to make large profits. He considered 5s. per quarter a suitable hire charge for electric cookers, and at Poplar they bought satisfactory electric cookers at £6 to £7 each.

Councillor Crowther (Sheffield) urged the necessity of using profits for the development of the undertaking; it was of far more importance to give cheap power in Sheffield than to reduce the rates. He was willing to work with the contractor, but not with his hands tied.

The author briefly replied to the discussion, and the meeting adjourned.

Design and Operation of Modern Boiler-house Plant.

(*Abstract of paper read by* S. E. Fedden, *Past President, Chief Electrical Engineer, Sheffield.*)

The main points to consider in the laying down of a steam-driven power station, are

(1) Adequate supply of water for condensing purposes.
(2) Ample facilities for dealing with ashes.
(3) Good accommodation for getting in and storing coal.

No 2, however, is becoming a very serious source of expense and concern in large cities, because of the difficulty of obtaining tips within a reasonable distance of the station. In Sheffield the cost of carting has increased no less than forty per cent. within the last few years. The author has lately gone to considerable expenditure to deal with ashes.

A lease of a valley adjacent to the power house has been obtained and a steel bridge erected for guard purposes over the main line of railway. A ropeway 200 yards long has been installed, capable of dealing with twenty tons of ashes per hour. This method of dealing with the ashes was arrived at after investigating the undermentioned alternative schemes, which worked out as follows :—

		s.	d.	
Disposal of Ashes	Railway	2	9½	per ton.
	Cartage	1	11	,,
	Ropeway	1	3	,,

No. 3. Dealing with the facilities for getting in coal it is advantageous to choose a site having a high level siding, so that the trucks come in straight off the railway over the top of the bunkers, thereby doing away with the expense of installing and running coal conveyors.

Needsend power-house is arranged on this plan, and the author had to cut sheer down sixty feet and excavate approximately 30,000 cubic yards of material. However, it was found that the material was suitable for brick making. The author, therefore, built three kilns, which were used for providing bricks for building a permanent kiln and chimney. A large portion of the material was converted into bricks for the power house; other portions of the excavations were found to be good hard rock, suitable for concrete and wall building, and the foundations were excellent. The expensive looking site, therefore, turned out to be a cheap one as regards capital cost, and is proving itself most convenient and economical in maintenance and running charges. The capital cost per KW. for the first section of the station is below £10, including the cost of land and sidings

The present equipment of the boiler house consists of eleven water-tube boilers, three more boilers being under construction. Provision is made for a three weeks' supply of coal opposite each boiler on the siding level, and each boiler has a shoot holding about 100 tons of coal, which feeds by gravity into the mechanical stoker hopper. Bottom-emptying trucks are brought directly over these shoots, and the major portion of the coal is never handled from the time of putting it in the trucks at the colliery until it is taken hold of by the mechanical stokers.

At the ends of the five railway lines over the top of the bunkers means had to be provided for the transference of the railway trucks from one line to the other, and in this connection the author has obtained an exceedingly useful and satisfactory traverser. It is electrically driven by means of an 8 H.P. two-phase motor.

The shoots are fitted with measuring chambers and indicating gear, and the coal is led through breeches pieces to the stoker hoppers. It is frequently claimed that measuring chambers are most inaccurate, but the author contends that this is not so

Many engineers argue that warming water by live steam is economical and saves coal, but that has never been proved to the author, although he concedes that any loss incurred by heating the feed water by live steam is amply repaid in the saving of repairs to the economiser and boiler tubes, and therefore is a saving of capital expenditure which would otherwise be required for extra economisers and boilers as spares. The author supports this contention from actual experience. The live steam feed-water heaters which the author has had in use with satisfactory results for some years have been those fitted with a patent indented tube.

The ash disposal arrangements should be such that the ashes can be lifted from two or three points in the ashes trench, and it is well not to be absolutely dependent on mechanical plant; openings should be left in the boiler-house floor, covered with plates, so that the ashes can in an emergency be taken away by carts.

At Neepsend the ashes are elevated to an overhead hopper and taken away to the tip ground by a bucket ropeway, which automatically tips the ashes wherever required.*

The automatic return terminal is mounted on eight steel wheels running on a pair of rails, so that as the ground around is filled up in course of time by the tipping, the terminal itself can be moved along. In this way the whole installation can be moved round fanwise for a total length of 190 feet, so that in time the whole of the low ground to the left of the ropeway will be automatically filled up. The whole of the hauling rope sheaves are mounted on roller bearings, and only occasionally require lubricating.

The whole installation, including the loading and despatch of the carriers, is worked by one man, so that the cost of disposing of the ashes is exceedingly small.

An additional shoot has been connected to the hopper, so that in the event of a breakdown of the ropeway a railway truck can be run under this shoot to give an alternative means of getting rid of the ashes.

A suction plant is about to be put in for all new boilers, and eventually for the old ones, by which the author expects to save considerable labour, and also do away with much dirt and dust, besides causing the atmosphere in the ashes trench to be less vitiated by the fumes; it will serve also to clean soot from soot chambers and economisers, thus reducing the amount of manual labour.

As to the type of boiler to be used, very little can be said; only water-tube boilers are suitable. The author is in favour of the vertical tube boiler, having experienced very good results from this type. The aim of all engineers is to get the maximum evaporation out of the smallest floor space. This means a large grate area and the burning of as much coal as possible per square foot of grate area.

The author considers with his present knowledge that the best over-all efficiency and least maintenance cost is obtained by running the following combination :—

> Water-tube boilers; economiser; chain-grate stokers; induced fan draught, at 25 lb. of coal (rough engine slack) per square foot of grate area. Evaporation per sq. ft. of heating surface, 5.25 lb. In-going gases to economiser, 450° Fah. Out-going gases from economiser, 300° Fah.

though it is quite possible to burn the same class of coal up to 30 lb. per square foot of grate area with good economy.

With regard to the rating of the water-tube boilers it is a matter of common knowledge that the rate of evaporation in the neighbourhood of the furnace is very high compared with other parts of the boiler. As the rate of combustion increases so does the rate of evaporation with the same size of boiler. The author has noticed that manufacturers have put forward for different capacities similar sizes of boiler, but with stokers having a larger grate area, so that some standard as to rating should be adopted. The standard adopted by the electric supply department at Sheffield is that the normal evaporation should be obtained by burning 25 lb. per square foot of grate area with a chain grate stoker burning engine slack.

The author has lately installed some 8 feet, Class E. underfeed stokers to two water-tube boilers fitted with both forced and induced draught. The boilers were specified to evaporate 35,000 lb. of steam each from and at 212° Fah. The combination is as follows :—

> Water-tube boilers; economisers; underfeed stokers; induced-draught fan, H.P. on load 55, giving 1.3 in. draught. Forced-draught fan H.P. on load 30, giving 2 in. draught. Normal coal per square foot of grate area, 33.5 lb. Evaporation per square foot of heating surface, 5.25. In-going gases to economiser, 518° Fah. Out-going gases from economiser, 290° Fah.

The results are : Burning up to 47 lb. of coal per square foot of grate area under the above working conditions the boiler evaporated 58,000 lb. of water per hour from and at 212° Fah. but the heat of the brickwork was so intense after the first hour's run that the rate of burning was reduced to 38 lb. per square foot of grate area.

The author thinks that this combination has a great future before it and its limit will be determined by the ability of the brickwork, etc., to withstand the intense heat generated in the furnace with the above conditions.

The author is a believer in mechanical induced draught, and strongly advocates that care should be exercised to install a fan or fans capable of dealing with the worst atmospheric conditions and of dealing with sufficient gases for the maximum possible overload of the plant.

The ideal stoker should be able to deal with clean nuts or smudge, should be able to get to full duty from banked fires in the shortest possible time, should be capable of doing 50 per cent. above its normal duty for short periods in case of emergency, should consume all combustible matter fed on to it with the most efficient percentage of CO_2, and should be smokeless under all conditions, besides which it must be strongly built, reliable, and easy of access for the repair of the working parts or the renewal of the bars. These conditions are, of course, difficult of attainment in one stoker. The chain grate has in the past done yeoman work, but it has its weak points. The underfeed stoker, which has recently been enlarged and strengthened in its mechanical parts, has proved itself, from the author's experience during the last eighteen months, most satisfactory, and complies more nearly with the conditions before-mentioned.

The author therefore considers that the safest arrangement for a large boiler-house is to install a certain proportion of the old reliable chain grate, which has proved satisfactory over a long series of years, and the remaining portion of the newer type, which, while being excellent from results obtained in a comparatively short time, has yet to prove its superiority over a longer period.

The boiler house foreman is responsible for the efficient working of the boilers, takes daily records of the coal consumption and water evaporation, temperature of flue gases and CO_2, records, and makes periodical tests on the boilers.

The boiler house repair foreman works in conjunction with the boiler house foreman, and is responsible for the quick repairs to the boilers, superheaters, stoker and economisers, feed pumps and other auxiliary plant. A chemist is now engaged to carry out all boiler house testing.

All coal delivered to the station is weighed on a weighbridge and either deposited in the coal shoots or bunkers, or sent to the coal storage ground. At the present time there are 3,000 tons immediately over the boilers and 5,000 tons on the coal storage ground. The author finds that rough slack obtained in the Yorkshire district and stored in large quantities is subject to spontaneous combustion. Consequently nothing but screened nuts are now being laid down and stored in 500 ton lots. The heaps are ventilated and temperatures are taken regularly. In this way, it is anticipated, the coal may be left in the open for a period of years, and the loss of calorific value will be only 10 to 15 per cent.

With regard to coal for storage, considerable capital expenditure is entailed for handling. The capital expenditure works out at approximately 15s. per ton of coal stored to about six feet high. If, however, a better class of fuel be purchased and the height increased, the cost will be proportionately less. This 15s. includes the provision of a complete scheme for delivering the coal from the wagons on to the storage ground and back again into the coal bunkers over the boiler. Another system of storing coal where spare ground space is limited is to erect a silo and install the Clayton or some similar system for extinguishing fire. A silo can be built to contain two or three thousand tons of coal, and, after filling it, the entrance manholes must be made air-tight. Through the silo pass two main pipes from which branch pipes can be taken as required. These main pipes connect up to an installation consisting of a generator, cooler, blower and engine. The blower driven by the engine draws air from the silo along one of the main pipes into the generator, where the oxygen of the air combines with sulphur by combustion and forms a mixture of nitrogen and sulphur dioxide. The gas is drawn through the cooler into the blower, which then forces it along a main delivery pipe back into the same compartment from which the air is drawn by suction. The suction and delivery of gas proceed simultaneously and as the volume withdrawn is equal to that delivered there is no leakage beyond what is due to diffusion.

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* A similar plant was described in the E.R., Nov. 3rd, 1911.

For the extinction of fire in the silo it is not sufficient merely to fill up the silo with inert gas; efficient means must be taken to get rid of the large amount of heat which the coal will hold. By this system, after the fire has been stopped by the introduction of gas, the generator is cut out of circuit and the gas-laden atmosphere circulated by means of the suction and delivery pipes through the cooler, until the temperature of the coal is brought down to normal. Fresh air is then admitted whilst this cooling process is continued, so that the gas is gradually dissipated and re-ignition prevented.

Experiments are also now being carried out to determine the effect of turning a portion of the flue gases into enclosed bunkers in which coal fires occur.

The coal is purchased to a rigid specification, and if the calorific value on delivery is below the specified amount a corresponding reduction is made in the price.

Frequent tests are made to ascertain the hardness of the water, and the degree of concentration in the boilers. No softening plant is required, as the supply for make-up contains only 3° of hardness.

Complete records are kept on a card system as to the cost of maintenance of each boiler complete with stoker, superheated, and economiser.

The following is a copy of the weekly costs sheet used in Sheffield, the figures being the actual figures obtained for the week named :—

CITY OF SHEFFIELD—ELECTRIC SUPPLY DEPARTMENT.

COMPARATIVE STATEMENT OF WORKS COSTS—Week ending April 30th, 1913.

Particulars.				Neepsend.				Sheaf Street.				Combined Stations.			
Units generated				532,500				33,170				565,670			
	Tons.	Cwt.	Qrs.	£	s.	d.	Cost per unit.	£	s.	d.	Cost per unit.	£	s.	d.	Cost per unit.
Coal—Neepsend	634	—	—												
Sheaf Street	77	5	3												
	711	5	3	240	7	10	·11	35	8	2	·28	275	16	0	·12
Ashes				10	17	8		2	18	8		13	16	4	
			Gallons.												
Water—Neepsend			78,260												
Sheaf Street			120,700												
			198 960	2	2	6	·00	3	4	3	·02	5	6	9	·00
Oil, waste and stores				4	14	9	·00	4	0	10	·02	8	15	7	·01
Salaries and wages				76	15	7	·03	29	18	7	·22	106	14	2	·05
Engine-room equipment				—			·04	1	8	8	·07	1	8	8	·04
Boiler-house equipment				25	11	5		5	4	4		30	15	9	
Buildings				1	11	4		—				1	11	4	
Sundries				3	18	4		—				3	18	4	
Lighting and power				59	19	9		3	3	11		63	3	8	
Total works costs				425	19	2	·18	85	7	5	·61	511	6	7	·22
Maximum demand ... ... KW.				8,331				1,611				9,942			
Load factor	$\frac{\text{units} \times 100}{\text{max. load} \times 24 \times 7}$			38·05				12·26				33·87			
Current used on works				23,527				807				24,334			

With regard to the suggestion made from time to time lately, that large electric power stations should be equipped with by-product plants, it will, of course, be necessary to bear in mind that if such plants were installed for distilling the coal and making gas either for burning under the boilers or for driving a gas engine, the capital expenditure per kilowatt of plant installed would have to be considerably higher than it is at present, in an ordinary coal-fired steam turbine station. In view of this larger capital expenditure, it will be necessary carefully to arrive at the percentage of the total plant, which could be economically operated by means of the fuel obtained by this by-product plant.

In looking through his present load curves, the author arrives at a figure of 2,000 KW. of plant installed out of a total of 25,000 KW. It would appear, therefore, other things being found satisfactory, that it might be economical to provide by-product plant for about 8 per cent. of the total plant of a power-house, and this plant should be run at practically 80 per cent. load factor to make it a paying proposition.

A much larger area would be required, and this in many places would be difficult to find with the requisite facilities as regards water, coal, etc.

Finally, the author wishes to impress on all the great importance of a present-day boiler house and plant, it is, in fact, of paramount importance; a place where more money can be saved than anywhere else in a power station, by employing and paying highly-trained and capable men who can bring scientific knowledge to bear on the many important problems that present themselves for investigation.

DISCUSSION.

MR. W. W. LACKIE (Glasgow), who opened the discussion, said his American visit had convinced him of the necessity of designing a boiler house as a boiler house, not as a stokehold; he suggested ash basement, boilers and economisers on three floors. Nothing but steel should be used in steam pipe lines and he had found an automatic coal weigher to each boiler the most reliable arrangement. If possible, arrangements should be made for uniform coal deliveries over the year, otherwise it would be better to receive more in the summer. The use of indicating instruments in the boiler house and the institution of special tests had resulted in a saving of £10,000 in one year at Glasgow. He found the suction-ash plant very satisfactory for removing both ashes and soot; it required some 5 KW. hours per ton for operation. The use of conveyors for ash handling had been given up on account of the expense. His investigations showed that under certain conditions and with coal at less than 10/- per ton it might pay to use gas firing and recover by-products. As a result of his visit to the States he had equipped two boilers with the American "Taylor" stoker, which was specially designed for giving the excess steam required for meeting sudden loads. He was now equipping each boiler with a steam meter as he had found them satisfactory. The cost of banking boiler fires at Glasgow was some £5,000 per annum, and the cost of stacking coal was estimated at 7/6 per ton there.

MR. J. W. BEAUCHAMP (West Ham), said the cost of ash disposal by tipping on land bought for the purpose became less owing to the fixed charges being spread over a quantity. The West Ham suction-ash plant for 10,000 tons per year cost 7d. in fixed charges and 2d. in electrical energy per ton; it appeared to be the most practical method of dealing with ashes. He used the Roots blower pattern and had no trouble with erosion. Trouble was experienced with dust where the air was blown out and this could be avoided by using a separater or filter. The ash tunnel itself was much cleaner than under the old conditions. The ashes were really carried by a current of air and he understood that the makers were now devising a means of using the air in a closed circuit which would get over the discharge trouble. He thought the placing of economisers above the boilers might lead to trouble if leaks occurred. Opinion was divided as to whether it was better to seal or ventilate coal heaps. The logical system of ventilating a boiler house was to draw in the warm air from the engine room. He thought the construction of a special pipe bay between the engine and boiler houses was worth considering as this would isolate trouble and provide some air insulation if closed.

Mr. C. H. Wordingham said he was surprised that more use was not made of the tippler for emptying trucks, as this got over the difficulty of the special coal trucks. He asked why both steam and electric feed pumps were used by the author? His dream was that gas-firing would eventually be brought about through a community of interests between the gas and electric suppliers, so that the two would be merged into one. The position might be much influenced by surface combustion and its higher efficiency, which would make possible smaller boilers and boiler houses more nearly proportionate to turbine houses.

Mr. W. C. P. Tapper (Stepney), remarked on the author's favourable situation in regard to ash disposal; in Stepney there were 300,000 people in 2 sq. miles and no space was available for ash tips. He found it quite possible to arrange boilers parallel to the engine house, using 5,000 kw. turbine units. At Stepney there were four chimneys on the Prat system, to eight boilers, using the cold blast system and giving satisfactory results. He was now adopting for new boilers the later "in-circuit" system, with forced draught below the grate and induced draught above, a balanced system, in single boiler units. Reference had been made to gas-firing and by-product recovery; he thought electrical engineers were not the proper people to take up gas production. This afforded an excellent opportunity of working in with the gas people who were specialists in that line, and it would do away with the coal and ash handling problem and might pay.

Mr. Yorath Lewis referred to the Niclausse boiler plant at Southend-on-Sea, which by giving a very high steaming capacity per unit area, greatly helped to solve the difficulties of design introduced by the turbine; boiler and other trusts were responsible for the stereotyped designs of present day stations.

Mr. A. E. Seaton pointed out that the sequel to the very fine steam consumptions offered by some turbine makers was found in the trouble which arose in the boiler house.

Mr. Bailey (Birmingham), urged the superiority of steam-driven auxiliaries, which were easier to start up after an interruption in supply, than motor-driven ones. Small steam plant was also more reliable than motors. He did not think the author's data as to boiler performance was consistent with practical working conditions. Between 3 and 4 per cent. of the coal passing over the grate fell through as riddlings and the usual practice of throwing these into the stoker hopper was unsatisfactory. At Summer Lane they fired two boilers entirely with riddlings. They carried a stock of 10,000 tons of coal at Birmingham; this was stacked 12 feet deep, the coal being graded to allow heat to escape if generated. One stack was 3 years old and another, containing 700 tons had been in place 6 years. The only deterioration in calorific value was on the surface; the stack was found to be free from sulphur which was a point of importance.

Mr. Brydges (Eastbourne), suggested that it was better to carry pump exhausts through the hot-well and economiser to the boiler; this arrangement would do away with eight steam-feed heaters employed by the author. Preheating of the air supplied to the furnace appeared to be a desirable feature; its disadvantage was the burning of the firebars. He had found it impossible to store Derbyshire slack more than 8 feet deep, but with a pea coal, containing sulphur, he stacked 18 feet deep and found the temperature rose some 10 deg., remaining stationary at that. In practice the horizontal tube boiler did not give so high an evaporation as the vertical tube boiler, and the cleaning was a much more serious matter, occupying twice as much time.

Mr. F. Ayton (Ipswich), suggested that forcing competition with the gas interests might facilitate the obtaining of reasonable offers in regard to gas firing. From observations made, he found that he obtained greatly improved boiler results when the wind was blowing into the big doors of the boiler house; he used Notts. slack, stacked 12 ft. deep, and had no trouble as regards heating. The flues at the Ipswich station were designed on a liberal scale having regard to the growth of the plant and in the initial stages this gave proportionately excessive radiating and leaking surfaces; he thought that as an alternative such flues could be subdivided in stories. In Ipswich a bonus was offered to all employes concerned for the reduction of coal consumed; he commented on the impossibility of comparing the records of coal consumption of the different undertakings with the usual data given.

Mr. Robt. Hammond felt that until the Electric Lighting Act was amended, to compel returns of calorific value, the previous speaker would have to be satisfied with the present state of affairs. He complimented the author on the use he had made of the Neepsend site and mentioned that while in South Africa, he had found the Vereeniging plant, which employed the Prat induced draught system, operating almost smokelessly on full load. Another speaker also dealt with the Prat system, pointing out that the "in-circuit" arrangement was at least 25 per cent. more efficient than the out-circuit type using cold air injection, and that the draught power quoted by the author was much in excess of that required with the Prat arrangement.

Dr. Ferranti said it was theoretically correct to heat air for combustion, but in practice it was not a satisfactory method. The apparatus was simple and not at all efficient; it was generally too small. He knew a number of cases of factories where it had proved unsatisfactory and where a moderately efficient system was in use trouble arose with the firebars which depended on incoming air for cooling them. As regarded the use of gas for firing, &c., if by-product recovery on a paying scale and gas-firing were to be adopted for electrical generating plants, the gas-making processes in use would have to be revolutionised. He saw no prospect of bringing gas and electrical people together in this matter, owing to the great difference in essentials in the processes involved.

Mr. Selvey pointed out as regards the Neepsend site, that many modern stations were obtaining similar arrangements for filling the bunkers, but by artificial means. He was much struck with the real commercial idea permeating municipal men at the present day. No one had referred to the point of view of the buyer of coal for the boilers; so far as he knew no one had attempted to apply the practical experience of the metallurgist to the purchase of coal and there was no sampler available on the results of which a purchase could be carried out. With large turbine units, the boilers largely depended on the firing equipment and our modern machine stoker was not on a par with the rest of the equipment, which explained the introduction of the Taylor stoker from America. To introduce gas-making as suggested would mean adding another link in the chain of generating electricity, and the gas people already had trouble in getting rid of their gas coke.

This concluded the discussion to which Mr. Fedden will communicate his reply.

Design and Operation of Modern Boiler House Plant.

This paper, read before the I.M.E.A. by Mr. Fedden is not quite so general as its title, but is more a description of the works at Neepsend, Sheffield, which were described in our issue of August 30th, 1912, p. 324. It is, nevertheless, interesting as touching upon points which are too often neglected.

The author, for example, gives as the main points to be considered in selecting a site:—(1) An adequate supply of water for condensing; (2) Facilities for dealing with ashes; (3) Accommodation for getting in and storing coal.

The author, however, excludes (1) as beyond the province of this paper, but it may be pointed out that power station designers have not always troubled themselves about condensing, but have regarded it as cheaper to omit this economy. To follow this policy nowadays would, of course, be impossible; on the contrary, the provision of an ample supply of water for condensing must be regarded as a crucial test of the suitability of a site for a large power station. The author had a lesson in site selection, and it appears that he is overlooking an economy on lines somewhat similar to those he followed in fitting a low site for this purpose. The site was full of stuff which had to be cut down as much as 60 ft. Trial holes showed that the stuff was suitable for brickmaking, and so three kilns were built to supply bricks to build a large permanent kiln and chimney, and the power station was built out of the bricks thus made, thus making the site a cheap one, and bringing it down to a low level, so that railway trucks are run over the coal bunkers. The capital cost of the first section of the station, including land and sidings, was under £10 per kw.

With this object lesson before him, it seems as though the author has gone aside somewhat in leasing a valley and building a 200 yards ropeway equal to dealing with 20 tons of ashes per hour, though we are not told why this figure should be so large even for a dirty coal of 15 per cent. ash, when the total evaporation is only 250,000 lb. per hour, as stated. The author's opinion as to the normal rating of a boiler is that it should be that evaporation which pertains to a coal consumption of 25 lb. per sq. foot per hour (the paper reads 251 lb.—an obvious misprint). But at page 8 the normal rating for three types or sizes of boiler of 80, 144 and 192 sq. ft. grate area is given as 30,000, 35,000, and 48,000 lb. The station is at present occupied to the extent of about five-eighths of its boiler capacity. But to return to the ashes; the coal consumption being perhaps 12 tons per hour at most can scarcely occupy such a big ash conveyor. But it is not that with which we would quarrel so much as that in a town like Sheffield there should not be some attempt to crush the ash and clinker and make concrete goods of it, thus saving the 1s. 3d. per ton of disposal costs, not to mention the destruction of a valley which appears at least to possess some amenities of vegetation.

The feed apparatus and pipes call for no special comment, unless it is that the provision of rollers to carry pipes is hardly necessary, but that simple rubbing pieces clamped to the pipes or riveted should be sufficient. Rollers are apt to be clogged by dirt, and to become the worst of rubbing surfaces. But an initially-provided rubbing plate acts as a brake against pipe vibration.

Each boiler is fed from a shoot of 100 tons, which feeds the stoker hopper, and there are grids to stop all large lumps in the coal which is tipped directly from the railway trucks. These trucks are of the bottom-emptying type, and only require the corners trimming out. There are five lines of rails over the bunkers, and the trucks are transferred by a traverser from one line to another. The shoots have measuring chambers and indicators to measure off the coal to the hoppers.

In a town like Sheffield, with a water supply of only 3° hardness, it is useless to discuss many questions, such as the class of boiler and water treatment. The only treatment of such a water, if oil free, is to heat it above 100° F. before it goes to the economiser. As to heating with live steam for the sake of economy, the author will have none of it. The actual facts are difficult to obtain, but he is up against so careful an authority as Normand.

A word of warning is given on the subject of ash removal from below the boilers, in that whatever the means employed, there should be openings in the boiler house floor as emergency ways by which the ashes may be removed for cartage, if the provided mechanism fails.

The ropeway to the tipping ground is arranged to swivel, and thus to shift its terminal as the ground becomes filled. The arc of the fan has a length of 190 ft. Locked coil steel carrier ropes are employed.

The question of boilers has settled itself almost entirely on the lines of grate area. It is not very practicable to supply huge turbines from shell boilers, because the grate area of the shell boiler is limited by the diameter of the furnace tubes. To get any serious grate breadth, a shell boiler must carry three furnace tubes, and must have a complicated stoker mechanism. Only by means of three furnace tubes can a shell boiler get a grate width of more than the boiler diameter, and then there is the disadvantage that the grates are not all on the same level. The need for wide grates implies very large boilers. At sea the shell boiler holds its own, but the need for reliability at sea is perhaps greater than in an electric station.

Whether a water-tube boiler should have tubes more nearly vertical on more nearly horizontal, does not seem to be of much matter with water of only three degrees of hardness. Nor is the question of heavy forcing so serious. The quality of the water rules the rate of combustion, and, incidentally, as the author sees, the relative proportions, of the economiser, superheater and accessories.

The author's provision of 25 lb. of slack per sq. ft. of grate is essentially moderate if the ash content of the coal is so much as 15 per cent. But his figure for evaporation, namely, 5·25 lb. per sq. ft. of heating surface seems to be based on Sheffield water, and again the temperature of 450° at the ingoing of the economiser seems low.

No particulars are given of the economiser in the combination on page 15 of the paper, but 290° for the outgoing of the economiser seems too low a temperature.

In this combination the combustion was tried as high as 47 lb. per foot, but the furnace brickwork became too hot—the draught was by fan—and it had to be moderated to 38 lb. The output was too much for the superheater, and the superheat fell from 150° to 110° F. Undoubtedly with boilers fed with suitable water, the limit is apt to be found in the ability of the brickwork to bear the high temperature of forced combustion. Such outputs as indicated by the writer cannot be got with natural draught, and only the best brickwork can stand the temperature. Brick arches are essential for bituminous coal, and the future must wait on improved brick material. It is perhaps allowable to question the real commercial value of all this hustle. It is wise to have a fan draught to enable bad atmospheric conditions to be dealt with, but is it wise to increase wear and tear so far that it does not really pay commercially ?

No large power station would now dispense with mechanical stoking. These machines are far from perfect, but are constantly becoming better as the result of experience. The author notes some of these faults without suggesting remedies. Few stokers are smokeless under all conditions, but very little smoke is now made by them where other essentials are present. As regards grates burning bare, this can be more or less guarded against by suitable under-baffles.

In storing coal, the Yorkshire slack is found very liable to heating. This is quite likely, for slack, if run-of-mine to some extent, is particularly liable to overheat, and it need be no matter for surprise that only screened nuts are now stored, and, in lots of 500 tons, ventilated and regularly tested for temperatures.

The author says that coal may be left in the open for a period of years—whatever this may mean—and lose only 10 to 15 per cent. of of its calorific value. The tests published by the American Coal Testing Department of the Geological Survey seem to indicate losses much less than this. This department found that run-of-mine coal was the most liable to heat, and that storage should not exceed 12 ft. in depth, and that the base of a coal pile should not consist of open floors such as clinker, or of large coal lumps which served to let in air.

To fit out Neepsend station to store coal in banks 6 ft. deep, has involved an expenditure of 15s. per ton stored.

If a silo can be afforded in which to store coal, there seems no reason to question that the cooled furnace gases might be blown into the middle of the mass of coal until the silo was charged with gas, chiefly inert, and so surrounded, there could be no spontaneous heating in a closed silo.

The author says that some experiment of this order is in progress. The outcome will be watched for with interest. Of the total working cost of the station, viz., £425 per week, coals stands for £240 and wages for £77 nearly.

The expenditure of £60 on lighting and power, without any wages, seems extravagant. The current used in the works amounts to nearly 4½ per cent. of the whole. The cost per unit comes out at 0·18d.

Apparently it would save £60 per week if the smaller Sheaf Street works could be closed, for there current costs 0·61d. per unit to produce on a load factor of 12·26 only. Now £60 per week represents good interest on a very considerable plant at £10 per KW.

The author touches on the question of by-product plants, and also on high superheat, and refers to a time when dull red gas (steam) will be passing through steam pipes and valves. On this point let it be remembered that economy is a good thing to aim at, and so is superheat. We do not know that there is any scientific reason which divides the working ability of iron at a line below red, and the new tool steels which cut and are yet red, do somewhat upset our instinctive objection to red-hot engine valves. Perhaps we are old fashioned in hoping that we shall never have to do with power station work that employs red-hot steam. True, the gas engine employs a white hot gas, but it does so in a water-jacketed cylinder, and it would hardly consist with reason to use red-hot steam in a water-jacketed cylinder.. Excessive superheat means risk and loss without commensurate gain.

Any description of a big electricity works has its lesson, and is so far valuable, and, as stated at the outset, this paper is more of a single works paper than a general thesis on power station design. It lacks simply the article *a* before the word "modern" of its title.—B.

The Tramways and Light Railways Congress.—The annual Congress of the Tramways and Light Railways Association will be held at Newcastle-on-Tyne, on July 16th and 17th. The programme includes papers on the following :—"Some Features of Newcastle Corporation Tramways," by Councillor R. Mayne, J.P., vice-chairman, Newcastle Corporation Tramways Committee ; "Tramway Experiences in Brazil," by Mr. H. M. Sayers, M.I.E.E. ; "Standard Tram Rails : a Comparison of English and Foreign Sections," by Fred Bland, M.I.Mech.E. (Member of the Council) ; "Rail-Joints : their Construction and Maintenance," by Mr. R. Humphries, tramways engineer, Birmingham and Midland Tramways Joint Committee ; "Town Planning," by Mr. J. A. Brodie, city engineer, Liverpool Corporation.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all enquiries should be addressed.

13,787. "[illegible]." [illegible]. June 8th.

13,800. "[illegible] shades and the like." F. D. Phillips. [illegible]

13,825. "[illegible]." A. A[illegible]. June 8th.

13,854. "Means for [illegible] communication between moving trains and railway stations or other stationary places." T. G. Thornblad, K. H. Wallinder and A. G. [illegible]. June 8th. (Convention date, June 10th, 1913, Sweden). (Complete).

13,883. "R[illegible]." A. R. Angus. June 8th. (Divided Application on 9,090/13. April 17th. Convention date, February 13th, 1913, Australia). (Complete).

13,884. "R[illegible] safe-running devices." A. R. Angus. June 8th. (Divided Application on 9,090/13. April 17th. Convention date, February 13th, 1913, Australia). (Complete).

13,920. "Search-lights or projectors." Siemens-Schuckertwerke G.m.b.H. June 9th. (Convention date, June 21st, 1913, Germany). (Complete).

13,933. "[illegible]." F. G. Waters and Callender's Cable & Construction Co., Ltd. June 9th.

13,945. "[illegible] tions thereon." F. de Palma. June 9th. (Complete).

13,951. "[illegible] purposes." H. Nathusius and Westdeutsche [illegible] Werke G.m.b.H. June 9th. (Complete).

13,960. "[illegible]." M. L. Holdaway, and B. J. Anderson. June 9th. [illegible]

13,961. "[illegible]." Compagnie de Signaux Electriques [illegible]. June 9th. (Convention date, June 27th, 1913, France). [illegible]

13,966. "[illegible] electrodes of different polarity arranged [illegible]." A. H[illegible]stein. June 9th. (Complete.)

13,973. "[illegible] rectifiers." G. W. Heimrod. June 9th. (Convention date, June 11th, 1913. Germany). (Complete).

13,976. "[illegible] switch gear or devices for automatically closing or breaking circuits." E. V. Gratze. June 10th.

14,006. "Construction of contact apparatus for closing electrical circuits." J. E. Colas. June 10th. (Addition to 26,268/13. Convention date, June 20th, 1913. Belgium). (Complete).

14,021. "Electrically-driven machine tools." Siemens-Schuckertwerke G.m.b.H. June 10th. (Convention date, June 13th, 1913, Switzerland.) (Complete.)

14,022. "[illegible] electric hand drilling-machines." Siemens-Schuckertwerke G.m.b.H. June 10th. (Convention date, June 19th, 1913, Switzerland). (Complete).

14,030. "Electric transformers." F. E. Berry. June 10th.

14,043. "Armatures of dynamo-electric machines and the like." W. H. Scott. June 10th.

14,044. "Method of insulating coils or the conductors for electric machines." Allgemeine Elektricitats Ges. June 10th. (Convention date, June 10th, 1913, Germany). (Complete).

14,049. "Means of transporting bodies or masses by electro-magnetic means." E. V. Gratze. June 10th.

14,060. "Portable electric lamps." M. H. Goldstone. June 11th.

14,081. "Electrically-operated cranes, elevators, colliery winding-gear, crane-luffing devices, and the like." G. Neale, and C. H. Nicholson. June 11th.

14,094. "Electric safety lamps or the like and apparatus in connection therewith." E. A. Hailwood. June 11th. (Addition to 436/11. Divided Application on 18,694/13. August 18th).

14,095. "Safety lamps or the like apparatus in connection therewith." E. A. Hailwood. June 11th. (Addition to 28,255/07. Divided Application on 18,694/13. August 18th).

14,098. "Current collectors for electric [illegible]." Compagnie Generale des Omnibus de Paris. June 11th. (Convention date, June 13th, 1913, France). (Complete).

14,102. "Control of dynamo-electric machines for use alternatively for generating electric current or to act as motors for starting internal-combustion engines." Carleon Electrical Co., Ltd., and G. Inrig. June 11th.

14,103. "Apparatus for electrically lighting vehicles." Carleon Electrical Co., Ltd., and G. Inrig. June 11th.

14,119. "Electric accumulators." A. D[illegible]. June 11th. (Complete).

14,125. "[illegible] apparatus for transmitting and receiving signals." Sir A. T. Dawson, and G. T. Buckham. June 11th.

14,146. "Electric switching device." [illegible] Pr[illegible]tt. June 12th.

14,156. "Sparking plugs for internal-combustion engines." W. V. Williams. June 12th.

14,159. "[illegible] fuses." A. H. R[illegible] and C. C. Garrard. June 12th.

14,162. "[illegible] heater and supports for [illegible] thereof." G. Cooper.

14,136. "Appliances for maintaining electric conductivity in conduit systems for carrying [illegible] for power, light, or other electrical installations." F. J. B. Winsbery and T. Parker.

14,189. "Railway safe-running devices." A. R. Angus. June 13th. (Divided Application on 9,090/13. April 17th. Convention date, February 13th, 1913, Australia). (Complete).

14,192. "Process and electric furnace permitting the extraction in a state of purity of [illegible] from its ores." E. F. Cote and P. R. Pierron. June 12th. (Convention date, November 19th, 1913, France). (Complete).

14,224. "[illegible] igniters." V. F. F[illegible]. June 12th. (Fabrik Elektrischer Zunder G.m.b.H. Germany). (Complete).

14,229. "Methods of manufacturing metal [illegible]." British Thomson-Houston Co., Ltd. June 12th. (General Electric Co. United States).

14,268. "Radio-active apparatus." Pierre G[illegible]. June 13th. (Convention date, July 5th, 1913, France). (Complete).

14,276. "[illegible]graphic code apparatus." F. B[illegible]. June 13th. (Convention date, June 13th, 1913, Germany). (Complete).

14,278. "R[illegible] for dynamo electric machines." Siemens Bros. Dynamo Works, Ltd., and E. O. Kieffer. June 13th.

14,294. "[illegible] controllers." A. West. June 13th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

7,232. I[illegible] and Starting Systems for Internal-combustion Engines. L. Langner. [illegible] 26th.

11,993. Electric Heaters. J. M[illegible]. [illegible] 22nd.

12,035. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). May 23rd. (Addition to 13,970/12).

12,074. Incandescent Electric Lamps. C. A. Harrison. May 23rd.

12,082. Arc Lamps. H. Ayrton. May 23rd.

12,100. Electrical Selectors and the like. T. G. Hodgkinson. May 23rd.

12,115. Fittings for Metallic Conduit Systems for Housing Electrical Conductors Specially Applicable to Ceiling Rose Fittings and the like. Simplex Conduits, Ltd., and L. M. Waterhouse. May 24th.

12,162. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). May 24th.

12,256. Process of and Means for Regulating the Vacuum in X-ray Tubes. H. C. Snook. May 26th. (June 18th, 1912).

12,266. Subaqueous Audible Signalling Apparatus. S. M. Davison. May 26th.

12,334. Moving Picture Target Apparatus. W. A. Bennett. May 27th.

12,663. Fluid Flow Meters. British Thomson-Houston Co. (General Electric Co.). May 30th.

12,821. Telephones, Phonographs, and like Sound-receiving Apparatus. J. F. Glover. June 2nd.

13,369. Mechanical Advertising Machine. J. Bennett. August 13th.

13,602. Manufacture of Electric Cables. C. J. Beaver and E. A. Claremont. June 12th.

14,027. Electric Striking and Damping Mechanism for Balls, Bars, Tubes and Plates. T. L. Southgate. June 17th.

14,796. Electric Motor Control Systems. British Thomson-Houston Co. (General Electric Co.). June 26th.

14,848. Junction Boxes for Electric Circuits. H. E. Walker. June 27th.

15,014. Electrical Heating Units and Resistance Coils and Method of Manufacturing the same. L. W. Campbell. June 30th. (November 13th, 1912).

16,853. Stereoscopic X-ray Systems. H. C. Snook and E. W. Kelly. July 22nd. (August 15th, 1912).

17,275. Electrical Switches. W. J. Fahn, and J. C. Hutton. July 28th.

17,345. Electric Cut-outs. T. E. Murray, Junr. July 28th. (February 4th, 1913).

17,439. Printing Telegraph Apparatus. A. D. Cardwell. July 29th.

18,018. Telephone Transmission Systems. Western Electric Co. (Woodward, acting for Western Electric Co.). August 7th.

18,409. Advertising Apparatus. R. Blakeney. August 13th.

20,181. Tube Lamps. A. Pilz. September 6th.

20,730. Self-starters for Automobiles. P. C. Campbell. September 13th. (April 3rd, 1913).

24,686. Headstocks of Electrically-driven Lathes and other Machine Tools. H. Kienzle. October 30th. (Divided Application on 12,235/13. May 26th).

25,236. Thermal Electric Current-limiting Apparatus. T. De Olazabal Y. Eulate. November 5th. (January 25th, 1913).

26,949. Cinematograph Target Apparatus. Life Targets, Ltd., A. W. Harris, and D. H. Corbin. May 28th. (Divided Application on 12,411/13. May 28th).

26,950. Cinematograph Target Apparatus. Life Targets, Ltd., A. W. Harris, and D. H. Corbin. May 28th. (Divided Application on 12,411/13. May 28th).

27,474. Train Dispatching and Signalling Systems. P. J. Simmen. November 28th.

28,234. Mechanism for Producing a Step by Step Motion by Electrical Means. Evershed & Vignoles, Ltd., and J. C. Needham. December 8th.

28,894. Vacuum Lightning-arrestors. Western Electric Co. (Woodward, acting for Western Electric Co.). December 15th.

1914.

2,092. Arrangements for Transmitting and Receiving Signals. Siemens Bros. & Co. (Siemens & Halske Akt. Ges). January 26th. (Addition to 17,124/13).

3,832. Brush-holder and Plug-contact for use with Magneto-electric Ignition Apparatus. Unterberg & Helmle (Firm of). February 13th. (December 4th, 1913).

4,215. Construction and Operation of Electrical Condensers of the Ring Type. Hartman & Braun Akt. Ges. February 18th. (February 20th, 1913).

4,308 Controlling of Electric Motors for Ship-propulsion and means therefor. Siemens-Schuckertwerke Ges & F. Hulss. February 19th. (Divided Application on 13,148/13. June 6th).

4,397. Hygienic Attachments for Mouth-pieces of Telephones, Speaking-tubes and the like. W. C. Hickmutt. February 20th.

8,565. Alternating Electric Current Machines having Bar-winding. Allmanna Svenska Elektricka Aktiebolaget. April 4th. (April 11th, 1913).

7,562. Electric Switch. G. Von Hutschler & A. Ordon. March 25th.

9,225. Starting and Synchronising of Rotary Converters. Siemens Schuckertwerke Ges. April 14th. (April 14th, 1913).

Napier Tercentenary Celebration.—On July 24th to 27th there will be held a celebration, under the auspices of the Royal Society of Edinburgh, of the tercentenary of the publication of Napier's "Mirifici Logarithmorum Canonis Descriptio," the work which embodies the discovery of logarithms. The Right Hon. Lord Moulton, LL.D., F.R.S., will deliver the presidential address on July 24th, and many distinguished mathematicians, astronomers, actuaries and engineers will make communications on July 25th and 27th. An exhibition of calculating machines, apparatus and books, and of objects associated with Napier and the history of mathematics, will be held in connection with the celebration, and social entertainments will be organised.

Immediately following the Napier celebration a mathematical colloquium will be held on July 28th to 31st, under the auspices of the Edinburgh Mathematical Society, in the course of which will be delivered, amongst others, four lectures on "Critical Studies of Modern Electric Theories," by E. Cunningham, M.A. Those who desire to become members are requested to communicate, as soon as possible, with Mr. P. Comrie, 19, Craighouse Terrace, Edinburgh.

Patent Restorations.—Orders have been made restoring the following patents:—

C. W. Higgs. "Improvements in and relating to the transmission gear of motor vehicles." No. 18,707 of 1909.

W. Alexander. "Improvements in and relating to rotary pumps, compressors, engines and the like." No. 14,702 of 1909.

Applications for restoration have been made as follows:—

H. Zalomo. "Improved Speed Reducing or Multiplying Gear." No. 25,210 of 1908.

W. G. Cordingley. "Improvements in Calculating Machines." No. 1,751 of 1909.

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